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- **Welcome to this tour of the computer application Trench®3.0.**
- **In Microsoft PowerPoint, it is best viewed as a full-screen 'Slide Show' presentation. If your current view is smaller, we strongly recommend you go to 'Slide Show' on the menu bar above, and select 'View Show' from the drop-down menu.**
- **To move from one slide to the next within the Slide Show, left-click your mouse (anywhere on your screen will do) or use the up and down arrow keys.**
- **To end the Slide Show at any stage, right-click and select 'End Show' from the drop-down menu.**
- **To revisit a slide from within the Slide Show, use the up arrow, or right-click and select 'Go' and 'By Title' from the drop-down menu.**

•left-click now
•(this instruction will not be repeated)

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- **This is a static, not a working, preview of Trench®3.0. For example, the buttons on its pages are inactive, and you cannot enter or change any data.**
- **For more information, or to purchase Trench®3.0, e-mail author Bill Cromer (billcromer@bigpond.com)**
- **Bill Cromer reserves the right to issue updated versions of this presentation at any time, without notice**

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Trench®3.0

Land Suitability and System Sizing for On-site Wastewater Management

Preview

Bill Cromer
BSc (Hons Geology)

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What is Trench®3.0?

- **A computer program to help assess sites, and size disposal systems (including absorption trenches, beds, re-use and irrigation areas, etc), for on-site wastewater management**
- **Marketed internationally**
- **Button-driven and easy-to-use, in the Windows environment**
- **Hardware requirements: an IBM-compatible Pentium computer or better, 32 Mb RAM, 6 Mb of hard disk space**
- **Software requirements: Microsoft Windows 95 or later, or Microsoft Windows NT operating system, and Microsoft Excel 97 or later**

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Who needs Trench®3.0?

- **Environmental Health Practitioners**
- **Environmental consultants and managers**
- **Engineering consultants**
- **Building Inspectors**
- **Planners and Surveyors**
- **Catchment Managers**
- **Regulators and Administrators**
- **Manufacturers, installers, and maintainers of on-site systems**
- **Educational institutions**

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Why do I need Trench®3.0?

- **To standardise assessment procedures. In Australia, Trench®3.0 is designed to support current guidelines and standards relating to on-site wastewater management. However, its flexible approach ensures that it can continue to be used even when standards change, and for this reason it has international application as well.**
- **To complement professional judgement**
- **As a guide towards due diligence**
- **As a training tool to aid new assessors**

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What can I do with Trench®3.0?

- **Systematically assess and record a full range of site and environmental factors**
- **Assign confidence levels to your data**
- **Use Trench®3.0's default limitations, or choose your own, to flag sensitive issues**
- **Use water balance or nutrient balance approaches to size disposal systems**

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What else can I do?

- **Help explain why an existing wastewater disposal system is failing**
- **Help design new systems which minimise the risk of failure**
- **Do full site assessments**
- **Do part site assessments**

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This tour is based on the Example (file name Example.xls) included in the full Trench®3.0 file folder.

On the following pages, comments like this in orange (and sometimes white) are explanatory notes for this preview only. They do not appear in Trench®3.0.

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Important notes

As a consequence of copying parts of Trench®3.0 from Microsoft Excel to PowerPoint, various text, objects and buttons have become slightly distorted in some of the following slides.

None of these distortions appears in Trench®3.0 itself.

When originally distributed in 1999, the name 'Trench' was trade-marked (™). It has since been registered (®)

This *Powerpoint* preview is currently being updated. All and any references to the Australian Institute of Environmental Health (a partner in Trench for almost 10 years) in the following pages are no longer applicable.

This is **Trench's title page.**

After installing the application, users might need to click 'Screen settings' to optimise the Trench page size.

In this Preview, we enter through the **Start** button.

DISCLAIMER

Every effort has been made to ensure the Trench™ software application is free from errors or omissions. However, William Craig Cromer and the Australian Institute of Environmental Health or their employees or agents shall not accept any responsibility for any injury, loss or damage occasioned to any person at any time as a result of any error or omission whether or not the error or omission is in any way due to any negligent act or omission, breach of duty or default on the part of William Craig Cromer or the Australian Institute of Environmental Health or their employees or agents.

COPYRIGHT WARNING

FEEDBACK

Quote your ID number (on your CD label) in all correspondence.

For information about ordering - Australian Institute of Environmental Health: **wa@aieh.org.au**

For questions or suggestions about using Trench™ : **billcromer@bigpond.com**

Getting started with this application

Quit | Back | All Menus

Trench's second page includes a Disclaimer, and Copyright and Feedback information.

New users should click on **Getting started with this application,** which takes you to.....

What do I do first?

Suggestions to help you get started

Browsing

If you are new to this application, it is strongly suggested that you thoroughly explore the **Help menu** pages (click below), which contain very useful information about how Trench™ is structured, how to enter data, and what different coloured buttons do. Spend time clicking and browsing.

Entering data

First, use the 'Save As' command to rename the worksheet. Call it 'Test' or similar. Then, click 'Site assessment menu' on the All menus page or 'Start new assessment' on the Main menu page, and explore the grey input pages. Enter some data (don't forget to click 'Enter' after each input), and review the results by (for example) clicking the Rank button, and perhaps changing the default rank, or going to a report page, etc. You could also open the Example worksheet ('Example.xls') to investigate a completed Trench™ assessment. Trench™ will not allow you to enter mathematically invalid data.

CAUTION - using the TAB button: Because Trench™'s 150+ pages were created in no particular order, you should always use the buttons provided to move around the application. **Do not use the TAB key to move off the page you are on**. (In Excel, pressing TAB takes you to the next unlocked cell in the worksheet, which may not be on the page you require. If you inadvertently press TAB, you can use the up and down arrows to go to a button, or you can use the vertical scroll bar by going to 'Tools'...'Options' and selecting 'Vertical scroll bar'.)

Title Page | All menus | Main Menu | **Help menu** | About Trench menu

...the first part of the **Help menu**.

Note the CAUTION about the Tab key. The same caution applies to scroll buttons on mouses. Avoid them both when moving through Trench.

William C Cromer Pty Ltd
ABN 48 009 531 613

Before previewing Trench®3.0's site assessment procedures, we will spend time exploring more of its **Help** section. This, and the dozens of **Information** pages, amount to an 'on-line' Manual

Help Menu

Click on any box.

What do I do first?	Some suggestions to help you get started.
Page colours	Four page colours are used for different purposes.
Layout	How the site assessment and supporting pages are arranged.
Buttons	To help you navigate, there is a range of buttons for specific purposes.
Entering data	Input and output boxes, Error Messages and Comment Boxes.
Capabilities	What the application can do, and a simple flowchart for site assessment.

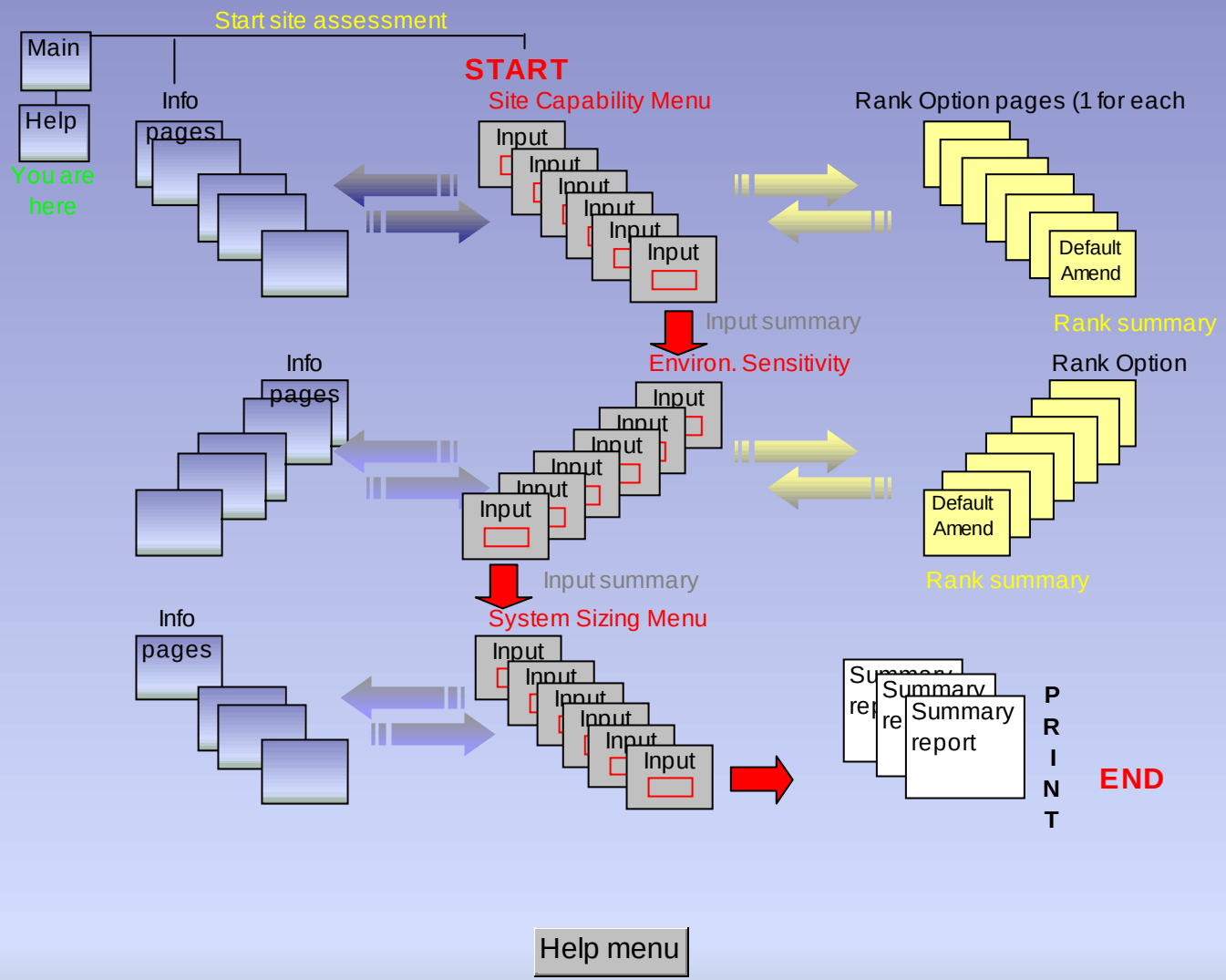
All menus | Main Menu

The **Help menu** has six sections. We have already seen the **What do I do first?** page.

The **Layout** page shows how Trench is structured.

Trench layout

Each of the grey input pages contains a 'road map' indicating your location in the assessment procedure.



Trench has three sets of pages.

- 1. The central, grey set is for **entering data.**
- 2. The blue-green pages at left are the **Information** (or help) pages.
- 3. The yellow pages at right are the **Rank Option** pages.

Return to the **Help menu.**

Help Menu

Click on any box.

What do I do first?	Some suggestions to help you get started.
Page colours	Four page colours are used for different purposes.
Layout	How the site assessment and supporting pages are arranged.
Buttons	To help you navigate, there is a range of buttons for specific purposes.
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Capabilities	What the application can do, and a simple flowchart for site assessment.

All menus | Main Menu

Next, explore the **Buttons** page.

Buttons used in Trench

... menu	Returns you to the menu you are operating in. 'All menus', 'Main menu' and 'Site Assessment menu' are variations on the word 'menu'.
Next	Takes you to the next page or section of the assessment.
Previous	Returns you to the previous page or section of the assessment.
More Back	'More' goes to the next information page; 'Back' goes to the previous information page.
(name)	Blue or small blank buttons allow you to loop back to the named factor to review or change information, and then return to view the effect of the change.
Rank	Goes from a data input on a grey page to its yellow Rank Options page where you assign a confidence level to your data, and inspect or amend the default
Options...	Goes to an Options Page where you may alter some of the default settings used
Info	Clicking **Info** takes you to blue-green shaded pages like this one, where you can view background information, definitions or hints. Click **OK** to return to the grey page you left.
Report	Goes to, and enables you to view or print, the selected report page
Print...	'Print...' produces a 'Print Preview' of the selected report. You must then select 'Print' and 'OK'. Buttons and other objects on such pages will not be printed.

Help menu

Before using Trench, a careful study of these buttons is strongly recommended.

Return to the **Help menu.**

Help Menu

Click on any box.

What do I do first?	Some suggestions to help you get started.
Page colours	Four page colours are used for different purposes.
Layout	How the site assessment and supporting pages are arranged.
Buttons	To help you navigate, there is a range of buttons for specific purposes.
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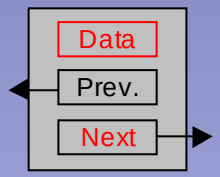
All menus | Main Menu

Now explore the **Page colours** page.

Colour coding of Trench pages



Grey pages are the **Site Assessment** pages, in which you are usually required to enter data. Click Next to go to the next page, or Previous to go back. Clicking any blue button allows you to review another section and return. Clicking **Info** takes you to one or more information pages on a subject, where you click **OK** to return. Clicking Rank allows you to visit and return from a Rank Option page.

Yellow pages are the **Rank Option** pages. There is a separate yellow page for each factor considered in the assessment. On each, enter the confidence level of your data. The current rank (1, 2, 3, 4 or 5) and corresponding site or environmental limitation of a factor are displayed. You have the option of changing each rank and limitation, and of indicating why you did so.

Blue-green shaded pages (like this one) are reserved for starting pages such as the title page and menu pages (except for the Site Assessment Menus, which are grey), and for information pages. There are one or more Info pages for each Info button.

White pages are reserved for the three report pages, which you may choose to print at any time, or at the end of an assessment. Any buttons and other objects on these pages do not print. Report pages are A4 in size, which is larger than your screen. Use the Scroll down or Scroll up buttons to view the whole page.

Help menu

Trench's pages are colour coded for easy reference.

Return to the **Help menu**.

Help Menu

Click on any box.

What do I do first?	Some suggestions to help you get started.
Page colours	Four page colours are used for different purposes.
Layout	How the site assessment and supporting pages are arranged.
Buttons	To help you navigate, there is a range of buttons for specific purposes.
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All menus | Main Menu

Visit the **Entering data** page.

Entering data in Trench

Trench uses orange-coloured boxes for entering data, and black-bordered boxes for data output.

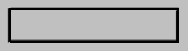
Orange boxes (but no others) require you to enter data. Usually, they are accompanied by messages such as Enter a number, or Type 1, 2, 3, 4 or 5, which are replaced by OK if your entry is acceptable, and you have pressed Enter. No other boxes require inputs. You do not need to enter data in every orange box if you are only doing a part-assessment, but you will be prompted if Trench requires missing inputs. Missing data are also indicated on the report pages.

Many orange boxes have a small red triangle in the upper right hand corner. Each of these boxes contains a **Comment** to help you enter data. Moving the mouse over these boxes shows the comment. All orange boxes will also display an **Error Message** if you attempt to enter mathematically-unacceptable values, or if your entry is outside a reasonable range for the factor in question.

How to show the 'Comments': Select 'Tools' on the Menu bar, then 'Options...', and on the 'View' tab select the 'Comments Indicator Only' option.

How to hide the 'Comments': Select 'Tools' on the Menu bar, then 'Options...', and on the 'View' tab select the 'None' option.

How to modify this worksheet's default 'Comments' setting: First manually show or hide the 'Comments' option (see above) then select the 'Set As Default' button below. Next time you open this worksheet your new default 'Comments' setting will be used.



Black-bordered cells always present the results of a calculation. Some results, however, are shown in un-bordered cells for ease of reading.

Set As Default | Help menu

- Only **grey pages** require data.
- Enter data only in **orange** input boxes.
- Need help? In Trench, placing your cursor over most orange input boxes shows helpful **Comments**. (This feature can be turned off)

Entering data in Trench

Trench uses orange-coloured boxes for entering data, and black-bordered boxes for data output.

Enter a number

Many of the orange input boxes contain a small red triangle and display a help message like this one when you point the cursor over the box. (Note that in the Rank Option pages, the help message is replaced by a Trench 3.0 Input Help box. Click to hide it, or drag it aside). To see an example of a typical Trench Error Message, click to select the box, type any number less than 10, and press Enter.

re you to enter data. Usually, they are
nter a number, or Type 1, 2, 3, 4 or 5, which
eptable, and you have pressed Enter. No
t need to enter data in every orange box if
but you will be prompted if Trench requires
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Black-bordered cells always present the results of a calculation. Some results, however, are shown in un-bordered cells for ease of reading.

Set As Default | Help menu

•The **Comment** box provides useful tips about the data you are about to enter.

•Also, if in Trench you try to enter an invalid number in any orange input box, an **Error Message** (not shown here) results.

Return to the **Help menu**.

Help Menu

Click on any box.

What do I do first?	Some suggestions to help you get started.
Page colours	Four page colours are used for different purposes.
Layout	How the site assessment and supporting pages are arranged.
Buttons	To help you navigate, there is a range of buttons for specific purposes.
Entering data	Input and output boxes, Error Messages and Comment Boxes.
Capabilities	What the application can do, and a simple flowchart for site assessment.

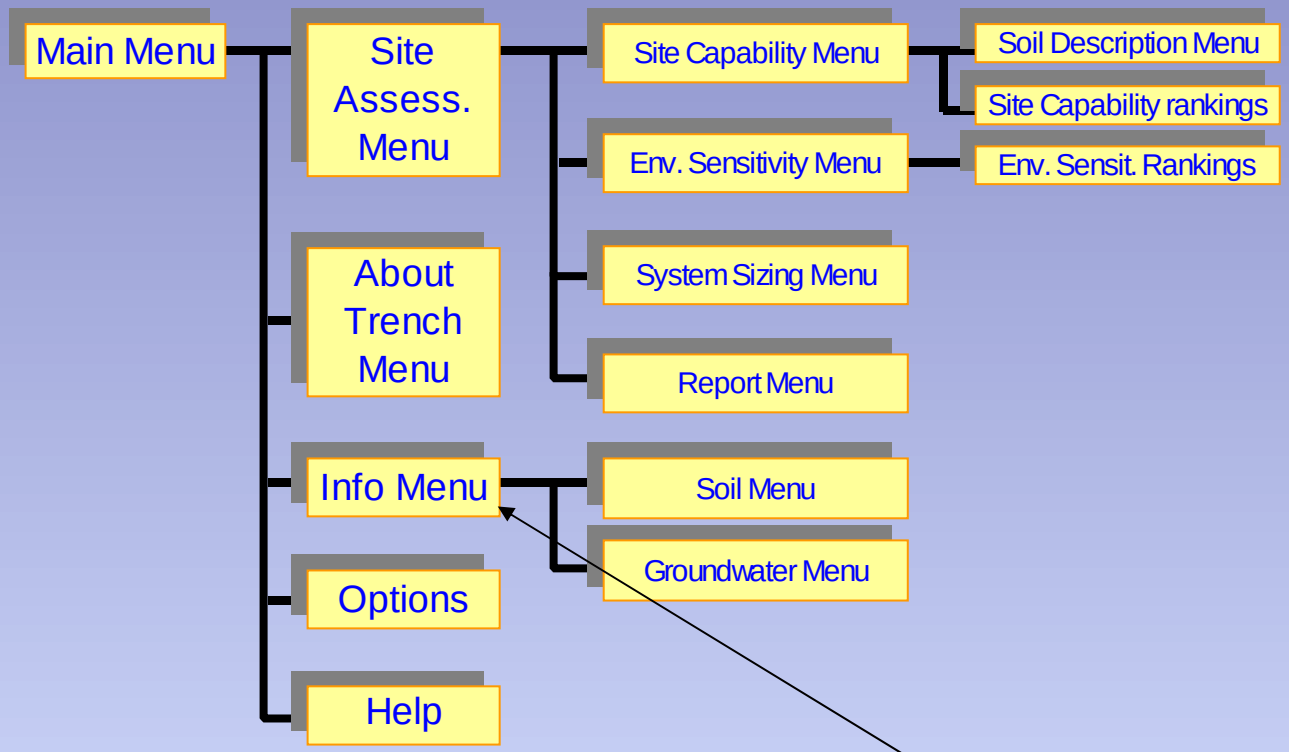
All menus | Main Menu

•We will now leave the Help menu and explore the **All menus** page.

Menus of Trench™

Click on any yellow box to go to that menu.

CAUTION: Do not use the TAB button to move from any page of Trench to the next



Getting started with this

Quit

Title Page

- This is a useful, and therefore frequently-visited, page. In Trench, each one of these menu boxes is active; simply select and click to go to any menu.

- In this preview, we will now visit the **Information Menu**.

Information Menu

Click on any item to visit its information box. Subjects are generally arranged in the order in which they appear in Trench.

What can this application be used for?

Flow chart for site assessment

Expected Design Area

Density of disposal systems in an area

Slope angle | Slope form

Wastewater volume (use one of two methods)

Wastewater volume (suggested daily figures)

Wastewater quality (table of analyses)

SAR (Sodium Adsorption Ratio)

ESP (Exchangeable Sodium Percentage)

SAR, wastewater quality and soil dispersion

SOIL MENU

Scientific notation (expressing results in.).

Rainfall (what monthly figures do I use?)

ET (Evapotranspiration; Forestry Tasmania

GROUNDWATER MENU

Water balance model

Daily water balance model

Landslips (classification of risk of instability)

Wetted area (climatic limitations)

Volume of overflowed wastewater

Wetted area (adjusting for cobbles and

Working with the nutrient models

Using the Rank Option pages

All menus | Main Menu

- Trench contains dozens of Information pages, all of which can be accessed from here, or from within the application. Note the Soil and Groundwater (sub)menus embedded here.
- Go to the **Soil Menu...**

Soil Menu

Click on any item to visit its information box. Subjects are generally arranged in the order in which they appear in Trench.

- Soil profiles and horizons
- Soil texture, plasticity and structure
- Textural names
- Plasticity
- Soil structure
- Soil tests
- Consistency and relative density, and bulk
- USCS soil classification
- Agricultural soil classification
- Soil categories (based on texture)
- Soil dispersion
- Modified Emerson dispersion test
- CEC (Cation Exchange Capacity)
- PAC (Phosphorus Adsorption Capacity)
- Permeability (defined, with diagrams)
- Indicative permeabilities in the sand-silt-clay
- Field permeameter
- Permeability equations for field determination
- LTAR (Long Term Acceptance Rate)

All menus | Main Menu | Information

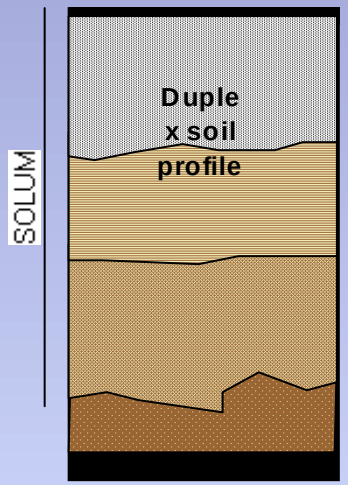
- ...which contains its own set of Information pages.
- To see a typical Information page, we will visit **Soil profiles**.

INFO: Soil profiles and horizons

The sequence of soil materials down to and including weathered parent material is called the regolith. That part of the regolith which exhibits soil properties (materials which can be broken down and remoulded in the hand) is the solum, itself usually comprising a series of layers called a soil profile.

In soils with recognisable layering, key soil horizons in the soil profile are usually designated , from the surface down, by the capital letters A, B and CB. The letter 'A' denotes eluvial horizons (those which have lost constituents by leaching); the letter 'B' denotes illuvial horizons (those which have gained constituents) from the overlying A horizon. 'A' horzons are often pale in colour, and relatively enriched in silica. 'B' horizons are often brightly coloured, and relatively enriched in clay, lime, iron and organic matter.

In addition to describing soil horizons, it is useful to describe the complete soil profile as one of: Uniform ('U'; profiles showing little or no textural change with depth), Gradational ('G'; profiles which become increasingly finer-grained or coarser-grained with depth), Duplex ('D'; profiles with marked textural contrast between the A and B horizons), or Organic ('O'; profiles dominated by organic matter, with the upper 0.3 metres or so containing more than about 20-30% organic matter).



O horizon (often absent)

A horizon (eluviated; often pale in colour, and depleted in iron, lime,

B horizon (illuviated; often strongly-coloured, and enriched in iron,

CB horizon (transition between B horizon and base of solum)

C (weathered parent material; no soil

R (bedrock)

Information | Soil Menu | OK

•Each Information page contains at least two buttons: one takes you back to the Information menu, and the other ('**OK**') always returns you to the part of the application you left.

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By this stage, you should understand:

- **The broad structure of Trench®3.0, and what it is designed to do**
- **how to move around the different menus**
- **that the Help and Information menus amount to an 'on-line' Manual**
- **that different page colours are used for different functions**
- **that data are only entered in orange input boxes**
- **that Trench®3.0 will not allow you to enter invalid data (an Error Message results)**
- **that Comment boxes are attached to most input boxes**
- **why using the Tab button, and scrolling, are discouraged**

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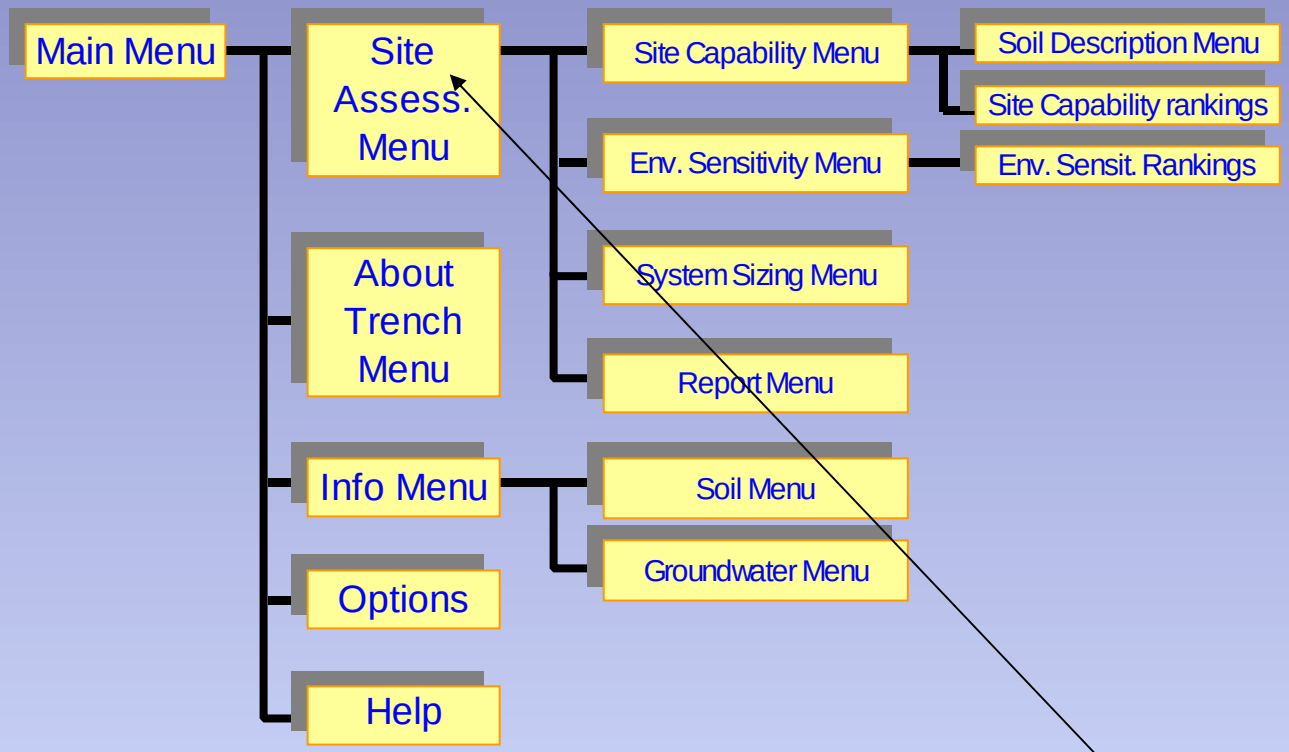
We will leave the Help and Information pages for now, and start touring Trench®3.0's site assessment procedures. These are sequential steps which (if you are doing a full assessment) require data input in orange boxes on grey pages. In Trench®3.0, you can enter this part of the application from the **All menus** or **Main menu** pages.

Menus of Trench™

Click on any yellow box to go to that menu.

CAUTION: Do not use the TAB button to move from any page of Trench to the next



Getting started with this

Quit

Title Page

•From the 'All menus' page, we will go to the **Site Assessment Menu**.

Site Assessment Menu

Click any box, or click Start New Assessment

Part 1. Site Capability

Part 2. Environmental Sensitivity

Part 3. Sizing and designing the system

REPORT MENU

Quit | Main Menu

All menus | Start New Assessment

This is the first page of the Site Assessment procedure. These pages are grey, and (apart from the Menu pages) most of them require data input.

A full site assessment in Trench comprises Parts 1, 2 and 3, as shown here.

In this preview, we will first visit the **Site Capability Menu**…

Site Capability Menu

Administrative/client details

Part 1. Site Capability

Expected Design Area, system density

Slope, drainage, flood potential

Wastewater volume

Wastewater quality, nutrients

SOIL DESCRIPTION MENU

Summary of Site Capability rankings

SITE CAPABILITY REPORT

All menus | Main Menu | Site Assessment Menu

…which opens to show the list of site capability factors requiring assessment. (These influence the physical capability of a site to accept wastewater, and are unrelated to the possible off-site environmental effects of disposal.)

But first, we will visit the **Administration details** page.

Administrative details

If this is a new assessment, use the Save As command now to rename the worksheet.

Trench™ road map

Site Cap. | Env. Sens

- Admin
- Area
- Density
- Slope, etc
- Flood, etc
- W/W vol
- Quality
- Quality
- Soil descrip
- Dispersion
- CEC
- PAC
- Perm text.
- Perm tests
- Perm summary
- LTAR
- Rankings

Env. s / Clima / Crop / Rainf / G'wat / Mode / Mode / Mode / Sep. d / Water / Env. v / Proxi / Lands / Ranki / Site Env.

This office assessment is dated 2/6/XX

Job or office reference No. M-123456

Client	**John Brown**		
Postal address	PO Box 0000, NoTown 9999, NSW		
Telephone	(00) 0123 4567	**Fax**	(00) 0123 4568
Site address	Lot 1, ABC Subdivision, NoTown 9999, NSW		
Job description	EXAMPLE ONLY: Assessment for on-site wastewater disposal		
		Title or credentials of assessor	
Assessed by	A. N. Evaluator		
Organisation	XYZ Consultants Pty. Ltd.		
Date(s) of site visit	23, 24, 25 May XXXX		
Local Govt. Authority	NoTown Shire Council		

Click Next for Part 1 and Expected Design Area

Report Menu | Site Assessment menu | Next

•This is the first data input page in Trench. Your entries here also form headers and titles for Trench's summary reports. On each of these grey pages, a **road map** at right shows its location in the assessment procedure. Clicking **Next** in Trench takes you to Part 1 of the procedure...

Part 1. Site Capability

Part 1 first assesses those factors of a selected site which affect its capability to accept on-site wastewater. A rank (a number between 1 and 5) is automatically generated every time you enter a value for a factor in an orange box. The rank estimates how limiting the value you selected might be for on-site disposal. You can inspect the rank for any factor, and amend the default value if appropriate, by clicking Rank. Environmental issues are considered in Part 2.

Trench™ road map

Site Cap.	Env. Sens.	Sizing
Admin	Env. sens	Sizi
Area	Climate	Wat
Density	Crop fact	Disp
Slope, etc	Rainfall	Tab
Flood, etc	G'water	Tab
W/W vol	Model 1	Tab
Quality	Model 2	Dail
Quality	Model 3	Sum
Soil descrip	Sep. dist.	Area
Dispersion	Water bores	Calc
CEC	Env. values	Tota
PAC	Proximities	Nutr
Perm text.	Landslip	N, P
Perm tests	Rankings	Nutr
Perm summary		Disp
LTAR		Site Capability Re
Rankings		Env. Sensitivity Rep
		Assessment Re

Info **Expected Design Area (available for on-site wastewater disposal)**

The Expected Design Area is defined as the area where a disposal system can reasonably be installed pending further information (in accordance with Australian Standard 1547- 1994).

Expected Design Area = **2,500** square metres

OK

Rank

Calculated Design Area

Click Next for density of disposal systems

Menu | Previous | Next

•Note where we are on the road map. Also, in Trench, the **Info** button takes us to an Information page, the small red triangle in the input box indicates that a helpful **Comment** is attached to it, the red 'OK' beneath the box indicates we have entered valid data, and we can inspect and change the rank and limitation of our 2,500 square metre 'Area' by going to its **Rank** page. In this preview, we will instead skip a few inputs and go to **wastewater quality**, several pages further down the road map...

Wastewater quality and nutrients

Wastewater quality may vary depending on its origin e.g. town water or groundwater supply. Values entered here are used to estimate nutrient loadings, and possible wastewater effects on soil structure and permeability. Enter suitable values in the boxes below.

Trench™ road map

Site Cap. | Env. Sens. | Sizing

- Admin | Env. sens | Sizi
- Area | Climate | Wat
- Density | Crop fact | Disp
- Slope, etc | Rainfall | Tab
- Flood, etc | G'water | Tab
- W/W vol | Model 1 | Tab
- Quality | Model 2 | Dail
- Quality | Model 3 | Sum
- Soil descrip | Sep. dist. | Are
- Dispersion | Water bores | Calc
- CEC | Env. values | Tota
- PAC | Proximities | Nut
- Perm text. | Landslip | N, P
- Perm tests | Rankings | Nut
- Perm summary | | Disp
- LTAR | | Site Capability Re
- Rankings | | Env. Sensitivity Rep
| | Assessment Re

Inf DISSOLVED CONSTITUENTS

Septic tank effluent (blackwater)

	Total N	Total P	Na	Ca	Mg	TDS
Concentration (mg/L)	40	15	120	100	100	450

Nitrogen generated from septic tank effluent = **4.4** **kg/year** Eff. volume

Phosphorus generated from septic tank effluent = **1.6** **kg/year**

Inf SAR of septic tank effluent = **2.9** Rank

Inf ESP (%) of soil due to septic tank effluent = **2.9**

Phosphorus

Click Next for sullage quality

Menu | Previous | Next

•On this page in Trench, you are asked to provide details about wastewater quality. If you needed help, you could click **Info** to see a table of typical analyses, or check the **Comment** which appears automatically when you move the cursor over any box. In this preview, the Comments for all six inputs are shown simultaneously on the next slide...

Wastewater quality and nutrients

Wastewater quality may vary depending on its origin e.g. town water or groundwater supply. Values entered here are used to estimate nutrient loadings, and possible wastewater effects on soil structure and permeability. Enter suitable values in the boxes below.

'Typical' range for sodium in untreated septic tank effluent is about 70 to 300 mg/L.

'Typical' range for calcium+magnesium in untreated septic tank effluent is 200 to 700 mg/L.

Inf DISSOLVED CONSTITUENT

Septic tank effluent (blackwater)

	Total N	Total P	Na	Ca	Mg	TDS
Concentration (mg/L)	40	15	120	100	100	450

Nitrogen generated from septic tank effluent =	**4.4**	**kg/year**
Phosphorus generated from septic tank effluent =	**1.6**	**kg/year**
SAR of septic tank effluent =	**2.9**	
ESP (%) of soil due to septic tank effluent =	**2.9**	

Inf

Inf

Eff. volume

Rank

Phosphorus

'Typical' range for Total N in untreated septic tank effluent is 20 to 80 mg/L, but values up to 120 mg/L may be recorded. Consider a range of 15 to 50 mg/L for AWTS effluent.

'Typical' range for Total P in untreated septic tank effluent is 5 to 30 mg/L. Consider a range of 5 to 15 mg/L for AWTS effluent.

'Typical' range for calcium+magnesium in untreated septic tank effluent is 200 to 700 mg/L.

'Typical' range for Total Dissolved Solids in untreated septic tank effluent is 100 to 500 mg/L.

Trench™ road map

Site Cap.	Env. Sens.	Sizing
Admin	Env. sens	Sizi
Area	Climate	Wat
Density	Crop fact	Disp
Slope, etc	Rainfall	Tab
Flood, etc	G'water	Tab
W/W vol	Model 1	Tab
Quality	Model 2	Dail
Quality	Model 3	Sum
Soil descrip	Sep. dist.	Are
Dispersion	Water bores	Calc
CEC	Env. values	Tota
PAC	Proximities	Nut
Perm text.	Landslip	N, P
Perm tests	Rankings	Nut
Perm summary		Disp
LTAR		Site Capability Re
Rankings		Env. Sensitivity Rep
		Assessment Re

Click Next for sullage quality

Menu | Previous | Next

•Remember, in Trench, only one **Comment** box is visible at any time. Also, the arrows shown here are for this preview only.

Wastewater quality and nutrients

Wastewater quality may vary depending on its origin e.g. town water or groundwater supply. Values entered here are used to estimate nutrient loadings, and possible wastewater effects on soil structure and permeability. Enter suitable values in the boxes below.

Trench™ road map

Site Cap. | Env. Sens. | Sizing

- Admin | Env. sens | Sizi
- Area | Climate | Wat
- Density | Crop fact | Disp
- Slope, etc | Rainfall | Tab
- Flood, etc | G'water | Tab
- W/W vol | Model 1 | Tab
- Quality | Model 2 | Dail
- Quality | Model 3 | Sum
- Soil descrip | Sep. dist. | Are
- Dispersion | Water bores | Calc
- CEC | Env. values | Tota
- PAC | Proximities | Nut
- Perm text. | Landslip | N, P
- Perm tests | Rankings | Nut
- Perm summary | | Disp
- LTAR | | Site Capability Re
- Rankings | | Env. Sensitivity Rep
| | Assessment Re

Inf DISSOLVED CONSTITUENTS

Septic tank effluent (blackwater)

	Total N	Total P	Na	Ca	Mg	TDS
Concentration (mg/L)	40	15	120	100	100	450

Nitrogen generated from septic tank effluent = **4.4** **kg/year** Eff. volume

Phosphorus generated from septic tank effluent = **1.6** **kg/year**

Inf SAR of septic tank effluent = **2.9** Rank

Inf ESP (%) of soil due to septic tank effluent = **2.9**

Phosphorus

Click Next for sullage quality

Menu | Previous | Next

•On this same page, Trench has calculated basic chemical ratios from your inputs - nutrients loads, sodium adsorption ratio (SAR) and Exchangeable Sodium Percentage (ESP). You could then check the SAR **Rank** page (which we will do now), or alternatively you could proceed to enter all inputs first, and then check all Rank pages as a group.

RANK OPTIONS - SAR OF SEPTIC TANK EFFLUENT

This section allows you to accept or amend the default rank for this factor.

Current value = 2.9 (rounded) Confidence level OK 3

Rank	1 (best)	2	3	4	5 (worst)
Value or range	<1	1-<2	2-<3	3-<5	>=5
Default limitation	Very low	Low	Moderate	High	Very high

Accept or amend the default rank for this factor.

	Default	Amended
Rank for this factor =	3	2
Limitation for this factor =	Moderate	Low

The default and amended rank and limitation will appear on the assessment report.

Complete the box below to further describe the limitation of this factor, specific to the site. Your choice is reported.

2 OK

1 = Rank not applicable. This factor has no bearing on wastewater disposal at this site, and is not an issue.
2 = The default rank has been reduced because other factors lessen the effect of this factor.
3 = The default rank has not been amended because it is neither reduced nor increased by other factors.
4. The default rank has been increased because other factors increase the effect of this factor.

Info | Site Cap. rankings | Septic effluent SAR | Previous | Next

In this example, the SAR of 2.9 is a rough estimate (Confidence level of 3, where 1 is best and 4 worst). It gets a default rank of 3, and a Moderate limitation, but the assessor has relaxed the rank and limitation because 'other factors lessen the effect…' For example, the soils might be clay-free, so that wastewater SAR is not an issue. The assessor's report would justify the relaxation.

A very powerful and flexible feature of Trench is its ranking and limitation pages for assessing the suitability of a site for on-site wastewater management.

There is a yellow **Rank Options** page for every Site Factor. Each page records and reports:

- whether or not you have assessed the factor,

- the confidence level you have assigned to your data, and

- whether or not you have accepted Trench's default rank and limitation (ie suitability) for the factor, and if not, why you changed them.

These pages are therefore critical for a full and defensible assessment.

From each of these pages, you can also visit (and return from) a summary page which lists ranks and limitations for all factors, or find out more about the ranking system and its implications by clicking **Info**.

In this preview, we will now return to **wastewater quality**…

Wastewater quality and nutrients

Wastewater quality may vary depending on its origin e.g. town water or groundwater supply. Values entered here are used to estimate nutrient loadings, and possible wastewater effects on soil structure and permeability. Enter suitable values in the boxes below.

Trench™ road map

Site Cap. | Env. Sens. | Sizing

- Admin | Env. sens | Sizi
- Area | Climate | Wat
- Density | Crop fact | Disp
- Slope, etc | Rainfall | Tab
- Flood, etc | G'water | Tab
- W/W vol | Model 1 | Tab
- Quality | Model 2 | Dail
- Quality | Model 3 | Sum
- Soil descrip | Sep. dist. | Are
- Dispersion | Water bores | Calc
- CEC | Env. values | Tota
- PAC | Proximities | Nut
- Perm text. | Landslip | N, P
- Perm tests | Rankings | Nut
- Perm summary | | Disp
- LTAR | | Site Capability Re
- Rankings | | Env. Sensitivity Rep
| | Assessment Re

Inf DISSOLVED CONSTITUENTS

Septic tank effluent (blackwater)

	Total N	Total P	Na	Ca	Mg	TDS
Concentration (mg/L)	40	15	120	100	100	450

Nitrogen generated from septic tank effluent = **4.4** **kg/year**

Phosphorus generated from septic tank effluent = **1.6** **kg/year**

Inf SAR of septic tank effluent = **2.9**

Inf ESP (%) of soil due to septic tank effluent = **2.9**

Eff. volume

Rank

Phosphorus

Click Next for sullage quality

Menu | Previous | Next

•...and skip several grey pages to go to **Permeability** input...

Info SOIL PERMEABILITY

Because of the natural variability of soil properties, soil permeability may vary over a disposal area. Field-identified soil texture is a useful guide to permeability in poorly-graded, structureless sandy soils, but not in structured finer-grained soils. This is because the effect of structure on permeability is very difficult to estimate visually, and moreover, some structural features (e.g. micropores; hairline fractures, etc) which can significantly affect permeability may not be detectable in a visual assessment.

Permeability estimated from soil texture and structure

Estimate permeability from soil texture using the textural guide below. Adjust for structure.

Indicative permeability (m/day)

	<.0001	0.001	0.005	0.01	0.05	0.1	1	5	50	100	500	1000
Soil texture	CLAYS				SILTS		SANDS			GRAVELS		
	SAND-SILT-CLAY ('LOAM')						Fine	Med.	Coarse	Fine	Med.	Coarse
	FRACTURED CLAYS											

Soil texture previously entered for effluent disposal = Sandy SILT with a trace of clay

Perm. range est. from soil texture and structure = [ ] to [ ] m/day

(Based on previously entered soil texture, the indicative permeability is 0.5 to 1.5 m/day)

Trench™ road map

Site Cap.	Env. Sens.	Sizing
Admin	Env. sens	Sizi
Area	Climate	Wat
Density	Crop fact	Disp
Slope, etc	Rainfall	Tab
Flood, etc	G'water	Tab
W/W vol	Model 1	Tab
Quality	Model 2	Dail
Quality	Model 3	Sum
Soil descrip	Sep. dist.	Are
Dispersion	Water bores	Calc
CEC	Env. values	Tota
PAC	Proximities	Nut
Perm text.	Landslip	N, P
Perm tests	Rankings	Nut
Perm summary		Disp
LTAR		
Rankings		

Site Capability Re
Env. Sensitivity Rep
Assessment Re

Soil texture

Click Next for field permeability measurement

Menu | Previous | Next

•Again, note where we are on the road map. Soil permeability is an important input. Trench allows you to estimate it from soil texture, or from a field permeameter test. The (optional) input boxes on this page require a permeability range, and in the comment in red under the input boxes Trench hints at suitable values based on your previously-entered soil textural category.

Info Permeability estimated from field measurement

Use the table to calculate permeability from field records.

Test hole configuration

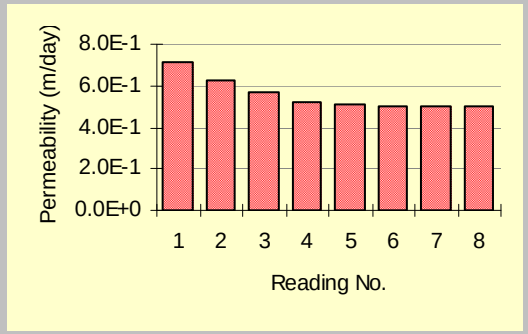
Depth (m) to base of test hole =	0.7	OK
Depth (m) below base of hole to impermeable layer =	0.2	OK
Hole diameter (mm) =	120	OK
Depth (m) of test water in hole =	0.3	OK
Estimated or measured SAR of test water =	5	OK
Estimated or measured TDS (mg/L) of test water =	400	OK

Info

FIELD RESULTS

No.	Water (L) infiltrated	Time (min) to infiltrate	Infilt. rate (L/min)	Perm. (m/day)
1	0.25	2	1.3E-01	**7.1E-1**
2	0.22	2	1.1E-01	**6.2E-1**
3	0.4	4	1.0E-01	**5.7E-1**
4	0.37	4	9.3E-02	**5.2E-1**
5	0.36	4	9.0E-02	**5.1E-1**
6	0.35	4	8.8E-02	**5.0E-1**
7	0.35	4	8.8E-02	**5.0E-1**
8	0.35	4	8.8E-02	**5.0E-1**

Adopt a steady state ('saturated') permeability.



Trench™ road map

Site Cap.
- Admin
- Area
- Density
- Slope, etc
- Flood, etc
- W/W vol
- Quality
- Quality
- Soil descrip
- Dispersion
- CEC
- PAC
- Perm text.
- Perm tests
- Perm summary
- LTAR
- Rankings

Env. Sens.
- Env. sens
- Climate
- Crop fact
- Rainfall
- G'water
- Model 1
- Model 2
- Model 3
- Sep. dist.
- Water bores
- Env. values
- Proximities
- Landslip
- Rankings

Sizing
- Sizi
- Wat
- Disp
- Tab
- Tab
- Tab
- Dail
- Sum
- Area
- Calc
- Tota
- Nutr
- N, P
- Nutr
- Disp

Site Capability Re
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Assessment Re

Click Next for permeability summary

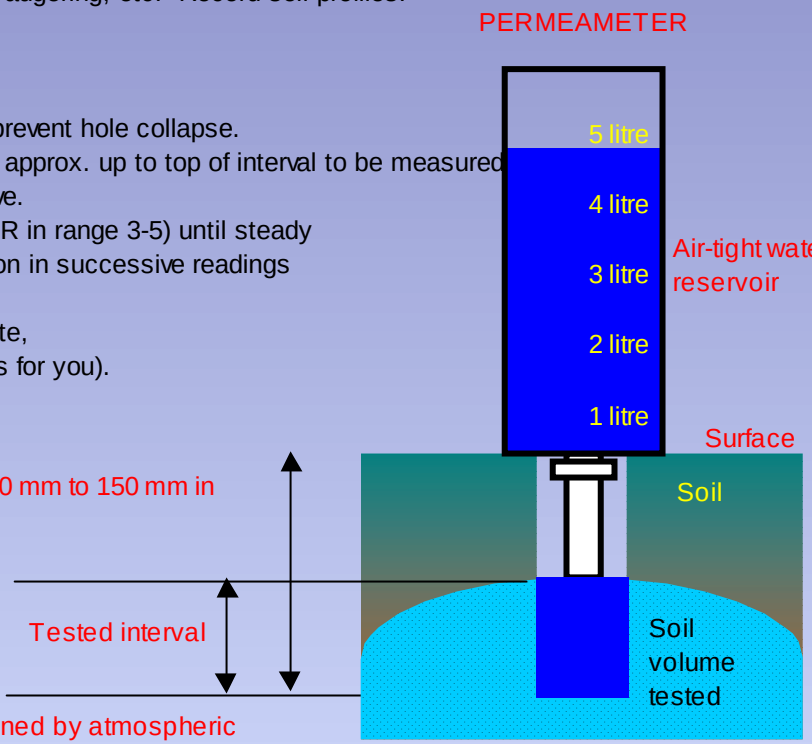
Menu | Previous | Next

This page allows you to input field data from one or a succession of permeameter tests. Trench calculates and graphs permeability for you. If you needed help or more information, you could click the **Info** button to take you to several Information pages which define and discuss permeability, and (as we will now see) explain how to use a constant head permeameter...

INFO: Field Permeameter (Constant head; falling head tests not recommended)

The constant head field permeameter, in its simplest form shown here, is an easy-to-use device which provides more than sufficient accuracy for water balance calculations. Basic steps for measuring permeability are, in order,

1. Establish the soil profile by test pitting, augering, etc. Record soil profiles.
2. Determine soil interval to be tested.
3. Auger a test hole to the required depth.
4. Scour the sides if clayey or smeared.
5. Insert a slotted screen if necessary to prevent hole collapse.
6. Place water (SAR in range 3-5) in hole, approx. up to top of interval to be measured.
7. Place permeameter over hole, open valve.
8. Measure rate of inflow of test water (SAR in range 3-5) until steady flow rate is achieved. Up to10% variation in successive readings is acceptable. Record readings.
9. From geometry of test hole, and flow rate, calculate permeability (Trench does this for you).



Permeabilities | Information | Soil Menu | Back

This is one of several Information pages dealing with permeability.

Return to the next of the **permeability** assessment pages...

Summary of field permeability tests in proposed disposal area

Permeability (m/day at steady flow from different locations on site)

Location 1	0.5	OK
Location 2	1.2	
Location 3	0.25	
Location 4	0.7	
Location 5	0.4	

Significant figures shown may be superfluous.

Geometric mean of field test results = 0.5305 m/day

(in scientific notation = 5.3E-01 m/day)

Choosing a soil permeability

From the results of field testing, or from observations of soil texture and structure, adopt a permeability which appropriately describes the site conditions. The permeability you adopt here will be used to calculate Long Term Acceptance Rate. (Tip: a permeability of zero can be used to simulate a lined facility eg evapotranspiration bed or treatment lagoon.)

Adopted permeability of soil **0.4** **m/day**

OK. Equivalent to 400 mm/day

or 2E+01 mm/hour

For adopted permeability, enter a rank between 1 and 5 as follows:
1 (between 0.1 and 0.25 m/day), 2 (between 0.05 and 0.1 m/day, or between 0.25 and 0.5 m/day), 3 (between 0.01 and 0.05 m/day, or between 0.5 and 1 m/day), 4 (between 0.001 and 0.01 m/day, or between 1 and 2 m/day), or 5 (less than 0.005 m/day or more

2 OK

Trench™ road map

Site Cap.	Env. Sens.	Sizing
Admin	Env. sens	Sizi
Area	Climate	Wat
Density	Crop fact	Disp
Slope, etc	Rainfall	Tab
Flood, etc	G'water	Tab
W/W vol	Model 1	Tab
Quality	Model 2	Dail
Quality	Model 3	Sum
Soil descrip	Sep. dist.	Are
Dispersion	Water bores	Cal
CEC	Env. values	Tota
PAC	Proximities	Nut
Perm text.	Landslip	N, P
Perm tests	Rankings	Nut
Perm summary		Disp
LTAR		Site Capability Re
Rankings		Env. Sensitivity Rep
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Disposal | Groundwat | Nutrients | LTAR | Rank

Click Next for Long Term Acceptance Rate

Menu | Previous | Next

This page summarises field permeability results (if any), calculates the geometric mean of two or more results, and prompts you for an adopted permeability which reasonably represents the soil being assessed. It also asks you for a rank based on your adopted permeability.

Long Term Acceptance Rate (LTAR) of soil for disposal

LTAR is obtained by adjusting soil permeability to help account for the clogging layer which develops in absorption trenches and beds.

CAUTION: The relationship between permeability and LTAR is not well established for permeabilities less than about 0.05 m/day and more than about 0.5 m/day.

Calculated LTAR (L/sq. m/day) = **20**

This LTAR will be used if box below is blank

Info

Adopted LTAR (L/sq. m/day) = **20** OK **= mm/month** **620** **= mm/year** **7,440**

For adopted LTAR, enter a rank between 1 and 5 as follows:

1 (between 12 and 17 L/sq m/day), 2 (between 10 and 12 L/sq m/day, or between 17 and 23 L/sq m/day), 3 (between 5 and 10 L/sq m/day, or between 23 and 28 L/sq m/day), 4 (between 2 and 5 L/sq m/day, or between 28 and 36 L/sq m/day), or 5 (less than 2 L/sq m/day or more than 36 L/sq m/day)

2 OK

Rank

Trench™ road map

Site Cap.	Env. Sens.	Sizing
Admin	Env. sens	Sizi
Area	Climate	Wat
Density	Crop fact	Disp
Slope, etc	Rainfall	Tab
Flood, etc	G'water	Tab
W/W vol	Model 1	Tab
Quality	Model 2	Dail
Quality	Model 3	Sum
Soil descrip	Sep. dist.	Are
Dispersion	Water bores	Calc
CEC	Env. values	Tota
PAC	Proximities	Nut
Perm text.	Landslip	N, P
Perm tests	Rankings	Nut
Perm summary		Disp
LTAR		Site Capability Re
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Disposal

Click Next for Summary of rankings for Sitre Capability factors

Menu | Previous | Next

Your adopted permeability is converted to a Long Term Acceptance Rate (LTAR). If you wish, you may repeat or amend this value in the Adopted LTAR input box. Then enter a rank for LTAR.

In this preview, we will now inspect an important page in Trench which summarises your ranks and limitations for all assessed factors in Part 1...

Summary of Ranks for Site Capability Factors

Info

Click on any factor below to see or amend its rank

	Trench defaults						Amended to					
	Rank					Site	Rank					Site	Revie
	1	2	3	4	5	Limitation	1	2	3	4	5	Limitation	w
Expected Design Area	X					Very low						No change	
Disposal system	X	X	X	X		High						No change	
Slope angle	X	X				Low						No change	
Slope form	X	X				Low						No change	
Surface drainage	X					Very low						No change	
Flood potential	X					Very low						No change	
Heavy rain events	X	X	X			Moderate						No change	
Aspect	X	X				Low						No change	
Frequency of strong	X					Very low						No change	
Wastewater volume	X	X	X	X		High	X	X	X			Moderate	
Septic effluent SAR	X	X	X			Moderate	X	X				Low	
Sullage SAR	X	X	X	X		High	X	X	X			Moderate	
Thickness of soil	X	X				Low						No change	

Click 'More ranks' to see more Site Capability Factors

In Trench, you can check your original inputs by clicking on the Review buttons on the right hand side, or review and amend the Rank Option pages by clicking on the boxes on the left hand side. This page in Trench completes the Part 1 Site Capability assessment.

Trench™ road map

Site Cap.	Env. S
Admin	En
Area	Cl
Density	Cr
Slope, etc	Ra
Flood, etc	GW
W/W vol	M
Quality	M
Quality	M
Soil descrip	Se
Dispersion	W
CEC	En
PAC	Pr
Perm text.	La
Perm tests	Ra
Perm summary	
LTAR	
Rankings	

Cap. Report | Env. Sens. rankings | More ranks

Click Next for Part 2. Environmental Sensitivity

All menus | Menu | Previous | Next

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By this stage, you should understand:

- **how to input data in Part 1 of Trench®3.0 (the Site Capability assessment)**
- **how to go to and return from Trench®3.0's Information pages**
- **how to inspect and amend the default rank and limitation for an assessed factor, and**
- **the Rank Summary Page (which you can print) and how to use it (if necessary) to amend any or all of your original inputs and ranks**

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- We will now move to Part 2 of Trench®3.0's assessment procedure - the **Environmental Sensitivity** section which assesses those factors at and near a site which have the potential to contribute to off-site environmental impacts from a wastewater disposal system.

- In Trench®3.0, you can enter this part of the application directly from the end of Part 1, or you can use any one of the menus e.g. **All menus**, **Main menu**, **Site assessment menu**, etc..

Part 2. Environmental Sensitivity

Trench™ road map

Site Cap.	Env. Sens.	Sizing
Admin	Env. sens	Sizi
Area	Climate	Wat
Density	Crop fact	Disp
Slope, etc	Rainfall	Tab
Flood, etc	G'water	Tab
W/W vol	Model 1	Tab
Quality	Model 2	Dail
Quality	Model 3	Sum
Soil descrip	Sep. dist.	Area
Dispersion	Water bores	Calc
CEC	Env. values	Tota
PAC	Proximities	Nut
Perm text.	Landslip	N, P
Perm tests	Rankings	Nut
Perm summary		Disp
LTAR		Site Capability Re
Rankings		Env. Sensitivity Rep
		Assessment Re

Whereas Site Capability describes the capacity of a selected disposal area to physically accept and treat wastewater, Environmental Sensitivity is concerned with those features on and near the same disposal area which might lead to environmental harm or nuisance, or adverse human health effects. Such effects mainly arise through odour or surface overflow of effluent, or subsurface seepage leading to contamination of groundwater or surface waters.

The principal aims of this Section are to:

(a) assess the climatic regime of the disposal area as a prelude to water balance considerations in Part 3,

(b) assign environmental sensitivity values to groundwater and surface waters near the disposal site, and

(c) estimate appropriate separation distances ('setbacks') between a disposal area and sensitive (usually downslope) features such as surface water bodies, road cuttings, embankments, land in other ownership, and domestic water bores.

Click Next for Climate

Menu | Previous | Next

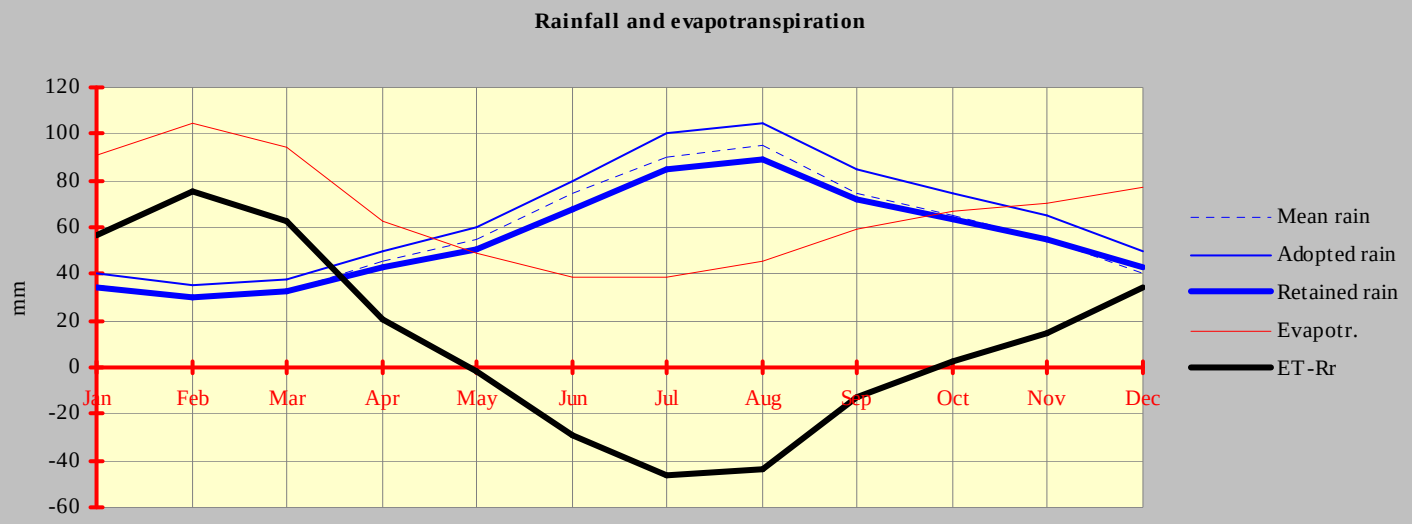
Environmental Sensitivity deals with climate, groundwater, etc. Note where we are on the **road map**. In this preview we will look at climatic inputs (which are needed for water balance calculations in Part 3 of Trench)...

Table 2. Monthly rainfall excess or deficit (enter mean rainfall, adopted rainfall, and temperature)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Mean rainfall (mm)	35	30	33	45	55	75	90	95	75	65	55	40	693
Adopted rainfall (R, mm)	40	35	38	50	60	80	100	105	85	75	65	50	783
Retained rain (Rr, mm)	34	30	32	43	51	68	85	89	72	64	55	43	666
Max. daily temp. (deg. C)													
Evapotrans (ET, mm)	91	105	95	63	49	39	39	46	60	67	70	77	798
ET-Rr (mm)	**57**	**75**	**62**	**21**	**-2**	**-30**	**-47**	**-44**	**-13**	**3**	**15**	**35**	
											Annual ET-Rr (mm)		**132**

This climatic model results in an annual rainfall deficit (ie annual ET - Rr > 0)

Rank



Trench™ road map

Site Cap.	Env. Sens.	Sizing
Admin	Env. sens	Sizi
Area	Climate	Wat
Density	Crop fact	Disp
Slope, etc	Rainfall	Tab
Flood, etc	G'water	Tab
W/W vol	Model 1	Tab
Quality	Model 2	Dail
Quality	Model 3	Area Sum
Soil descrip	Sep. dist.	Area
Dispersion	Water bores	Calc
CEC	Env. values	Tota
PAC	Proximities	Nut
Perm text.	Landslip	N, P
Perm tests	Rankings	Nut
Perm summary		Disp
LTAR		
Rankings		

Site Capability Re
Env. Sensitivity Rep
Assessment Re

Disposal rate | Groundwater | Slope of

Click Next for Groundwater issues

Menu | Previous | Next

In Trench, enter Mean monthly rainfall, and an Adopted rainfall (which may differ from the mean rainfall). Trench then calculates a Retained rain based on the slope angle of the site. It also calculates Evapotranspiration (from either your crop factor, or from mean maximum daily temperature), and a monthly rainfall deficit or excess. All these data are graphed, as shown.

Groundwater models and separation distances

This Section addresses human health issues potentially arising from subsurface seepage from trenches, beds and surface irrigation areas.

The aim is to estimate separation distances between a disposal site and downgradient sensitive features, using accepted scientific principles rather than applying ad-hoc separation distances which lack a scientific basis and which take no account of wastewater quality or site-specific factors.

The separation distances are estimated in Trench using a combination of (a) die-off times for water-borne viruses, and (b) groundwater flow velocities. Click **Info** for step-by-step help and other details.

Info **Groundwater models.** Four simple subsurface models are considered:

Model 1. Two-layered soil with 'impermeable' subsoil; no water table

Model 2. Uniform soil with water table

Model 3. Two-layered soil; water table in lower, more permeable layer

Model 4. Water bores in uniform soils

Click on Model 1, 2 or 3 which best approximates subsurface conditions beneath and downslope from the proposed disposal area, enter data, click Record, and go to Model 4.

Click Next for Model 1 | Next Section | Menu | Previous | Next

Trench also contains four groundwater models which are combined with the viral die-off method to estimate setback (separation) distances. If you needed help, you could click on the **Info** button to see more details on each model. We will visit Information pages for Models 1 and 4 now, and then look at Model 1's data input page...

Trench™ road map

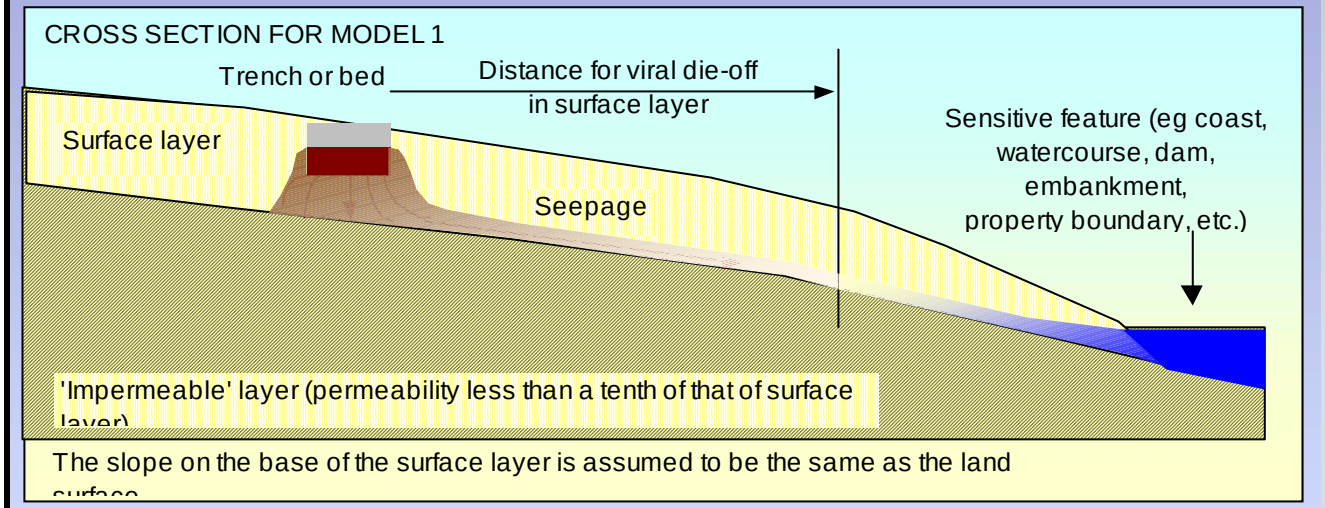
Site Cap.	Env. Sens.	Si
Admin	Env. sens	
Area	Climate	
Density	Crop fact	
Slope, etc	Rainfall	
Flood, etc	G'water	
W/W vol	Model 1	
Quality	Model 2	
Quality	Model 3	
Soil descrip	Sep. dist.	
Dispersion	Water bores	
CEC	Env. values	
PAC	Proximities	
Perm text.	Landslip	
Perm tests	Rankings	
Perm summary		
LTAR		Site Capabil
Rankings		Env. Sensitiv
		Assessm

INFO: Groundwater Model 1

This model applies to most duplex (ie two-layered) soils where, for example, sand, silt or 'loam' topsoils overlie clay-enriched subsoil. Apply it also to uniform soil overlying 'impermeable' bedrock.

Wastewater infiltrates vertically below the trench, bed or irrigation area to, and then along the base of, the more permeable surface layer. As it does so, it generally undergoes a reduction in viral and bacterial numbers (shown as shaded brown in the diagram), as well as changes in other constituents.

The separation distance you adopt is an estimate based on your inputs. It is designed to protect human health values, but it may not protect environmental values.



Information | Groundwater Menu | OK

Each of the four groundwater models is presented as a cross-section like Model 1 shown here.

The data input page for this model, used to estimate a setback distance for a disposal site, looks like this...

Info MODEL 1. TWO-LAYERED SOIL WITH 'IMPERMEABLE' SUBSOIL; NO WATER TABLE

Click the Info button to see a cross section of Model 1. From there, you can also visit the Groundwater Menu to see Models 2, 3 and 4, and information on viral die-off and other subjects.

Review

No. of acceptable inputs = 5 out of 5

Surface slope (degrees)	7	OK
Surface layer permeability (m/day)	0.4	OK
Effective porosity of surface layer (%)	20	OK
Min. wastewater temp. (deg. C)	13	OK
Level of viral reduction required	7	OK
Approx. viral die-off period (days)	72	
W'water travel distance in die-off period =	18	metres
Adopted minimum separation distance =	**35**	**metres**

Record

If this model best suits site conditions, click Record to enter your adopted separation value

In this example, Trench has calculated a viral die-off period of 72 days, and a wastewater travel distance of 18 metres during that time. You can then elect to enter the same or a different adopted separation distance - in this case, 35 metres has been entered as a conservative measure. In this preview, we will now visit one of the five Information pages which deals with the viral die-off method....

Click Next for Model 2

Groundwater

Menu Previous Next

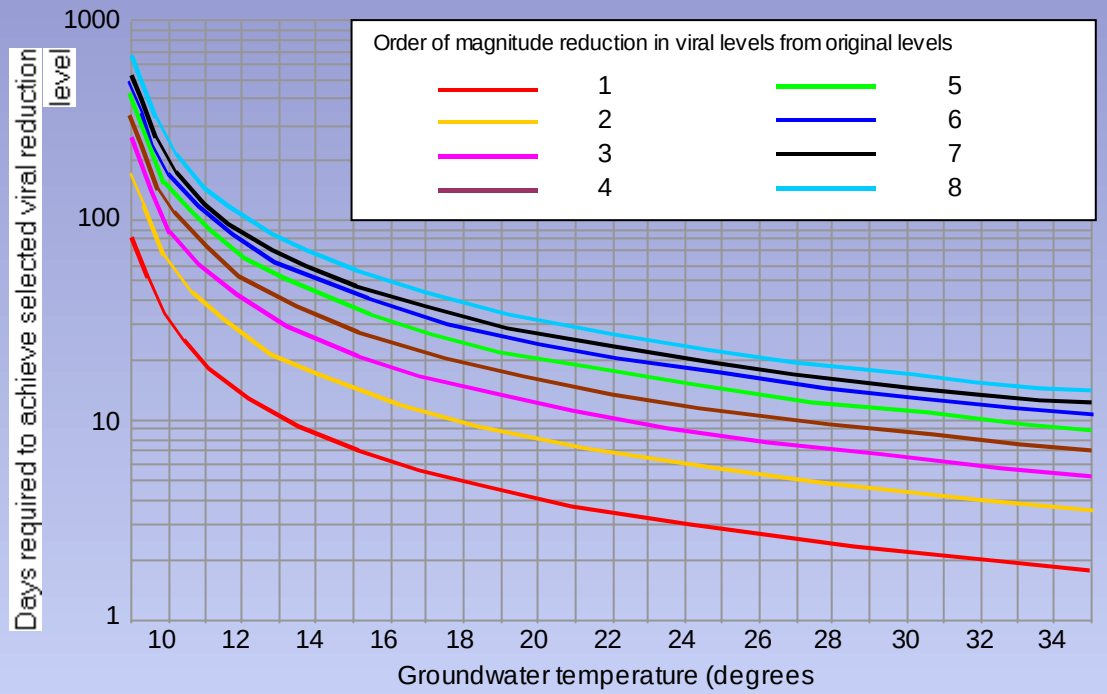
Trench™ road map

Site Cap.
- Admin
- Area
- Density
- Slope, etc
- Flood, etc
- W/W vol
- Quality
- Quality
- Soil descrip
- Dispersion
- CEC
- PAC
- Perm text.
- Perm tests
- Perm summary
- LTAR
- Rankings

Env. Sens.
- Env. se
- Climate
- Crop fa
- Rainfall
- G'water
- Model 1
- Model 2
- Model 3
- Sep. dis
- Water b
- Env. va
- Proximi
- Landsli
- Ranking

Site C
Env. S
A

INFO: Chart to determine die-off times for different groundwater temperatures and order of magnitude reduction of viruses. Note that below 9 degrees, viral survival times rapidly increase.



Back

Trench has manipulated previously-published data to enhance the viral die-off method. This graph answers the question in relation to saturated groundwater flow: how many days (at any given temperature) are required to reduce viral levels by a specified amount?

In this preview, we will now skip the remaining sections of Part 2, and look at the Environmental Sensitivity **report** which summarises (for printing) all our inputs...

XYZ Consultants Pty. Ltd.

Land suitability and system sizing for on-site wastewater management

Trench 3.0 (Australian Institute of Environmental Health)

Environmental Sensitivity Report

EXAMPLE ONLY: Assessment for on-site wastewater disposal

Assessment for	John Brown	Assess. Date	2/6/XX
	PO Box 0000, NoTown 9999, NSW	Ref. No.	M-123456
Assessed site(s)	Lot 1, ABC Subdivision, NoTown 9999, NSW	Site(s) inspected	23, 24, 25 May XXXX
Local authority	NoTown Shire Council	Assessed by	A. N. Evaluator

This report summarises data relating to the environmental sensitivity of the assessed site(s) in relation to applied wastewater. Physical capability and system design issues are reported separately. The 'Alert' column flags factors with high (A) or very high (AA) limitations which probably require special consideration in site acceptability or for system design(s). Blank spaces indicate data have not been entered into TRENCH.

Alert	Factor	Units	Value	Confid level	Limitation Trench	Limitation Amended	Remarks
A	Cation exchange capacity	mmol/100g	20	Mod.	Very high	High	Other factors lessen impact
A	Phos. adsorp. capacity	kg/cub m	0.3	Mod.	High		
	Annual rainfall excess	mm	-132	High	Very low		
	Min. depth to water table	m	2.5	High	Very low		
	Annual nutrient load	kg	15.9	Guess	High	Moderate	Other factors lessen impact
	G'water environ. value	Agric sensit/dom irrig		High	Moderate		
A	Min. separation dist. required	m	35	High	High		
	Risk to adjacent bores		Low	Mod.	Low		
AA	Surf. water env. value	Pristine/drink/aquacult		High	Very high		
AA	Dist. to nearest surface water	m	50	High	Very high		
	Dist. to nearest other feature	m	30	High	Moderate		
	Risk of slope instability		Very low	High	Very low		
	Distance to landslip	m	1000	High	Very low		

To enter comments, click on the line below 'Comments'. (This yellow-shaded box and the buttons on this page will not be printed.)

Comments (Example only)

The very high and high limitations for CEC and PAC respectively indicate a potential impact on groundwater and surface waters, especially in view of the sensitive environmental value assigned to surface water (which is close to the proposed disposal area (50 metres; very high limitation). Possible design modifications include nutrient reduction at source, or trench backfill of suitable loam to increase CEC and PAC, or both. Downgradient groundwater monitoring, and surface water monitoring, is also indicated (particularly since the Site Capability Report shows an 'alert' for the density of disposal systems

This is one of three, one-page reports in Trench which are automatically generated from your data entries.

In this preview, we will now move to Part 3 - Sizing the disposal system...

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By this stage, you should have a better understanding of:

- how to input data in Trench®3.0, including the use of the viral die-off method to estimate setback distances
- important inputs of the Environmental Sensitivity assessment,
- how to go to and return from Trench®3.0's Information pages, and
- how the application presents data in summary reports

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- We will now move to Part 3 of Trench®3.0's assessment procedure - the **System sizing** section which uses water balance and nutrient balance approaches to estimate optimum dimensions for absorption trenches and beds, and reuse and surface irrigation areas

- In Trench®3.0, you can enter this part of the application directly from the end of Part 2, or you can use any one of the menus e.g. **All menus**, **Main menu**, **Site assessment menu**, etc..

Part 3. Sizing & designing the system

Part 3 of Trench allows you to size a wastewater disposal system or area by using water balance and nutrient balance approaches, in general accordance with the current Australian guidelines and codes of practice.

The water balance method is based on monthly climatic data, but you may also choose to investigate the behaviour of a disposal system on a daily basis. The monthly balance may be used to size any disposal system (absorption trenches, evapotranspiration beds, lagoons, surface irrigation areas, etc.) because in each case, the simple hydrological principles are identical, and only the values for various inputs change. (For example, a surface irrigation area is simply a shallow, wide absorption trench, and you may choose whether or not its base is 'impermeable'.) The daily water balance can be used to refine the dimensions of a system to better cope with short-term rainfall events.

One of Trench's most useful water balance features is its graph of monthly wastewater depths in the disposal system. You are encouraged to alter inputs until you achieve the optimum system configuration for the site.

The nutrient balance approach uses simple models which track the fate of nitrogen and phosphorus through vegetation uptake, soil adsorption and attenuation in groundwater. You have complete flexibility in controlling these processes and can thus model any desired disposal system. Click Next for Water balance, or go directly to Nutrient balance.

Trench™ road map

Site Cap.	Env. Sens.	Si
Admin	Env. sens	
Area	Climate	
Density	Crop fact	
Slope, etc	Rainfall	
Flood, etc	G'water	
W/W vol	Model 1	
Quality	Model 2	
Quality	Model 3	
Soil descrip	Sep. dist.	
Dispersion	Water bores	
CEC	Env. values	
PAC	Proximities	
Perm text.	Landslip	
Perm tests	Rankings	
Perm summary		
LTAR		Site Capabil
Rankings		Env. Sensitiv
		Assessm

Nutrient balance | Menu | Previous | Next

Note where we are on the **road map**. The main page in Part 3 is the water balance table which is used to hydraulically size your disposal system. In this preview, we will skip several input pages and look at it now...

Table 5. Monthly effluent depths in trench, bed, etc. (with storage)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Trench or bed area (sq. m)	46	46	46	46	46	46	46	46	46	46	46	46
Trench or bed depth (mm)	600	600	600	600	600	600	600	600	600	600	600	600
Calc. application (mm)	607	548	607	587	607	587	607	607	587	607	587	607
Applic. less disposal (mm)	-70	-87	-76	-34	-11	16	33	30	-20	-16	-28	-48
Increase or decrease in depth (mm) of stored effluent	-282	-350	-303	-134	-46	66	132	121	-81	-65	-111	-192
Effluent depth (mm)	**100**	**100**	**100**	**100**	**100**	**166**	**298**	**419**	**338**	**273**	**162**	**100**
Effluent above freeboard?	No	No	No	No	No	No	No	No	No	No	No	No
Effluent above surface?												

Volume overflowed (kL)

Total annual overflow (kL) None Info

Average annual depth (mm) of effluent = 188

This important Table is a summary of the monthly water balance for you system (you have already selected basic information such as climate, permeability, system width and depth, freeboard, minimum effluent level, etc). Note the red 'No's' which, for this example, indicate no effluent overflow in any month. No overflow might be your preferred outcome; alternatively, you might allow overflow - in which case Trench calculates the overflow volume for storage requirements. Need Help? Click Info to go to Trench's water balance information page...

Daily water | Summary | Table 4 | Graph

Click Next for the 12-day water balance model

Menu | Previous | Next

Trench™ road map

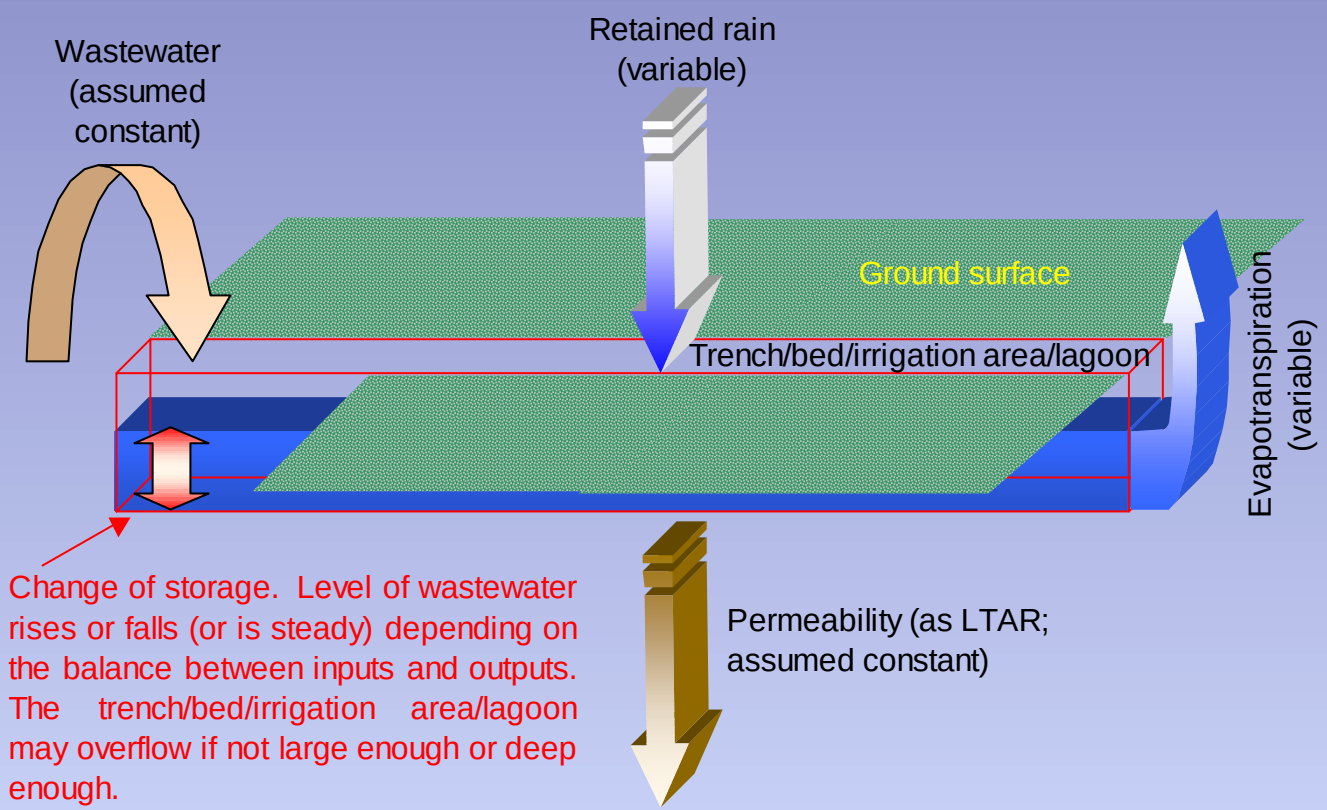
Site Cap.
- Admin
- Area
- Density
- Slope, etc
- Flood, etc
- W/W vol
- Quality
- Quality
- Soil descrip
- Dispersion
- CEC
- PAC
- Perm text.
- Perm tests
- Perm summary
- LTAR
- Rankings

Env. Sens.
- Env. sens
- Climate
- Crop fact
- Rainfall
- G'water
- Model 1
- Model 2
- Model 3
- Sep. dist.
- Water bores
- Env. values
- Proximities
- Landslip
- Rankings

Sizing
- Sizi
- Wat
- Disp
- Tab
- Tab
- Tab
- Dail
- Sum
- Area
- Calc
- Tota
- Nutr
- N, P
- Nutr
- Disp

Site Capability Re
Env. Sensitivity Rep
Assessment Re

INFO: Schematic diagram of the Water Balance Model



Information | Back

Effluent level in the trench (or bed) rises and falls because rainfall and ET varies monthly.

(Wastewater volume and permeability are assumed constant).

Return now to the assessment pages, and see a graph of monthly effluent levels in our system...

CROSS-SECTION OF TRENCH/BED/IRRIGATION AREA/LAGOON

This graph generated from Table 5 shows the monthly variation in wastewater level in the trench, bed or irrigation area, for the inputs you have selected. It is strongly suggested you inspect it each time you alter the inputs to Table 5.

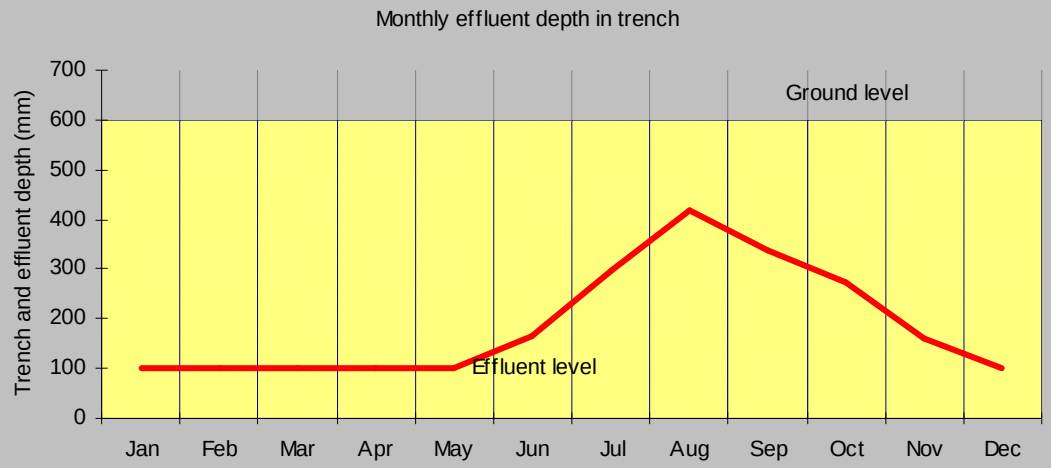


Table 5 inputs | Table 5

This is a frequently-used graph in Trench, and it is derived directly from the water balance table we saw two slides ago. It shows the depth of effluent in our trench/bed/irrigation area (the yellow rectangle is in fact a side-view of our system). No overflow is occurring. But what happens if we reduce the available wetted area?...

CROSS-SECTION OF TRENCH/BED/IRRIGATION AREA/LAGOON

This graph generated from Table 5 shows the monthly variation in wastewater level in the trench, bed or irrigation area, for the inputs you have selected. It is strongly suggested you inspect it each time you alter the inputs to Table 5.

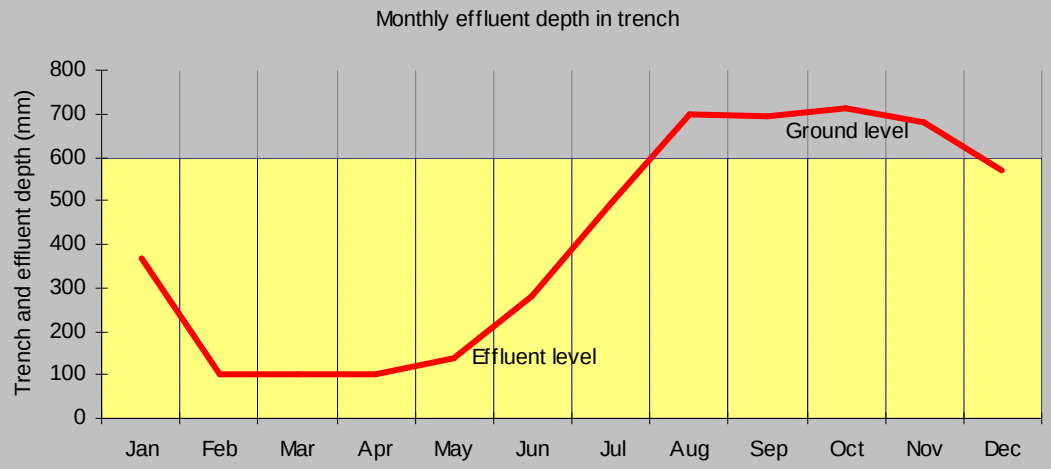


Table 5 inputs | Table 5

Effluent overflow occurs, in this example, between August and December.

You can elect to adjust the system dimensions of width, depth and wetted area to avoid overflow in all months, or, if overflow is permissible, to size the 'wet weather' storage facility required. After you are satisfied with all inputs and system dimensions, Trench provides you with a summary page which calculate the last remaining dimension (length)….

SUMMARY OF TRENCH, BED OR SYSTEM DIMENSIONS

This page calculates the trench or bed dimensions required to avoid overflow in any month, for the selected rainfall regime - provided no overflow is indicated in Table 5 and its attached graph. Note that this water balance method does not consider the environmental sensitivity of the site (Part 2), or any specifications which might be appropriate for trench or bed design, layout or location.
From Table 5, adopt a wetted area which avoids effluent overflow, and produces an acceptable graph of monthly effluent depth.

The wetted area currently used in Table 5 =	46	square metres	
Adopted wetted area (sq. m) =	**50**	OK	
Wetted area (sq. m) adjusted for cobbles/boulders =	**56**		Info

The resulting trench/bed/system dimensions are:

Options...

total length =	**46**	**metres**	Revise Table 5
width =	**0.6**	**metres**	
depth =	**0.6**	**metres**	
Septic tank trench (if applicable) =	12	metres	Design
Sullage trench (if applicable) =	35	metres	

Lengths are rounded, so septic+sullage may not equal total

First, Trench allows you to amend the existing wetted area, and corrects this entry for your previously-entered value for cobbles/boulders in the soil profile. Trench then calculates a length for your system.

This completes the hydraulic sizing of your system. However, you have the option to size the system based on nutrient balance considerations, which we will look at now...

Click Next for area required for disposal

Menu | Previous | Next

Trench™ road map

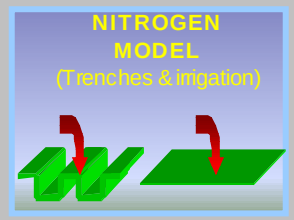
Site Cap.	Env. Sens.	Sizing
Admin	Env. sens	Sizi
Area	Climate	Wat
Density	Crop fact	Disp
Slope, etc	Rainfall	Tab
Flood, etc	G'water	Tab
W/W vol	Model 1	Tab
Quality	Model 2	Dail
Quality	Model 3	Sum
Soil descrip	Sep. dist.	Are
Dispersion	Water bores	Calc
CEC	Env. values	Tota
PAC	Proximities	Nut
Perm text.	Landslip	N, P
Perm tests	Rankings	Nut
Perm summary		Disp
LTAR		Site Capability Re
Rankings		Env. Sensitivity Rep
		Assessment Re

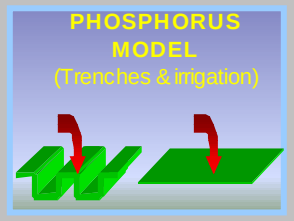
Inputs for nutrient calculations

By default, Trench uses your previously-entered or calculated values for the factors listed below. However, you may enter different values in the orange boxes. You can also click on any factor to see (and perhaps revise) your original data. Click the Models to see the results of your inputs, and return here to continue to change the inputs if necessary.

Click to view factor	Default	Amended to	
Total wastewater volume (L/day) =	900		OK
Total N load of disposal system (kg/yr) =	11.0		OK
Total P load of disposal system (kg/yr) =	4.9	5	OK
Primary disposal area (sq. m) =	250		OK
Soil density (g/cub. cm) =	No data	1.6	OK
Soil PAC (kg/cub. m) =	0.3		OK
Depth to base of trench/bed/irrig. area	0.6		OK
Minimum depth to water table (m) =	2.5		OK

Click a model





Trench requires you to build your own nutrient balance model, based on previously-entered data, or amended data (change existing values in the orange boxes). In Trench you would click on one of the two models provided here. In this preview, we will visit the Nitrogen model...

Click a model, or click Next to skip both models and go to Groundwater Protection

Groundwater protection

Menu | Previous | Next

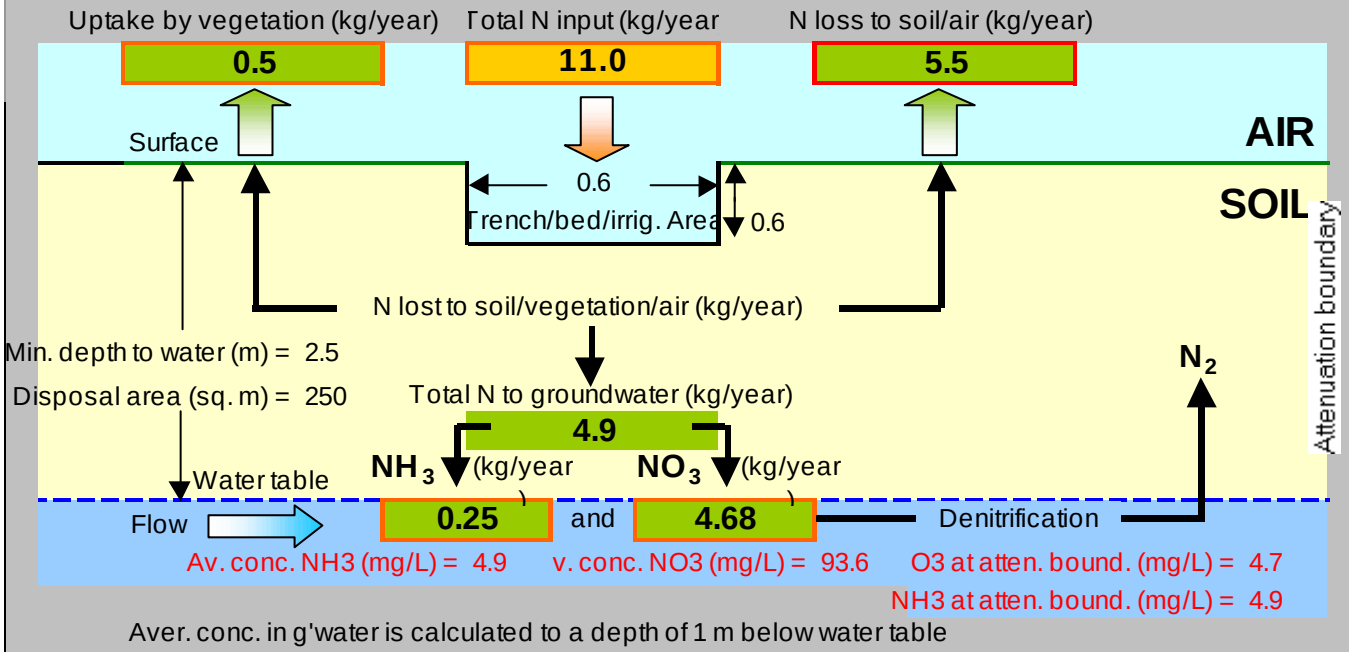
Trench™ road map

Site Cap.	Env. Sens.	Sizing
Admin	Env. sens	Sizi
Area	Climate	Wat
Density	Crop fact	Disp
Slope, etc	Rainfall	Tab
Flood, etc	G'water	Tab
W/W vol	Model 1	Tab
Quality	Model 2	Dail
Quality	Model 3	Sum
Soil descrip	Sep. dist.	Are
Dispersion	Water bores	Cal
CEC	Env. values	Tota
PAC	Proximities	Nut
Perm text.	Landslip	N, P
Perm tests	Rankings	Nut
Perm summary		Disp
LTAR		Site Capability Re
Rankings		Env. Sensitivity Rep
		Assessment Re

Info NUTRIENT MODEL FOR NITROGEN

The orange box (input) and green boxes (outputs) in the cross-section below estimate the fate of nitrogen species beneath trenches, beds and irrigation areas. Click Options or Inputs to edit your data, or Phosphorus for the phosphorus model.

Total wastewater volume =	329	kL/year
Total nitrogen loading at site =	0.04	kg/sq. m/year
equivalent to	438	kg/hectare/year



Aver. conc. in g'water is calculated to a depth of 1 m below water table

Click Next to go to Groundwater Protection

Options | Inputs | Phosphorus | Next

Trench™ road map

Site Cap.	Env. Sens.	Sizing
Admin	Env. sens	Sizi
Area	Climate	Wat
Density	Crop fact	Disp
Slope, etc	Rainfall	Tabl
Flood, etc	G'water	Tabl
W/W vol	Model 1	Tabl
Quality	Model 2	Dail
Quality	Model 3	Sum
Soil descrip	Sep. dist.	Area
Dispersion	Water bores	Calc
CEC	Env. values	Tota
PAC	Proximities	Nutr
Perm text.	Landslip	N, P
Perm tests	Rankings	Nut.
Perm summary		Disp
LTAR		
Rankings		

Site Capability Rep
Env. Sensitivity Rep
Assessment Re

Trench then allocates nitrogen sinks according to pre-set options. If you don't agree with Trench's options, you would click **Options**....

Info **MODEL OPTIONS**: NITROGEN INPUTS

You are encouraged to change the proportions (and thus the fate) of various nitrogen species used in the model to better represent your specific site conditions. WARNING: this Option page enables you to generate any nutrient result you wish. Your selection must therefore be defensible.

	Trench default setting	Change to
Proportion of total N lost to soil/air (%) =	50	
Proportion of total N used by vegetation (%) =	5	
Proportion of NH_3 converted to NO_3 in soil (%) =	95	
Proportion of NO_3 in g'water denitrified to N_2 from disposal site to attenuat. boundary (%) =	95	
Eff. porosity of material below water table (%) =	20	

Phosphorus options | Groundwater

Prev. Option | Next Option | Options menu | Back

Here, you can enter your own options for Nitrogen to best suit site conditions.

(Trench has a range of pre-set options, which you can visit and amend by clicking on the **Options menu** button (we will do this now)...

Options Menu

A range of options (or preferences) allows considerable flexibility for assessing sites. Click on any one of the boxes below to see or change the default value for each option. You can (a) use this page to specify all or some of the options before you start an assessment, or (b) ignore it and, if appropriate, change each option individually during the assessment.

- Slope factor used to calculate retained rainfall
- Aspect (southern or northern hemispheres)
- Daily wastewater volume per bedroom
- Wetted area used in calculating length of trench/bed
- Fate of nitrogen species
- Fate of phosphorus species

For example, you can change the manner in which effluent infiltrates from a trench/bed/irrigation area etc. by selecting the base, sides, or any combination of both, in this option.

All menus | Main Menu

You can personalise the Trench options from here, or at any point in the assessment.

Trench concludes with a summary Assessment Report...

XYZ Consultants Pty. Ltd.

Land suitability and system sizing for on-site wastewater management

Trench 3.0 (Australian Institute of Environmental Health)

Assessment Report

EXAMPLE ONLY: Assessment for on-site wastewater disposal

Assessment for	John Brown	Assess. Date	2/6/XX
	PO Box 0000, NoTown 9999, NSW	Ref. No.	M-123456
Assessed site(s)	Lot 1, ABC Subdivision, NoTown 9999, NSW	Site(s) inspected	23, 24, 25 May XXXX
Local authority	NoTown Shire Council	Assessed by	A. N. Evaluator

This report summarises wastewater volumes, climatic inputs for the site, soil characteristics and sustem sizing and design issues. Site Capability and Environmental sensitivity issues are reported separately, where 'Alert' columns flag factors with high (A) or very high (AA) limitations which probably require special consideration for system design(s). Blank spaces on this page indicate data have not been entered into TRENCH

Scroll down | Admin. | Cap. ranks | Env. ranks | Cap. report | Env. report | All Menus | Report Menu | Previous | Print... | Quit

Wastewater Characteristics

Wastewater volume (L/day) used for this assessment = 900 (using the 'No. of bedrooms in a dwelling' method)

Septic tank wastewater volume (L/day) = 300

Sullage volume (L/day) = 600

Total nitrogen (kg/year) generated by wastewater = 11.0

Total phosphorus (kg/year) generated by wastewater = 4.9

Climatic assumptions for site

(Evapotranspiration calculated using the crop factor method)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean rainfall (mm)	35	30	33	45	55	75	90	95	75	65	55	40
Adopted rainfall (R, mm)	40	35	38	50	60	80	100	105	85	75	65	50
Retained rain (Rr, mm)	34	30	32	43	51	68	85	89	72	64	55	43
Max. daily temp. (deg. C)												
Evapotrans (ET, mm)	91	105	95	63	49	39	39	46	60	67	70	77
Evapotr. less rain (mm)	**57**	**75**	**62**	**21**	**-2**	**-30**	**-47**	**-44**	**-13**	**3**	**15**	**35**

Annual evapotranspiration less retained rain (mm) = 132

Soil characterisitics

Texture = Sandy SILT with a trace of clay Category = 3 Thick. (m) = 0.9

Adopted permeability (m/day) = 0.4 Adopted LTAR (L/sq m/day) = 20 Min depth (m) to water = 2.5

Proposed disposal and treatment methods

Proportion of wastewater to be retained on site:	All wastewater will be disposed of on the site
The preferred method of on-site primary treatment:	In dual purpose septic tank(s)
The preferred method of on-site secondary treatment:	In-ground
The preferred type of in-ground secondary treatment:	Trench(es)
The preferred type of above-ground secondary treatment:	None
Site modifications or specific designs:	Are needed

Suggested dimensions for on-site secondary treatment system

Total length (m) = 46

Width (m) = 0.6

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Only half of this A4 final Assessment Report is visible in this presentation. It summarises all relevant features of your assessment.

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This presentation has shown you several dozen pages from Trench®3.0's 150+ pages, and should have given you a fair indication of the scope, content, power and flexibility of the application.

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Workshops for Trench®3.0

- **Bill Cromer conducts full-day workshops of Trench®3.0 for groups. In Australia he has also presented half-day demonstrations of the software as part of On-site Wastewater Management Workshops organised by the *Centre for Environmental Training*)**

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- **Trench®3.0 is available only from Bill Cromer**
- **Price on application**

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