
IRRICAD

User Guide

Developed By AEI Software

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Contents

1 Overview	1-1
1.1 How to Use Help	1-3
1.1.1 Finding Information and Getting Help Quickly	1-4
1.2 Some Comments for New Users	1-5
1.3 Moving From DOS IRRICAD to Windows IRRICAD	1-6
1.3.1 New Features and Enhancements in Windows IRRICAD	1-7
1.3.2 Converting IRRICAD Data and Templates	1-9
1.3.3 Finding DOS IRRICAD Commands in Windows IRRICAD	1-9
1.3.4 DOS IRRICAD Settings in Windows IRRICAD	1-20
1.3.5 Removing DOS IRRICAD from Your Computer	1-24
1.4 Bug Trapper	1-25
2 User Manual	2-1
2.1 Introduction	2-3
2.1.1 Glossary - Design Terminology	2-3
2.1.2 Nomenclature	2-4
2.2 Installation	2-5
2.2.1 Before Installation	2-5
2.2.2 Software Installation	2-7
2.2.3 Hardware Set Up	2-8
2.2.4 Setting Up Defaults	2-9
2.2.5 Saving and Backing up Designs	2-9
2.2.6 Loading and Setting up Working Databases	2-10
2.3 The Design Process	2-11
2.3.1 The Basic Design Process	2-11
2.3.2 Details of the Design Process	2-12
2.4 Entering Information into IRRICAD	2-18
2.4.1 Entering a Scale Plan	2-18
2.4.2 Entering Hydraulic Items	2-24

2.4.3 Making Changes to Your Design or Drawing	2-31
2.4.4 Allowing For Elevation Changes	2-40
2.4.5 Outlets & Risers (Outlet Connectors)	2-43
2.4.6 Pipes & Pipe Sizing	2-48
2.4.7 Entering Control Valves	2-51
2.4.8 Using Misc. Hydraulic Items	2-52
2.4.9 Working with Uniformly Spaced Outlets on a Pipe	2-53
2.4.10 Entering Driplines in a Design	2-55
2.4.11 Using Water Supplies	2-57
2.4.12 Using Pumps in Design	2-59
2.4.13 Working with Junctions	2-61
2.4.14 Defining Areas with Water Requirements	2-62
2.5 Helping with Design	2-64
2.5.1 Automatically Placing Sprinklers for Small Park or Residential Design	2-64
2.5.2 Analyzing Existing Systems	2-66
2.5.3 Aligning Arcs with Boundaries	2-67
2.5.4 Sprinklers in Odd-Shaped Areas	2-69
2.5.5 How to Layout a Design with Blocks of Laterals	2-70
2.5.6 Laying Out Sports Fields or Other Solid Set Systems	2-76
2.5.7 Using Mainline Outlets	2-79
2.5.8 Wheel Line (Side Roll) Systems	2-81
2.5.9 Travelling Irrigator Systems	2-83
2.6 Management & Designing the System	2-86
2.6.1 Selecting a Management Practice	2-86
2.6.2 Partial Management	2-87
2.6.3 Design	2-88
2.6.4 LP Design Limits	2-93
2.6.5 IRRICAD Selecting Fittings for the Design	2-94
2.7 Enhancing the Presentation of Plans	2-98
2.7.1 How to Find Lengths and Distances	2-98
2.7.2 Sizing and Placing Objects Accurately	2-98
2.7.3 Accurately Placing Items (Using Snaps)	2-99
2.7.4 Placing Symbols on the Plan	2-100
2.7.5 Creating New Database Symbols	2-101
2.7.6 Making the Database Symbols Larger for Large Designs or Smaller for Small Designs	2-102
2.7.7 Using Hatches and Fills	2-103
2.7.8 Grouping Items to Display – Using Layers	2-104
2.7.9 Using Dimensions	2-105
2.8 Printing Reports and Plans	2-122

2.8.1 Producing Reports	2-122
2.8.2 Using Plot Templates to Create Plot Layouts	2-122
2.8.3 Using Plot Templates	2-130
2.8.4 How to Print a Plan	2-131
2.9 Advancing	2-133
2.9.1 How To Simulate Tapes Using Spraylines	2-133
2.9.2 Detailed Analysis of Tapes Under Flushing	2-135
2.9.3 Modeling Multiple Driplines as a Single Line	2-137
2.9.4 Pipe Sizing Notes	2-139
2.9.5 Using a Pump in a Design	2-143
2.9.6 Multiple Water Supplies	2-147
2.9.7 Using Pumps in Parallel	2-148
2.9.8 Pumps in Series	2-148
2.10 Trouble Shooting Problems	2-149
2.10.1 How to Recover a Design After Crashing	2-149
2.10.2 Fittings Selection Errors	2-149
2.10.3 LP Design Errors	2-152
2.10.4 Detailed Analysis Errors	2-153
2.10.5 Database Issues	2-154
2.10.6 Management Issues	2-157
2.10.7 Connectivity Problems	2-158

3 Database Editor Manual 3-1

3.1 Introduction	3-3
3.2 Using the Database Editor	3-4
3.3 Database Structure	3-6
3.3.1 Common Controls	3-7
3.3.2 About Assemblies	3-9
3.3.3 Nozzles	3-10
3.4 Database Details	3-11
3.4.1 Data Common to all Databases	3-11
3.4.2 Database Codes, Symbols & Line Types	3-13
3.4.3 Assemblies	3-16
3.5 Irrigation Components – Details of Individual Groups	3-21
3.5.1 Pipes	3-21
3.5.2 Tapes	3-22
3.5.3 Valves	3-24
3.5.4 Other Hydraulics	3-25
3.5.5 Lateral Take Offs	3-26
3.5.6 Couplers	3-27
3.5.7 Elbows / Bends	3-28
3.5.8 Tees	3-28

3.5.9 Crosses	3-29
3.5.10 Pumps	3-29
3.5.11 Outlets	3-30
3.5.12 Nozzles	3-34
3.5.13 Outlet Connections	3-35
3.5.14 Wires	3-36
3.5.15 Controllers	3-37
3.5.16 Lights	3-37
3.5.17 Other Electrics	3-38
3.5.18 Miscellaneous	3-38
3.6 File Menu	3-39
3.6.1 New	3-39
3.6.2 Open	3-39
3.6.3 Merge	3-40
3.6.4 Exit	3-40
3.7 View Menu	3-41
3.7.1 Toolbar	3-41
3.7.2 Status Bar	3-41
3.7.3 Database	3-41
3.8 Utilities Menu	3-42
3.8.1 Curve Fitting	3-42
3.9 Help Menu	3-45
3.9.1 About DB Editor	3-45
3.9.2 Contents	3-45
3.9.3 Setup options	3-48
3.10 Default Database Order	3-50
3.11 Globally Updating Prices in the Database	3-52
4 Tutorials	4-1
4.1 Introduction to Design Tutorials	4-3
4.1.1 Helpful Hints	4-4
4.1.2 The First Steps	4-6
4.2 Basic Start	4-8
4.2.1 Very Basic Initial Design	4-8
4.2.2 Important Rules to Remember	4-14
4.2.3 A Simple Turf Design	4-14
4.2.4 Methods to Lay Out Sprinklers	4-20
4.2.5 Applying a Specific Amount of Water to an Area	4-29
4.2.6 Placement Aids and Tips	4-32
4.3 Design Tutorials	4-35
4.3.1 A Simple Orchard Design	4-35
4.3.2 Working with Multi-Valve Designs	4-44

4.3.3 Simple Drip Tape Design	4-49
4.3.4 Managing Larger Drip Tape Blocks	4-54
4.3.5 Micro Irrigation Design	4-63
4.3.6 Solid Set Sprinkler Design	4-77
4.3.7 Residential Design	4-86
4.3.8 Wheel Line Design	4-99
4.4 Mainline Designs	4-111
4.4.1 Using Demand Points	4-111
4.4.2 A Rural Water Supply	4-112
4.5 Database and Fitting Selection	4-115
4.5.1 Customising Your Database	4-115
4.5.2 How IRRICAD Selects Fittings and Understanding the Fitting Selection Rules	4-117
4.5.3 Correcting Fittings Errors	4-120
4.5.4 Creating and Modifying Assemblies	4-121
4.6 Creating and Modifying Symbols	4-125
4.6.1 Creating New Symbols	4-125
4.6.2 Modifying an Existing Symbol	4-126
4.6.3 Setting Up a Block of Symbols	4-128
4.7 Printing Using Plot Layouts	4-130
4.8 Digitizing Plans	4-133
4.8.1 Using the Scale Method	4-135
4.8.2 The Reference Method	4-136
4.9 Plot Templates	4-138
4.9.1 Edit an Existing Plot Template	4-138
4.9.2 Creating a New Plot Template	4-139
4.10 Tips for Advanced Users	4-148
4.10.1 Using a Pump in a Design	4-148
4.10.2 Multiple Water Supplies	4-153
4.10.3 Using Pumps in Parallel	4-155
4.10.4 Pumps in Series	4-156

5 Tool & Command Reference 5-1

5.1 Right-Click Menus	5-3
5.1.1 Done	5-4
5.1.2 Restart	5-4
5.1.3 Object Info	5-4
5.1.4 Modify	5-4
5.1.5 Close	5-4
5.1.6 Default Name	5-5
5.1.7 Stop	5-5
5.1.8 Snaps	5-5

5.2 File	5-14
5.2.1 New	5-14
5.2.2 Open...	5-14
5.2.3 Save	5-15
5.2.4 Save As...	5-15
5.2.5 Import...	5-16
5.2.6 Import Contours	5-16
5.2.7 Import Bitmap	5-17
5.2.8 Export...	5-18
5.2.9 Repair	5-18
5.2.10 Compress	5-19
5.2.11 Convert	5-19
5.2.12 Print...	5-21
5.2.13 Direct Plot	5-24
5.2.14 Recent File List	5-28
5.2.15 Exit	5-29
5.3 Edit	5-30
5.3.1 Undelete	5-30
5.4 View	5-31
5.4.1 Redraw	5-31
5.4.2 Zoom All	5-32
5.4.3 Zoom In	5-32
5.4.4 Zoom Out	5-33
5.4.5 Zoom Previous	5-34
5.4.6 Zoom Window	5-34
5.4.7 Zoom Selected	5-35
5.4.8 Pan	5-36
5.4.9 Goto Coords	5-36
5.4.10 Birds Eye View	5-37
5.4.11 Toolbars	5-38
5.4.12 Status Bar	5-39
5.4.13 Wetted Radii	5-40
5.4.14 Sprayline Outlets	5-40
5.5 Draw	5-41
5.5.1 Point	5-41
5.5.2 Line	5-42
5.5.3 Polyline	5-44
5.5.4 Rectangle	5-45
5.5.5 Polygon	5-47
5.5.6 Circle	5-50
5.5.7 Curve	5-53
5.5.8 Arc	5-55
5.5.9 Hatch	5-58

5.5.10 Fill	5-60
5.5.11 Dimension	5-63
5.5.12 Symbol	5-76
5.5.13 Text	5-78
5.5.14 Plot Layout	5-81
5.5.15 Contour	5-82
5.5.16 Spot Height	5-83
5.6 Zone	5-85
5.6.1 Autohead	5-85
5.6.2 Outlet	5-86
5.6.3 Control Valve	5-88
5.6.4 Misc. Hydraulic	5-89
5.6.5 Pipe	5-90
5.6.6 Cut Pipe	5-92
5.6.7 Sprayline	5-93
5.6.8 Tape	5-95
5.6.9 Block	5-97
5.6.10 Tape Block	5-100
5.6.11 Area	5-102
5.6.12 Junction (Hydraulic)	5-104
5.7 Mainline	5-106
5.7.1 Outlet	5-106
5.7.2 Control Valve	5-108
5.7.3 Misc. Hydraulic	5-108
5.7.4 Pipe	5-108
5.7.5 Sprayline	5-109
5.7.6 Junction	5-109
5.7.7 Water Supply	5-109
5.7.8 Pump	5-111
5.8 Electrical	5-113
5.8.1 Controller	5-113
5.8.2 Wire	5-114
5.8.3 Light	5-115
5.8.4 Misc. Electrical	5-115
5.8.5 Junction	5-116
5.9 Settings	5-118
5.9.1 Snap	5-119
5.9.2 Layers	5-120
5.9.3 Grid	5-122
5.9.4 Irrigation Items	5-123
5.9.5 Drawing Items	5-125
5.9.6 Cursor	5-127
5.9.7 Units	5-128

5.9.8 Design Details	5-128
5.9.9 Miscellaneous	5-129
5.9.10 Irrigation – Design Specific	5-131
5.9.11 Names	5-133
5.9.12 Company	5-134
5.9.13 Client	5-135
5.9.14 Bitmap	5-135
5.9.15 Moving Grid	5-135
5.9.16 Digitizer	5-136
5.10 Tools	5-139
5.10.1 Tool Tips	5-140
5.10.2 Select Object	5-140
5.10.3 Clear Selection	5-141
5.10.4 Invert Selection	5-141
5.10.5 Selection Filter	5-141
5.10.6 Select	5-142
5.10.7 Delete	5-144
5.10.8 Delete Type	5-145
5.10.9 Change	5-145
5.10.10 Change Type	5-146
5.10.11 Move	5-147
5.10.12 Move Point	5-148
5.10.13 Copy	5-148
5.10.14 Rotate	5-152
5.10.15 Explode	5-153
5.10.16 Resize	5-153
5.10.17 Break	5-154
5.10.18 Cut Lasso	5-155
5.10.19 Trim	5-155
5.10.20 Move Sizes	5-156
5.10.21 Create Wetted Radii	5-156
5.10.22 Create Sprayline Outlets	5-157
5.10.23 Create Symbol	5-157
5.10.24 Convert to Elevations	5-158
5.10.25 Spraylines to Tapes	5-159
5.10.26 Tapes to Spraylines	5-159
5.11 Design	5-160
5.11.1 Design Parameters	5-160
5.11.2 Check Outlet Connectivity	5-164
5.11.3 Zone Operating Times	5-164
5.11.4 Water Supply Times	5-164
5.11.5 Assign System Flows to Zones	5-165
5.11.6 Assign All Zones to One System Flow	5-166

5.11.7 Assign Each Zone to a Unique System Flow	5-167
5.11.8 Re-interpolate Elevations	5-167
5.11.9 Zone and Mainline Design	5-168
5.11.10 Valve Analysis	5-170
5.11.11 Zone Design Configuration	5-171
5.11.12 Computer Selection of Fittings	5-172
5.11.13 Riser Selection Rules	5-172
5.11.14 Pipe Fitting Matching Table	5-173
5.12 Reports	5-176
5.12.1 Reports Settings	5-176
5.12.2 Show Flow	5-177
5.12.3 Management Reports	5-177
5.12.4 Design Reports	5-181
5.12.5 Costing Reports	5-190
5.12.6 Bill of Materials Reports	5-194
5.12.7 View Errors	5-199
5.12.8 Miscellaneous Costs	5-199
5.12.9 Supplier Code Multipliers	5-199
5.12.10 Costing Reports Options	5-200
5.12.11 Zone Design Reports Configuration	5-201
5.12.12 Mainline Design Reports Configuration	5-202
5.13 Plot Template	5-203
5.13.1 Edit Template	5-203
5.13.2 Make Active Area	5-204
5.13.3 Make Legend	5-204
5.13.4 Move Fills to Back	5-205
5.13.5 Save Template	5-205
5.14 Help	5-207
5.14.1 Release Notes	5-207
5.14.2 Help Topics	5-207
5.14.3 About IRRICAD	5-210

6 Technical Reference 6-1

6.1 Technical Support, Sales and Training Services	6-3
6.1.1 Contact Details	6-3
6.2 Appendix A: IRRICAD Limits	6-5
6.3 Appendix B: Design Files	6-6
6.4 Appendix C: Hazen-Williams C Values	6-7
6.5 Appendix D: Default Database Order	6-8
6.6 Appendix E: Available Line Types	6-12
6.7 Appendix F: Design Technical Information	6-15
6.7.1 Use of Elevations in Design	6-15

6.7.2 Zero Flow Pipes	6-16
6.7.3 Valve Pressure Calculation	6-17
6.7.4 Pipe Diameter Selection	6-17
6.7.5 Highly Looped Mainlines	6-18
6.7.6 Multiple Water Supply Designs	6-19
6.8 Appendix G: Fitting Selection Details	6-20
6.8.1 Two Pipe Junctions	6-20
6.8.2 Three-Pipe Junctions	6-22
6.8.3 Four-Pipe Junctions	6-24
6.8.4 Five-Pipe Junction	6-28
6.8.5 Angle Tolerance	6-28
6.8.6 Fittings for Valve-Under-Head Systems	6-28
6.9 Appendix H: Form of the Equations	6-30
6.10 Appendix I: Keywords for Use in Plot Templates	6-31
6.11 Appendix J: Screen Messages	6-33
6.11.1 Introduction	6-33
6.11.2 IRRICAD File Handling Messages	6-34
6.11.3 Screen Messages	6-37

1 Overview

1.1 HOW TO USE HELP

On-line help is a convenient and quick way to look up information during use. You can view help on your computer in the following ways:

- In any IRRICAD window, press F1 to open the Help Topics
- The Help Topics can also be accessed by selecting Help Topics from the Help menu in the main IRRICAD screen

You can then display information for performing tasks within IRRICAD, advice on troubleshooting common problems, and technical information about IRRICAD folders and database fields.

The help file can be loaded as WinHelp or HTML Help. For HTML Help, Internet Explorer is required. If you do not have Internet Explorer 3.04 or later, you can choose to install Internet Explorer 4.0. The installation files for Internet Explorer 4.0 are available on the IRRICAD CD (CD Drive:\Install\IE4\iesetup.exe).

There are three ways in which to find a topic in On-line Help:

- Contents
- Index
- Search / Find

Contents

If this tab is selected, the Contents page is displayed. Each heading with a + sign can be opened to reveal its sub-headings. The sub-headings can be hidden by clicking on the - sign. Clicking any heading or subheading will take you directly to that section of the manual. The text is displayed on the right hand side of the help window. If you are unable to find a topic in the Help contents, the Index or Search can be used to look for specific topics or key words.

Index

Use the Index tab to select an indexed keyword. These words have been selected to aid you in finding topics. Select a topic and click the Display button.

Search / Find

Use Search to find a topic. Search lists all the places the word is found in the on-line help.

1.1.1 FINDING INFORMATION AND GETTING HELP QUICKLY

The manual is divided into several sections: Overview, User Manual, Database Editor Manual, Tutorials, Tool & Command Reference and Technical Reference.

The Overview describes how to use the online help, moving from DOS IRRICAD to IRRICAD 7 and outlines the differences between the DOS and Windows versions.

The User Manual describes how to use IRRICAD for irrigation design. It explains layout types, tips to help you use fast ways of drawing or changing items and explains the uses for hydraulic items. This manual describes the use of tools and commands and how the options in the dialogs can be used in design.

The Database Editor Manual explains the use of the database editor, how to enter and modify items, merge databases and use the database editor to complete IRRICAD designs right through to fittings selection.

The Tutorials section describes tutorials for several design types, to give you step-by-step help in becoming familiar with IRRICAD. Tutorials are included to cover entering items in to the database, creating symbols and printing designs. These tutorials are also available as ScreenCam movies on your Installation CD. (See Some Comments for New Users, Section 1.2).

The Tool & Command Reference outlines each menu option and what each dialog field is for. It gives steps for the mechanical operation for the tool or command.

The Technical Reference includes information to aid in understanding the way IRRICAD works. It includes information such as Hazen-Williams C Values used in pipe friction loss calculations, the rules fittings selection uses to select fittings for junctions, IRRICAD program limits, default database ordering of items, program warning messages, design technical information and line types available in IRRICAD.

1.2 SOME COMMENTS FOR NEW USERS

All documentation is available both as on-line help and in hard copy manuals.

Overview

Before you attempt designs of your own, we strongly recommend that you first read the User Manual. This will give you an overview of how to produce a design using IRRICAD. A Tool & Command Reference is also available.

Tutorials

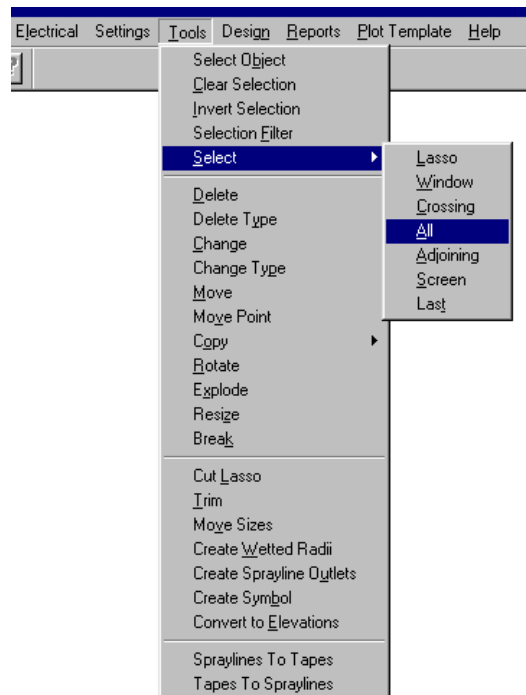
Tutorials are intended to introduce you to IRRICAD use. We recommend that you complete these, as a way of becoming familiar with the design process. The tutorials are also available as a Movie. Select the appropriate tutorial movie from the Autorun screen when the CD is placed in the CD-ROM drive or open the Movie folder on the CD using Windows Explorer and double click to run the movie.

1.3 MOVING FROM DOS IRRICAD TO WINDOWS IRRICAD

If you are a current DOS IRRICAD user, this guide will acquaint you with the many new features and enhancements in Windows IRRICAD. Reading this guide will help you minimize the time needed to discover what's new in Windows IRRICAD.

The following convention is used in this manual:

- When directed to select a command from a menu: the menu name, menu option and sub menu option (if applicable) will be listed.
- For example, *Tools|Select|All*. This refers to selecting the All option from the Select submenu that is found in the Tools menu. The Tools menu is found on the Menu bar at the top of the IRRICAD window.



1.3.1 NEW FEATURES AND ENHANCEMENTS IN WINDOWS IRRICAD

This chapter looks at the new features that have been included in the Windows version.

1.3.1.1 AUTOSAVE

Design changes are not saved until *File|Save* is selected, though an AutoSave function can be set to create a temporary backup file in the temp folder in the case of power failures.

1.3.1.2 IMPORTING / EXPORTING

IRRICAD can now import DXF, DWG, VCD, GCD, SHP and MIF files and export designs in DXF, DWG, VCD, GCD, SHP or WMF file format.

1.3.1.3 UNDELETE

Undelete undoes the last Delete command, handy for those accidental deletes.

1.3.1.4 BIRDS EYE VIEW

Birds Eye View allows you to view the whole design while zoomed in on a particular section. This greatly aids navigation around your design.

1.3.1.5 DRAW

A number of drawing tools have been added:

- Polygon
- Ellipse
- Bezier and Spline Curve
- Elliptical Arc
- Hatch
- Fill
- Dimension

1.3.1.6 ZONE

A Junction tool has been added to place permanent junctions easily.

Tapes and Spraylines are now selected in separate dialogs.

1.3.1.7 MAINLINE

A Junction tool has been added to place permanent junctions easily.

1.3.1.8 SELECTION TOOLS

A range of selection tools has been added for extra flexibility. These include a selection filter, selection window, crossing, adjoining, screen, all, last, invert selection, clear selection and select object.

1.3.1.9 MOVE

A group of selected items can be moved in one action instead of one point object being moved by rubberbanding.

1.3.1.10 COPY

A group of selected items can be copied in one action. New copy tools such as array copy, linear copy, multiple copy and radial copy have increased IRRICAD's flexibility, shortening the time required to duplicate and place objects.

1.3.1.11 REPORTS

Reports are now viewed in a fully editable window. A range of different fonts can be selected as required.

1.3.1.12 DIGITIZING

The Zoom State is now independent of referencing, making it possible for you to zoom in and out while digitizing, without the need to re-reference.

SCALE OPTION

This option is used for one-sheet digitizing only. A plan is simply put on the tablet and the scale entered. No reference points are required.

REFERENCE OPTION

Reference points no longer need to be re-entered. Click on any two known points on the plan, enter the world coordinates for those two points and enter the scale. It is easy to re-reference after moving the plan.

1.3.1.13 MANAGEMENT

Assign System Flows has been extended to automatically allocate each zone to a unique system flow, allocate all zones to one system flow, or to be individually entered as in Version 6.

1.3.2 CONVERTING IRRICAD DATA AND TEMPLATES

Old IRRICAD files can be converted for use in the new Windows version. Designs, symbols, templates and databases can be converted as needed.

You can open an old design, which will then be converted automatically or select *File|Convert|Design*. To convert templates (plot layouts), symbols and databases select the relevant option from the *File|Convert* menu.

It is handy to remember to convert the relevant database and required symbol libraries prior to converting the design. This will ensure that all the hydraulic items will be found and the symbols appear as required when you do open or convert the old design.

To find out more about how to convert old files, see Convert, Section 5.2.11.

Before converting a design file which has spraylines in the design, go into *Settings|Irrigation - Design Specific* and uncheck the Create Sprayline Outlets check box. Click the Save As Defaults button. Now convert the design.

Files need to be Version 6 in order to be converted successfully, if you have Version 5 files, open them in Version 6 prior to converting them to Version 7. It will probably only be necessary to convert files as needed.

1.3.3 FINDING DOS IRRICAD COMMANDS IN WINDOWS IRRICAD

Below is an outline of where commands existed in Version 6 and where to find them in Version 7.

The Version 6 item is listed on the left-hand side under the menu title. The Version 7 option is listed on the right hand side with the name of the menu and option, for example: *File|Repair* means the Repair tool is found in the File menu.

1.3.3.1 DESIGN SELECTION

DESIGN NUMBERS

Design Numbers are no longer used; designs are identified by alphanumeric names. To start a new design use *File|New*. To select an existing design use *File|Open*.

DESIGN HEADINGS

Design Headings can be found in *Settings|Design Details* and *Settings|Client*.

REFERENCE POINT EDITING

Scale or reference points are no longer required prior to starting a design.

1.3.3.2 DESIGN INPUT

DRAWING

Point:	<i>Draw Point</i>
Line:	<i>Draw Line Single</i>
Rectangle:	<i>Draw Rectangle 2 Point</i>
Circle:	<i>Draw Circle Center Radius</i>
Arc:	<i>Draw Arc Center Start End</i>
Curve:	<i>Draw Curve Continuous Bezier</i>
Label:	<i>Draw Text</i>
Symbol:	<i>Draw Symbol</i>
Polyline:	<i>Draw Polyline</i>

SITE DATA

Spot Height:	<i>Draw Spot Height</i>
Contour:	<i>Draw Contour</i>

TOOLS

Reference

Reference:	<i>Settings Digitizer Reference</i>

Placement Aids

Grid:	<i>Settings Grid</i>
Circular Cursor:	<i>Settings Drawing Items</i>
Snap to Grid:	<i>Settings Snap</i>
Flow Check:	<i>Settings Irrigation Items</i>

Moving Grid

Moving Grid:	<i>Settings Moving Grid</i> – not currently enabled

Lasso

Change:	<i>Tools Change Type</i> - first select the objects
Move:	<i>Tools Move</i> - first select the object(s)
Copy:	<i>Tools Copy</i> - first select the object(s)
Delete All:	<i>Tools Delete</i> - first select the object(s)
Delete Type:	<i>Tools Delete Type</i> - first select the objects
Delete Imported:	<i>Tools Delete</i> or <i>Tools DeleteType</i>
Show Flow:	<i>Reports Show Flow</i>
Trim:	<i>Tools Trim</i>

Cut Lasso

Cut Lasso:	<i>Tools Cut Lasso</i>

Display

Display:	<i>Settings Layers</i>

Move Sizes

Move Sizes:	<i>Tools Move Sizes</i>

SCREEN

Redraw:	<i>View Redraw</i>
Show All:	<i>View Zoom All</i>
Zoom In:	<i>View Zoom In</i>
Pan:	<i>View Pan</i>

Zoom Out:	<i>View Zoom Out</i>
Zoom Previous:	<i>View Zoom Previous</i>
Go To Coords:	<i>View Goto Coords</i>

MODE

Insert:	<i>Settings Snap - Connect option</i>
Delete:	<i>Tools Delete</i>
Change:	<i>Tools Change</i>
Move:	<i>Tools Move</i>
Rotate:	<i>Tools Rotate</i>
Copy:	<i>Tools Copy</i>
Place:	<i>Settings Snap - Place option or Right-Click Place</i>

UTILS

Symbols

Create:	<i>Tools Create Symbol</i>
Explode:	<i>Tools Explode</i>
Block:	<i>Tools Copy Array</i>
Delete:	Use Windows Explorer to delete symbol files

Plots

Paper Box:	<i>Plot Template Make Active Area</i>
Create Layout:	<i>Plot Template Save Template</i>
Edit Layout:	<i>Plot Template Edit Template</i>
Delete Layout:	Use Windows Explorer or My Computer to delete template files
Plot Area:	Not used
Pipe key:	<i>Plot Template Make Legend</i>
Sprinkler Key:	<i>Plot Template Make Legend</i>
Combined Key:	<i>Plot Template Make Legend</i>

Labels

Add:	Replaced by <i>Draw Text</i> . Labels are no longer stored in libraries

Edit:	Select Change to edit text on the design
Delete:	<i>Tools Delete</i>

DEF

See Input, Section 1.3.4.2.

ZONE

Autohead:	<i>Zone Autohead</i>
Outlets:	<i>Zone Outlet</i>
C/Valves:	<i>Zone Control Valve</i>
Misc. Hyd.:	<i>Zone Misc. Hydraulic</i>
Pipes:	<i>Zone Pipe</i>
Cut Pipes:	<i>Zone Cut Pipe</i>
Spr/line:	<i>Zone Sprayline and Zone Tape</i>
Blocks:	<i>Zone Block and Zone Tape Block</i>
Areas:	<i>Zone Area</i>

MAINLINE

Outlets:	<i>Mainline Outlets</i>
C/Valves:	<i>Mainline Control Valves</i>
Misc. Hyd.:	<i>Mainline Misc. Hydraulic</i>
Pipes:	<i>Mainline Pipe</i>
Spr/lines:	<i>Mainline Sprayline</i>
W/Supply:	<i>Mainline Water Supply</i>
Pumps:	<i>Mainline Pump</i>

ELECTRICAL

Ctrllers:	<i>Electrical Controller</i>
Wiring:	<i>Electrical Wire</i>
Lights:	<i>Electrical Light</i>
Misc. Elect.:	<i>Electrical Misc. Electrical</i>

1.3.3.3 MANAGEMENT

Enter Management Cycle: *Design|Design Parameters|Economic Parameters*

Enter Water Supply Data:	Flow and pressure - <i>Mainline Water Supply</i> dialog box
Operating Times:	<i>Design Water Supply Times</i>
Enter Irrigation Area Data:	<i>Zone Area</i> dialog box
Check Outlet Connectivity:	<i>Design Check Outlet Connectivity</i>
Enter Zone Operating Times:	<i>Design Zone Operating Times</i>
Assign System Flows to Zones:	<i>Design Assign System Flows to Zones</i>
Display Reports:	<i>Reports Management Reports</i>
Change Design:	<i>File Open</i>

1.3.3.4 DESIGN

Re-interpolate Elevations:	<i>Design Re-interpolate Elevations</i>
Zone Design / Analysis:	<i>Design Zone Design</i>
Change Valve Pressures:	This option is no longer available. Set pressures in Zone Design Configuration.
Control Valve Design / Analysis:	<i>Design Valve Analysis</i>
Mainline Design / Analysis:	<i>Design Mainline Design</i>
Display Reports:	<i>Reports Design Reports</i>
Display Errors:	<i>Reports View Errors</i>
Change Design:	<i>File Open</i>

1.3.3.5 FITTING SELECTION

Computer Selection of Fittings:	<i>Design Computer Selection of Fittings</i>
Edit Fittings Selection:	Fittings can be edited by selecting the item and by using <i>Tools Change</i> , pressing the Show Fittings button on the dialog. You can then add, replace or delete fittings as required.
Miscellaneous Costs:	Not available in this version. Use Change and Show Fittings to select any Misc. items to add to the Bill of Materials.
Display Bill of Materials Reports:	<i>Reports Bill of Materials</i>

Display Costing Reports:	<i>Reports Costing Reports</i>
Edit Riser Selection Rules:	<i>Design Riser Selection Rules</i>
Change Design:	<i>File Open</i>

1.3.3.6 REPORTS

MANAGEMENT REPORTS

Water Supply Report:	<i>Reports Management Reports Water Supply</i>
Zone Flows Report:	<i>Reports Management Reports Zone Flows</i>
System Flows Report:	<i>Reports Management Reports System Flows</i>
System Management Report:	<i>Reports Management Reports System Management</i>
Water Requirements Reports:	<i>Reports Management Reports Water Requirements</i>

ZONE DESIGN REPORTS

Zone Design / Analysis Report:	<i>Reports Design Reports Zone Full</i>
Zone Summary Report:	<i>Reports Design Reports Zone Summary</i>
Control Valve Summary Report:	<i>Reports Design Reports CV Summary</i>
Detailed Outlet Report:	<i>Reports Design Reports Zone Outlet</i>
Zone Pipe Report:	<i>Reports Design Reports Zone Pipe</i>
Zone Reports Configuration:	<i>Reports Zone Design Reports Configuration</i>

MAINLINE DESIGN REPORTS

Mainline Design / Analysis Report:	<i>Reports Design Reports Mainline Full</i>
System Duty Report:	<i>Reports Design Reports System Duty</i>
Mainline Summary Report:	<i>Reports Design Reports Mainline Summary</i>
Mainline Pipe Report:	<i>Reports Design Reports Mainline Pipe</i>
Mainline Reports Configuration:	<i>Reports Mainline Design Reports Configuration</i>

BILL OF MATERIALS REPORTS

Zone / Mainline BOM:	<i>Reports Bill of Materials Reports Zone / Mainline BOM</i>
BOM with Costs:	<i>Reports Bill of Materials Reports BOM with Costs</i>
BOM:	<i>Reports Bill of Materials Reports BOM</i>
BOM by Supplier:	<i>Reports Bill of Materials Reports BOM by Supplier</i>
Costing Reports Options:	<i>Reports Costing Reports Options</i>

COSTING REPORTS

Zone / Mainline Costing Summary:	<i>Reports Costing Reports Zone / Mainline Summary</i>
Detailed Zone / Mainline Costing:	<i>Reports Costing Reports Zone / Mainline Detailed</i>
Design Costing Summary:	<i>Reports Costing Reports Design Summary</i>
Detailed Costing Report:	<i>Reports Costing Reports Detailed Costs</i>
Inventory by Warehouse Code:	<i>Reports Bill of Materials Reports Inventory by W/H Code</i>
Inventory by Description:	<i>Reports Bill of Materials Reports Inventory by Description</i>
Inventory by Description and Warehouse Code:	<i>Reports Bill of Materials Reports Inventory</i>
Costing Reports Options:	<i>Reports Costing Reports Options</i>

DATABASE REPORTS

The databases are created using Microsoft Access. This can be used as a database report.

JOB REPORT

This option is no longer available. Use Windows Explorer to list all designs in a folder.

CHANGE DESIGN

Change Design:	<i>File Open</i>

1.3.3.7 PLOTTING

SCREEN MENU

Screen menu: View menu

TOOLS

Lasso: N/A. Use layers and Zoom State to control what is printed.

Layers: N/A. DXF layer names are the same as the design layer names (*Draw|Plot Layout*).

DRAWING

Drawing: *Draw|Plot Layout* show check box. To print only some items in a layer, create a new layer and move those items to it and turn off the old layer.

SITE DATA

Site Data: *Draw|Plot Layout* show check box. To print only some items in a layer, create a new layer and move those items to it and turn off the old layer.

ZONES

Zones: *Draw|Plot Layout* show check box. To print only some items in a layer, create a new layer and move those items to it and turn off the old layer.

MAINLINE

Mainline: *Draw|Plot Layout* show check box. To print only some items in a layer, create a new layer and move those items to it and turn off the old layer.

ELECTRICAL

Electrical: *Draw|Plot Layout* show check box. To print only some items in a layer, create a new layer and move those items to it and turn off the old layer.

IMPORTED

Imported: *Draw|Plot Layout* show check box. To print only some items in a layer, create a new layer and move those items to it and turn off the old layer.

LAYOUT / KEY

Layout / Key: *Draw|Plot Layout*

SCALE

Scale: *Draw|Plot Layout* or *File|Print* if no layout

POSITION

Position: Position layout using *Tools|Move*

ROTATE

Rotate: Rotate the layout using *Draw|Plot Layout* or print rotated design using Rotation Angle in the Print dialog

PLOT

Plot: *File|Print* or *File|Direct Plot*

1.3.3.8 UTILITIES

EDIT DESIGN DETAILS

Edit Design Details: *Settings|Design Details* and *Settings|Client*

EDIT DEFAULTS

Edit Defaults: See Utilities, Section 1.3.4.1

SETUP DIGITIZER BUTTONS

SetUp Digitizer Buttons: This can be accessed in the control panel for your operating system. Click *Start|Settings|Control Panel*. An icon should be present in the control panel for the digitizer driver you have installed. Double-click on this icon and set up the digitizer buttons if required.

FILE UTILITIES

Delete a Design:	Use Windows Explorer or My Computer to delete files
Purge a Design:	No longer available
Backup a Design:	Save the design to a floppy disk. Select <i>File Save As...</i>
Restore a Design:	<i>File Open</i>
Duplicate a Design:	<i>File Save As...</i>
Backup Databases:	Save the database to a floppy disk using Windows Explorer or My Computer
Restore Databases:	The working database is loaded with the design it was used with. You can also load or select databases to use in <i>Settings Irrigation - Design Specific</i> .
Copy Design Base Information:	Select <i>File Open</i> to access previous design information. Use <i>File Save As...</i> to save under a different file name.
Merge Designs:	Not available at present

DXF INPUT

Import DXF File Into IRRICAD Design:	<i>File Import</i> or <i>File Import Contours</i>
Create Symbol File From DXF Blocks:	<i>File Import + Tools Create Symbol</i>

CHANGE DESIGN

Change Design:	<i>File Open</i>

1.3.3.9 DATABASES

- Pipes and Components
- Pipe Fittings
- Miscellaneous Components
- Electrical Components

The component groups now exist in one database which is accessed through the Database Editor (*Start|Programs|Irricad|Irricad Databases*).

Global Price Changes:	Not available at present
Curve Fitting Utility:	<i>Utilites Curve Fitting</i> in the Database Editor. Move the open database window down in order to see the database editor menu bar, or click Save Changes to close the current open database.

1.3.3.10 RECOVER

Recover:	<i>File Repair</i>

1.3.4 DOS IRRICAD SETTINGS IN WINDOWS IRRICAD

Below is an outline of where commands existed in Version 6 and where to find them in Version 7.

The Version 6 item is listed on the left-hand side under the menu title. The Version 7 option is listed on the right hand side with the name of the menu and option, for example: *Settings|Design Headings* means the Design Headings setting is found in the Settings menu.

1.3.4.1 UTILITIES

EDIT DESIGN DETAILS

Design Headings can be found in *Settings|Design Details* and *Settings|Client*.

EDIT DEFAULTS

General Defaults

Default Pricing Type:	<i>Design Design Parameters Economic Parameters</i>
Margin or Discount:	<i>Design Design Parameters Economic Parameters</i>
Default Interest Rate:	<i>Design Design Parameters Economic Parameters</i>

Economic Term:	<i>Design Design Parameters Economic Parameters</i>
Default Pump Efficiency:	<i>Design Design Parameters Economic Parameters</i>
Power Cost:	<i>Design Design Parameters Economic Parameters</i>
Operation Hours per Year:	<i>Design Design Parameters Economic Parameters</i>
Maximum Zone Pipe Velocity:	<i>Design Design Parameters Hydraulic Parameters</i>
Maximum Mainline Pipe Velocity:	<i>Design Design Parameters Hydraulic Parameters</i>
Minimum Lateral Length:	<i>Design Design Parameters Hydraulic Parameters</i>
Mainline Analysis Factor:	<i>Design Design Parameters Analysis Parameters</i>
Maximum Iterations:	<i>Design Design Parameters Analysis Parameters</i>
Company Name / Description:	<i>Settings Company</i>

Pipe Defaults

Pipe Defaults	<i>Design Pipe Fitting Matching Table</i>

Supplier Code Multipliers

Supplier Code Multipliers	<i>Reports Supplier Code Multipliers</i>

Colors and Pens

Color, line type and line width:

Each layer:	<i>Settings Layers</i>
Geometric items:	<i>Settings Drawing Items</i>
Areas:	<i>Settings Irrigation Items</i>
Wetted radii:	<i>Settings Irrigation Items</i>
Contours:	<i>Settings Irrigation Items</i>
Computer-sized pipe:	<i>Settings Irrigation Items</i>

Color, symbol name and size:

Spot heights:	<i>Settings Irrigation Items</i>
Water supplies:	<i>Settings Irrigation Items</i>

Junctions:	<i>Settings Irrigation Items</i>
Computer-sized pipe:	<i>Settings Irrigation Items</i>
<u>Line Width:</u>	
Laterals:	<i>Settings Irrigation – Design Specific</i>
Pipes:	<i>Settings Irrigation – Design Specific</i>
Wires:	<i>Settings Irrigation – Design Specific</i>

Hardware Defaults

Mouse and digitizer:	These settings can be found in the control panel for your operating system. Click the Start button and select <i>Settings Control Panel</i> . An icon should be present in the control panel for the digitizer or mouse driver you have installed. Double-click on this icon and set up the digitizer or mouse if required.
Printer port:	Windows printer settings
Printer page length:	<i>Reports Report Settings</i>
Reports border type:	<i>Reports Report Settings</i>
Condensed print on / off:	Obsolete
Printer settings:	Obsolete
Video display type:	Control Panel
Plotter Settings:	Control Panel

Default Units

Metric / US buttons:	<i>Settings Units</i>

SET UP DIGITIZER BUTTONS

Found in the Windows control panel.

1.3.4.2 INPUT

DRAWING DEFAULTS

Line thickness, line type, color:	<i>Settings Drawing Items</i>
Autohead spacing:	<i>Settings Irrigation Items</i>
Grid display:	<i>Settings Grid</i>
Crosshairs Cursor:	<i>Settings Drawing Items</i>

Object type:	No longer available

TOOLS

Placement Aids

Grid:	<i>Settings Grid</i>
Crosshairs Cursor:	<i>Settings Drawing Items</i>
Snap to Grid:	<i>Settings Snap</i>
Flow Check:	<i>Settings Irrigation Items</i>

Display

Display:	<i>Settings Layers</i>

1.3.4.3 OTHER

SEARCH.INI

Minimum Search Distance:	<i>Settings Snap</i>
Maximum Search Distance:	<i>Settings Snap</i>
Search Factor:	<i>Settings Snap</i>
Min near to:	<i>Settings Snap</i>
Max near to:	<i>Settings Snap</i>
Near to factor:	<i>Settings Snap</i>
Cut Pipe near to factor:	<i>Settings Snap</i>
Factor for dbs symbols:	<i>Settings Miscellaneous</i>
Contours:	<i>Design Design Parameters Analysis Parameters</i>
Max iterations for detailed analysis:	<i>Design Design Parameters Analysis Parameters</i>
Detailed analysis convergence factor:	<i>Design Design Parameters Analysis Parameters</i>
Detailed analysis flow close fraction (difference as a fraction):	<i>Design Design Parameters Analysis Parameters</i>
Number of virtual emitters for iteration tape calculations:	<i>Design Design Parameters Analysis Parameters</i>
Maximum number of iterations for tape calculations:	<i>Design Design Parameters Analysis Parameters</i>
Tolerance in metres for tape	<i>Design Design Parameters Analysis</i>

calculations:

Parameters

1.3.5 REMOVING DOS IRRICAD FROM YOUR COMPUTER

It is not necessary to remove DOS IRRICAD from your computer in order to use Windows IRRICAD, but if you wish to remove DOS IRRICAD from your computer read the following:

Open your DOS IRRICAD folder. Highlight each file you do not wish to keep. By pressing the Ctrl key you may highlight more than one item. You may also use the Shift key to highlight a portion of the list of files. Press the delete key.

Do not delete any TC0*. * files, .dbs files, .zip files, .lay files, .blk files or Turfcad.def, pl_def.dat or Symbols.dat.

All files must be in the unzipped state prior to converting to the Windows version of IRRICAD. To do this, use the Restore Design or Restore Database function in File Utilities in DOS IRRICAD. Remember to convert the database and symbol library required with a design before converting the design.

Once designs, databases, etc. have been converted the old files can be removed. For safety ensure the old design or database is backed up before removing the files.

1.4 BUG TRAPPER

Bug Trapper has been included to aid in the tracking of bugs and their causes. It can be used to trace an illegal operation or to trace a problem while IRRICAD is still running. Bug Trapper creates a log file that can then be sent to AEI Software for analysis.

Before Bug Trapper can be used it needs to be installed. Double-click on the file `bta_zip.exe` located in the IRRICAD folder where Version 7 has been installed. By default this is in `C:\Program Files\AEI Software\Irricad`. Double clicking on the `bta_zip.exe` file in Windows Explorer will automatically cause the file to self-extract and run the installation for Bug Trapper Version 2.2. Bug trapper needs to be running when a crash occurs. Bug Trapper will automatically dump the information into the log file (e.g. `Winicad728.btl`).

When IRRICAD is running, select *Start|Programs|Mutek Bug Trapper 2.2|BugTrapper Agent*. The first time this program is run, a dialog will appear. Select the `.tci` file required from your IRRICAD folder, for example, `Winicad733.tci` if you are running IRRICAD Version 7.33. If BugTrapper Agent is running before running IRRICAD, a message will appear and BugTrapper Agent must be exited before IRRICAD will run.

When BugTrapper Agent is running you should see the BugTrapper icon flashing on the status bar. If you right-click on the icon and select comment, you can add comments to the trace. If you double-click on the icon, the Bug Trapper window will appear. Bug Tracker dumps the trace into the log file upon closing IRRICAD or when an illegal operation occurs. If wishing to trace a problem which does not cause a Crash select Dump or Stop Trace immediately after the problem has occurred.

The `.btl` (default log) file can be deleted between sessions. Make sure the file you email is a recent file containing recent events. If possible, please zip this file using PkZip or WinZip before emailing to IRRICAD@Lincoln.ac.nz.

The steps required are described below:

To trace a crash in the program:

To trace a crash, Bug Trapper needs to be running when the crash occurs. It is advisable NOT to have Bug Trapper running all the time. Therefore when a crash occurs run Bug Trapper and try to recreate the circumstances which caused the crash. When a crash does occur

(WINICAD performed an illegal operation... message) Bug Trapper will automatically dump the recent events into the log file.

1. Run IRRICAD
2. Run Bug Trapper
3. Try to re-create the circumstances which caused the initial crash
4. After the crash has occurred email the zipped .btl file to IRRICAD@Lincoln.ac.nz for analysis. Explain what you were doing and when the crash occurred.

To trace a problem in IRRICAD:

1. Run IRRICAD
2. Run Bug Trapper
3. Make the problem happen.
4. Double-click on the Bug Trapper icon flashing on the Windows status bar.
5. In the Bug Trapper dialog click the Dump button.
6. If you are finished click Stop Trace.
7. Zip the file and email it to IRRICAD@Lincoln.ac.nz with comments about your problem, what you did and what happened.

For further information about BugTrapper Agent please read BTAgent.pdf available in the IRRICAD folder or click on Help in the BugTrapper Agent window.

2 User Manual

2.1 INTRODUCTION

Welcome to the User Manual. This manual is designed to help you accomplish tasks to complete designs. Instead of explaining simply how to use tools, this manual helps you to understand the task you wish to accomplish and which tool to use, as well as understanding the tool.

This chapter includes information about design terminology and how to follow the nomenclature used in this manual.

2.1.1 GLOSSARY - DESIGN TERMINOLOGY

Because IRRICAD can be used for the design of any pressurized irrigation system, the following terminology is used:

- Block:** An option for laying out an area of equally spaced spraylines. The spraylines may be connected or unconnected. Immediately after entry, each sprayline becomes an independent item.
- Control Valve:** Any device which can be used to turn water on or off to an outlet or group of outlets.
- Misc. Hydraulic Items (zones):** Items such as isolating valves, backflow preventors, air release valves that are connected into or onto a Zone pipe.
- Outlet:** Any device that discharges water from an irrigation system.
- Sprayline (connected):** A zone or mainline pipeline containing equally spaced outlets, also known as a lateral. A connected sprayline is maintained as a single unit.
- Sprayline (unconnected):** A method of spacing outlets uniformly along a Zone or Mainline pipe. As soon as the sprayline has been entered it is converted into individual pipes and outlets, i.e., it is not maintained as a single unit.
- Mainline Outlets:** Outlets on a mainline. Each outlet is treated as a zone and is assumed to also perform the function of a zone control valve. Valve-in-head sprinklers are mainline outlets.

Mainline Pipes:	Pipes used to connect zone control valves to water supplies.
Misc. Hydraulic Items (mainline):	Items such as isolating valves, back flow preventors, air release valves that are connected into or onto a mainline pipe.
System Duty:	The pressure and flow required at the water supply for a particular system flow number.
System Flow:	A situation in the mainline (resulting from the turning on or off of control valves) in which the flows are fixed for a particular time interval. Also known as stations, sets or groups.
Water Supply:	A point of supply for the irrigation system.
Zone:	Items including and downstream of control valves. A zone becomes defined when control valves are entered, and zone pipes or spraylines connected to it, regardless of how or when those spraylines, pipes and outlets were entered.
Zone Outlets:	Outlets within a zone.
Zone Pipes:	Pipes used to connect zone outlets to zone control valves. Also known as submains.

2.1.2 NOMENCLATURE

The following conventions are used in this manual:

- When directed to select a command from a menu, the menu name, menu option and sub menu option (if applicable) will be listed.
- For example, *Settings|Digitizer|Scale*. This refers to selecting the scale option from the Digitizer submenu that is found in the Settings menu. The Settings menu is found on the Menu bar at the top of the IRRICAD window.
- Any measurements will be given in US units first and the metric unit will be supplied in brackets e.g. 300ft (91.5m).

2.2 INSTALLATION

This chapter contains installation instructions and information about setting up accompanying hardware. Also included is how to customize the program to suit your particular situation and preferences, backing up your work and the databases.

2.2.1 BEFORE INSTALLATION

Before you install and run IRRICAD, please carefully read the following.

2.2.1.1 PACKAGE CONTENTS

The IRRICAD package supplied should contain:

- CD-ROM - The IRRICAD program and setup files required to install and use IRRICAD.
- Manuals:
 - User Guide including Overview, User Manual, Database Editor Manual and Tutorials.
 - Reference Manual including Tool & Command Reference and Technical Reference.
- Hardware Key - For new users only.

2.2.1.2 PROTECTION SYSTEM

Please Read Carefully:

IRRICAD software is supplied with a hardware protection device (HPD) which should be inserted in the parallel printer port of the computer; the printer cable plugs into the rear of the HPD. The HPD should not interfere with the running of other packages.

This form of protection has been chosen to provide you with maximum flexibility in program use. It permits you to transport the package to another machine in your office or to another geographic location. It does, however, make the HPD an integral part of your IRRICAD package and accidental loss or theft of the HPD will mean that IRRICAD cannot be operated. You may wish to consider insurance, as another package would need to be purchased.

If the HPD is damaged, return to us an identifiable portion of the HPD and a replacement will be supplied at cost. Accidental loss or theft of the HPD will require the purchase of a replacement at the appropriate discount rate for the total number of IRRICAD programs owned.

2.2.1.3 COPY AND USE RESTRICTIONS

Copyright laws protect the software. It is illegal to make copies of the software except for backups. It is illegal to give copies to another person, or to duplicate the software by any other means, including electronic transmission. The software contains trade secrets and you may not recompile, reverse engineer, disassemble, or otherwise reduce the software to human perceivable form. You may not modify, adapt, translate, rent, lease, or create derivative works based upon the software or any part of it.

2.2.1.4 HARDWARE AND MEMORY REQUIREMENTS

The following hardware is the minimum recommended for IRRICAD, although less powerful system configurations may be used for smaller jobs.

Computer:	Pentium class computer, minimum 32Mb Ram and 100Mb free hard disk space, 15 inch or 17 inch color screen, monitor and video card capable of 800x600 or better, CD-ROM drive.
Operating System:	Windows 95, Windows 98, Windows NT 4.0+, Windows 2000 or Windows XP.
Digitizer:	To digitize from scaled plans, a digitizer or a tablet with a WinTab32 driver is required. An 18x12 tablet is adequate for most jobs although a 12x12 digitizer can be used for smaller designs.
Scanner:	Plans and aerial photographs can be scanned and saved as BMP files for importing.
Plotters and Printers:	IRRICAD can print plans and reports on any Windows compatible printer or plotter.

Color is recommended for plans, although black and white plans can be produced. At least an ANSI B or A3 printer / plotter is desirable, although for small plans an A / A4 printer may be sufficient.

The monitor size depends on your budget and the value you place on the benefits of a large screen. When long periods of time are spent at

the computer a large monitor is easier on your eyes. A 20-inch monitor is very good but over 4 times the price of a 14-inch monitor.

The plotter or printer size you require will depend on the size of schemes you design and the size of plan you prefer. Large plotters have the ability to plot small plans if required.

A digitizer is optional but recommended for those who have access to any type of scaled plan that can be traced into IRRICAD. These may be aerial photographs, landscape plans, orchard layouts, subdivision plans, existing designs, or plans you have drawn from measurements taken in the field.

A scanner is optional. This can be used to scan in scale plans or photographs as required.

Electronic mail is very useful for sending information or designs to your IRRICAD support for analysis and answers to questions. A suitable modem and Internet access is required to accomplish this.

2.2.2 SOFTWARE INSTALLATION

IRRICAD must be installed by using the Setup.exe program file supplied on the CD-ROM.

Place the CD in your CD-ROM drive. An Autorun executable should automatically show a dialog containing icons. If Autorun does not automatically run, browse the CD using My Computer or Windows Explorer.

Before you begin the installation of IRRICAD, we recommend that you view the Readme.txt file, which contains additional information not included in the manual. To view the Readme.txt file on the screen, double-click this file in the Autorun dialog or browse for Readme.txt on the CD drive. Using My Computer or Windows Explorer double-click on the CD drive, then double-click on the Install folder and then double-click on the Readme.txt file.

Close all applications that may be running before installing IRRICAD.

To begin the installation process double-click on the Install IRRICAD icon or open Windows Explorer or My Computer, double-click on the CD

drive and double-click on Setup.exe. Follow the instructions on the screen to install IRRICAD on your hard drive.

The installation procedure can be cancelled at any time, if you do so it will be necessary to double-click on Setup.exe to repeat the installation.

Once the installation is complete run IRRICAD by selecting *Start|Programs|Irricad*).

2.2.3 HARDWARE SET UP

2.2.3.1 MOUSE

IRRICAD uses the mouse installed with Windows operating systems. Clicking the right mouse button will bring up additional menus of choices for aiding or finishing tasks when using tools.

2.2.3.2 DIGITIZER

To use a digitizer, a WinTab driver must be loaded. A WinTab driver can be obtained from the digitizer manufacturer, the Internet or your hardware technician. Internet addresses are as follows: for Calcomp, Summagraphics or Gtco tablets - www.Calcomp.com; for Wacom tablets - www.Wacom.com; for Kurta or Altek tablets - www.Altek.com; for Graphtec tablets www.Graphteccorp.com; for Acecad tablets - www.Acecad.com. Usually after downloading a file from the Internet, double-clicking on the file will cause it to self-extract and create a folder for its component files. There will be a Readme.txt present. Read this file and follow the instructions for the installation procedure.

The puck button configurations can usually be accessed and changed in the Windows Control panel. Select *Start|Settings|Control Panel* and then double-click on the icon representing the installed tablet. Click on the Buttons button and change as required.

Do not select Map to Screen mode. This can also be available as a check box labeled Enable Mapping. The option WYPIWYG can also have the same effect as the above two options. These modes distort the scale on the screen to match the tablet area.

By default the digitizer acts as the standard windows pointing device; to operate it in the scaled mode in IRRICAD select *Settings|Digitizer|Scale* or *Settings|Digitizer|Reference*.

2.2.4 SETTING UP DEFAULTS

Before attempting your own designs, you should check that the defaults are correct. The Settings menu allows you to specify your personal preference for:

- Snaps
- Grids
- Layers
- Drawing values
- Units
- Design Details
- Names
- Miscellaneous
- Irrigation Items
- Irrigation - Design Specific
- Company Details
- Client Details

When you first start IRRICAD, select *Settings|Irrigation Items* to change the default values to those that will apply to all designs. These tend to be items that you set up once and rarely change.

Settings|Irrigation - Design Specific can be used to set default values for each design individually. These settings are saved with the design. If you wish these settings to be the same for all designs, click the Save As Defaults button.

Hydraulic, economic and other design parameters can be altered in the *Design|Design Parameters* dialog. These parameters are design specific, but can also be saved as the default for all future designs.

2.2.5 SAVING AND BACKING UP DESIGNS

It is very important that you backup a design regularly both during the design process and when a design is complete. IRRICAD, like other Windows programs, keeps the design in memory until you select *File|Save* or *File|Save As* to save the design to disk.

To save the design to a floppy disk as a backup, insert a disk into the floppy drive. Select *File|Save As* and click on the arrow to the right of

the Save In box. Select the floppy drive from the dropdown list under My Computer then type in a file name and click Save. Note this method will only work for designs small enough to fit on a floppy disk. Large designs will need to be compressed using a program like PkZip or WinZip, and then the compressed file can be copied to a floppy disk using Windows Explorer.

If the system crashes (e.g. a power failure) you will lose any changes made to the design since the last *File|Save* unless AutoSave is enabled. This is an IRRICAD setting that, if enabled, saves the design periodically to a temporary file name (~Irricad~Backup.des) in your PC's Temp directory.

You can also backup a design using Windows Explorer or My Computer by selecting the design files (all files with the design name) and copying them to another folder, a floppy disk or to a network drive. It is a good idea to save the external (working) database with the design files.

2.2.6 LOADING AND SETTING UP WORKING DATABASES

The database loaded during a new installation by default is your working database. Before starting the tutorials the tutorial database (provided with the program) must be selected as your working database. To do this use the Browse button in *Settings|Irrigation - Design Specific* and locate Tutorial.mdb in the Irricad\database folder. The Irricad\database folder should be opened by default. Click on the Tutorial.mdb file and click the Open button. For any other database to be used for a design, select the database by using the Browse button in *Settings|Irrigation - Design Specific*. If you wish to retain the selected database as your default database, click the Save As Defaults button.

2.3 THE DESIGN PROCESS

This chapter looks at the basic design process and the details of the design process.

2.3.1 THE BASIC DESIGN PROCESS

To begin using IRRICAD it is helpful to know the steps that are necessary to produce a design. Although there is no rigidly prescribed way of producing designs (this is a major strength of the program), the following procedure is recommended as a starting point. A basic outline of the design procedure is:

1. Enter design details.
2. Enter background information - place property boundaries, buildings and elevation data on the design.
3. Layout the Irrigation System - position water supplies, outlets, valves and connect with pipes.
4. Management and Design - enter system management information (zone and system flow operating times), and hydraulically design and / or analyze the system.
5. Costing - select fittings and generate a Bill of Materials and Costs for clients.
6. Printing - print or plot plans and reports.

2.3.2 DETAILS OF THE DESIGN PROCESS

2.3.2.1 DESIGN DETAILS

Select *Settings|Design Headings* and enter the design details as required to specify the design - see Figure 1.

The screenshot shows the IRRICAD software interface with the 'Settings' dialog box open to the 'Design Details' tab. The dialog box is titled 'Settings' and has a menu bar with 'Snap', 'Grid', 'Layers', 'Drawing', 'Units', and 'Irrigation Items'. Below the menu bar are tabs for 'Irrigation - Design Specific', 'Design Details' (selected), 'Misc', 'Names', 'Company', and 'Client'. The 'Design Details' tab contains two main sections: 'Headings' and 'Miscellaneous'. The 'Headings' section has fields for 'Site' (containing 'Optional Block'), 'Date' (containing '22 March 2000'), 'Description' (empty), and 'Notes / Comments' (empty). The 'Miscellaneous' section has fields for 'Rep Name' (empty), 'Rep Code' (empty), 'Job Address' (empty), 'Quote Number' (empty), 'Acceptance Date' (empty), 'Commencement Date' (empty), 'Completion Date' (empty), 'Labor' (0), 'Hours' (empty), 'Mileage' (0), 'km' (empty), and 'Installation Cost' (0). At the bottom of the dialog box are buttons for 'Restore Defaults', 'Save As Defaults', 'OK', 'Cancel', and 'Help'. The status bar at the bottom of the window shows 'Object : Select Object', '100.25m', and 'a= 74.5°'.

Figure 1

2.3.2.2 BACKGROUND INFORMATION

Draw in any property boundaries, buildings present on the site, roads and other topographical features required by using the tools from the Draw menu. Use the mouse to draw objects or digitize from a scaled plan (see By Using a Digitizer, Section 2.4.1.1). There are many other drawing aids that can be used to assist with this process, for example, Snaps (see Section 5.1.8), Snap to Grid, Grid, Circular Cursor, etc. (see Section 5.9).

Elevation data, if applicable, needs to be drawn on or imported into the design. An existing DXF file containing elevation data can be imported into IRRICAD as can DWG, VCD, GCD, SHP and MIF files (see By Importing a DXF, VCD, DWG, GCD, SHP or MIF File, Section 2.4.1.2).

Some drawing objects can also be converted to elevations at a later stage (see Convert to Elevations, Section 5.10.24). Figure 2 shows the contours from an imported DXF file.

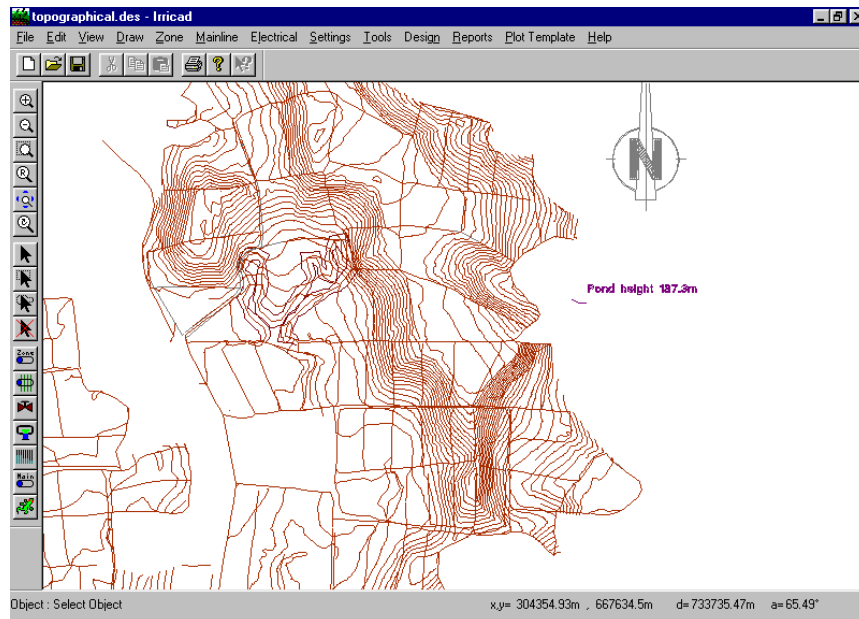


Figure 2

2.3.2.3 IRRIGATION SYSTEM LAYOUT

The irrigation system can be drawn in any order. However to follow a progression in the explanation below, we have started with the water supply end.

Place a water supply (*Mainline|Water Supply*). Type in any flows or pressures as provided by the water supply. If these values are left as zero, then IRRICAD will assume that these values need to be calculated. Select *Mainline|Pipe* and connect it to the water supply. For IRRICAD to size pipes for the system you are designing, leave the pipe type as Computer Selected. For manual sizing, select specific pipes from the dropdown list and then IRRICAD will analyze the system and report back on system performance. You may use a combination of computer sized and manually entered pipes. You may also select pipe sizes but leave the Computer Sized check box checked so that if the analysis shows

a problem you can then use Computer Sizing immediately to select the pipe sizes for you.

Pipe ends will be automatically connected to other hydraulic items, providing that they are within the set snap distance and the default snap mode is Connect rather than Place (see Default Snap Mode, Section 5.9.1.1).

A control valve is always used to separate a zone from the mainline. Select *Zone|Control Valve* and connect it to the Mainline pipe where it will be connecting to a zone pipe. Outlets can be placed individually using *Zone|Outlet*. Connect outlets using *Zone|Pipe*. Add any additional components required such as backflow preventors, pressure regulating valves, etc. as Misc. Hydraulic items. See Using Misc. Hydraulic Items, Section 2.4.8. Figure 3 shows an irrigation system layout.

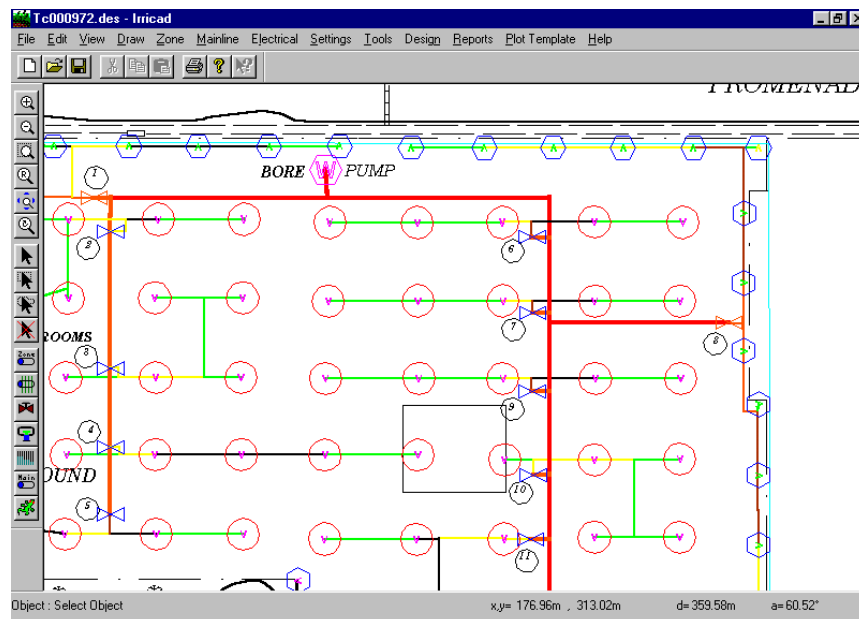


Figure 3

Pipes and outlets can be treated as a single object using *Zone|Sprayline* or *Zone|Tape*. Multiple spraylines or tapes can be laid out using *Zone|Block* or *Zone|Tape Block*.

2.3.2.4 MANAGEMENT

There are two ways to enter management data for the system:

- Group zones by specifying operating times
- Group zones by assigning to system flows

Design|Zone Operating Times requires you to enter operating times for each individual zone in the system. This is best used for small irrigation systems where actual start and stop times for valves are important and need to be reported. Based on the operating times entered, IRRICAD will calculate the resulting flows in the mainline. This option cannot be used for multiple water supplies. See Figure 4.

	Zone Name	On	Off	On	Off	On	Off
12	Zone no. 40	1:0:0	1:0:0	1:0:0	1:0:0	1:0:0	1:0:0
13	Zone no. 41	1:0:0	1:0:0	1:0:0	1:0:0	1:0:0	1:0:0
14	Zone no. 42	1:0:0	1:0:0	1:0:0	1:0:0	1:0:0	1:0:0
15	Zone no. 43	1:0:0	1:0:0	1:0:0	1:0:0	1:0:0	1:0:0
16	Zone no. 44	1:0:0	1:0:0	1:0:0	1:0:0	1:0:0	1:0:0
17	Zone no. 45	1:0:0	1:0:0	1:0:0	1:0:0	1:0:0	1:0:0
18	Zone no. 46	1:0:0	1:0:0	1:0:0	1:0:0	1:0:0	1:0:0
19	Zone no. 47	1:0:0	1:0:0	1:0:0	1:0:0	1:0:0	1:0:0
20	Zone no. 48	1:0:0	1:0:0	1:0:0	1:0:0	1:0:0	1:0:0
21	Zone no. 49	1:0:0	1:0:0	1:0:0	1:0:0	1:0:0	1:0:0
22	Zone no. 50	1:0:0	1:0:0	1:0:0	1:0:0	1:0:0	1:0:0
23	Zone no. 51	1:0:0	1:0:0	1:0:0	1:0:0	1:0:0	1:0:0
24	Zone no. 53	1:0:0	1:0:0	1:0:0	1:0:0	1:0:0	1:0:0

Figure 4

Design|Assign System Flows to Zones allows you to choose the number of system flows and their operating times and then to select which of these system flows each zone will operate on. It is the preferred option for larger systems where valve grouping is important. See Figure 5. The Design menu has three Assign System Flows to Zones options, two of which partly automate the assigning of system flows to zones (Assign All Zones to One System Flow, Assign Each Zone to a Unique System Flow).

Check all outlets are connected to a valve and all valves are connected to a water supply (*Design|Check Outlet Connectivity*).

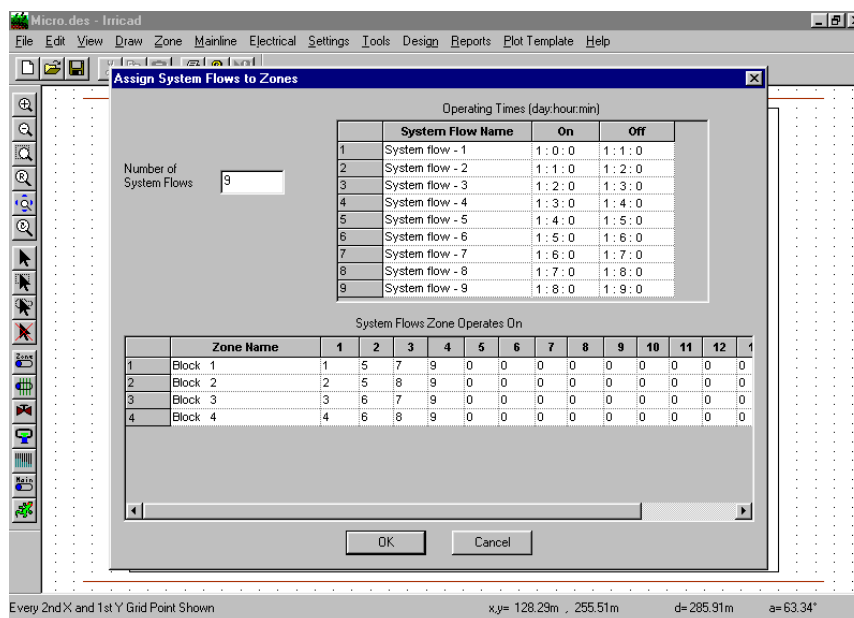


Figure 5

2.3.2.5 DESIGN

Firstly, you will need to design the zones. For Computer Selected pipes in the design, run *Design|Zone Design|LP Design*, unless you have a system containing loops (closed systems), use *Design|Zone Design|Velocity Design* in this case.

If you have selected your own pipe sizes, run *Design|Zone Design|Analyse*.

Take note of any warning messages that may occur. Some messages are simply warnings to draw your attention, while others terminate the design process and the problem should be rectified before proceeding. Check the Screen Messages, Section 6.11.3 to help you pinpoint the reason for the warning messages.

After successfully running Zone Design, run *Design|Valve Analysis*. Any headloss through the valve is reported in the Zone Summary report and the Zone Design Full report (*Reports|Design Reports|...*).

Now run Mainline Design. For Computer Selected pipes in the design, run *Design|Mainline Design|LP Design*, unless the design is a looped system or has more than one water supply. In this case use *Design|Mainline Design|Velocity Design*. If you have selected your own pipe sizes, run *Design|Mainline Design|Analyse*. Check the Mainline Design Reports (*Reports|Design Reports|...*).

2.3.2.6 COSTING

After successfully running Mainline Design, IRRICAD can automatically select fittings for the design. To do this select *Design|Computer Selection of Fittings*. IRRICAD will look at each pipe or component junction in the design and select suitable fittings from the database.

The Bill of Materials (BOM) or Costing reports in the Reports menu can be viewed to determine if IRRICAD was able to successfully select all the fittings required. If any problems are found these can be corrected by adjusting the database and re-running Fittings Selection or manually correcting using the Change tool (Show Fittings button).

2.3.2.7 PRINTING AND PLOTTING

To print a report, first select the required report from the Reports menu, which will display the report in a report viewer window. Click the print icon, or select Print... from the File menu in this window.

Predefined plotting layouts can be placed on the plan by selecting *Draw|Plot Layout*. These layouts can be moved or altered. Then the final plan can be printed by selecting *File|Print*.

See also:

<i>How to Print a Plan</i>	<i>Section 2.8.4</i>
<i>Producing Reports</i>	<i>Section 2.8.1</i>
<i>Enhancing the Presentation of Plans</i>	<i>Section 2.7</i>

2.4 ENTERING INFORMATION INTO IRRICAD

This chapter looks at entering a scale plan, entering hydraulic items, changing items on the screen, allowing for elevation changes and using the different types of hydraulic objects in the design.

2.4.1 ENTERING A SCALE PLAN

There are four ways to enter information from a scale plan into IRRICAD:

- By using a digitizer
- By importing a DXF, **VCD**, DWG, GCD, SHP or MIF file
- By importing a bitmap image
- By using the mouse or keyboard

2.4.1.1 BY USING A DIGITIZER

The section headed Digitizer, Section 2.2.3.2 gives you a brief outline of setting up and using a digitizer. To recap, a WinTab32 driver must be loaded, and the digitizer attached to an available communication port.

In normal drawing mode, you can use the digitizer in exactly the same way as the mouse to select commands and tools. In Tablet Mode you can trace over scale drawings which have been placed on the digitizer tablet.

Before tracing a drawing you must either reference the digitizer (*Settings|Digitizer|Reference*) or set the scale (*Settings|Digitizer|Scale*). Tablet Mode is automatically turned on if Reference or Scale is selected (*Settings|Digitizer|Tablet Mode*).

GENERAL

In Tablet Mode (i.e. when you are tracing with the digitizer) it is not possible to use the cursor to select items from the menu or toolbars. Selections can be made by:

- using the keyboard with ALT key combinations. To use the ALT key combinations you will notice that one letter in each menu and menu item is underlined. To select a menu press the Alt key and the underlined letter key e.g. Alt+D to open the Draw

menu. Use the arrow keys or the underlined letter key to select a menu item e.g. L for a line option.

- using the mouse instead of the digitizer puck
- toggle Tablet Mode off with a Middle Click button. You can set a puck button to be Middle Click (in Control panel for the digitizer). When this button is pressed, it will turn Tablet Mode off (the rectangle disappears around the cursor and menu items can be selected) or will turn Tablet Mode on if it is off (the rectangle around the cursor re-appears and you cannot select from the menu).
- use the Right-Click menu. The Right-Click contains all zooms, all drawing tools and all the modifying tools when Tablet Mode is on.

Toggling Tablet Mode on again will return the digitizer to using the scale and alignment of the last Reference or Scale operation. Tablet Mode is automatically turned off when the right click is invoked and automatically turned on again when the selection is made and the cursor is returned to the input screen.

The digitizer scale is only used when in Tablet Mode. When in drawing mode, the digitizer scale has no effect. The Reference or Scale option must be selected to initially turn Tablet Mode on.

When Tablet Mode is on, Draw and Settings options are also available in the right click menu. When Tablet Mode is on, a box appears around the cursor. When Tablet Mode is off, the box around the cursor disappears.

REFERENCING

Securely attach the scale plan to the digitizer tablet using tape or other means. Select *Settings|Digitizer|Reference*.

Align the digitizer cross hairs over a known point on the scale plan then click the digitizer button which represents the left mouse button to place the point. Repeat this for a second known point. These known points are ones where the world coordinates based on some origin and axis are known. Note that when waiting for the second reference point the cursor does not appear to move on the screen.

Every point is given a coordinate - that is, a distance measured in ground units (feet or metres) along a horizontal and vertical plane from

the origin 0,0. If point A is the origin and point B is 45ft (m) along the horizontal and 5ft (m) on up the vertical axis, then the coordinates of point B are 45,5. World coordinates give a point on a plan the real physical distance as would be measured in the field. Both points must be measured from the same origin using the same set of axes (see Figure 6).

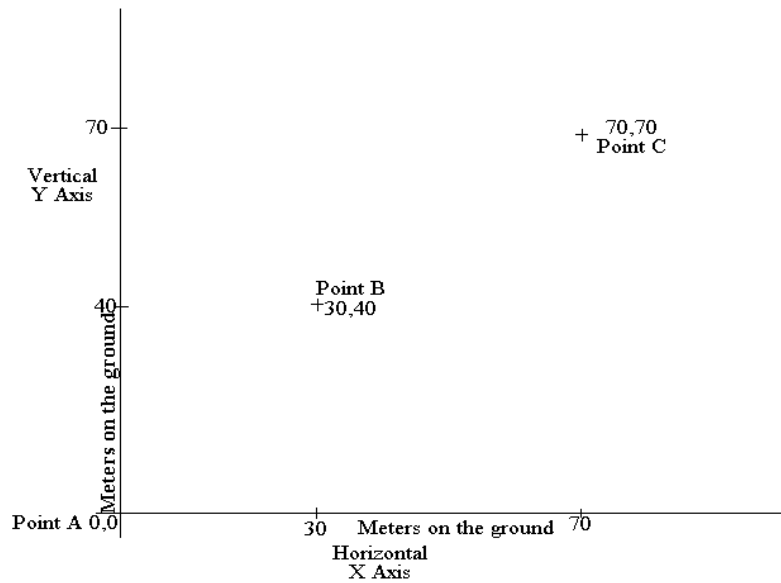


Figure 6

Try to avoid pairs of points that have the same X or Y values e.g. where point 1 has the coordinates 31,45 and point 2 has the coordinates 81,45.

After the second point is placed a dialog will appear, enter the world X and Y coordinates for each corresponding point. Enter the known scale of your plan. The scale is calculated by dividing the real length as measured in the field by the length of the same item on the plan. For a metric scale, make sure that all units used are the same, for a US scale make sure the units on the plan are inches, and the units used in the field are feet. IRRICAD will now check this scale against a calculated value and issue a warning if the difference is greater than 5%. Note that the entered scale is always used, rather than the calculated one. If a warning is given and you would like to use a scale closer to the calculated scale, select *Settings|Digitizer|Reference* and re-enter the reference points.

Now you are ready to start digitizing in the scale plan, by tracing over the plan using any of the drawing or hydraulic tools. Use the mouse, Alt key or Right-Click menu to select tools and commands or temporarily turn off Tablet Mode to select from the main menus.

PLANS LARGER THAN TABLET SIZE

Plans that are larger than the tablet can be entered by referencing points at a number of different positions. The same scale and world coordinate system (i.e. location of origin and direction of axes) needs to be used, and care should be taken to accurately place the points used for referencing. If moving the plan, re-reference before digitizing. If the plan needs to be moved during digitizing, place reference points on the whole plan prior to starting. As the plan is moved to digitize an area not currently in the tablet area, select *Settings|Digitizer|Reference* and enter two of the reference points now visible in the tablet area. These new reference points will have been measured before digitizing started and therefore will relate to the same coordinate system and origin as the first part of the plan digitized. Even if this part of the plan is entered sideways or upside down IRRICAD will be able to align the plan up with that already on the screen.

SCALE

The Scale option can only be used in the following conditions:

- The plan to be digitized fits totally on the tablet
- The plan will not be moved during digitizing
- The scale is known
- The plan to be digitized will be digitized in one session

The scale of the plan is entered in the dialog when *Settings|Digitizer|Scale* is selected. The scale is calculated by dividing the real length as measured in the field by the length of the same item on the plan. For a metric scale, make sure that all units used are the same, for a US scale make sure the units on the plan are inches, and the units used in the field are feet. No alignment is necessary as the world axes are assumed to be aligned with the digitizer (with the origin set at the tablet's origin).

With this method the plan should not be moved on the tablet. If it is to be moved then the Reference method must be used. It is also not possible to use this method to digitize plans that are larger than the

tablet. The plan can be digitized in more than one session providing the plan has not been moved on the digitizer.

See also:

Hardware Set Up

Section 2.2.3

2.4.1.2 BY IMPORTING A DXF, VCD, DWG, GCD, SHP OR MIF FILE

Plans that have been created in other CAD packages may be able to be exported as a file type that IRRICAD can read. IRRICAD is able to import DXF, VCD, DWG, GCD, SHP or MIF files. Note that to import contours complete with height data, you will need a DXF file that contains Z values (vertex - not attributes) and you will also need to specify the contour layers. (See Import Contours, Section 5.2.6). Use *File|Import Contours* and select the name(s) of the contour layer(s). If a file is imported without elevations, the Convert to Elevations tool can be used (see Section 5.10.24).

In some cases, a file may be supplied which includes a viewport - a window into another file. If this is the case, you will not see much information on the screen after importing the file. If a viewport exists in the file, IRRICAD creates a file called ~Convert-ModelVCD. This file is found in the \Irricad folder. Start a new design and import ~Convert-ModelVCD as a VCD file. Save the design.

If a file has been sent to you via email or a floppy disk in zipped form (.zip file), the file will need to be unzipped before IRRICAD can import it. Use WinZip or PkZip to extract the file. If you do not have WinZip or PkZip programs, these can be downloaded from the Internet.

In many cases a DXF or DWG file will be supplied without you knowing what units the file was exported (note this does not apply to VCD or GCD files). *Settings|Units* has a field labeled Importing. Select the units in which the file was exported as (e.g. m or ft). If the units are not what the file was exported as, the scale will be wrong for the file.

To check the scale, find an object in the design that you know the length of in world units (e.g. ft, m). Place the cursor at one end of the object. Press the F9 key to zero the distance on the status bar. Move the cursor to the other end of the object and look at the d = value on the status bar. If the length of the line is incorrect, start a new design and change the importing units accordingly. If you originally imported the file in m, and the length of the object is 3.28 times too long, select ft. Start a

new design and select *File|Import* or *File|Import Contours* to re-import the file.

Fonts have been mapped so that most fonts can be displayed in a like font or mapped to something sensible when you import a DWG file.

See also:

Import
Import Contours

Section ...5.2.5
Section 5.2.6

2.4.1.3 BY IMPORTING A BITMAP IMAGE

If you have obtained an aerial photograph of an area you can scan photograph and save it as a bitmap (BMP) image. This image can then be imported in to IRRICAD. Before importing you will need to know the world size of the photograph e.g. the photograph image is 1.5 x 2ft (m) and correlates to a world distance of 3500 x 6000ft (m). After selecting *File|Import Bitmap* two points need to be placed for the top left corner and bottom right corner of the image. This drags the image to the correct size. *Tools|Resize* can be used to resize the image after importing. You can also use direct distance entry to specify the coordinates of the top left corner and bottom right corner of the image (see *By Using the Mouse and Keyboard*, Section 2.4.1.4).

2.4.1.4 BY USING THE MOUSE AND KEYBOARD

You can use the mouse to draw lines or other drawing objects on the screen. The status bar will tell you how long you have drawn a line. The status bar value d = measures from each click used to place each point of a drawing and hydraulic tool. To measure a distance or length of an object already on the screen, place the cursor at one end of the object. Press the F9 key to zero the distance on the status bar. Move the cursor to the other end of the object and look at the d = value on the status bar.

DIRECT DISTANCE ENTRY

The keyboard can be used to specify lengths, coordinates and angles of drawing tools. To specify a length of a line, radius, side of a rectangle, etc., select the tool and place the first click, using the mouse, on the screen (drawing objects only). Type the length, e.g. 30 (ft, m) and press the Enter key. Note prior to pressing the Enter key the value you type appears in the left-hand corner of the status bar.

To specify the angle of a line, radius, side of a rectangle, etc. you must also specify a length. Type in the length, then <, then the angle (e.g. 50,<90 for a line the length of 50ft (m) long at an angle of 90° from the starting point).

To use coordinates to place the start and end points of a line, radius, side of a rectangle, etc., type in the required X and Y coordinates for the starting point (e.g. 0,0) and press the Enter key. Once again, note the values you type will appear in the left-hand corner of the status bar. Now type the X and Y coordinates of the end point (e.g. 50,30) and press the Enter key.

See also:

Draw

Section 5.5

2.4.1.5 SUMMARY

- If using a digitizer:
 - If Reference is to be used, ensure there are reference points on the plan using world coordinates
 - If Scale is to be used, ensure the whole plan fits within the tablet's active area and you know the scale
- If importing a file:
 - Select the Import units for the file
 - Check the scale once the file is imported
 - If a viewport is present, import ~Convert-ModelVCD
- If importing a bitmap:
 - Coordinates can be used to specify the world size of the image
- If using the mouse or keyboard
 - Use lengths, coordinates and angles to enter data
 - Direct distance entry cannot be used for entering hydraulic items

2.4.2 ENTERING HYDRAULIC ITEMS

Hydraulic items are those which have a hydraulic or irrigation significance in the design. These items are required in the design for any design and analysis to take place.

Hydraulic items in IRRICAD are divided into two types - those upstream from the control valve named mainline items, and those downstream from a control valve named Zone items.

Some of the more frequently used hydraulic tools are available from the hydraulic toolbar on the left side of the screen. Those available are:

- *Zone|Pipe*
- *Zone|Cut Pipe*
- *Control Valve*
- *Zone|Outlet*
- *Zone|Block*
- *Mainline|Pipe*

Select the database to use for the design in *Settings|Irrigation - Design Specific*. Click the Browse button if you wish to change the currently selected database to another database. If you wish to have a database for a specific manufacturer, please contact your technical support or visit our website www.IRRICAD.com. Databases are downloadable and can be merged with an existing database if required. (See Merge, Section 3.6.3).

Hydraulic items can be either connected to existing items, or placed near existing items without connecting. Zone and mainline items can only be connected via a control valve. Select Connect or Place in *Settings|Snap*. If you are in Connect mode, but would like to place one or two objects without them connecting to existing items, select *Right-Click|Snaps|Place*. See Connecting and Placing Hydraulic Items, Section 2.4.2.2 for more information. Any items not connected to a water supply will not be included in the design and analysis process.

Pipes require a junction where they connect to other pipes. However, where pipes connect to point objects such as valves, outlets and water supplies, the junction symbol will disappear when connected. If you can see the junction symbol, the item is not connected to the pipe.

Electrical items, though having no hydraulic significance can be selected from the Electrical menu. Electrical items can not be designed to a specification. IRRICAD will not tell you the size of wire required. Any electrical items entered are for reporting (quantities required) and visual purposes only.

See also:

IRRICAD Database Editor
Pipes & Pipe Sizing

Section 3
Section 2.4.6

2.4.2.1 ITEM SELECTION

In order to select a hydraulic item for use in a design, it must first have been entered into the working database using the Database Editor.

Select the required tool from the Zone or Mainline menu, e.g. Outlet, Pipe, etc. Select the component you wish to use from the dropdown list. For items to be present in the list, they must first be entered in the database and enabled for use (have a usage code entered into the Usage field for the item). The items in the selection list are ordered according to the order specified for the type of item (see Default Database Order, Section 3.10).

When the tool is selected a dialog box appears. Select the item you wish to use in the design. Pipes can be Computer Selected which allows IRRICAD to size pipes for you according to the system requirements. For other items, e.g. outlets, tapes and spraylines, a summary of the hydraulic data is present in the dialog to help you select the correct item.

The characteristics of each hydraulic item are found in the database.

If an operating pressure is entered for an outlet which is outside the operating range of the item, a warning message will be given before closing the dialog. There are recommended and absolute ranges in IRRICAD. A recommended range will give you a warning message if the range is exceeded, but can be overwritten by clicking the Continue or Yes button. Absolute ranges will not let the exceeded range be entered - it must be changed before closing the dialog.

Items can be placed at a depth to indicate they are installed below ground and will require fittings to account for the change in depth. See Entering Items at Different Levels, Section 2.4.2.3.

An orientation can be specified to rotate the symbol of the item as required. The orientation does not have any hydraulic significance and is visual only.

Items selected can be changed individually or globally (many like items at one time) if required by using *Tools|Change* for an individual item or *Tools|Change Type* for more than one item. See Making Changes to Your Design or Drawing, Section 2.4.3.

See also:

<i>IRRICAD Database Editor</i>	<i>Section 3</i>
<i>Making Changes to Your Design or Drawing</i>	<i>Section 2.4.3</i>

2.4.2.2 CONNECTING AND PLACING HYDRAULIC ITEMS

In order for a system to be designed and analyzed, hydraulic items must be connected in some way to a control valve (Zone) or water supply (Mainline). Items can either be connected to other hydraulic items, or placed on the screen. Note that even though it may be visually in the same position, an item *placed* on the screen is not considered to be physically connected to other hydraulic items. Such items will therefore not be included in any analysis process.

In *Settings|Snap*, you can select the default snap mode

- Connect
- Place
- Snap to Grid

There are two ways to check if all hydraulic items have been connected:

1. *Design|Check Outlet Connectivity*
 - Checks to make sure all outlets are connected to a control valve (if a control valve is present) and that all control valves are connected to a water supply. (In the case of Mainline Outlets, they must be connected to a water supply).
2. *Tools|Move*
 - If *Tools|Move* is used on an object and moved, the connecting rubberbands will be seen. A rubberband will appear to all items connected to the selected object as well as a rubberband to show the movement of the selected object. (Select *Right-Click|Restart* to disengage Move).

Junctions will be seen where pipes end and are joined together. However, if a junction is visible where an outlet, control valve, misc. hydraulic item or water supply is connected to a pipe, then the item is NOT connected to the system. If the point item is correctly connected, the junction will be invisible.

Connect

To enable items to be connected to each other the cursor must be in Connect mode (*Settings|Snap*). When Connect has been selected all hydraulic items will be connected together, providing that the mouse click on the screen is within the Tolerance range. If you click the mouse outside this range, then the item will be simply placed, as when in Place mode, as IRRICAD assumes you do not wish to connect to an existing item.

The tolerance range is indicated by a Snap Tolerance in inches or mm (or the specified Paper units selected in *Settings|Units*) on the screen, and the Min and Max Tolerance as world units (the specified Distance units selected in *Settings|Units*). If a point is clicked on the screen when the zoom is a long way out, 2mm on the screen can cover quite a large distance in world units. If the zoom is a long way in, 2mm on the screen covers a very small world distance and care may need to be taken to click as close as possible to the existing item so the items are connected. The Max Tolerance is the maximum distance that you can click and have IRRICAD connect this item to an existing item. If the click is outside this maximum distance, the item will be placed.

Select *Right-Click|Snaps|Place* to place the next point when in Connect mode. The next point will be placed but not connected to any nearby items.

Place

When Place has been selected in *Settings|Snap*, no items will be connected, just placed on the screen where you click the mouse, even if the mouse is clicked over an existing item. *Zone|Cut Pipe* will work as when in Connect.

Snap to Grid

Snap to Grid is an option to have the cursor move only between grid points on the screen. These grid points can be visible or invisible. The size of the grid can be altered in *Settings|Grid*.

When Snap to Grid mode is selected in *Settings|Snap*, hydraulic items will not always connect. This may be due to an item not being precisely on a grid point. *Zone|Cut Pipe* will work as when in Connect.

RULES FOR CONNECTING ITEMS

IRRICAD uses these rules for placing and connecting various hydraulic items in a design:

- Mainline pipes and spraylines will not directly connect to zone pipes or spraylines. Only control valves can connect to both mainline and zone pipes.
- Zone items can only connect to other zone items.
- Mainline items can only connect to other mainline items
- Be careful when in Snap to Grid mode that outlets connect to pipes and pipe ends.
- If a junction can be seen where point objects such as water supply, control valves or outlets connect to pipes or pipe ends, they are not connected. Move the item until the junction disappears upon connection.

See also:

Default Snap Mode
Snap

Section 5.9.1.1
Section 5.1.8

2.4.2.3 ENTERING ITEMS AT DIFFERENT LEVELS

During installation pipes and valves may be placed at different levels in the ground or above ground. With items at different levels, fittings and risers are required to resolve the differences in depths. If these depths are entered for each item in the design, IRRICAD can select the fittings required between the levels and add these fittings to the bill of materials for the design.

Depths allow you to apply specific depths to items in IRRICAD. Entering depths is optional; they can be left at 0 in the dialog if you do not wish to use this utility. All depths entered are measured from ground level. If the item is under the ground e.g. 24" (600mm), type in 24 (600). If the item is 24" (600mm) above the ground, type in -24 (-600).

If you specify a depth for an item, IRRICAD uses this depth to calculate pressure differences resulting from the depths and the required fittings to connect items at different depths.

Where pipes are specified at different depths, IRRICAD will automatically select a riser pipe when you run *Design|Computer*

Selection of Fittings. The type of pipe and size can be controlled by the settings in the riser table (see Riser Selection Rules, Section 5.11.13). These rules apply to all hydraulic items (except outlets) at different depths.

RISER SELECTION RULES

Where pipes or valves with different depths meet at a junction, IRRICAD will assume that the diameter of the vertical riser pipe is equal to the diameter of the largest pipe or valve at the higher of the two depths being connected. IRRICAD will also assume that the type of material for the riser pipe is the same as the largest item at the lower of the two depths.

In *Design|Riser Selection Rules*, the table provides the means to specify a diameter or pipe type other than that assumed by IRRICAD.

For each combination of two depths in the design, Depth 1 is the higher depth and Depth 2 is the lower of the two depths relative to ground level. For example, if mainline pipes are at a 2 foot depth and zone pipes at a 20" depth, enter Depth 1 as 20 and Depth 2 as 24 (check the units you have specified for depths and enter accordingly). If a valve is at 18" height above ground level and the mainline is at 2 foot depth, enter Depth 1 as -18 and Depth 2 as 24. Repeat entries can be entered for all combinations of depths where components join at different levels.

Note: If two depths are identified by IRRICAD as requiring a riser connection and that depth combination is not specified in the Riser Selection Rule table, the default rules for riser size and type will be used.

In the Riser column, select Rule or User.

Rule:	Gives the choice of specifying the size and type of riser to be the same as the larger pipe or valve at the higher or at the lower of the depths.
User:	Allows selection of a pipe to be used for risers between the two depths. The list of pipes is found in the Riser Description column.

If Rule has been selected:

In the Size column, select Top or Bottom.

Top:	Sets diameter to the largest pipe or valve at the higher level (Depth 1).
Bottom:	Sets the pipe type to the same as the largest pipe or valve at the lower level (Depth 2).

In the Type column select Top or Bottom.

Top:	Sets diameter to the largest pipe or valve at the higher level (Depth 1).
Bottom:	Sets the pipe type to the same as the largest pipe or valve at the lower level (Depth 2).

If User has been selected:

Choose the riser from the dropdown list in the Riser Description column. Note that it may be necessary to click on this column in order for the list to appear.

Note: Where a type is specified of a pipe that is not in the pipe database and able to be selected, IRRICAD will be unable to find a riser and will report this in the list of fittings for the junction.

Where Top is selected for the Type and the object of largest size is a valve (which does not have a pipe type), it automatically changes to Bottom for that connection.

2.4.2.4 SUMMARY

- Items to be used must first be in the current working database and enabled
- Pipes can be computer selected
- Use Connect mode to physically connect items to the system
- Depths are measured from ground level
- A depth above ground (e.g. for a valve) is given as a negative (-) value

2.4.3 MAKING CHANGES TO YOUR DESIGN OR DRAWING

Once items have been entered into the design, there may be reasons for wishing to change one or more items. Hydraulic items and drawing objects can be changed individually or all like objects at the same time. To change one item, select *Tools|Change*. To edit several items at one time, select *Tools|Change Type*. Use the Selection Filter, available in

the Tools menu to aid you in selecting the correct item or items prior to selecting the Change tools.

2.4.3.1 CHANGING INDIVIDUAL ITEMS

To change a single object use *Tools|Change*. The dialog for that item will allow you to edit any characteristic available in the dialog. It may aid you to zoom in to the object you wish to change before clicking on it to avoid the wrong item being selected.

The Change tool is also available on the hydraulic toolbar and in *Right-Click|Modify*.

When in Select Object mode, double clicking on an item will bring up the Change dialog.

DRAWING OBJECTS AND ELEVATIONS

For drawing objects the common drawing properties are:

- Layer
- Color
- Line type
- Line width

These properties can be edited by selecting from a dropdown list. In the case of editing the color select from the resulting palette dialog. The item can also be specified By Layer meaning the item will have the color, line width and line type as specified for the layer the item is on, in *Settings|Layers*.

Other object properties are specific to the item. For example the radius of a circle may be edited by over-typing the current radius of the circle, likewise the length of a line.

Drawing objects that cannot be changed are dimensions, hatches and fills. You must redraw these items if you wish to change them.

HYDRAULIC ITEMS

The drawing properties available for editing in the hydraulic dialogs are:

- Layer
- Line width (pipes, tapes and wires)
- Color, symbol (water supplies and junctions)

- Color, line type, line width (areas)

The initial values of the drawing properties in the dialogs are based on the defaults specified in *Settings\Irrigation Items* and *Settings\Irrigation - Design Specific*, which you can change.

The line width determines how thick or thin the pipe appears on the screen and plan. Line widths on the screen may differ from those on the plan depending on your screen resolution. Line widths for specific objects e.g. Mainline pipes, Zone pipes, can be set and saved as default in *Settings\Irrigation - Design Specific*. For example, you may wish Zone pipes to be a default width of 2.

Other properties such as orientation and depth may be edited by over-typing the existing value. The Computer Sized option for pipes and spraylines can be checked or unchecked to turn computer sizing on or off respectively. Fittings can be edited by clicking the Show Fittings button on the dialog.

All other drawing properties for hydraulic items, e.g. color, symbol and line type, are specified in the database, as outlined in the IRRICAD Database Editor Section 3. These properties can only be edited in the database.

***Note:** If multiple items are selected and the Change tool is invoked, you will not be able to change the hydraulic item to another of its kind e.g. you will not be able to change a 3" (80mm) pipe for a 2" (50mm) pipe as this field will not be present in the dialog. Use Change Type for multiple selections.*

2.4.3.2 SPECIFYING GROUPS OF ITEMS TO CHANGE OR DELETE

It is a common occurrence to wish to change or delete a group of objects. To be able to specify what characteristics the objects must possess in order to belong to the group is important. The way in which IRRICAD allows this is using the Selection Filter (see Selecting Specific Items – Filtering Your Selection, Section 2.4.3.3), or the Match / Change dialog present in Change Type and Delete Type.

To use Change Type, click on a representative object of those you wish to change. Only those selected will be eligible for the change. Edit the dialog as described above in Changing Individual Items, Section 2.4.3.1. When the OK button is clicked a Match / Change dialog appears. This

dialog allows you to match characteristics you wish to be the same in the objects you wish to change, and also allows you to specify which changes should be global.

If an item in the Match column is checked, then all items to be changed must have this characteristic matched e.g. line width. If an item in the Change column is checked, then all selected items which match on the match criteria will have the change (e.g. layer) imposed.

If the representative item has a new pipe or sprinkler selected during this function, all the selected items that match the criteria can be globally changed to the pipe or sprinkler chosen. See Figure 7 for an example of changing existing sprinklers to a different sprinkler.

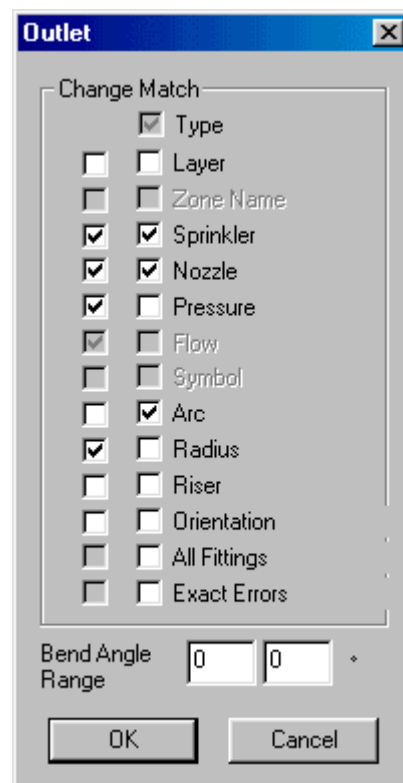


Figure 7

The representative item had a new sprinkler selected and therefore a new nozzle selected. To apply these changes to all sprinklers selected, regardless of their sprinkler or nozzle uncheck sprinkler and nozzle in the right-hand Match column. Items that have different sprinklers or nozzles than the representative item will still change. If the arc has changed and you wish all items to conform to the new criteria, uncheck arc in the right-hand Match column. When all criteria for changing and matching has been decided, upon clicking OK, IRRICAD will proceed to find all selected items which match the Match criteria and change these items to the criteria specified in the Change column. IRRICAD will display the number of items matched (i.e. the number of items changed) on the status bar. This also provides a means of checking that the expected number of items have been changed.

The Change Type tool is also available from *Right-Click|Modify*.

When using Change Type the process is:

1. Select all the objects you should wish to change or select the whole design.
2. Select *Tools|Change Type*.
3. Click on one item that is a representative of the items you wish to change.
4. Edit the dialog for the changes. The dialog that appears will differ depending on the type of object you have selected. Click OK.
5. The Match / Change dialog appears. It displays a default based on the changes you have made in the previous dialog. Make changes to the Match / Change dialog. If you are not sure, accept the default. Click OK.

The number of items that matched the Match criteria and were therefore changed will be displayed in the status bar.

Note: *Only those items that are selected (highlighted) are eligible for the change.*

Remember that the initial dialog that appears will depend on the type of representative object selected. For example, if you have selected an outlet as the representative object, the Outlet dialog will appear.

When using Delete Type the process is:

1. Select all the objects you should wish to delete or select the whole design.
2. Select *Tools|Delete Type*.
3. Click on one item that is a representative of the items you wish to delete.
4. The Match / Change dialog appears. It displays a default based on the type of object you selected as the representative. Make changes to the Match / Change dialog. If you are not sure, accept the default. Click OK.

The number of items that matched the Match criteria and were therefore deleted will be displayed in the status bar.

Note: *Only those items that are selected (highlighted) are eligible for the deletion.*

The principles behind the Match / Change dialog are:

- Select the criteria the objects must match on e.g. all pipes or the pipe selected (a 2" pipe for example)
- Select the characteristics to change, based on the changes made to the representative item
- Only the objects that match on all selected criteria can make the changes specified.

If you wish to make all pipe non-computer sized i.e. uncheck the Computer Sized check box so that IRRICAD cannot reselect a new pipe size during the design process, you would do the following:

1. Select all pipes or select the whole design using *Tools|Select|All* or *Tools|Select|Window*.
2. Select *Tools|Change Type*.
3. Click on a representative pipe (i.e. one you know you want to change).
4. Edit the dialog for the pipe - in this case uncheck the computer sized check box. Click OK.
5. Check the Match / Change dialog. Since you wish all pipes, regardless of the size, to change, uncheck the Match Pipe. This also applies if you are changing the pipe size and wish all pipes, regardless of current size, to change. Make sure the Change Computer Sized is checked. Click OK.

All pipes (except Computer Selected, i.e. have no current size) will have the Computer Sized check box unchecked and will retain their size during the design process.

When changing items like text it is important to know what the Match column implies. If you wish to change all text to a new font regardless of the current size of the font make sure Match Text is unchecked so that all text, regardless of what the text says, will be changed. Uncheck Match Height so that all sized text will change to the new font. If you have more than one current font in the design and wish all fonts to change to the new font uncheck Match Font. In the case outlines here you would want to make sure that Change Text is also unchecked or all text that falls into the Match criteria will change to what the representative text says.

The IRRICAD Selecting Fittings for the Design section Changing and Fixing Many Fittings Errors in One Go, Section 2.6.5.2 has an example of how to fix a common fittings error at many places in the design in one action. The principles to remember here are issues involving All Fittings and Exact Errors in the Match / Change dialog. If All Fittings are checked in the Match column, then only those items that are the same item and have exactly the same fittings, no more and no less, as the representative item you selected, will be applicable for the change. If Exact Errors is checked in the Match column, then only those items that are the same item and have exactly the same errors (as seen in the Show Fittings dialog), no more and no less, as the representative item you selected, will be applicable for the change. The Bend Angle Range will broaden the Exact Errors option (see Changing and Fixing Many Fittings Errors in One Go, Section 2.6.5.2). If the Exact Errors and All Fittings are different then the change will not apply.

See also:

Selecting Specific Items – Filtering Your Selection

Section 2.4.3.3

Changing Layers

Section 2.4.3.4

Changing and Fixing Many Fittings Errors in One Go

Section 2.6.5.2

2.4.3.3 SELECTING SPECIFIC ITEMS – FILTERING YOUR SELECTION

To make selecting a specific item or type of items easier to select the Selection Filter should be used. This tool is particularly useful if the item you wish to select has many close neighbours on the plan.

The Selection Filter can be used as an aid to filter out all other items you do not wish to select. Selection filter is found in the Tools menu.

In Figure 8, the layer has been specified as ELEVATIONS, All colors have been selected, and Spot Height has been specified as the type. While the Filter check box is checked, only spot height on the elevations layer will be selected using any of the selection tools or modify tools. In this way you can specify the items you wish to select or modify without other nearby items being selected.

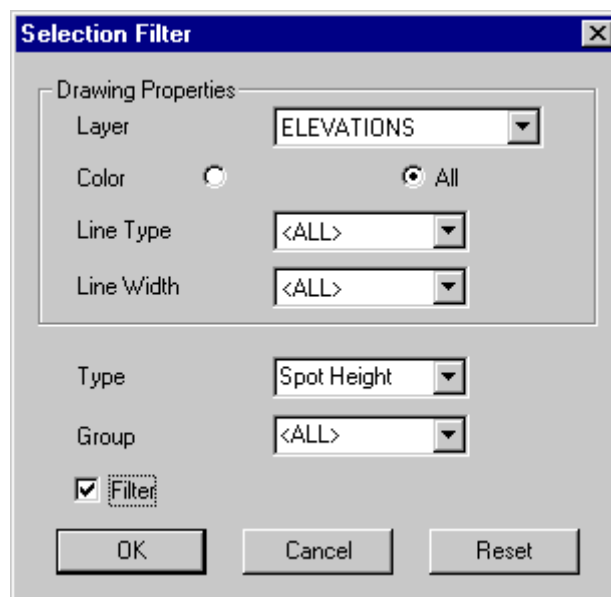


Figure 8

Layers, colors, line types and line widths can be chosen from the drop down lists or left as <ALL>. Type describes the item you wish to select e.g. rectangle, water supply, wetted radii, etc. Groups are specified as Drawing, Electrical or Hydraulic. Select the combination that best suits the item to filter.

Note: If the Selection Filter is set to exclude Zone Pipes, then the Zone|Cut Pipe tool will not connect to any zone pipes.

Return to *Tools|Selection Filter* and uncheck the Filter box when you have completed the action.

Tips: When the filter is turned on, subsequent selection operations capture only those objects meeting all of the filter criteria. For example, say you set the filter to screen for red circles of line type 3, width 4, and layer DRAWING. If you turn the filter off, then use the window selection tool, all objects completely enclosed within the window are selected. However, if you turn the filter on, then only red circles of line type 3, width 4, and layer DRAWING are selected, even though other objects were completely enclosed within the selection window.

The set of criteria defined by a filter can include only one entry for each property or entity type. For example, you cannot select for red and green circles at the same time. However, you can build your selection set by making multiple passes with the selection tools, and changing the filter criteria between each pass.

Changing the filter does not alter any previous selections. However, the filter can be used to selectively remove objects from the selection set if you press Ctrl as you click the desired selection tool. If you press Ctrl and the filter is on, then only objects meeting the filter criteria are de-selected by the selection tools.

Until turned on, the filter will have no effect on selection or de-selection operations. It can be turned on or off, or re-configured as often as needed during a selection operation to build up your selection set before performing an editing function.

2.4.3.4 CHANGING LAYERS

Layers can be used to differentiate objects, specify the drawing properties for a group of items, turn layers off or on to display different sets of items as required. When an item is selected for input the layer is <DEFAULT> - meaning the item will be put into its default layer for its type. For example, a rectangle's default layer is DRAWING. A zone pipe's layer is ZONE_PIPES. A different layer can be selected when selecting the item. However, the layer may be changed at a later stage.

Items can be moved from one layer to another by using Change or Change Type. Select the layer you wish to move the item to. The new layer must be selected from the dropdown list.

If a large group of items is to be moved, for example, you wish to move all spot heights from the ELEVATIONS layer in order to be able to turn off the display of spot heights and still retain the display of contours, selection filter can be used. In Figure 8 ELEVATIONS have been selected as the layer, spot heights as the type. Using a selection tool, all spot heights are selected. Use Change Type to change the layer to one other than ELEVATIONS. The Change Layer check box needs to be checked in order for the change in layer to apply to all spot heights. Both the Change and Match check boxes for Height should be unchecked, as you do not want to change the elevation data of any of the existing spot heights. Now all selected spot heights will be present on the new layer you had selected. This layer can be turned off or on (*Settings|Layers*) or modified as required.

2.4.3.5 SUMMARY

- For a single item use Change
- For more than one item use Change Type, except to edit the drawing properties of hydraulic objects, use Change
- To delete a group of items in one action, use Delete Type
- Change Type and Delete Type only work on selected items
- Selection Filter is an aid to help select the correct item

See also:

<i>Irrigation Items</i>	<i>Section 5.9.4</i>
<i>Irrigation - Design Specific</i>	<i>Section 5.9.10</i>
<i>Drawing Items</i>	<i>Section 5.9.5</i>

2.4.4 ALLOWING FOR ELEVATION CHANGES

Elevation data allows for the topography of the area for which an irrigation system is being designed. Elevation data differs from other background data, in that it has hydraulic significance relating to the design. It is therefore important to include all relevant elevation data in the design. IRRICAD uses this data to calculate the correct pressure losses and gains due to elevation changes. To include these changes in IRRICAD design and analysis, elevation changes need to be drawn on the screen or imported. Drawing with the mouse or digitizing from a

scale plan, or importing a file containing elevation data can enter elevation data. Elevations can be defined as contours - lines of elevation, or spot heights - points of elevation.

It is important to make sure that the elevation data spans the whole design. If hydraulic items are outside the contours or spot heights, IRRICAD will issue a warning and assume a height for these items, based on the closest data. Both contours and spot heights can be used together in a design. If you have the available data, place spot heights on items that you know are at a specific elevation to ensure the correct elevation is given to that point. IRRICAD interpolates between the closest points of data to determine the elevation of an item in the design.

Please note that elevations are only calculated and used at pipe junctions and where hydraulic items have been placed. If you wish to have pressures calculated part way down long pipelines or laterals, place permanent junctions where you wish these extra interpolations to be carried out.

Select Zone or Mainline Junction to add extra junctions. Check the Permanent check box. If you wish to put a line of junctions across a block of laterals, use *Tools|Cut Lasso*, selecting Cut Only and checking Permanent to enter the permanent junctions which will remain during the design process. The junctions will be placed where the lasso crosses the laterals.

The Change tool (*Tools|Change*) can be used to change any contour or spot height's elevation data. After adding or making changes to contours or spot heights select Re-interpolate Elevations, Section 5.11.8 to ensure that the changes are used. Re-interpolate Elevations after adding additional hydraulic or electrical items to the design if it has been previously analyzed.

IRRICAD uses 3-D lengths for the bill of materials for a design, using the elevation changes to calculate the additional length of pipe or wire.

2.4.4.1 GETTING ELEVATION CHANGES INTO IRRICAD

Contours and spot heights may be placed on the screen by the mouse using *Draw|Contour* or *Draw|Spot Height*. Alternatively the elevation data may be traced from a topographical map of known scale by using a digitizer (see *By Using a Digitizer*, Section 2.4.1.1). Geometric items

can also be converted to elevations at a later date (Convert to Elevations, Section 5.10.24).

You may import contours from a DXF file (see By Importing a DXF, VCD, DWG, GCD, SHP or MIF File, Section 2.4.1.2). Initially the full dxf file may be imported so as to determine the name of the layer or layers that any elevation data may be on. Import the dxf file using *File|Import*. Using the Change tool or a Selection tool together with *Right-Click|Object Info*, click on any objects that look like contour lines or spot heights. Once the name of the layer or layers is determined, select *File|Import Contours*. Select the layers that contain the elevation data - more than one can be selected by holding down the control key. All items in these layers will be placed on the Elevations layer in IRRICAD. All items imported in to the Elevations layer will be visually displayed as the color, line type and line width designated for contours and spot heights in *Settings|Irrigation Items*. If an item in the layer was not created as an elevation it will have no elevation data and its height will be displayed as 0.

See also:

<i>Contour</i>	<i>Section 5.5.15</i>
<i>Entering a Scale Plan</i>	<i>Section 2.4.1</i>
<i>Spot Height</i>	<i>Section 5.5.16</i>

2.4.4.2 ELEVATIONS ALONG PIPES OR LATERALS (UNEVEN CONTOURS)

IRRICAD assumes a constant slope between pipe junctions as elevations are interpolated at pipe junctions only. To overcome this when using spraylines use the unconnected spraylines option, by unchecking the Connected box, in the sprayline dialog. This means that the sprayline is not treated as a single item, but rather as individual pipes and outlets. IRRICAD then takes into account the elevation at each outlet in its design process. The option between using connected and unconnected spraylines will need to be decided before laying out the spraylines.

Another way to ensure changes in slope along a single pipe are accounted for, is to connect permanent junctions at the appropriate changes in slope. These will not be removed during the removal of redundant junction process. Use *Zone|Junction* or *Mainline|Junction* to add these extra junctions. This also allows a different pipe size to be selected if required.

See also:

Working with Junctions
Junction

Section 2.4.13
Section 5.6.12

2.4.4.3 SUMMARY

- Draw, digitize or import elevation data.
- Re-interpolate Elevations if Re-designing
- Elevations are used at junctions only.
- Use unconnected spraylines or permanent junctions

2.4.5 OUTLETS & RISERS (OUTLET CONNECTORS)

An outlet can be any type of device that discharges water under pressure. Examples include pop-up sprinklers, drip emitters, big guns, travelling irrigators, micro-sprinklers or mini-sprinklers or simply demand points. All outlets must have been previously entered in the Outlet group of the database and enabled for use (see Irrigation Components - Details of Individual Groups, Section 3.5) before they can be selected for use in a design.

Outlets can be entered into a design as Zone or Mainline outlets by selecting *Zone|Outlet* or *Mainline|Outlet* and connecting them downstream or upstream of a control valve, respectively. Outlets can be spaced at regular intervals by entering them as spraylines, where pipes and outlets are selected at the same time, or as blocks. Blocks are a tool to enter evenly spaced spraylines or pipes and sprinklers.

You must connect zone outlets to zone pipes, and mainline outlets (valve-in-head outlets) to mainline pipes. Attempting to connect a zone outlet to a mainline pipe or vice versa will result in the outlet being placed on the pipe and not connected to it.

By default, outlets (excluding connected spraylines) are created with wetted radii. There are a number of outlet types such as drippers where wetted radii may not be appropriate. In this case, select *Settings|Irrigation - Design Specific* and uncheck the Create Wetted Radii box before selecting and placing the outlet(s). If the wetted radii are created, the wetted radii layer can be toggled on and off by selecting *View|Wetted Radii*.

PLACING EVENLY SPACED OUTLETS USING SPRAYLINES

Connected spraylines (where the pipe and outlets are treated as a single entity) may be created with or without outlet symbols. Often, it is not appropriate to create symbols for items such as drippers due to the large number required. If you wish to see the outlets (and wetted radii), select *Settings|Irrigation - Design Specific* and check the Create Sprayline Outlets box before placing the sprayline(s). If you have already placed a sprayline without outlet symbols and then wish to see it, select *Tools|Create Sprayline Outlets* and click on the sprayline. Alternatively, select *Create Wetted Radii* and click on the sprayline. This will create both outlet symbols and wetted radii in one action. Note that the SL_WETTED_RADII layer must be on (*Settings|Layers*) for you to see the wetted radii for connected spraylines. A shortcut is available for you to toggle sprayline outlets on and off in *View|Sprayline Outlets*. If Unconnected spraylines are used, the outlets are treated as when an outlet is placed using *Zone|Outlet* or *Mainline|Outlet*.

If created, sprayline outlets or sprayline wetted radii may be turned off. The SL_WETTED_RADII layer can be turned on or off by selecting layer in *Settings|Layers*. The SPRAYLINE_OUTLETS layer can be turned on or off by selecting *View|Sprayline Outlets*, or in *Settings|Layers*.

Note: *The Wetted Radii option in the view menu will turn on and off the wetted radii on outlets that are not in connected spraylines.*

If the Connected check box is unchecked then once placed the pipe and sprinklers become individual entities.

The spacing between sprinklers can be set in the *Zone|Sprayline* dialog. In the Options dialog the spacing can be Fixed (Fixed check box checked) for the spacing of the outlets to be exactly as specified along the length of pipe of drawn. If the Fixed check box is unchecked, the spacing of the outlets will be such that outlets are placed at the start and end of the pipe and the spacing of outlets adjusted between with the spacing entered as a guide.

See also:

<i>Create Wetted Radii</i>	<i>Section 5.10.21</i>
<i>Create Sprayline Outlets</i>	<i>Section 5.10.22</i>
<i>Arc Types and Nozzle Properties</i>	<i>Section 2.4.5.1</i>
<i>Settings Create Sprayline Outlets</i>	<i>Section 5.9.10.3</i>
<i>Settings Create Wetted Radii</i>	<i>Section 5.9.10.2</i>

2.4.5.1 ARC TYPES AND NOZZLE PROPERTIES

In IRRICAD, any type of sprinkler, big gun, travelling irrigator or dripper is given an outlet body and a nozzle, even if the outlet does not physically have nozzles e.g. a dripper, or if the outlet we represent has many nozzles e.g. a travelling irrigator. The outlet body contains the description of the outlet, the arc type, price and some default values as those most commonly used when the outlet is selected. When you select an outlet from the dropdown list, the default nozzle for that sprinkler (as specified in the database, normally the most commonly used) is initially selected. The required nozzle can be selected from the dropdown list. Other default values can also be changed depending on the arc type of the outlet.

The nozzle part of an outlet can be the actual nozzles supplied with an outlet body, or simply hold the technical data for the outlet, such as a dripper's hydraulic characteristics. Nozzles contain the minimum and maximum recommended pressures from the manufacturer, and parameters to calculate the flow and radius at a given pressure.

Outlets are specified as having one of four different nozzle types: demand points, fixed arc with fixed flow (Fixed), variable arc with constant flow (Variable), or variable arc and matched flow (Matched). The type of outlet and the technical data in the Nozzle component group of the database determines how a nozzle's flow and radius responds to pressure changes and changes in arc.

Pressure, flow, radius and intensity change when one of these fields is changed, e.g.:

- For any sprinkler type (excluding demand points):
 - if the pressure is changed, the flow, radius and intensity are recalculated.
 - if the flow is changed, the pressure, radius and intensity are re-calculated.
 - if the radius is changed, only the intensity will be re-calculated.

For variable sprinklers, if the arc is changed the intensity will be re-calculated.

For matched sprinklers, if the arc is changed, the flow is re-calculated.

- Any changes made in data fields regarding nozzle pressure, flow rate or arc will produce the appropriate wetted radius. You can also enter a radius other than this when it is to be manually set at installation. It will remain at the user-defined value until further changes are made to one of the other fields; the radius will then revert to the value predicted by the manufacturer's data.
- For variable or matched sprinklers, you can change the arc to the required angle, e.g. 180°, 90°, etc. Changing the arc of a matched sprinkler will maintain the same intensity by altering the flow, whereas changing the arc of a variable sprinkler maintains the flow and therefore will increase the intensity as the arc decreases.

***Note:** When entering outlet and nozzle data in the database you need to know whether an outlet is Fixed, Matched or Variable. If you enter data and decide the outlet is fixed you cannot change the arc because it is made to be a fixed angle. If you choose Variable, then the flow does not change as the arc changes i.e. the same flow is emitted regardless of the arc you select upon placement. However, for Matched outlets, IRRICAD assumes that the data you input is for 360°. If you change the arc, the flow is matched and is decreased accordingly. Therefore if you use 180° as the arc you will get half the flow. If the said outlet is indeed Matched, then you will need to enter the data for 360° so that when you change the arc you will achieve the correct flow according to the manufacturers data.*

Demand points (pressures and flows are simply entered) are particularly useful for quick mainline or large turf designs. Where you know the flow and pressure requirements at a point but do not want to use a specific type of outlet or wish to replace a large group of outlets with one item, use a demand point. These are useful when used as a hydrant with a required pressure and flow at the hydrant, or at a control valve to replace all items downstream from the valve. Demand points do not contain an associated nozzle.

See also:

Entering Hydraulic Items
Nominal Pressures
Using Mainline Outlets

Section 2.4.2
Section 2.6.3.1
Section 2.5.7

2.4.5.2 RISERS (OUTLET CONNECTORS)

Outlet connectors (risers, stake and tube assemblies, etc.) are used to connect outlets to pipes. An outlet connector does not need to be selected, but if you have differences in height between the pipes and outlets or significant pressure loss in the connector, or you wish to include a specific riser in the bill of materials, you should select one.

Select the required outlet connector from the dropdown list. Risers are selected in the Outlet, Block or Sprayline dialogs.

Sprinklers are always assumed to be at ground level. If in your design they are not at ground level, you must select an outlet connector with the appropriate height previously entered in the Height field (in the database) to ensure that IRRICAD uses that height in the pressure calculations at the sprinkler. Note the height entered into the database is the height above ground, not the length of the outlet connector from a buried submain to the height of the outlet. For subsurface outlets (e.g. subsurface dripline) the height above ground will be negative (-ve).

A riser may not be required in the field e.g. a wheel line system where the sprinklers are connected straight into the sprayline or sprinklers on an above-ground lateral. You still require an outlet connector with the correct height gain, but no pressure loss and no cost. The connector and corresponding fittings can also be edited out of the reports if required. The alternative is to ignore selecting the riser if the height difference is small.

Another option for compensating for the height gain is to allow for it in the sprinkler hydraulic characteristics. When using the curve fitting utility to calculate the constant and index values before inserting a sprinkler into the database, decrease the pressure by an amount equivalent to the height the sprinkler. For example, if your sprinkler is 1ft (1m) above the ground decrease the pressures you insert into the curve fitting utility by 0.434psi (1m). Label this sprinkler carefully, so you will not mistake it for a normal sprinkler that has not had compensation for a height difference. Note that for every foot above the ground, the pressure needs to decrease by 0.434psi if using US units. If using metric units, the pressure decreases by 1m for every metre above the ground.

2.4.5.3 SUMMARY

- Connect zone outlets to zone pipes and mainline outlets to mainline pipes
- Use spraylines for placing evenly spaced outlets
- Outlets consist of an outlet body and an associated nozzle or nozzles
- Select an outlet connector to raise the outlet above the ground if required

2.4.6 PIPES & PIPE SIZING

Pipes in IRRICAD are any Zone or Mainline pipes used in a design, excluding tapes (driplines) and connected spraylines (laterals). Pipes can be selected from the Zone or Mainline menu. A control valve must be placed at the connecting junction between zone and mainline pipes, and can also be selected from the Zone or Mainline menu.

Pipes are represented as lines with designated properties of color, width and type. Pipe colors and line types are specified in the database for each individual pipe. Pipe widths can be specified in *Settings\Irrigation - Design Specific* and saved as the default setting for pipe widths if you wish to continue to use these settings for each design.

***Note:** If you have already placed pipes on the design and then change the pipe width setting in Settings\Irrigation - Design Specific the pipe widths on the screen do not change. You must change these using Change or Change Type.*

If you are unsure that pipes are connected to each other, or to another hydraulic item, select the junction and select *Tools\Move*. If it is connected, everything will move with the junction.

2.4.6.1 COMPUTER SIZING

If IRRICAD is required to size the pipe or sprayline, then ensure that Computer Sizing is chosen in the item field. Even if you have specified the sizing yourself, if the Computer Sizing check box in the dialog is checked, the pipes will be resized by IRRICAD by running LP Design or Velocity Design. If you do not want IRRICAD to change the sizes, turn off computer sizing by leaving the box unchecked when selecting pipe sizes, or unchecking the box at a later date. This can be achieved globally over all existing pipes if required by using Change Type. Highlight all the pipes you wish to have Computer Sizing switched

off, and select *Tools|Change Type*. Click on a representative pipe and uncheck the Computer Size box. In the Match / Change dialog uncheck all Match check boxes as we want all selected pipes to change regardless of pipe name, and check the Computer Sizing in the Change column.

When running Design options (such as LP Design or Velocity Design) any pipes that have the Computer Sized box checked will be re-sized regardless of whether or not they have been previously sized.

If Analyze or Detailed Analysis is selected and the design contains pipes that have not been sized either manually or by IRRICAD an error message will be issued.

All pipes (other than connected laterals) are given one size between junctions. In a long straight mainline, for example, add extra permanent junctions to the mainline if you wish LP sizing to consider using different sizes. Velocity Sizing will retain the same size wherever the flow in the pipes is the same. Elevations are only interpolated at pipe junctions. To increase the number of interpolations, place permanent junctions on the pipeline.

See also:

<i>Connecting and Placing Hydraulic Items</i>	<i>Section 2.4.2.2</i>
<i>Design</i>	<i>Section 2.6.3</i>
<i>Item Selection</i>	<i>Section 2.4.2.1</i>
<i>Outlets & Risers (Outlet Connectors)</i>	<i>Section 2.4.5</i>

2.4.6.2 USING CUT PIPE

Cut Pipe is a useful tool for connecting a pipe to many existing pipes (*Zone|Cut Pipe*). It can be computer sized or manually selected. It is primarily used to enter a submain pipe for connecting a block of laterals to a control valve or to connect a row of outlets without clicking to connect to each one. Cut Pipe connects to all zone items it crosses. When placed near to the end of a pipe or a series of pipes it will connect to the ends.

In some cases, cut pipe may connect to an item you do not wish it to connect to, or it may not connect to items it is placed close to. To help cut pipe in connecting to items it crosses or comes with a small distance of an item, tolerances are specified in *Settings|Snap*.

- Cut Pipe Tolerance:** The distance to which cut pipe will connect to the pipes or zone items it crosses or to the end of pipes / laterals in mm or inches on the screen. In this case, if your cut pipe tolerance is 2mm, but in your design you have laterals 1mm apart, then only every second lateral will be connected to the submain.
- Cut Pipe Length Factor:** This factor is used along with the Cut Pipe Tolerance to determine if the cut pipe is close enough to the ends of laterals to be connected to them. This factor is used as a proportion of the total length of the cut pipe and is not related to the Zoom State. The greater of the Cut Pipe Length Factor multiplied by the total length of the cut pipe or the world value (metres or feet on the ground) of the Cut Pipe Tolerance is used to determine if the ends of laterals are close enough to snap to.

When using cut pipe to connect to many laterals laid out on a design, or for connecting outlets, a utility called Flow Check can be used to ensure that a specified maximum zone flow will not be exceeded. In *Settings\Irrigation Items* the maximum zone flow can be specified. When connecting the cut pipe the status bar will display the flow currently connected and the Maximum flow. If the Maximum flow is exceeded, a warning message displays the amount of flow connected if you accept. If you do not accept the last connection, cut pipe rubberbands back to the last click placed.

If you decide to move the submain after you have inserted it, the quick way is to use *Tools\Select\Lasso* to select all the sections of the submain. Move the submain where required and the connected pipes and outlets will move also. You can also use Select Lasso and *Tools\Delete* to remove the submain and re-enter it where required. Junctions created by cut pipe previously will not be deleted but will be removed during the design process.

See also:

<i>Entering Items at Different Levels</i>	<i>Section 2.4.2.3</i>
<i>Working with Junctions</i>	<i>Section 2.4.13</i>
<i>Cut Pipe</i>	<i>Section 5.6.6</i>

2.4.6.3 SUMMARY

- Pipes are designated a color and line type in the database
- Use the Computer Selected option to have IRRICAD size pipes for you or use a combination of computer sized and manually selected pipes
- A control valve must be placed between zone and mainline pipes
- Use Flow Check to help with breaking a layout into groups of outlets for a control valve
- Draw Cut Pipe across all laterals, zone pipes or zone outlets as required

2.4.7 ENTERING CONTROL VALVES

Control Valves define groups of outlets running at the same time. Items downstream from the control valve are Zone items, items upstream from the control valve are Mainline items. Consequently control valves are the only items that can be placed between mainline and zone pipes. When a control valve is required in the design, select Control Valve from the Zone or Mainline menu. IRRICAD checks if the chosen valve is within the manufacturer specifications but does not choose the valve for you. As with any hydraulic item, the hydraulic characteristics of control valves are stored in the Database.

When placing a control valve, a unique zone name is required for you to be able to identify each valve and zone and to avoid confusion in the design process. The default naming of zone names is specified in *Settings|Names*. You can change the default name and numbering system if required. The zone name can be entered each time the zone name dialog appears after connecting a valve. Alternatively, after selecting a Control Valve to use in the design, select *Right-Click|Default Name* before placing any control valves. The zone name can be edited for the following control valves until another tool is selected. The Change tool can also be used to change the zone name and numbering for individual control valves once they are placed.

You can specify a pressure at the control valve if required in *Design|Zone Design Configuration*. If a pressure is not entered, IRRICAD calculates the pressure at the control valve. Note that a pressure needs to be specified if you wish to use Detailed Analysis.

See also:

<i>Connecting and Placing Hydraulic Items</i>	<i>Section 2.4.2.2</i>
<i>Zone Summary Design Report</i>	<i>Section 5.12.4.2</i>
<i>Making Changes to Your Design or Drawing</i>	<i>Section 2.4.3</i>
<i>Item Selection</i>	<i>Section 2.4.2.1</i>
<i>Names</i>	<i>Section 5.9.11</i>

2.4.8 USING MISC. HYDRAULIC ITEMS

Misc. Hydraulic Items can be valves, pressure regulating valves, air release valves, headwork losses, rising column losses, well drawdown losses or any item that needs to be included in the design due to their hydraulic character and performance or for fittings selection. These characteristics are stored in the Other Hydraulics component group of the database. They can be selected from the Zone or Mainline menu. Misc. Hydraulic items must not be connected to a 3-pipe junction as IRRICAD needs to know which two pipes it physically spans, enabling IRRICAD to know which way the water is flowing through the item and to solve fittings for the item connecting to a pipe or pipes.

Pressure Reducing Valves (PRVs) are unique in that they require a threshold of pressure before they can regulate or burn up pressure. If the actual pressure is below this threshold, the PRV will not work as designed. This threshold is determined by the headloss equation in the database. PRVs can be placed on Zone or Mainline pipes but must not be placed in looped sections, although they can be used in designs containing loops. PRVs should always be in branched sections of pipeline to avoid IRRICAD becoming confused as to which way the water is going through them. As with Misc. Hydraulic items in general, PRVs should be placed in pipelines, not at 3-pipe junctions.

To use a PRV in a design, select Misc. Hydraulic from the Zone or Mainline menu. The dialog that appears is similar to that for other Misc. Hydraulic items, with the exception that a downstream pressure is required. This pressure will be maintained (provided the upstream pressure is enough for the PRV to work) during pipe sizing (LP or Velocity Design) and hydraulic analysis of the system.

See also:

<i>Connecting and Placing Hydraulic Items</i>	<i>Section 2.4.2.2</i>
<i>Other Hydraulics</i>	<i>Section 3.5.4</i>
<i>Making Changes to Your Design or Drawing</i>	<i>Section 2.4.3</i>

2.4.9 WORKING WITH UNIFORMLY SPACED OUTLETS ON A PIPE

Spraylines are used to place pipe and outlets at a defined spacing in one action. Spraylines can be defined as Connected or Unconnected.

Connected - This indicates that the sprayline will be treated as a single item with emitters on it. Connected spraylines should only be used in situations where you have more than 10 emitters per lateral due to the high number of emitters and pipe segments. This method is very accurate if there are over 30 emitters present. The elevations will only be calculated at the start and end of each sprayline segment. These may sound like tapes (driplines) but there are some major differences between tapes and connected spraylines. Tapes have many emitters at a low flow and the flow is not constant during analysis and the small emitters are embedded in the internal wall of the tape. Connected spraylines tend to have higher flows than tapes and the flow remains relatively constant during analysis.

Unconnected - This indicates that once placed the sprayline will be individual pipes and outlets. If non-pressure-compensating emitters are used, then this method is more accurate than the Connected option as elevation data is calculated for each segment between emitters, depending on what sort of system you are designing.

Spraylines are selected from the Zone or Mainline menu, depending on what sort of system you are designing. Mainline spraylines are always unconnected - separate pipes and outlets once placed with each outlet being treated as a separate zone. Spraylines can be computer sized.

When connected spraylines are specified as computer sized you can specify the maximum number of sizes for each sprayline segment in Zone Design Configuration. The number can be between 1 and 3 with the default as one size per lateral.

The spacing can be specified between outlets. If the lateral (Block tool only) or outlet spacing you have entered is greater than 120% of the radius value a message will appear to warn you in the case of having entered a wrong number. This is a warning only and can be ignored.

The offset is a percentage of the entire length of the sprayline (Block tool only). If the offset is entered as 50%, the outlets on the sprayline do not start until half way long the sprayline. For single spraylines, the offset is specified in the distance units (ft, m, etc.) from the start of the sprayline.

The Fixed Spacing option allows you to indicate whether the outlet spacing is fixed as determined by the Outlet Spacing field, or adjusted to fit between the start and end of the sprayline segment (see Figure 9). If the box is checked, the outlet spacing will be maintained along the pipe. If the box is unchecked, the outlet spacing will be adjusted by IRRICAD to ensure that an outlet is placed at each end of the sprayline and that those between will be equally spaced. IRRICAD will space the outlets as near as possible to the value entered in the spacing field.

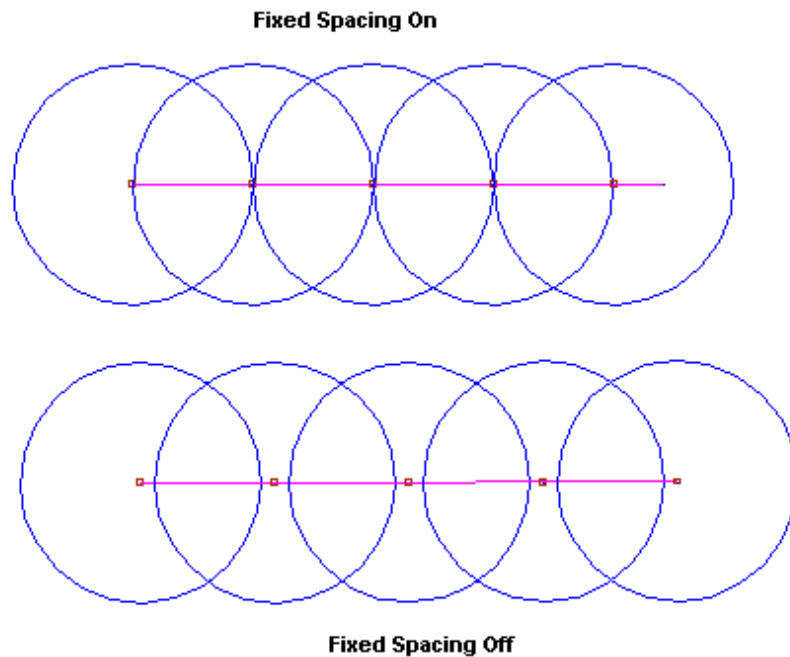


Figure 9

Zone|Block is usually used to place multiple spraylines in a design. *Zone|Sprayline* can be used to add extra spraylines, or to replace ones accidentally deleted.

See also:

<i>Outlets & Risers (Outlet Connectors)</i>	<i>Section 2.4.5</i>
<i>Nominal Pressures</i>	<i>Section 2.6.3.1</i>
<i>Connecting and Placing Hydraulic Items</i>	<i>Section 2.4.2.2</i>
<i>Making Changes to Your Design or Drawing</i>	<i>Section 2.4.3</i>
<i>Item Selection</i>	<i>Section 2.4.2.1</i>

2.4.10 ENTERING DRIPLINES IN A DESIGN

Tapes (driplines) are defined as any pipes with integral emitters at a relatively small spacing. These may sound like connected spraylines but there are some major differences between tapes and connected spraylines. Tapes have many emitters at a low flow and the flow is not constant during analysis and the small emitters are embedded in the internal wall of the tape. Connected spraylines tend to have higher flows than tapes and the flow remains relatively constant during analysis.

The value for the inlet pressure required in the dialog when entering a tape is the pressure you are aiming to achieve at the start of the tape. A zone pressure tolerance is entered into the Database Editor in percentage deviation above and below the specified inlet pressure. If the allowable deviation above is 10% and below is 10%, the total tolerance is 20%. If any tape inlet pressure is outside the tolerance range a warning message will be given during Design.

Pressure Regulated Tapes are those where pressure regulation (e.g. PRVs, spaghetti tube) will be used to control the pressure at the tape inlet. Submain Min Pressure is the minimum pressure required in the submain for the pressure-regulated tapes. The difference between the submain and tape inlet pressures provides a differential pressure in which the pressure regulators must operate. In the non-regulated case (box is unchecked) then the Submain Min Pressure field is dimmed since it is not appropriate. Note that tapes that have pressure-compensating emitters are not normally regulated at the tape inlet.

Tapes can be analyzed using the one of two calculation methods. In the Tape database the Iteration method is selected if the check box is checked, if it is not checked then the Tape Factor method is used.

Tapes are normally entered using *Zone|Tape Block* rather than single tapes at a time (*Zone|Tape*). It is normally faster to enter all the blocks as one and delete out sections between zones using *Tools|Cut Lasso*.

Tapes can not be computer-sized. Tapes cannot be telescoped or have junctions. If you have drawn tapes with telescoping sizes or junctions, a warning message will appear during Zone Design. However, tapes can be analyzed with a flushing main.

Tapes can be drawn with bends by checking the User Defined check box for Lateral Direction (Tape Block tool only) and then checking the Polyline check box which is made available when User Defined is checked. After drawing the block lasso, specify the direction with of the tapes with bends. Select *Right-Click|Done* when finished drawing the lateral direction as in Figure 10.

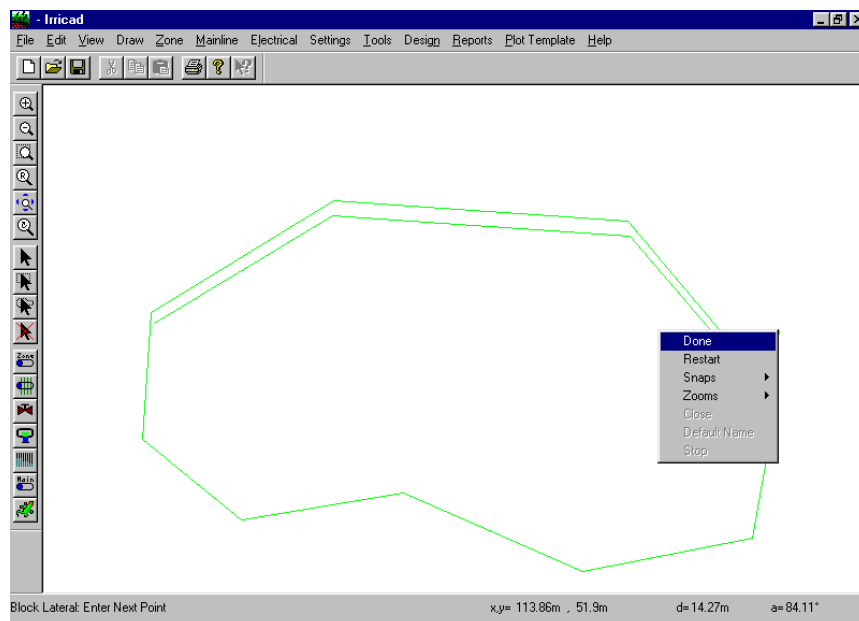


Figure 10

See also:

<i>Connecting and Placing Hydraulic Items</i>	<i>Section 2.4.2.2</i>
<i>Making Changes to Your Design or Drawing</i>	<i>Section 2.4.3</i>
<i>Item Selection</i>	<i>Section 2.4.2.1</i>
<i>How To Simulate Tapes Using Spraylines</i>	<i>Section 2.9.1</i>
<i>Detailed Analysis of Tapes Under Flushing</i>	<i>Section 2.9.2</i>
<i>Modeling Multiple Driplines as a Single Line</i>	<i>Section 2.9.3</i>
<i>Tapes</i>	<i>Section 3.5.2</i>

2.4.11 USING WATER SUPPLIES

Water Supplies are used in the design as a point of supply for the irrigation system. A water supply may be a mains supply, pond, pumping station, tap etc. Water Supplies are mainline items and must be placed upstream from the control valves. IRRICAD does not permit you to connect a water supply directly to a zone pipe. A water supply can only have one pipe connected directly to it (i.e. it must not be placed in-line on a pipe) and must feed into the irrigation system from a branch.

Where only one water supply is specified, it is not necessary to enter flow information or pressure information. If these entries are left as zero, the supply is assumed to be unrestricted and IRRICAD will calculate the required duty for the system. Where more than one water supply is used, it is necessary to specify at least the pressure information. You can specify the operating times for each water supply (*Design|Water Supply Times*) if you wish, or simply designate each water supply to supply specific system flows (*Design|Assign System Flows to Zones* options).

Design flow is the flow available from the water supply that ideally should not be exceeded for the design. Where the valve operating sequence results in a water supply that exceeds this value, you will be warned but allowed to proceed. If a Design flow is entered, you must also enter a Maximum flow, but a Maximum flow can be specified without a Design flow. The Maximum flow is the flow that can not be exceeded under any circumstances. IRRICAD will prevent you from continuing if you enter a control valve operating sequence that results in a water supply flow demand greater than this value. The Design flow should allow for possible flow reductions (e.g. may occur during summer) or any other factors that make it desirable for you to design the system for a lower flow. There may be circumstances where the Design flow requirement is exceeded, and with your acceptance, this may be done provided the Maximum flow is not exceeded. Flows entered here have no effect in the design calculations; they are only used in Management. The outlets determine the resulting flow in the system.

The Design pressure is the pressure available from the water supply (i.e. a pump, height above ground, etc.) that ideally should not be exceeded for the design. This pressure, if specified, is used in the calculation of mainline pressures. If a Design pressure is entered, a Maximum pressure must also be entered which cannot be exceeded, but a Maximum pressure can be specified without a Design pressure.

When more than one water supply is used, the flows each water source supplies is very sensitive to the pressure entered. Changing the pressure at each water supply has a significant effect on the flow provided. In some circumstances, particularly in highly looped situations, the mainline analysis of designs with a number of water supplies **operating at the same time** results in outflows or inflows being wrongly assigned to a small number of pipe junctions, or pressure losses through some pipes which are incorrect. Sometimes these inconsistencies are so small that they have virtually no effect on the final results. At other times this is not so. Some potential problems are trapped and screen messages are displayed. However, there may be occasions where this does not occur and so users should always check the Mainline Full report before proceeding.

You must always enter at least the pressures when more than one water supply is used in a design. If these water supplies are supplying separate systems i.e. they are not joined in any way via pipe work, join the water supplies with a temporary pipe. The assigning of system flows to water supplies in *Design|Assign System Flows to Zones* options determines which water supply feeds which valves. This can be deleted after Design / Analysis has been completed.

For a gravity system, where there is no starting pressure, enter a small number to prevent IRRICAD from calculating the required pressure at the water supply to supply the system requirements. If the water supply is a tank, dam or weir with a water level height above the ground, enter the height as the Design pressure. For other gravity systems type in a small number other than zero (e.g. 0.1) to indicate that the available starting pressure is close to zero.

Water supply pressures are required before selecting *Design|Mainline Design|Detailed Analysis*. To enter or change pressures (and flows) in an existing water supply, select *Tools|Change* and click on the water supply symbol. Enter or edit the water supply details as required.

***Tip:** If a junction symbol can be seen where the pipe meets the water supply, the water supply is not connected to the system. Move the water supply until the junction disappears (connects to the pipe end).*

For pumped systems, there are several ways to indicate the Design pressure at the water supply. If you are not intending to connect a pump to the supply line, you can set the Design pressure as the pressure that the pump will supply at the required flow (e.g. 60ft) as determined by the

manufacturers data for the pump model. If you do intend to place a pump in the design, the Design pressure then becomes the height of the water level in a tank or well. If the water level is below ground, type in a negative number e.g. -3ft for a water level 3ft down a well.

See also:

<i>Pumps</i>	<i>Section 3.5.10</i>
<i>Using Pumps in Design</i>	<i>Section 2.4.12</i>
<i>Assign System Flows to Zones</i>	<i>Section 5.11.5</i>
<i>Assign All Zones to One System Flow</i>	<i>Section 5.11.6</i>
<i>Assign Each Zone to a Unique System Flow</i>	<i>Section 5.11.7</i>
<i>Assigning System Flows to Zones</i>	<i>Section 2.6.1.2</i>

2.4.12 USING PUMPS IN DESIGN

Pumps can be placed on the design as either main supply pumps or booster pumps by selecting *Mainline|Pump*. The pumps available from the dropdown list in the dialog have been previously entered and enabled for use in the database.

Main supply pumps are connected after the water supply on the Mainline pipe before feeding into the system. It is usual to connect the main pump quite close to the water supply. If the water supply static water level is below ground level, this should be entered in the water supply dialog as a negative design head (e.g. -30ft for a water level 30ft down a well). The resulting pressure in the pipe between the water supply and the pump will be negative. Screen messages will occur to this effect, they can safely be ignored, after checking that the only negative pressures are in the pipe between the water supply and the pump.

Ensure that all pumps are connected within a pipeline, not at a 3-pipe junction.

When connecting a pump to the design, other factors may need to be taken into consideration. Headworks and rising column losses and well drawdown may need to be accounted for. These items are usually placed on the mainline downstream from the pump as *Mainline|Misc. Hydraulic* items (even though some of them may physically be upstream of the pump). Each of the losses is calculated using the appropriate constant, index and intercept from the database, these values having been previously calculated using the Curve Fitting utility of the Database Editor.

Pumps can be used in loops as long as they are placed in branched sections of the design only (see Figure 11). If a system is looped, no more than ten pumps can be used in that design.

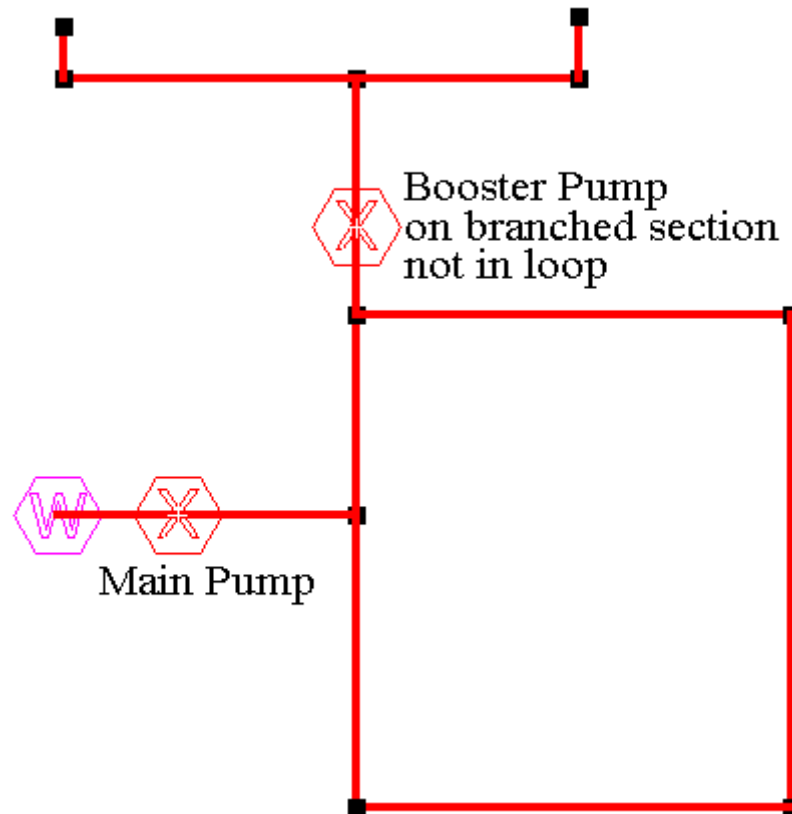


Figure 11

If two of the same pump are to be placed in parallel, enter this as two water supplies side by side each with a pump attached, as pumps can not be entered in loops. Alternatively, in the Database Editor create and enter a pump that will model the increase in flow and represent the two pumps as one. If two of the same pump model is being used in parallel the flow doubles, if used in series the pressure doubles. Before entering manufacturer's data of the pressure / flow relationship into the curve fitting, double the flow (if in parallel) or the pressure (if in series). For example, if the pump curve shows the pump to produce 120gpm at 60ft

(120m³/h at 60m), and you wish to create one pump to emulate two pumps in parallel, enter the pressure as 60ft (60m) in the curve fitting utility and the flow as 240gph (240m³/h). At least three sets of data are required for the curve fitting. The A, B and C factors will be calculated and manually entered into the database for this new pump.

Pumps operate based on the required flow of a control valve or Mainline outlet or series of valves and Mainline outlets (system flows). The pressure supplied by a pump is the pressure the pump can produce when providing the required flow for the system (i.e. based on the pump curve) at any one point in time.

See also:

*Other Hydraulics
Pumps*

*Section 3.5.4
Section 3.5.10*

2.4.13 WORKING WITH JUNCTIONS

Pipes require a junction, as pipes need to connect to a point object, such as junctions, outlets, valves or water supplies.

Sometimes it is beneficial to place a junction in a design. For example, you may wish to specify where a change in pipe size should take place when using Computer Sizing. Elevations are only interpolated at junctions, so it may be desirable to place extra permanent junctions on very long pipe lines. Redundant junctions (i.e. those on a straight piece of pipe) are removed during design. If a junction is designated as Permanent (i.e. check the Permanent check box in the Pipe, Sprayline, Cut Pipe, Junction or *Tools|Cut Lasso* dialog) it will not be removed during the design process.

There are three ways to place junctions in a design:

- Cut Pipe
- Cut Lasso
- Junction

Zone|Cut Pipe will connect junctions where the pipe cuts other pipes. You can then delete the resulting pipe. When selecting Cut Pipe, check the Permanent check box to avoid the junctions being removed during the design process. This method would be used when there are several

pipes you want junctions on, particularly if you require the junctions in a straight line.

Tools|Cut Lasso will connect junctions where the lasso cuts pipes. By selecting *Cut Only* and checking *Permanent* you can create a line of permanent junctions, e.g. for elevation calculations.

Connect a junction where required on the pipe by selecting *Junction* from the *Zone* or *Mainline* menu, and checking the *Permanent* check box. This ensures that the junction will remain throughout design and analysis and, in the case of computer sizing, the pipes each side of the junction will be sized individually.

To check that items are connected together, select the junction and the select *Tools|Move*. If all items move with the junction, they are connected. If a junction can be seen where a pipe connects to other point objects (outlets, valves, water supplies, etc) then the item is not connected. Junctions should only be seen where pipes connect to each other.

The orientation of the symbol is purely visual; e.g. an orientated square is a diamond shape.

See also:

Pipes & Pipe Sizing
Cut Lasso
Using Cut Pipe

Section 2.4.6
Section 5.10.18
Section 2.4.6.2

2.4.14 DEFINING AREAS WITH WATER REQUIREMENTS

Irrigation Areas are useful in cases where you wish to know the amount of water applied to an area and the required run time for the operation. Irrigation Areas (*Zone|Area*) allow you to specify a group of controlled outlets or define sections of the design that have the same water requirements. These Areas are defined by placing a boundary around the required section. They are also used to automatically orientate and adjust the arcs of sprinklers within the Area. Any outlets that are placed within the Area are assumed to contribute to the Area.

The results of the area can be seen in the Management Reports - *Zone Flows* report and *Water Requirements* report. In the Management reports the *Zone Flows* report will indicate the time required to operate to apply the amount of water specified in the Areas dialog. The actual

precipitation and the maximum precipitation (as entered in the Areas dialog) is reported here also. The Water Requirements report shows the depth and volume of water applied over the Irrigation Area. The applied amount of water is based on the run time specified in the Assign System Flows to Zones or Zone Operating Times dialog, not on the operation time calculated in the Zone Flows report. Adjust the run time in the dialog to the operation time calculated to see the applied amount of water during the calculated operation time.

Irrigation Areas must be closed before being used for calculating water requirements or specifying arcs. It is possible to connect on to a partially completed Area and then complete it. Individual Areas may enclose several zones, but an individual zone cannot span more than one Area. Areas may fully enclose other Areas but may not overlap them. The outlets within the inner small Area are assumed to contribute only to the small Area not the larger Area it is within. The small Area is not considered to be contributing to the large Area.

Areas are also used by IRRICAD to correctly orientate the arcs of part circle sprinklers. If Areas are not used it may be necessary to orientate the arcs manually. When an Area is placed initially the Set Arc Orientation... check box controls whether arcs of outlets already existing within the Area are adjusted. Any emitters entered after the Area is closed, will automatically have the appropriate arcs selected (if variable or matched) and orientated.

The name of the Area can be changed manually in the name edit field, when placing an Area or you can set a new default name in *Settings|Names*.

See also:

Aligning Arcs with Boundaries
Names
Area

Section 2.5.3
Section 5.9.11
Section 5.6.11

2.5 HELPING WITH DESIGN

This chapter looks at different types of designs and how to draw these in IRRICAD quickly and efficiently. It will outline the tools to use and point out the key issues for each design type.

2.5.1 AUTOMATICALLY PLACING SPRINKLERS FOR SMALL PARK OR RESIDENTIAL DESIGN

Zone|Autohead is a tool that can be used to automatically place sprinklers in small irregularly shaped areas, like those found in domestic or small commercial turf systems. It should be used as a fast way of placing sprinklers in an area, with final adjustments made using tools such as Change, Move and Copy.

Autohead will place sprinklers on the boundary and work into the center; the center then tends to have irregularly spaced sprinklers. Hence it works best when there is not much center to fill in. With larger sports fields and parks Autohead is not usually used as it is desirable to have regularly spaced sprinklers in the center and acceptable to have irregular spaced sprinklers on the boundary of the field. However, with smaller parks and residential landscape design Autohead is a valuable tool.

When *Zone|Autohead* is selected, select a representative sprinkler body, nozzle, riser for the area in exactly the same way as you would select an outlet. Autohead attempts to match the precipitation rate of all sprinklers within the area to the precipitation rate of the sprinkler you have selected. It does this by choosing appropriate nozzle sizes and arcs from the range available for that sprinkler. For this reason, you need to ensure that a range of suitable nozzles and arcs are available in the database for the type of sprinkler you wish to use. Autohead works best with Matched or Fixed sprinklers.

If the sprinkler has matched precipitation rate nozzles with variable arcs, make sure that you select a sprinkler with an appropriate radius of throw for the job, as only one nozzle needs to be used. If the sprinkler has non-matched variable arc nozzles, a range of nozzle sizes should be available in the database to give roughly equal precipitation rates over the range of arcs expected. Generally, this means that if you select a nozzle with a 360° arc as your representative sprinkler, it should be one

of the larger nozzles in the range so that smaller nozzles can be selected for 180° arcs and 90° arcs, and so on. When a sprinkler has fixed arcs (such as many of the pop-up spray heads available), a full range of arcs and nozzle sizes should be available to allow the precipitation rate to be matched. As with variable arc nozzles, the representative nozzle / arc combination you select should take this into account.

Once you have selected the representative sprinkler, click OK on the dialog. You will notice that the status bar will tell you that you are in Lasso mode. Draw in the Autohead boundary for the automatic sprinkler placement using the lasso in the same way as you would for Show Flow boundaries. After closing the area, the automatic head placement will take place. Note that Autohead selects but does not orientate part circle arcs. If correct orientation is required, use *Zone|Area* to first draw a boundary just outside the location of the Autohead boundary you will be entering (see *Aligning Arcs with Boundaries*, Section 2.5.3).

Once the Autohead has been completed for an area, further areas (using the same sprinkler) can be drawn and have heads automatically placed. To terminate the Autohead placement tool, select another tool or command.

Two warnings may occur during Autohead:

Cannot correctly space selected sprinkler along area edge

This means that the length of one or more of the area boundary lines does not allow sprinklers to be spaced along it within the overlap ranges set in *Settings|Irrigation Items* - Autohead Spacing Limits. If this happens, IRRICAD will place the sprinklers as close as possible to the limits.

Autohead, where possible, will space sprinklers so that the overlap lies between the minimum and maximum values. The default values are 40% minimum to 60% maximum. (A 50% value corresponds to head-to-head spacing). Reduce these values for closer spacing (e.g. in windy areas), or increase them for wider spacing.

Required nozzle arc not found for selected sprinkler

IRRICAD has not been able to find a nozzle / arc combination that gives the precipitation rate required. The nearest available arc will be selected.

See also:

Irrigation Items

Section 5.9.4

2.5.2 ANALYZING EXISTING SYSTEMS

IRRICAD is not only useful for designing new irrigation systems, but is also used for analyzing existing systems. You may wish to analyze an existing system to check the performance of the system to determine if:

- All outlets are operating within the required range
- The pipe sizes are adequate
- The well / pump is producing enough flow / pressure
- Wish to extend an existing system

You may need to design an existing system with a proposed extension. Therefore you will need to enter the existing system in to IRRICAD in order to analyze the system and / or design the extension.

To enter an existing system into IRRICAD you will need all the details of the system you are analyzing. This includes:

- Pipe types, sizes and lengths
- Control valve descriptions
- Outlet / irrigator descriptions
- Working pressure at the outlets / irrigators
- Water supply output and any restrictions
- Pump curves for the existing pumps
- Well details if applicable, well depth, drawdown, rising column details
- Elevation data

Before starting to draw the design check all the existing hydraulic components are present in the database. Add any missing pipes or components with their hydraulic characteristics using the Database Editor (see IRRICAD Database Editor, Section 3). Once the items are available in the database enter the existing system on the screen. When everything on the screen mirrors the existing system, proceed to connect the extension or proposed items to the design if required.

Enter the management data - use either *Design|Zone Operating Times* or *Design|Assign System Flows....* If many system flows are present, select up to ten (guideline only) system flows that you think might be the

worse case scenarios. These are system flows containing zones that you think might be the ones that will prove to be over pressure, or under pressure. The pressure at the control valves can be set for existing zones in *Design|Zone Design Configuration* (see Section 5.11.11). Water supply pressures can be entered when placing the water supply in the design. The pressures used here can be entered to reflect a pump or a well with a pump attached (see Using Water Supplies, Section 2.4.11).

If the proposed system has Computer Selected Pipe, run LP Design or Velocity Design to size the pipe. Before you do this, make sure that all existing pipe sizes have the Computer Sized check box unchecked. If you have not done this when entering the pipe select all the existing pipes and use *Tools|Change Type* to uncheck the Computer Sized check box for all sized pipe (see Specifying Groups of Items to Change or Delete, Section 2.4.3.2). If you have entered the water supply data run *Design|Mainline Design|Detailed Analysis* and view the reports (*Reports|Design Reports|...*).

Where the Analyse option is used, IRRICAD uses the nominal pressures and flows for the items in the system such as would be done in manual design calculations. When Detailed Analysis is used, IRRICAD requires a starting pressure, (Control Valve pressure in *Design|Zone Design Configuration* for Zone Design or a Water Supply pressure for Mainline Design). The starting pressure enables IRRICAD to be able to use a series of iterations (small calculations) to find the actual resulting flows in the system such as would be found in the field. This means that the Analyse option tends to be conservative in its answers and the Detailed Analysis option is more accurate and closer to the real situation

See also:

<i>The Basic Design Process</i>	<i>Section 2.3.1</i>
<i>IRRICAD Database Editor</i>	<i>Section 3</i>
<i>Entering Information into IRRICAD</i>	<i>Section 2.4</i>
<i>LP Design</i>	<i>Section 2.6.3.3</i>
<i>Management & Designing the System</i>	<i>Section 2.6</i>
<i>Using Pumps in Design</i>	<i>Section 2.4.12</i>

2.5.3 ALIGNING ARCS WITH BOUNDARIES

To align sprinkler arcs with the boundaries of the area you wish to irrigate can be a very time consuming operation to do manually. The

wetted radius arc of part-circle outlets can be automatically aligned with a boundary by using Irrigation Areas. Any outlets inserted after the Irrigation Area has been placed will automatically be orientated. Make sure that before you select an outlet, you have also checked the Create Wetted Radii option in *Settings\Irrigation - Design Specific*.

Select *Zone\Area* to draw an Irrigation Area just outside the boundary of the area you wish to irrigate. If the outlets have already been drawn in the design check the Set Arc Orientation Using Area check box. If you have yet to draw the outlets this box does not need to be checked, as all arcs will automatically be aligned within the Area. When you place variable arc or matched outlets within the Area, the arcs will be automatically aligned with the Area boundary. If the outlets are matched, the nozzle flow will be adjusted in proportion to the arc.

Sprinklers, which are just inside the Area boundary, will have their arcs adjusted and oriented according to the Area boundary line. The intersection of the arc with the Area boundary, at a distance of half of the radius of throw of the sprinkler (not the full radius) is used to determine the arc. This means that sprinklers can over-spray corners and still maintain the correct arc (see Figure 12). When placing the sprinklers, arcs should be set to approximately the desired value if automatic arc orientation is to be used.

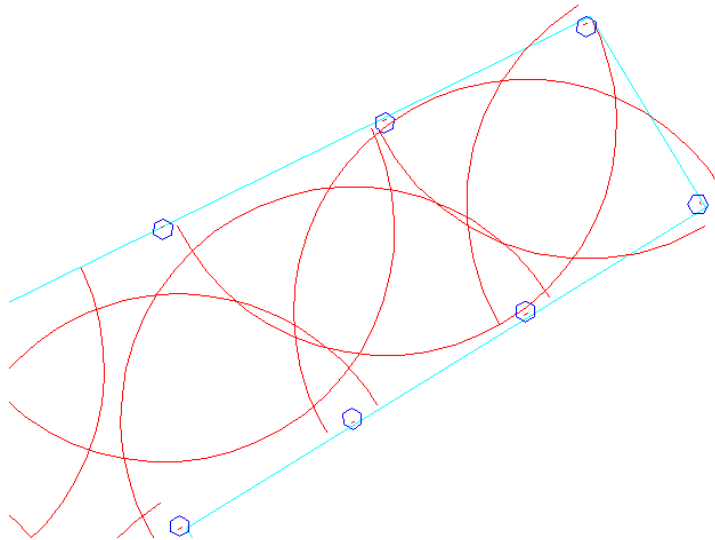


Figure 12

Arcs can also be manually rotated, globally or individually, by using *Tools|Rotate*. Select the arc or arcs to be rotated. Select *Tools|Rotate* and select an origin to rotate around. As the mouse moves the angle (a) will change on the status bar showing the angle of rotation from 0°. Click to place when the required angle of rotation is reached. *Tools|Change* can also be used on individual arcs to reset the Start Angle and / or the Included Angle.

2.5.3.1 OUTLET AND WETTED RADII ARC ORIENTATION

When an outlet is used in a design the symbol or wetted radius may not be drawn at the required orientation. You can change the orientation as follows:

- Symbols can be rotated by using *Tools|Rotate* (see the angle of rotation from the starting point on the status bar) or by bringing up the Outlet dialog (using the Change or Change Type tools). Edit the current orientation of the symbol. This will alter the symbol orientation of the symbol by the figure entered from the horizontal plane. If you change the arc or orientation of the outlet, it will remain fixed at the new value.
- Arcs can be edited using the Change tool and clicking on the individual wetted radius. The drawing properties dialog allows you to edit the Start angle (where the arc starts from) and the Included angle (how big the arc is). This allows for better positioning and a higher standard of presentation on the printed design.

See also:

<i>Defining Areas with Water Requirements</i>	<i>Section 2.4.14</i>
<i>Irrigation - Design Specific</i>	<i>Section 5.9.10</i>
<i>Area</i>	<i>Section 5.6.11</i>
<i>Rotate</i>	<i>Section 5.10.14</i>
<i>Specifying Groups of Items to Change or Delete</i>	<i>Section 2.4.3.2</i>

2.5.4 SPRINKLERS IN ODD-SHAPED AREAS

For odd-shaped areas, the aim is to achieve relatively even precipitation over the area.

Zone|Area can be used to orientate part circle sprinklers within the boundary to be irrigated (see *Aligning Arcs with Boundaries*, Section 2.5.3).

Several tools are available to help with placement of outlets in an odd-shaped area. *Settings|Grid* can be used to help place outlets at the required distances apart. Enter the grid point distance in X and Y (e.g. 5m for both will give you a 5 x 5m grid). *Zone|Sprayline* is useful when placing pipes with outlets. Use the Unconnected option and specify no fixed spacing (options button on *Zone|Sprayline* dialog).

Zone|Autohead can be used for small irregularly shaped areas. Select the required sprinkler, nozzle and arc. Draw a boundary for Autohead to work within inside the Irrigation Area boundary if used (see *Automatically Placing Sprinklers for Small Park or Residential Design*, Section 2.5.1).

See also:

<i>Automatically Placing Sprinklers for Small Park or Residential Design</i>	<i>Section 2.5.1</i>
<i>Area</i>	<i>Section 5.6.11</i>
<i>Sprayline</i>	<i>Section 5.6.7</i>
<i>Irrigation Items</i>	<i>Section 5.9.4</i>

2.5.5 HOW TO LAYOUT A DESIGN WITH BLOCKS OF LATERALS

You may wish to design a large area of parallel spraylines or driplines (tapes) for an orchard, vineyard or field containing rows of crops. The following section details methods and IRRICAD tools that can be used to accomplish this.

Block and Tape Block are layout tools used for entering a group of equally spaced parallel spraylines or tapes respectively in one action. This facility is commonly used to select and position laterals over a large area. Blocks are laid out by drawing the boundaries of the required group of laterals. Information on the physical arrangement (block properties) of these laterals is entered before the drawing process is commenced. Once entered, the spraylines or tapes are treated individually, i.e. the block laterals are not retained as a unique entity. If unconnected spraylines are used, once placed, each sprayline becomes individual pipes and outlets.

2.5.5.1 BLOCK PROPERTIES

A lateral spacing must be specified for the spraylines or tapes, indicating the distance between the parallel lines. You can specify the number of laterals on the block (enter a number) or leave as zero (0) for IRRICAD to fill the block boundary with as many laterals as the lateral spacing will allow. If you enter a number greater than the block boundary and lateral spacing will allow, a message will be given to indicate the specified number and the number of laterals positioned after drawing the block boundary. If you enter a number smaller than the block boundary, IRRICAD will place the number required at the spacing specified.

The User Defined option for Lateral Direction indicates that the direction will be determined by drawing a line to indicate which way the laterals will run, rather than being determined by the first side of the block drawn on the screen. Alternatively, the lateral direction can be determined by the direction of the first side of the block boundary drawn - this is the Determine Automatically option.

Upon closing the lasso (*Right-Click|Close* can be used for this or click to place a point on the starting point) the laterals will be drawn. If you have selected User Defined for lateral direction then also draw a line to specify the direction of the laterals. Similarly, if you have selected User Defined for the reference outlet, place a point to indicate the position of the first outlet (spraylines only). The laterals will be drawn automatically after the direction and / or reference position is specified.

2.5.5.2 CONNECTING A SUBMAIN (MANIFOLD)

A tool is available to connect to the laterals placed by the Block or Tape Block tools. *Zone|Cut Pipe* will automatically connect to all laterals or zone items it crosses. After selecting the tool draw a line through or along the end of the laterals as required. Make sure that the pipeline crosses all the existing laterals.

If no block subdivision has been worked out it can be useful to enable the Flow Check while you are connecting up the submain. Flow Check is found in *Settings|Irrigation Items*. Check the Enabled check box and type in the maximum zone flow. You will notice $f =$ and $m =$ on the status bar. M is the Maximum flow you have entered in *Settings|Irrigation Items* and f is the flow through the currently connected tapes / spraylines. If you have exceeded the Maximum flow, a warning message will appear. Click Yes to continue if you wish to connect to the

next item or No to keep the flow under the maximum requirement and Cut Pipe will snap back to the last tape / lateral you connected.

Note: If you have run Cut Pipe through all the tapes / spraylines, and the total flow exceeds the maximum you have set, upon pressing the No button, Cut Pipe will snap back to the starting position.

2.5.5.3 TOOLS TO AID IN PLACING LATERALS

Some tools are useful in aiding to draw the block boundary on the screen or positioning the laterals inside a fence boundary, for example.

The circular cursor is a useful tool to help place the lateral block the required distance from the boundaries (this creates the headlands and sidelands required). In *Settings|Drawing*, check the Circular Cursor check box and enter a radius. The radius is equal to the distance you wish to place an object from an existing object e.g. if the headlands are to be 5ft (5m), enter a radius of 5ft (5m).

Grid and Snap to Grid options can also be used to help with accurate placing of block boundaries and laterals. In *Settings|Grid* a grid spacing can be entered. In *Settings|Snap* the Snap to Grid option can be enabled where the cursor can only move between grid points. The grid points do not need to be displayed for Snap to Grid to work.

Blocks can be entered in one action with the option to delete out unwanted sections. Use *Tools|Cut Lasso* to delete, cut or change any laterals. *Zone|Sprayline* or *Zone|Tape* can be used to add extra spraylines, or to replace ones accidentally deleted.

2.5.5.4 BLOCK TOOL

The *Zone|Block* tool is used for multiple spraylines (connected and unconnected).

Note: The Block tool is only available in the Zone menu. Although the Sprayline option is also available in the Mainline menu, this is merely a tool used for placing pipe and outlets at a required spacing and they are always unconnected.

OUTLET SPACING PROPERTIES

The block properties include Outlet spacing properties. Triangular spacing indicates that the outlets will be offset between alternating the laterals. See Figure 13.

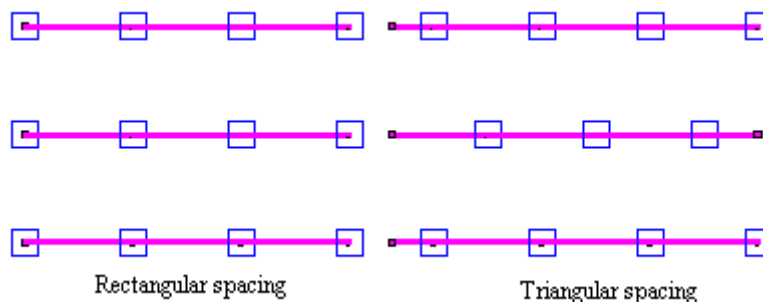


Figure 13

The value in the Offset edit field in the Block dialog (as opposed to that of offset in the sprayline dialog) is the distance of the first sprinkler on the next row expressed as a percentage from the first sprinkler on the first row measured perpendicularly between the rows. If the Rectangular spacing has been selected the percentage change is cumulative. This moves the first sprinkler in each consecutive sprayline by the specified percentage change from the first sprinkler position on the sprayline above. If the Triangular spacing has been selected, the percentage difference only applies to every second sprayline. See Figure 14.

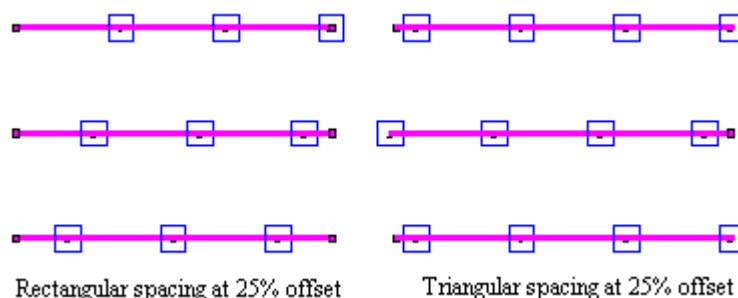


Figure 14

The Extra Outlets on Ends option allows for extra outlets placed on the ends of the spraylines. If this check box is checked, IRRICAD will position outlets on a lateral starting with the reference outlet and placing outlets at the designated spacing until the end of the lateral is reached. If the remaining length of pipe between the last outlet and the end of the

lateral is greater than 50% of the outlet spacing, an extra outlet will be connected to the end of the lateral. This is treated as a separate outlet and does not form part of the connected sprayline.

The User Defined option for Reference Outlet indicates a starting or reference position for the first outlet to be placed. All other outlets in the block are placed relative to this known reference outlet. By default (i.e. Determine Automatically option) the reference outlet is assumed to be at the start of the first lateral drawn in the block.

Usually the Create Sprayline Outlets check box in *Settings|Irrigation - Design Specific* will be unchecked as there are likely to be a large number of outlets. If you wish to see the sprayline outlets check the Create Sprayline Outlets check box in *Settings|Irrigation - Design Specific* before drawing the spraylines. If the spraylines have already been drawn, select the spraylines (*Tools|Select|...*) and select *Tools|Create Sprayline Outlets*. Turn the Sprayline Outlets layer on in the View menu (*View|Sprayline Outlets*).

If you wish to see connected sprayline wetted radii, turn on Created Wetted Radii in *Settings|Irrigation - Design Specific* before drawing the spraylines or select the spraylines (*Tools|Select|...*) and select *Tools|Create Wetted Radii*. Turn the SL_WETTED_RADII layer on in *Settings|Layers* to display connected sprayline outlets' wetted radii.

***Note:** If you have not created the sprayline outlets before drawing the spraylines, the Create Wetted Radii tool (in the Tools menu) will create both the sprayline outlet and its wetted radii.*

See also:

Working with Uniformly Spaced Outlets on a Pipe Section 2.4.9

2.5.5.5 TAPE BLOCK TOOL

The *Zone|Tape Block* tool is used for laying out an area of equally spaced tapes (driplines).

Tapes are pipes with integral emitters at a relatively small spacing. Tapes have many emitters at a low flow and the flow is not constant during analysis and the small emitters are embedded in the internal wall of the tape. Connected spraylines tend to have higher flows than tapes and the flow remains relatively constant during analysis.

By checking the User Defined check box for Lateral Direction, and then checking the Polyline check box bent tapes can be drawn.

See also:

Entering Driplines in a Design

Section 2.4.10

2.5.5.6 TURF

Turf irrigation systems include golf courses, parks and reserves, and landscape design. There are several situations where the Block tool is useful for setting up these types of systems.

If you wish to place sprinklers at regular intervals over an entire area, e.g. a wall to wall watering for a golf course, use *Zone|Block* (unconnected) with a Circular Cursor or Grid to help position the laterals. This will give you parallel laterals and a regular sprinkler pattern, e.g. rectangular. Options such as Extra Outlets on Ends can be used to place additional outlets on the end of laterals when the outlet spacing is fixed. Pipes can be deleted and re-entered as required, especially if the block tool has been used to place sprinklers at a fixed spacing where the layout of the pipes is not required. See *How to Layout a Design with Blocks of Laterals*, *Tools to Aid in Placing Laterals* (Section 2.5.5), and *Block* (Section 2.5.5.4).

For other types of turf systems where it is uncommon to use the block tool use *Zone|Sprayline*. Use Unconnected spraylines as described in *Block*, Section 2.5.5.4. Use Circular Cursor or Grid and Snap To Grid to place the spraylines an equal distance from the boundary all the way around. See *How to Layout a Design with Blocks of Laterals and Tools to Aid in Placing Laterals*, Section 2.5.5. This is particular useful when the area is oval.

See also:

Pumps

Section 3.5.10

Block

Section 5.6.9

Using Cut Pipe

Section 2.4.6.2

2.5.5.7 HORTICULTURAL SYSTEMS

For a horticultural or market garden design, you may wish to lay a block of spraylines with drippers, sprinklers, or a block of dripline (Tape). See

How to Layout a Design with Blocks of Laterals, Tools to Aid in Placing Laterals (Section 2.5.5), and Block (Section 2.5.5.4).

2.5.5.8 SUMMARY

- Blocks are used to layout multiple laterals at a designated spacing
- The physical arrangement of the laterals is entered before drawing the blocks
- Cut Pipe is used to connect a submain to all existing laterals, or other zone items
- Circular Cursor, Grid and Snap To Grid are tools to aid in placing blocks or other items
- Outlet spacing properties are entered before drawing Sprayline Blocks
- Tapes are not the same as Connected Spraylines
- Blocks can be used to place outlets at fixed spacing and the pipes deleted after placement

2.5.6 LAYING OUT SPORTS FIELDS OR OTHER SOLID SET SYSTEMS

Sports fields come in different shapes and sizes, with different irrigating methods, management and design. This section looks at the basic shapes you are likely to encounter and how to approach the drawing of such a design in IRRICAD. Designs of this type tend to have regularly spaced sprinklers in the center, and may have irregularly spaced sprinklers along the boundary of the field or area.

2.5.6.1 FOR RECTANGULAR FIELD:

For a field that is a regular shape the Block tool or the Grid tool can be used to help layout the sprinklers at a fixed spacing.

Using *Settings|Grid*, enter the desired outlet spacing for the X and Y-axis. The grid can be set to have the outlets the required distance apart to achieve a good coverage and overlap of the wetted radius. This can be visually seen if the wetted radii are turned on (*View|Wetted Radii*). *Settings|Snap* - Snap to Grid can be used for drawing the field boundaries and placing outlets as the cursor can only move between the grid points. Pipe can be selected to connect to each outlet placed.

If the Block tool is used to place the outlets, the pipe can be deleted after placement if required. Use Unconnected spraylines (see How to

Layout a Design with Blocks of Laterals Section 2.5.5). Grid and Snap to Grid can also be used to aid with placement of the block in the design (see above). Alternatively Circular Cursor in the *Settings|Drawing Items* menu can be enabled to aid in drawing the block of laterals a specified distance from the field boundaries. If you do not wish to use the Block tool, each sprayline can be entered individually, using Grid to aid in the placement of the pipe and outlets. The distance between the spraylines should reflect the desirable overlap of the wetted radius of the sprinklers you wish to use. For example, if you wish to have the sprinklers head to head, the distance should match the wetted radius. The circular cursor will help to ensure that you have the last outlet on the sprayline at the required distance from the edge of the field.

Zone|Cut Pipe can be used to connect pipe or a submain to all zone items. It can be used across a row of sprinklers, connecting to each one automatically.

2.5.6.2 FOR AN OVAL FIELD:

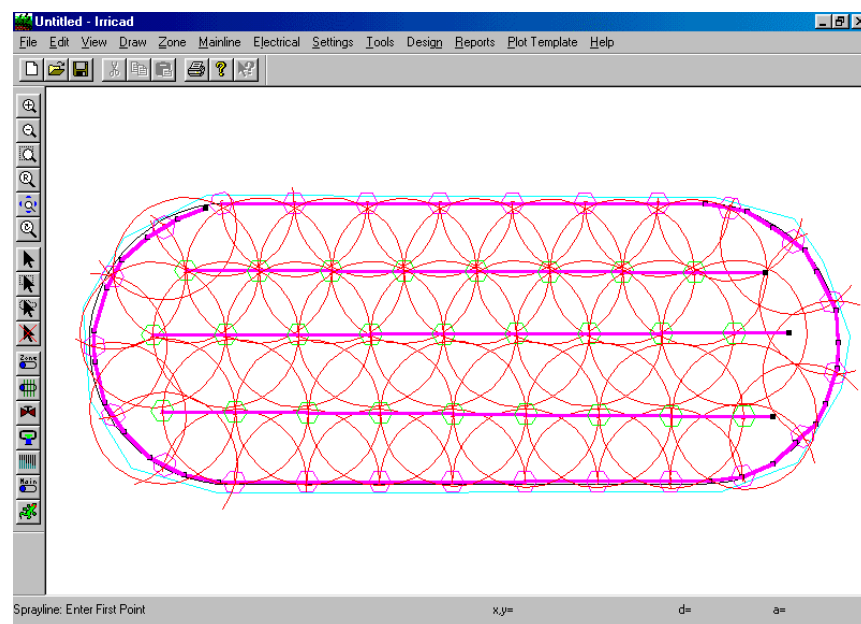


Figure 13

Viewing the field as a rectangle and two semi-circles is a way to approach an oval field design. The field can be drawn on the screen by using Rectangle and Circle. The Break tool can be used to erase the part of the circle inside the rectangle.

Draw an irrigation area boundary just outside the existing field boundary lines to orientate sprinklers to irrigate within the designated area by using *Zone|Area*. Enter as many spraylines using *Zone|Sprayline* within the field as possible. These can be Unconnected and the pipes deleted after placement if required. If the sprinkler selected is a variable or matched sprinkler the spraylines drawn along the boundaries of the field will automatically be aligned to water inside the field (see Figure 13). If not, and half circle sprinklers are required, select an outlet or nozzle that allows for 180° arcs and place along the field boundary. All outlets and pipe can be moved or deleted and re-drawn.

Use *Zone|Cut Pipe* to connect all outlets or spraylines to a submain.

2.5.6.3 FOR AN IRREGULARLY SHAPED FIELD:

Draw the outline of the field on the screen using the drawing tools. Use *Settings|Grid* and *Settings|Snap* - Snap to Grid to place spraylines or outlets in a regular pattern over the main area as described in How to Layout a Design with Blocks of Laterals, Section 2.5.5. Draw an Irrigation Area boundary along the existing field boundary lines to orientate part circle or variable sprinklers to irrigate within the designated Area by using *Zone|Area*. Place extra spraylines or outlets (*Zone|Sprayline*, *Zone|Outlet*) as required to encompass the outer boundary. The outer edges may not necessarily have regularly spaced outlets.

Use *Zone|Cut Pipe* to connect all outlets or spraylines to a submain. Cut Pipe will connect to any zone item it crosses or is within range (see Using Cut Pipe, Section 2.4.6.2).

2.5.6.4 SUMMARY

- Fill in regular shaped areas using Block, Sprayline, Circular Cursor or Grid to help with placement of outlets
- Use Area to orientate sprinkler arcs
- Draw a sprayline or place outlets around the boundary of the field to complete

2.5.7 USING MAINLINE OUTLETS

You may be designing a system using mainline outlets rather than zones (control valves and zone outlets). The main differences are:

- All pipes are mainline pipes
- All outlets are mainline valve-in-head outlets (sprinkler with a valve) and therefore mainline outlets are considered as separate zones
- No control valves are required

Connect the Mainline outlets on the Mainline pipe by choosing the outlet and nozzle you require. Risers can be selected if applicable to the situation. The *Mainline|Sprayline* tool can also be used to quickly place equally spaced valve-in-head outlets. Note that this tool does not actually create a lateral since the spraylines are assumed to be unconnected (individual pipe and outlet once placed).

Because the outlets themselves are assumed to have an on / off switch like a valve, a control valve is not required to create the zones. If other valves are necessary for the design, use *Mainline|Misc. Hydraulic* valves (valves that have been entered into the Other Hydraulic component group of the database) rather than Control Valves. For each mainline outlet positioned in the design a zone is created and named accordingly - default zone 1, zone 2, etc.

The default names can be changed in the *Settings|Names*. You can change the default name for the immediate action by selecting Default Name in the right click menu after selecting the *Mainline|Outlet* or the *Sprayline* tool.

Note that, although there are no zone items, it is still necessary to carry out the Zone Design function in order to set up the required pressures and flows for each zone. Select *Design|Zone Design|Analyse* to do this. Run *Design|Valve Analysis* before running the *Design|Mainline Design* options.

2.5.7.1 VALVE-IN-HEAD SPRINKLER SYSTEMS

Valve-In-Head Sprinkler designs are an example of a mainline design using mainline outlets. Each sprinkler used is a mainline outlet with on / off control. Select the valve-in-head sprinkler from the *Mainline|Outlet* dialog where the sprinkler has been previously entered and enabled in the database.

If the *Mainline|Sprayline* tool has been used to place sprinklers, the default names for the zones are Sprayline 1-1, Sprayline 1-2 for outlets on Sprayline 1, and Sprayline 2-1, Sprayline 2-2 for outlets on Sprayline 2, etc. In *Settings|Names* or *Right-Click|Default Name*, the name can be altered for the design or for the current action. This makes the naming of many valve-in-head sprinklers, for example in a golf course design, flexible and easy to use.

2.5.7.2 STOCK WATER SYSTEMS

Mainline outlets can be used in a stock water supply design. An outlet is entered into the database to reflect the hydraulic characteristics of water discharging through a ballcock valve.

If only one set of data is available (the flow through a valve at a specified pressure) enter the Index as 0.5. Calculate the Constant to solve the equation $Q = \text{Constant} \times \text{Pressure}^{0.5}$. If more than one set of data is available for the valve, enter the pressure / flow combinations into the Outlet Flow Curve Fitting Utility (*Database Editor|Utilities*). Use the Constant and Index generated when creating a nozzle for the trough.

Alternatively, you can use a demand point as the water trough. When placing a demand point, you specify the flow and pressure required at that point. This is useful if you have not yet decided on the valve you will use. Depending on the valve, you may only require 7 – 15psi (5 – 10m) pressure at the valve – just enough to get the water out into the trough. Some valves will have a higher headloss than others.

The newly entered outlets or demand points are placed on the pipe system where a water trough is to be situated, or already exists.

Management is determined by a series of troughs running at the same time or potentially running at the one time.

It is fairly common to have a pumped system up to a tank and then gravity feed to the water troughs. In this case, two separate systems need to be designed, the first with the pump (at the water supply) supplying a tank (the outlet), and the second with the tank (the water supply) supplying the troughs (outlets). In the first case, where the pump is supplying the tank, the tank can be a demand point (see Simple Mainline Design - Using Demand Points, Section 2.5.7.3) or entered into the database as an outlet / nozzle combination with a pressure / flow relationship. If an outlet / nozzle combination is used the outlet needs to represent an open pipe scenario (basically filling a tank is the same as

discharging into the atmosphere). The formula $v^2/2g$ can be used to find the pressure and flow.

2.5.7.3 SIMPLE MAINLINE DESIGN - USING DEMAND POINTS

Demand points are very useful when designing a mainline system where the flow and pressure requirements are known at certain points. The pipe system can be designed or analyzed and the system duty calculated.

An example is hydrants for a travelling irrigator. Where a demand can be used for any situation, it is usually only used for a quick design or analysis of a system. As long as you know what pressure and flow required at the hydrant to run the irrigator, hose and cover any headloss through the hydrant, hose and irrigator, then a demand point may simply be placed at each hydrant and a suitable mainline connected to these demand points. Select *Mainline|Outlet* and select a known demand point that has been entered into the database prior. Enter the pressure and flow required. Place on the design, or connect to a mainline pipe.

This method can be helpful in presenting the basic requirements of the system. You can use demand points for a quick idea of the system capabilities without having to get into the intricacies of all the components that are downstream from the hydrant.

See also:

Outlets

Section 3.5.11

2.5.7.4 SUMMARY

- Mainline Outlets are assumed to have on / off control and are therefore zones
- *Zone Design|Analyse* and *Valve Analysis* needs to be completed before running *Mainline Design*
- Demand points can be used to designate flow and pressure requirements at placement points.

2.5.8 WHEEL LINE (SIDE ROLL) SYSTEMS

Wheel line or side roll systems can be entered in to an IRRICAD design as a Zone Sprayline. The active hydrant (the hydrant you have chosen to represent as a drawn wheel-line) is entered as a control valve and the

idle hydrants drawn as demand points using Mainline Outlets. Each hydrant becomes a zone. If a system has two wheel lines operating at the same time, they would both be entered as spraylines and there would be two active hydrants (control valves).

Draw in the wheel line as an unconnected sprayline (See Block, Section 2.5.5.4). A riser can be selected. This can be a custom-made wheel line sprinkler riser assembly, which uses components that take into account the height from the ground. Note that a riser must be used for any system where the outlets are above the ground. All sprinklers are assumed to be at ground level regardless of the height above or below ground the pipes may be at. All sprinklers connected to pipes above the ground require a riser or outlet connector with the appropriate height data. Because a riser is not physically required in the field in this case, as the sprinklers are connected straight into the sprayline, it is suggested you add a riser with no pressure loss and no cost to the database. The risers and corresponding fittings can be edited out of the reports if required.

Place the wheel line (sprayline) on the screen. Make the length of the wheel line relative to the lengths you are able to purchase the aluminum pipe in. For example, if it is obtainable in 40 foot lengths, run the line out to a number divisible by 40 and add an extra 20 feet for the hose from the hydrant to the wheel line.

Place the control valve at the end of the wheel line to represent the active hydrant. Use *Mainline|Outlet* to represent other hydrants as demand points (see Using Mainline Outlets, Section 2.5.7). An appropriate riser can be selected with the demand point. The required flow and pressure at the hydrant can be entered. Set the pressure and flow for the demand points, as required for the pressure and flow to be available in the mainline at the hydrants. The pressure is an upstream pressure, not a downstream pressure. Allow for the losses through the hydrant, losses through the sprayline and any elevation changes. Grid points (*Settings|Snap* - Snap To Grid) can aid in the placement of the items in this section. Use a grid point spacing that enables you to calculate distances easily for example, if the hydrants are 60ft (18m) apart a logical grid spacing would be 60 x 60 (18 x 18).

Mainline|Pipe is used to connect the demand points and control valve(s) to the water supply. By running the mainline pipe out past the last hydrant or control valve, IRRICAD will tee the mainline into the last hydrant rather than elbow into it.

You are now ready to analyze the design. If you have left the mainline pipe as Computer Sized run *Design|Mainline Design|LP Design* after you have analyzed the Zones (*Design|Zone Design|Analyse*) and run Valve Analysis (*Design|Valve Analysis*).

2.5.9 TRAVELLING IRRIGATOR SYSTEMS

Travelling irrigators have turbines, piston drives or other mechanical methods to move the irrigator via water pressure. This often produces a pressure loss that will need to be taken into account to simulate a true picture of what is happening in the field. These items will need to be added to the database with the correct hydraulic characteristics as outlet connectors, other hydraulics or hydrants.

Travelling Irrigator designs tend to be mainline designs using Mainline Outlets where each outlet is a zone. If only one irrigator is running at any time, select Assign Each Zone to a Unique System Flow to automatically set up the management of the system.

If two or more irrigators are running at a time then each system flow will have two or more zones operating on it.

There are several ways to design a travelling irrigator system:

- Placing each item
- Combining hydraulic properties
- Using demand points

2.5.9.1 PLACING EACH ITEM

In this method the individual item is placed as required in the design.

Create a fixed outlet (fixed arc) for the irrigator in the database. The nozzles will express the necessary pressure / flow relationship as calculated by the curve fitting utility from manufacturer's data (see Curve Fitting Utility, Section 3.8.1). Each nozzle will have a different pressure / flow relationship. Even though an irrigator may physically have many nozzles, IRRICAD requires one nozzle to be used at a time to reflect the hydraulic characteristics of the many physical nozzles for the entire machine.

Create an outlet connector for the hose. If the hose is a flexible hose, the Equivalent Length Diameter may be different to the nominal diameter e.g. 114mm flexible hose may have an internal diameter of 120mm when under pressure. To calculate the Equivalent Length Diameter use trial and error to achieve the required headloss based on the manufacturers information. To do this, connect an outlet with the riser to a length of pipe in IRRICAD. Connect a control valve to the pipe and set up the management of the system to be one zone operating on one system flow. Run *Design|Zone Design|Analyse*. Check the reports to find the headloss through the length of riser (*Reports|Design Reports|Zone Full* - find the section labeled Inflows and Outloss). Change the Equivalent Length Diameter in the database for the riser until the headloss is correct.

If the outlets are above ground level, this static lift can be accounted for as Height in the Outlet Connector component group dialog. For example if the outlets on the irrigator are physically 10ft (3m) above the ground, enter 10ft (3m) in the Height edit field.

If the travelling irrigator uses a drive method that has a significant pressure loss an item will need to be created in the Other Hydraulic component group in order to allow for this pressure loss. A Headloss Equation Constant, Index and Intercept is required. It may be difficult to attain manufacturer's data on the losses, and the values may not be fixed as a change in speed could result in a change in headloss. If this is the case, make a guess at the average pressure change between the inlet to the drive and outlet of the drive. This pressure change will depend on the amount of power used, which is relative to the speed of the drive. The equation used to calculate the pressure loss is $H = KQ^n + C$, where H is the pressure loss, Q is the flow, K is a constant, n is an exponent and C is an intercept. If n is estimated to be approx. 1.5 the equation can be solved for K. If K and n remain at 0, C can be used to include an estimated loss e.g. 4ft (m). Connect the Misc. Hydraulic item slightly upstream from the outlet. Do not connect the Misc. Hydraulic item directly to the outlet.

The outlet in most circumstances will be a mainline outlet connected to a mainline pipe. The Misc. Hydraulic items will also be selected from the Mainline menu and connected to Mainline Pipe.

2.5.9.2 COMBINING HYDRAULIC PROPERTIES

This method would be more commonly used and involves placing an outlet that will account for the losses through the drive system. This

means that only one item is placed on the mainline pipe per irrigator position. The outlet and nozzle will need to hydraulically account for the nozzle flow and turbine losses. Measure the pressure / flow relationship at the inlet of the irrigator and the flow at the nozzle. At least three sets of pressure / flow data are required. Use the constant and index generated by the curve fitting utility (see Curve Fitting Utility, Section 3.8.1) in the nozzle dialog by entering the pressure / flow data (P going into irrigator inlet, flow coming out of nozzle). This method may not be as accurate as the above method, because change in irrigator travel speed will affect the pressure / flow relationship.

Create the outlet with a fixed arc type, nozzle and outlet connector as above (in Placing Each Item), using the new constant and index for the nozzle dialog. Connect the Outlet, nozzle and riser (selected using *Mainline|Outlet*) to the mainline pipe at the hydrant positions.

2.5.9.3 USING DEMAND POINTS

Another method is to assume a required pressure and flow at the hydrants to run the irrigator. The assumed pressure will need to take into consideration any headloss that may result between the hydrant and the nozzle, with enough pressure to supply the required flow.

Create the demand point in the Outlet component group in the database. Select Demand Point as the Arc Type. When selecting the demand point from the *Mainline|Outlet* dialog the default pressure and flow can be entered as required. Place on the mainline design where hydrants are required.

See also:

About Assemblies

How to Use and Create Assemblies

Section 3.3.2

Section 3.4.3

2.6 MANAGEMENT & DESIGNING THE SYSTEM

This chapter looks at how to specify how the system is divided and run, the designing process and using the program to select all the fittings to complete the list of materials required.

2.6.1 SELECTING A MANAGEMENT PRACTICE

Management is defined as entering zone control information to inform IRRICAD how the system will be operating. Worst case scenarios can be used, or all zones entered. The management options are Zone Operating Times and Assign System Flows to Zones.

Select a Management option from the Design menu before selecting a Design option.

2.6.1.1 ZONE OPERATING TIMES

This method requires you to enter the operating times for each individual zone in the system (up to three separate pairs of start / stop times can be entered for each zone). Zone operating times would be used when start / stop times are important.

This method of entering system management information requires the designer to enter the required operating times for zones that are operating at different and overlapping times.

This option is best used for small irrigation systems where actual start and stop times for valves are important and need to be reported. Based on the operating times entered, IRRICAD will calculate the resulting system flows in the mainline.

Checks are made to ensure that the water supply flow, pressure or time limits are not violated, both for individual zones and for the system flows resulting from the management strategy entered. If violations occur, the designer is required to modify the entered times so that all limits are satisfied before being allowed to continue.

To use Zones Operating Times select *Design|Zone Operating Times* before running the Design options.

2.6.1.2 ASSIGNING SYSTEM FLOWS TO ZONES

Assigning system flows to zones allows you to decide which zones operate at the same or different times, thus allowing for control over the operation and the duty of the system.

This method of entering zone management information allows you to choose the number of system flows (or stations) and their operating times, and then to select which of these system flows each zone will operate on. It is the preferred option for larger systems where valve grouping, rather than actual valve start and stop times, is important.

***Note:** For quick editing of assigning system flows to zones there are three options - Assign System Flows to Zones, Assign all Zones to One System Flow, and Assign Each Zone to a Unique System Flow.*

To use Assign System Flows to Zones (or the automated options Assign all Zones to One System Flow, Assign Each Zone to a Unique System Flow) select *Design|Assign...* before running the Design options.

2.6.2 PARTIAL MANAGEMENT

Where designs contain a large number of zones, a designer will not normally examine all operating conditions in order to size the mainline. In these cases it is more efficient to design the mainline based on a number of worst case scenarios. IRRICAD allows this to be done.

Where a selection of zone control valves will be grouped to operate together in order to represent a single worst case situation or a number of worst case situations use *Design|Assign System Flows to Zones*.

You decide the number of system flows or groups to enter and which valves or valve-in-head outlets (mainline outlets) will operate on each group.

Any number of system flows or groups can be specified. Actual operating times can be entered or the one-hour defaults accepted. The zone valves are assigned to a system flow by entering the number of the system flow next to the zone name. Zones not included in any system flow have their entries left as zero.

When you click OK, IRRICAD checks for flow violation, and if all Zones have not been assigned to at least one system flow, issues a warning on screen to this effect. You can continue (by clicking Yes), or click No to return to the table to make further entries or changes. This is a warning message only, in case you meant to assign all zones. It can be ignored.

By deciding which combination of zones would provide worst case situations, you can cut down the number of system flows. A worst case situation is one which you think might have the highest possibility to being outside the design limits as you have set them. If the worst case situations design within the limits, then other zones and outlets should not be under or over pressure either. It may also pay to analyze a combination of zones nearer to the water supply, as too much pressure is not beneficial, and a pressure-regulating valve may need to be installed.

Possible worst case situations are normally chosen by the following factors:

- Distance from the water supply / pump
- Two irrigators working close together
- Rise in elevation
- Fall in elevation if a worst case is considered to be too much pressure

2.6.3 DESIGN

For completing a quick analysis of zone pipes or spraylines only, you are not required to enter mainline pipes or a water supply; the zone pipes and control valves will be sufficient. You can also complete a quick mainline analysis providing you have at least one water supply entered and one or more mainline outlets, e.g. demand points or VIH sprinklers, connected by one or more pipes to the water supply.

In *Design|Zone Design Configuration*, you may specify the maximum number of sizes allowed for each lateral (connected spraylines) by typing in a numbers 1-3 in the Number of Lateral Sizes column. The number of submain sizes allowed can be specified by a number, or left as 0 - meaning IRRICAD is unlimited by the number of submain sizes it can use.

When using IRRICAD to size pipes, select either LP Design or Velocity Design. LP Design sizes pipes based on the pressure requirements of the outlets, velocity limits, and elevations, and trade off annualized

capital cost against annual running costs to find a low total cost solution. It is important that your pipe prices in the databases are relatively correct, i.e. increasing with increasing diameter. If you have a large pipe with a very low price, it may be selected in preference to a smaller pipe (assuming outlet pressure requirements can be met) because it results in a low valve or water supply pressure and lowest overall costs.

Velocity Design sizes pipes based only on the flow in the pipes. Often, this method is used to select pipe sizes as a starting point, particularly where LP Design is unable to find a solution due to the constraints on the system. Velocity Sizing will always give a solution. However, there is no guarantee that the pressures at the outlets will be correct. If you are having difficulty with LP Sizing, run Velocity Sizing and then check the reports to identify problem areas. Velocity design must be used to size looped systems.

When computer sizing pipes, either by LP or Velocity Design, a pipe can change for different scenarios each time you computer size. You can, however, fix a computer selected pipe to a pipe size which LP or Velocity design has chosen, by using the Change tool and unchecking the Computer Sized box; then re-run LP Design or Velocity Design to size other pipes.

2.6.3.1 NOMINAL PRESSURES

The Nominal pressure for outlets is the pressure that you are aiming to achieve. In the Database Editor a flow tolerance is specified as % above and % below. If the flow tolerance is 5% above and 5% below, this gives a pressure tolerance of approximately 10% above and 10% below (20% window) the nominal pressure you designate. Hence, any outlet outside this pressure window will produce a warning message during Design. Therefore, for a 20% pressure window with the nominal pressure set at 10psi (m), any outlet less than 9psi (m) or over 11psi (m) will be out of the required range. Tape inlet pressures work in the same way. The Inlet pressure is the pressure you are aiming to achieve at the start of the tape.

See also:

IRRICAD Database Editor

Section 3

2.6.3.2 ANALYZE (EXISTING SIZES)

In *Design|Zone Design|Analyse*, IRRICAD will calculate, using non-linear pipe network analysis routines, the flows in all pipes and determine the pressures at outlets, pipe junctions and on the downstream side of zone control valves.

If the pressures at any outlets fall outside the allowable pressure range of the outlet / nozzle combination as specified in the database, a message will appear on the screen to that effect.

In *Design|Mainline Design|Analyse*, the methods are exactly the same except that the outlets are now zone control valves and the water supplies are the source of flow. The analysis occurs under a range of flow conditions resulting from management of the zones.

Select the Analyse option for pipes already sized where you wish to know the downstream valve pressure. IRRICAD will analyze the system based on nominal pressures and flows and calculate the downstream valve pressure. View the *Reports|Design Reports|...*

2.6.3.3 PIPE SIZING - LP DESIGN OPTION

In zone design, LP determines the downstream control valve pressure and selects pipe diameters so that the cost of pumping and the cost of pipe are reduced. For zones that contain spraylines, LP also determines suitable start and end pressures to enable sprayline or lateral sizing to take place.

Pipes (other than spraylines) regardless of their lengths are sized in a single diameter. In order to allow for the possibility of using two diameters in long pipelines, permanent junctions should be inserted to divide the pipes into shorter lengths (see Working with Junctions, Section 2.4.13).

Velocity limits specified in the *Design|Design Parameters|Hydraulic Parameters* are considered in LP sizing, although in some cases pipe sizes may be selected which result in these velocities being exceeded. A warning message will be displayed when this happens. IRRICAD will try to select a pipe even if the velocity is slightly exceeded to produce a solution. You can then see where a problem is occurring and rectify it.

If LP is unable to select suitable pipe diameters to meet the pressure constraints at the outlets, a warning message will be displayed and IRRICAD will continue with the next zone.

In mainline design, if a water supply pressure has been specified in management, IRRICAD uses this pressure to determine the pipe sizes needed to produce the pressure required at the zone valves. If a water supply pressure is not specified, IRRICAD considers the annual capital cost of pipes, annual running cost of the system and maximum allowable mainline velocities to determine a suitable pressure.

Select *Design\Zone Design\LP Design* or *Design\Mainline Design\LP Design* to size pipes and analyze the system.

2.6.3.4 PIPE SIZING - VELOCITY DESIGN OPTION

During Velocity design, the pipes are sized on velocity (as set in *Design\Design Parameters*) but a pressure at the control valve is determined to achieve close to the required outlet pressures. This includes any PRVs that are in the system.

Because this pipe sizing method is based on flow, there is no guarantee in velocity design that the required pressures at the outlets will be met. By setting the velocity lower, or by simply changing pipe sizes as necessary to meet the pressure requirements at the nozzles, the system can be designed within the pressure and flow limitations. As with Analyze, a message will appear on the screen informing the designer if outlet pressures are outside their allowable range. Pipes can be changed manually and re-analysed to complete the design.

In mainline design, if water pressures have been specified, then after sizing the pipes IRRICAD uses these pressures to determine the available pressure at the valves. If a water supply pressure is not specified (single water supplies only), a pressure is calculated so as to supply the required pressure to all valves.

A comparison is made between the available pressure and the required pressure at the valves.

Select *Design\Zone Design\Velocity Design* when sizing pipes with loops in the Zones, or when LP Design fails to find an answer.

Select *Design\Mainline Design\Velocity Design* when sizing pipes with loops in the Mainline, when there is more than one water supply, or when LP Design fails to find an answer.

2.6.3.5 DETAILED ANALYSIS

In the standard analysis mode (Analyse option in the *Design|Zone Design* and *Design|Mainline Design* menus) IRRICAD uses the selected nominal flows for emitters, spraylines and tape inlets to calculate the flow and resulting pressures in a system. In most circumstances this method is slightly conservative. Detailed Analysis however uses an iterative process to exactly match the flow of an emitter, sprayline or tape to the pressure at that point and therefore allows a designer to more accurately gauge how a system would perform in practice. This is especially so when the resulting pressures are substantially different from those specified.

Detailed analysis can be used for Zone drippers, sprinklers tapes, spraylines and also VIH sprinklers in mainline. There is obviously no advantage in running a detailed analysis for systems that only contain pressure compensated emitters.

The control valve pressures in *Design|Zone Design Configuration* table must be specified before a detailed analysis of a zone. Similarly the Water Supply pressure(s) need to be specified for a mainline detailed analysis.

The default maximum number of iterations for detailed analysis is 50, this can be altered by editing the Max for Detailed Analysis field in *Design|Design Parameters|Analysis Parameters*. Also in this dialog is a factor which controls how quickly the analysis converges (Detailed Analysis Factor field). The default value is 0.75 and in normal circumstances this should not be changed. Valid values are between 0.0 (fastest) and 0.99 (slowest), however using a smaller factor may mean that some systems will not converge at all.

Select *Design|Zone Design|Detailed Analysis* when you have specified a control valve pressure in *Design|Zone Design Configuration*. Select *Design|Mainline Design|Detailed Analysis* when you have specified water supply pressures (*Mainline|Water Supply*).

2.6.3.6 SUMMARY

- Select pipe sizes or Computer Selected pipe
- Uncheck the Computer Sized check box if wishing to fix the manually selected pipe size
- Complete the design
- Run LP or Velocity Design to size pipe

- Run Detailed Analysis when sizing stage is complete.

2.6.4 LP DESIGN LIMITS

The size of zone that can be designed using LP based sizing is limited by the amount of memory able to be allocated within IRRICAD for that purpose.

There is a trade-off between the complexity of a zone and the size of the zone that can be sized. The more complicated the zone in terms of shape, elevation changes and the number of pipe sizes required in the submain the smaller the zone will be before exceeding the memory limits of LP. The time taken to find a solution will also be increased.

For a particular zone, there may be little that can be done to reduce the complexity of shape or the effect of elevation changes without making major changes to layout. However if a pipe in a submain has a fixed size it does not need to be sized by LP, i.e. LP does not have to make a choice of diameter for that particular pipe, and therefore it is not included in the LP problem and hence reduces memory requirements.

Fixed size pipes can arise in four ways, they are:

- Specified by the user as a fixed size pipe.
- Restricted in size by the zone velocity limit set (*Design|Design Parameters|Hydraulic Parameters*).
- Restricted due to the pipes enabled for use (flagged in the database). Again, if smaller or larger pipes could have been used than those available for selection from the database, LP may be forced to use a particular size. A typical example of this situation is where small zone pipes have been flagged out of the database that results in a number of the pipes towards the end of the submain forced to be a larger size.
- The number of submain sizes has been restricted in the Zone Configuration table. If there are no restrictions on the number of submain sizes and none of the above restrictions apply, LP will be required to determine diameters for all pipes. If the number of submain sizes is specified as 2, the bottom segments of the submain would be fixed in one size, and the top segments fixed in a larger size. This leaves a few segments in the middle of the submain that could be one or the other of the two sizes. The

number of pipes where LP has to make a choice is very much reduced.

In large complex zones, restricting the number of sizes to be used (*Design|Zone Design Configuration* - number of lateral sizes and number of submain sizes), setting sizes manually (*Zone|Pipe*) and restricting velocity (*Design|Design Parameters|Hydraulic Parameters*) may result in LP being unable to find a solution. Some trial and error may then be required.

In smaller complex zones where LP size is not a problem, the chances of finding a solution may be enhanced by increasing the velocity limit to 30ft/s (10m/s) in *Design|Design Parameters|Hydraulic Parameters* (simply to make sure the velocity is not restricting LP from making a choice). Making a full range of zone pipe sizes available in the database will also enhance the chance of finding a solution. Do not restrict the number of submain sizes by specifying a number in the *Design|Zone Design Configuration* table if a solution is difficult to find.

2.6.5 IRRICAD SELECTING FITTINGS FOR THE DESIGN

For IRRICAD to automatically solve junctions in a design, select *Design|Computer Selection of Fittings*. IRRICAD then considers the geometry of the junction, the type of components to be joined, and attempts to select a suitable arrangement of fittings to resolve the junction.

As IRRICAD completes the fitting selection, the internal junction numbers will be displayed on the screen. Details of missing fittings or unsolved junctions may be viewed in Costing and Bill of Materials reports (*Reports|Costing Reports|...*, *Reports|Bill of Materials Reports|...*) and in the Show Fittings part of the Change Tool dialog.

Missing items can be entered into the database and enabled for selection. New items that solve previously unsolved junctions will be selected when Computer Selection of Fittings is re-run.

Fittings that IRRICAD has chosen to solve a junction can be changed if required. Select a junction, outlet or control valve using *Tools|Change* and click on the Show Fittings button in the dialog.

Items that have been selected to solve the junction are listed. Click the Add or Remove buttons as required. Changes made here are reflected

in the Bill of Materials or Costing reports. Note that any changes made here will be lost if Computer Selection of Fittings is re-run. Hence it is better to edit the database to solve fittings problems.

Miscellaneous items can also be selected and added to the design and subsequently the Bill of Materials or Costing reports by clicking the Add button and selecting any item currently in the database. Note that any changes made in Show Fittings dialog are lost if Computer Selection of Fittings is re-run. Select miscellaneous items last.

2.6.5.1 MANUALLY ADJUSTING FITTINGS

It is often the case that adding one item, or turning items on or off in the database will solve many fittings errors. This is the preferred method, as the next design will also automatically select the fittings you normally use if you customize the database.

However, you can edit the fittings at each junction.

After running *Design|Computer Selection of Fittings*, you may wish to view the fittings selected at a particular point in the system. The Bill of Materials or Costing reports will list any errors after running Computer Selection of Fittings. The reports will also give the coordinates where a problem is occurring. By using *View|Goto Coords* and typing in the numbers supplied, the connection point can be identified. You can view these fittings at a point object (junction, valve, outlet etc) by selecting the item (*Tools|Select Object*) and using *Tools|Change* to bring up the dialog for the item. Click the Show Fittings button. The dialog will show each item involved in the connection. If IRRICAD has failed to find an item from the database required for solving a connection, the error is listed in this dialog. This error is the same as reported in any of the Bill of Materials or Costing reports. You may want to view the fittings in this way to: a) make changes, or b) find out the connection codes for items IRRICAD may not have found a fitting for.

Add

This adds an item to the connection. These items would then be listed in the Bill of Materials and Costing reports. Click the Add button on the Show Fittings dialog and select an item or items from the database list. You can move between component groups by clicking on the tabs. Click on the gray square to the left side of the item to automatically select, or click in the white description field of the item and click the Select button.

Items selected will be listed at the bottom of this dialog. Click Close to finish.

You can edit the quantity of an item by editing the number in the Quantity field of the Show Fittings dialog. Click the Hide Fittings button on the Show Fittings dialog to return to the Change dialog.

REPLACE

An item existing at the connection can be replaced. Highlight the item you wish to replace and click the Replace button on the Show Fittings dialog. Select another item from the database list; you can move between component groups by clicking on the tabs. Click on the gray square to the left side of the item to automatically select, or click in the white description field of the item and click the Select button. Click Close to finish.

You can edit the quantity of an item by editing the number in the Quantity field of the Show Fittings dialog. Click the Hide Fittings button on the Show Fittings dialog to return to the Change dialog.

DELETE

An item existing at the junction can be deleted. Highlight the row by clicking on the gray square to the left of the item you wish to delete and click the Delete button on the Show Fittings dialog.

2.6.5.2 CHANGING AND FIXING MANY FITTINGS ERRORS IN ONE GO

It is often the case that adding one item, or turning items on or off in the database will solve many fittings errors. This is the preferred method, as the next design will also automatically select the fittings you normally use if you customize the database.

However, if you do not wish to edit the database, Change Type can be used to solve fitting errors for like items:

1. Select all junctions that will have the same fitting to be changed or added.
2. Select *Tools|Change Type*.
3. Click the Show Fittings button in the dialog.
4. Make the change required (e.g. click on the Replace button or Add button and select an item or items from the database dialog).
5. Click OK

6. Select the appropriate Match and Change fields in the Change Type dialog.

If All Fittings is checked, for example, then those items, e.g. sprinklers, which have the same fittings, will be included in the global change. If Exact Errors is checked, then only those sprinklers, for example, which had the same error message during Computer Selection of Fittings will be included in the global change. The Bend Angle Range option will broaden the Exact Errors option. For example, an error message was displayed, concerning sprinklers in the design, that a bend could not be found to solve the junctions. Where each instance of the error displayed a slightly different bend angle, the Bend Angle Range could be set to 43°-50° and both junctions would be solved with the same bend. E.g. sprinkler 1 is looking for a bend with 46° angle, and sprinkler 2 requires a bend with a 44.5°.

7. Click OK.

2.7 ENHANCING THE PRESENTATION OF PLANS

This chapter looks at many of the drawing aids and tools to help you enhance the design plans you are presenting to your client.

2.7.1 HOW TO FIND LENGTHS AND DISTANCES

Use F9 to measure the length of an object or the distance between two objects.

Hold the cursor over the point to start from and press the F9 key. Move the cursor to the point to finish at and read the status bar. The distance and angle the cursor has moved since pressing F9 is displayed.

2.7.2 SIZING AND PLACING OBJECTS ACCURATELY

The keyboard can be used to specify lengths, coordinates and angles when using drawing tools. To specify a length of a line, radius, side of a rectangle, etc., select the tool and place the first click, using the mouse, on the screen (drawing objects only). Type the length, e.g. 98ft (30m), and press the Enter key. Note prior to pressing the Enter key the value you type appears in the left-hand corner of the status bar.

To specify the angle of a line, radius, side of a rectangle, etc. you must also specify a length. Type in the length, then < and then the angle (e.g. 50,<90 for a line the length of 50ft (m) long at an angle of 90° from the starting point).

To use co-ordinates to place the start and end points of a line, radius, side of a rectangle, etc., type in the required X and Y co-ordinates for the starting point (e.g. 0,0) and press the Enter key. Once again, note the values you type will appear in the left-hand corner of the status bar. Now type the X and Y co-ordinates of the end point, (e.g. 50,30) and press the Enter key.

Note: You may need to turn Num. Lock off on the keyboard in order to use the decimal point for metric measurements in the direct distance entry.

Often your work in IRRICAD consists of drawing or editing along horizontal and vertical axes. You can ensure this by manually entering coordinates, but it's much quicker to work in ortho mode (*Settings|Drawing Items*, Section 5.9.5). You can use the Ortho settings to constrain point placement so that each point placed is in perfect horizontal or vertical alignment with the previous point. If you are going to enter only a few points orthogonally, you can hold down the CTRL key while entering the points (if you are already in ortho mode, using the CTRL key takes you temporarily out of the mode).

Although the default orientation of the orthogonal axes is $0^\circ / 90^\circ$, these axes can be rotated to any angle you choose. This allows you to draw or edit by placing points that are in 90-degree alignment to one another but not on the horizontal and vertical axes. To change the angle of the orthogonal axes, use the Ortho Angle setting.

See also:

Draw

Section 5.5

2.7.3 ACCURATELY PLACING ITEMS (USING SNAPS)

Perhaps the most important feature of a CAD program is the ability to place or constrain points in relationship to other elements in your drawing. IRRICAD offers a complete set of referencing options called snaps. When you use a snap option while locating a point, the point snaps into position.

Snap are tools that allow you to connect to existing objects on the screen. By right-clicking the mouse after having selected a drawing tool you can access the following snaps:

- Midpoint
- Endpoint
- Perpendicular
- Percent
- Object
- Intersection
- Tangent
- Closest
- Center
- Quadrant

- Parallel

The ones you are most likely to use on a regular basis are Midpoint, Endpoint and Perpendicular. By using the Endpoint snap, lines and geometric objects will connect to the endpoint of an existing object. This means that the drawing will be tidy. If you try to connect to the end point of an object by eye, then zoom into to this connection you will see that the two objects are quite distant. If the *Right-Click|Snaps|Endpoint* is used, the two objects are connected. *Right-Click|Snaps|Midpoint* allows you to connect to the middle of an object. *Right-Click|Snaps|Perpendicular* allows you to connect to an object at 90°.

For all the snaps, you must be within a tolerance distance to the object you wish to snap to.

When one of the snap tools has been invoked, it will only affect the next click you place on the screen. If you wish to use the same snap for the subsequent click, it must be selected again.

Only Midpoint, Endpoint and Place are enabled for use with hydraulic objects. Place can be turned on for a period if required by selecting *Settings|Snap* and clicking the Place option. Remember that if Place is selected, hydraulic objects will not be connected together. If a hydraulic object is not connected, a warning message will be given during Design.

For further information about each of the above snaps, see Snaps, Section 5.1.8.

2.7.4 PLACING SYMBOLS ON THE PLAN

Symbols are used to store pictures for use in several designs. They can be used to enhance presentation and can contain trees, details, North symbols, copyright symbols, or anything else you wish to place on the drawing.

To place a symbol select *Draw|Symbol*. Click the Load button to select a symbol to use. To use your company logo, you must first have imported the file in dxf, dwg, vcd or gcd format, or have drawn / digitized the logo into IRRICAD and saved the logo as a symbol. If you have imported your logo in bitmap format, you cannot save it as a symbol.

2.7.4.1 MAINTAIN SHAPE

If the Maintain Shape box is checked the shape or relative dimensions of the symbol are maintained regardless of size. If it is unchecked then the shape of the symbol may be distorted. For most symbols you should leave the box checked e.g. trees, shrubs, logos, but you may wish to uncheck the box to elongate symbols such as hedges, walls and the North symbol.

2.7.4.2 DYNAMICALLY SIZE

If the Dynamically Size box is checked, then you can drag the symbol out to any size using a rubberband rectangle. If it is unchecked then you specify the size of the symbol using the width and height fields and place the symbol with a single click. Often the symbols are just representative and size does not matter e.g. you might place a few bushes of different sizes to indicate a garden area on the plan. In this case the Dynamically Size box would be checked. However sometimes a particular feature needs to be drawn to scale e.g. a large tree whose size is known. In this case the box would be unchecked and the size entered in the width field.

The orientation field is set to 0° since new symbols are created unrotated. To change a symbols orientation, select the symbol using *Tools|Select Object*, for example, then *Tools|Change* and type a new value in the Orientation field. *Tools|Rotate* can also be used.

2.7.5 CREATING NEW DATABASE SYMBOLS

Database symbols are used in the database to display a symbol for each hydraulic item. The exception is the Pipes and Wires groups, where a line type is selected.

The program comes with quite an extensive choice of symbols, however, you may still wish to create your own.

Start with a clean design (*File|New*). Draw the new symbol at the size 100 inches by 100 inches. This will make sure that it is the same scale as the existing database symbols so a size 5 for your new symbol will be the same size as a size 5 of existing symbols. Use any of the drawing tools to draw the elements of the symbol on the screen.

Using a selection tool select all the items required to make up the symbol. When everything is highlighted use *Tools|Create Symbol* to store the items as symbol. Enter a name for the symbol and check the Database check box. Leave the path as suggested as this path is stored in *Settings|Irrigation Items*, however you can save the symbol elsewhere if you wish. Now the symbol is present in the folder containing the database symbols.

Run the database editor program and open your working database (if this is not your default database click Save Changes on the database that initially appears and select *File|Open* to open your working database). Go the item you wish use the new symbol for. Click the Edit / View button when this item is highlighted. To the left of the Plotting Symbol field is a small button with three dots on it. This is a Browse button. Click this button and find your new symbol in the \symbols\database folder or where you have stored it. Select it and click open. After you have made the changes to this item click Save and Save Changes to save and close the database.

2.7.6 MAKING THE DATABASE SYMBOLS LARGER FOR LARGE DESIGNS OR SMALLER FOR SMALL DESIGNS

Database symbols are assigned a size in the database by selecting a size from 1-10. This size can not be converted into a measurement as such. Size 5 is assigned the base database symbol size and the other sizes are relative to this e.g. if the Base Database Symbol Size in *Settings|Miscellaneous* is selected as 3.28ft (1m) then a size 5 symbol will be 3.28ft (1m) in diameter. A size 4 symbol would then be $\frac{4}{5}$ of this 2.62ft (0.8m) and a size 6 symbol would be $\frac{6}{5}$ of this 3.94ft (1.2m).

If the design you are creating is getting larger and larger and the symbols are disappearing as you zoom out, select *Settings|Miscellaneous* and increase the Base Database Symbol Size until you are happy with the results. Make sure the Update Database Symbols check box is checked to ensure existing symbols in the design are updated to the new size.

Similarly, if the design is a small design decrease the Base Database Symbol Size until the symbols are an appropriate size.

Changing the Base Database Symbol Size changes all the database symbols in the design. To change the size of a particular hydraulic item e.g. an outlet, you will need to change the symbol size of that item in the database. If the symbol size is currently a size 5 and you wish to increase the size of the symbol relative to other symbols select a number 6-10. To reduce the size of this symbol relative to other symbols select a number 1-4.

You will note that water supply and junction symbols cannot be changed in this way. These symbols are found in the *Settings|Irrigation Items* tab and can be adjusted there.

See also:

Design Size
Irrigation Items

Section 5.9.9.3
Section 5.9.4

2.7.7 USING HATCHES AND FILLS

Hatches and fills are great tools to add that little bit extra to the plan and enhance the presentation.

Both hatches and fills can be used in three ways:

- Selection
- Boundary
- Seed

There are a few key things to know when using hatches and fills:

1. an object needs to be completely closed if using the Selection or Seed options. If using lines or curves to create the object select *Right-Click|Close* to connect the start point to the end point to close the object.
2. the hatch or fill can be any color you wish. Select the color from *Settings|Drawing Items* - Current Color before drawing the Hatch or Fill.
3. hatches and fills can not be changed after they are drawn. If you wish to make changes, delete what is there and re-draw it with the correct color.
4. hatches need to have a scale so they know how large to draw the pattern. If the scale is too small, the hatch cannot be drawn.

***Tip:** If you have already placed text on the plan, see what size you have made the text so it is readable. This is an indication of the starting scale you could try e.g. if the text has a 3m height to be readable, try a scale of 3 to start with.*

If there are many closed objects or intersecting objects on the plan Seed hatch or fill may have difficulty filling the area you have pointed to. A message may appear indicating there are over 100 objects or IRRICAD may beep and no fill or hatch appears. The Selection option can be used in this case with the same results, if the correct items are selected.

See also:

Hatch
Fill

Section 5.5.9
Section 5.5.10

2.7.8 GROUPING ITEMS TO DISPLAY – USING LAYERS

IRRICAD automatically groups items in what are called Layers. When selecting items to place on the screen the resulting dialog will normally have the layer as <DEFAULT>. This means that all drawing items will be put into the DRAWING layer, all text is put in the TEXT layer, all pipes are put in the relevant PIPES layer and all outlets in the OUTLETS layer unless specified otherwise.

You can place everything on one layer or you can store related groups of information on different layers. This is similar to manually drawing different types of information on the overlay sheets commonly used in conventional drafting that can be viewed independently or stacked on top of one another to compose a complete drawing. For example, you might place a basic plan on layer 1, its mainline on layer 2, the electrical system on layer 3, the control valves on layer 4, and so on.

You can create, edit, view, and print any combination of layers together. You can move objects from one layer to another. You can draw an object on any layer and with any properties you choose, or you can designate any layer to apply certain properties automatically when you draw objects on that layer.

If you look at *Settings|Layers* you will see a series of larger groups with the <DEFAULT> layer specified at the top of the dialog. You will notice that the Zone group is also <DEFAULT>. This means that depending on the item drawn e.g. an outlet, the item will be put in the correct layer e.g. OUTLETS layer. You can however, select a layer e.g. TEMPORARY

from the dropdown list so that all zone items will be placed in the TEMPORARY layer.

You can create you own layers and delete any layers you have created. You cannot delete any layers that came with the program.

Layers can be turned off (uncheck the check box for that layer in the Show column) to hide the items in them. Items can have their drawing properties selected as By Layer, which means that the item will display the color, line type and line widths as per the layer defined properties. These layer properties can be changed by clicking on the color column to change the color or selecting a new line type and width from the dropdown lists when clicking in the line type or line width column.

You can also move items from one layer into another. The main reason for doing this would be to turn off some items but have other items remain visible. All visible items are printable. See Changing Layers, Section 2.4.3.4 to see how to do this.

2.7.9 USING DIMENSIONS

When any of the first five dimensions are selected (Linear, Angular, Radial, Diameter, Ordinate) the Dimension Settings dialog appears. This dialog has two tabs - Dimension and Dimension Text.

See also:

Dimension

Section 5.5.11

2.7.9.1 DIMENSION TAB

DRAWING PROPERTIES

The first part of the Dimension tab deals with the drawing properties. These can be editing as required - changing the layer from the default layer of <DRAWING> to another layer of your choice, changing the color, line type or line width of the dimension line.

LINE DIRECTION

The section headed Line Direction determines the direction of the dimension line.

Aligned

If Aligned is selected, the dimension line will dimension horizontal lines and vertical line parallel to the line you select to dimension.

Horizontal

If Horizontal is selected, only the horizontal component of the selected object is measured. For a non-horizontal line e.g. at 95° , the distance between a specified point on the line and vertical (90°) will be measured. (See Figure 15).

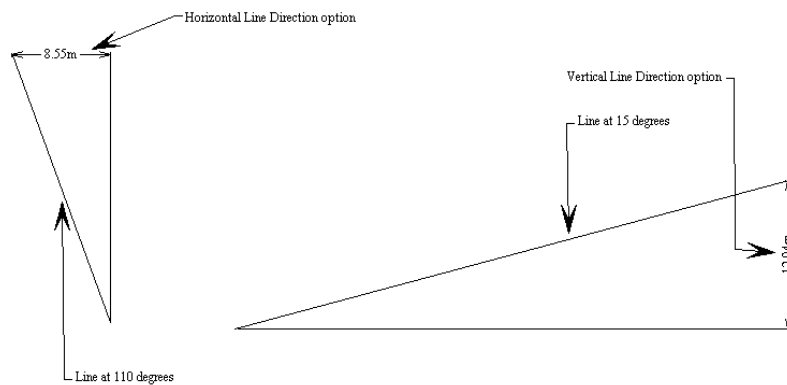


Figure 15

Vertical

If Vertical is selected, only the vertical component of the selected object is measured. For a non-horizontal line e.g. at 15° , the distance between a specified point on the line and horizontal (0°) will be measured. (See How to Find Lengths and Distances, Section 2.7.1). Note that if you wish the vertical text direction to be the same on all vertical lines, select the vertical option, not the Aligned option.

Angle

If Angle is selected, enter the required angle. If the angle you entered is 45° , the dimension line will be drawn at a 45° angle to horizontal (0° plane). (See Figure 16). A horizontal dimension is equivalent to a 0° -angle dimension, and a vertical dimension is equivalent to a 90° -angle dimension.

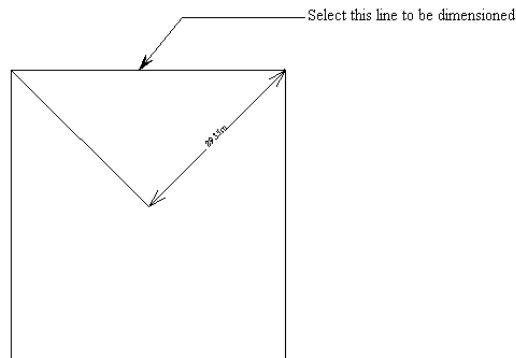


Figure 16

MODE

A section at the top right, headed Mode, selects the type of dimensioning. To demonstrate the different modes, draw a 2-point rectangle. Using *Right-Click|Snaps|Midpoint*, place a line to divide the rectangle in half. Name the top left corner A, the top midpoint B and the top right hand corner C.

Single

Select *Draw|Dimension|Linear* and select Single as the mode. Click on the top line of the rectangle, the whole rectangle length will be dimensioned.

Partitioned

Select *Draw|Dimension|Linear* and select Partitioned mode. Right mouse click and select *Right-Click|Snaps|Endpoint* and click on point A. Wherever you click your next point is where the dimension will finish, so right mouse click and select *Right-Click|Snaps|Endpoint* to finish exactly at the midline (point B). Now right mouse click and select *Right-Click|Snaps|Endpoint* again and click on point C. Each partition of the rectangle has been dimensioned.

Cumulative

Label the bottom left corner D, the bottom midpoint E and the bottom right corner F. Select *Draw|Dimension|Linear* and select the Cumulative option. Using *Right-Click|Snaps|Endpoint*, select point D. Select *Right-*

Click|Snaps|Endpoint again and select Point E. Select *Right-Click|Snaps|Endpoint* and select Point F. The dimensions are cumulative distances. (See Figure 17).

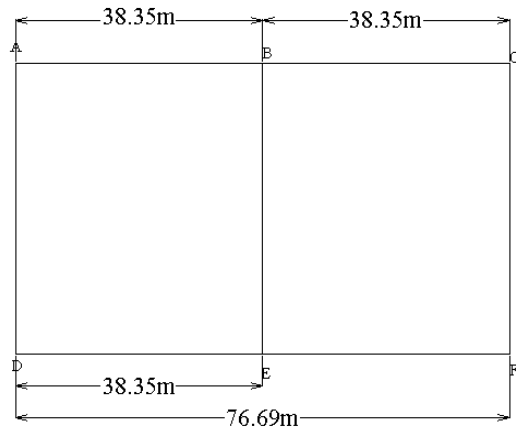


Figure 17

EXTENSION

This section looks at Extension options.

Offset, Above, Below with Proximity Fixed on

An Offset, Above and Below distance can be entered (see Figure 18). If the Proximity Fixed check box is checked:

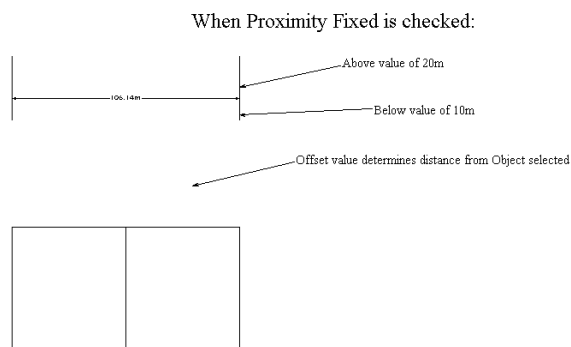


Figure 18

- The Offset value adjusts the space between the drawing object and the end of the extension lines.
- The Above value adjusts the distance that the extension line extends past the dimension line and away from the drawing object.
- The Below value adjusts the distance the extension line extends beyond the dimension line and toward the drawing object when Stretch is also unchecked.

Offset, Above, Below with Stretch on

When Stretch is checked, the extension lines stretch to reach the drawing object (minus the Offset distance). When unchecked, the Offset setting is ignored, and the extension lines follow the setting of the Below distance. If Proximity Fixed is checked when Stretch is checked, Stretch is ignored as the dimension is placed at the offset distance (see Figure 19).

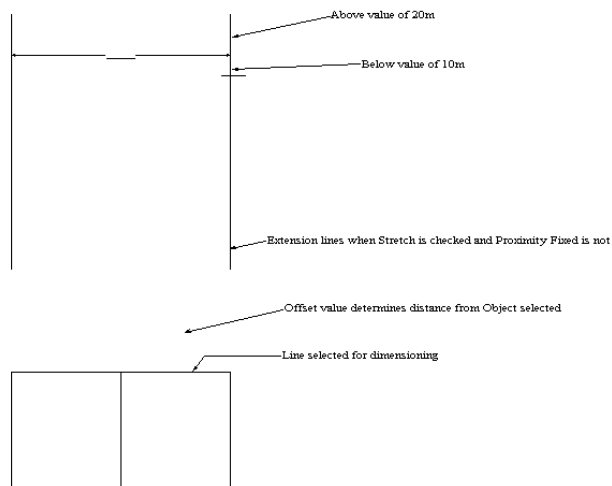


Figure 19

ARROW

This section allows you to specify how you want the arrow to be displayed.

Type

Select an arrow type from the dropdown list.

Size

Change the size of the arrowhead.

Angle

Change the angle of the arrowhead as required.

Flip

Check the Flip box to draw the arrowhead outside the extension lines.

Flip Distance – Left and Right

Enter the length of each arrow required if Flip is used. (See Figure 20).

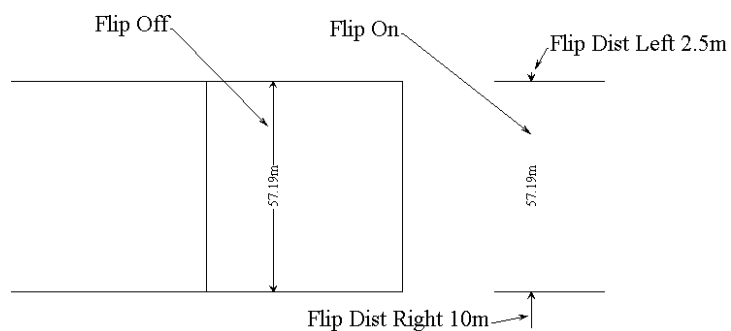


Figure 20

2.7.9.2 DIMENSION TEXT TAB**TOLERANCE**

An allowable variation in the dimension can be specified and displayed.

Type

Select the type of tolerance required from the dropdown list.

Lower and Upper Tolerances

Enter a lower and upper tolerance. In Figure 21 each tolerance type is displayed. Each tolerance has a lower value of 5m and an upper value of 1m.

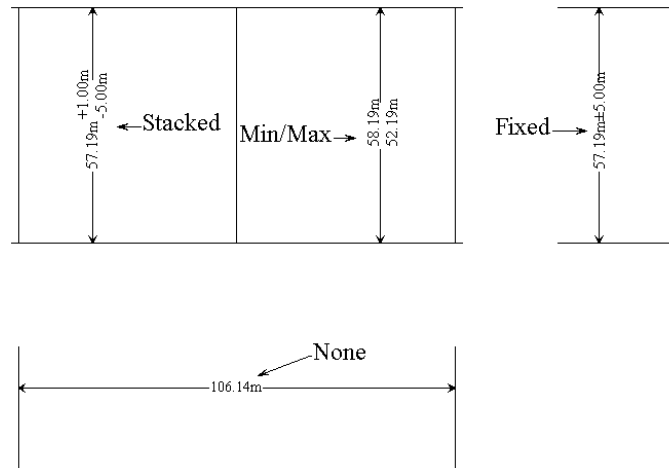


Figure 21

PREFIX, SUFFIX AND OVERWRITE

If Prefix, Suffix or Overwrite is checked, any text entered for the checked option will be placed before, after or in place of the dimension length. See Figure 22 where the use of a prefix is shown (text placed before the dimension length) and use of Overwrite is used.

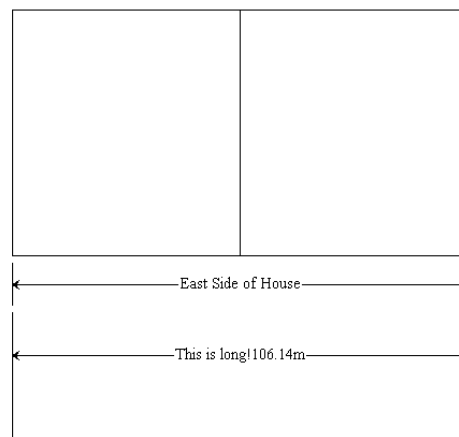


Figure 22

LOCATION

Two location options can be chosen (see Figure 23):

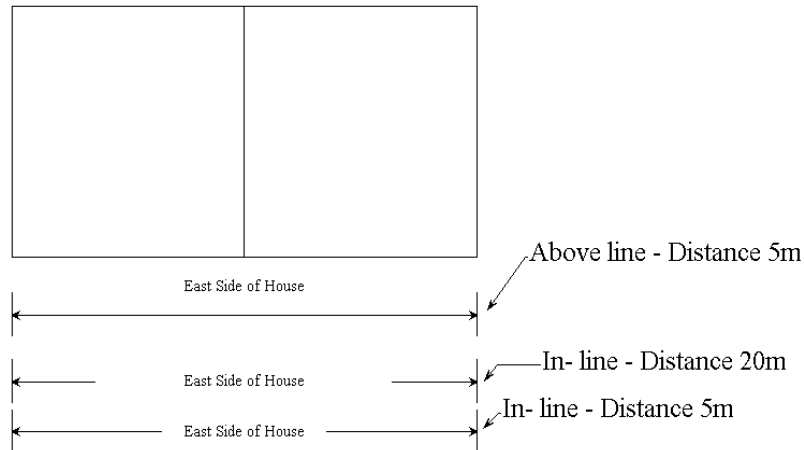


Figure 23

In Line

In Line - where the dimension text will be in the middle of the line, and the distance entered will be the space between the text and the dimension line.

Above Line

Above Line - where the text will be placed above the dimension line at the distance entered. Only positive values can be entered.

VECTOR TEXT SETTINGS

These options only apply to Vector fonts and will not affect any True Type fonts.

Note that Dimension can only have one font. If you select another font to use in a subsequent dimension, all previously placed dimensions will change to the new font selected.

Char Space

Char Space specifies the spacing between characters of a text line as a percentage of the character size. The default is 20%.

Slant Angle

Slant Angle specifies the angle at which vector text is slanted to emulate Italics. The angle must be between -45° and 45° (see Figure 24).

Mono Space

Mono Space specifies all characters to be the same width. When unchecked, wide characters (M and W) take up more space than narrow characters (I and L).

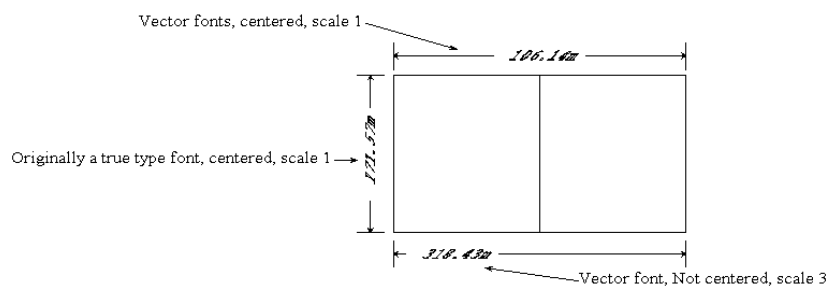


Figure 24

Fill Text

When Fill Text is checked, characters are solid filled. When unchecked, characters are displayed in outline, making both redrawing and printing faster.

SCALE AND CENTERED OPTIONS

The scale sets the real-world size of dimension text in current drawing units. Enter the appropriate scale.

When the Centered check box is checked, dimension text is placed at the midpoint of the dimension line, regardless of the orientation or mode chosen. When unchecked, you position the dimension text by moving the cursor along the dimension as you position the line (see Figure 24).

ORIENTATION

Two options are available with Orientation - Aligned and Horizontal.

Aligned

If Aligned is selected then the dimension text is aligned to the orientation of the dimension line. If the dimension line is vertical, then the text will be vertical, if the dimension line is horizontal the text will be horizontal.

Horizontal

If the Horizontal action is selected, then the text is placed horizontally regardless of the orientation of the dimension line. This can make the text easier to read, as it will always be the right way up and not sideways (see Figure 25).

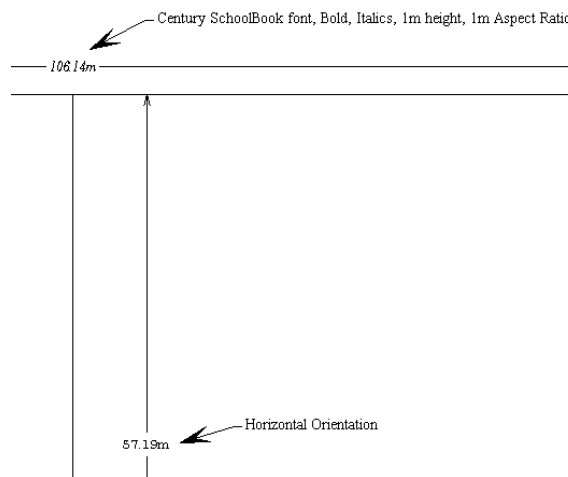


Figure 25

DIMENSION TEXT

Dimension text deals with the properties of true type text placed. Select the font required, type in the height required - which will be relative to the size of the drawing, type in the aspect ratio required (width relative to height), style required (bold, italics, underlined), and line spacing. The line spacing sets the spacing (as a percentage of one line height) between lines of text for stacked tolerance display (see Figure 25).

2.7.9.3 HOW TO USE LINEAR, ANGULAR, RADIAL, DIAMETER AND ORDINATE DIMENSIONS

USING LINEAR DIMENSION

Dimension Tab, Section 2.7.9.1 and Dimension Text Tab, Section 2.7.9.2 explain the use of the different options available in the Dimension Settings dialog.

Typically, linear dimensions are used to show the length of an object, but they can also show the distance between objects, or any other distance.

Linear Dimension can be used for dimensioning lengths of pipelines, buildings, fence lines etc. on any IRRICAD drawing. This dimension can be used on any object e.g. rectangles, lines and pipes simply by clicking on the line to dimension.

Other objects such as circles and partitioned objects can be dimensioned by using snap options from the right mouse menu to select a start and end point anywhere on an existing object boundary. Mode options such as Single, Cumulative and Partitioned can be used to dimension a segregated object entirely (Single), each section from the same starting point (Cumulative) or each section singly (Partitioned).

Distances between objects can also be dimensioned, by using Snaps to select the first object and the second object.

USING ANGULAR DIMENSION

Dimension Tab, Section 2.7.9.1 and Dimension Text Tab, Section 2.7.9.2 explain the use of the different options available in the explain the use of the different options available in the Dimension Settings dialog.

Angular dimension will give you the angle between any two points specified. Use the Angular Dimension tool to measure any angle in your drawing by first identifying a vertex and then a point on each ray. For every angle, you have a choice of dimensioning either the inside or the outside measurement (see Figure 26).

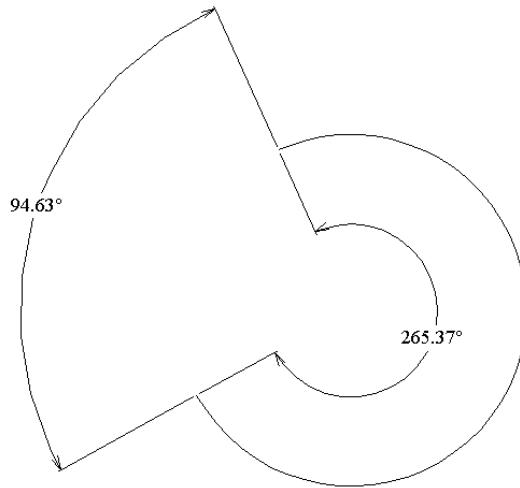


Figure 26

USING RADIAL DIMENSION

Dimension Tab, Section 2.7.9.1 and Dimension Text Tab, Section 2.7.9.2 explain the use of the different options available in the explain the use of the different options available in the Dimension Settings dialog.

Radial Dimension is used to display the radius of any circular object such as a circle or arc. Select *Draw|Dimension|Radial* and click on the boundary of the circle or arc. The radial dimension will appear. Move the cursor along the circular boundary to position it. Click when in the correct position.

USING DIAMETER DIMENSION

Dimension Tab, Section 2.7.9.1 and Dimension Text Tab, Section 2.7.9.2 explain the use of the different options available in the explain the use of the different options available in the Dimension Settings dialog.

Diameter Dimension is used to display the diameter of any circular object such as a circle or arc. Select *Draw|Dimension|Diameter* and click on the boundary of the circle or arc. The diameter dimension will appear. Move the cursor along the circular boundary to position it. Click when in the correct position.

USING ORDINATE DIMENSION

Dimension Tab, Section 2.7.9.1 and Dimension Text Tab, Section 2.7.9.2 explain the use of the different options available in the explain the use of the different options available in the Dimension Settings dialog.

Ordinate dimensions allow you to place a series of dimensions based on a point you specify on the drawing. If a large rectangle has been drawn, the base point may be placed on the bottom side of the rectangle. Future points will have the measurement displayed relative to the distance from the base point.

After selecting *Draw|Dimension|Ordinate*, select the base point to use (you will be prompted to enter an origin point). Now draw a line at 90° from the direction you wish the dimension labeled. This also indicates the direction in which the dimension will measure from the base point (you will be prompted to enter a direction point). If the measurements are to be vertical (e.g. from ground level upward) draw the first line horizontally. You will now be prompted to enter the text placement point. You will notice that if you have entered the previous direction as vertical, you can only place text horizontally, either to the left or right of the origin point. Click to place the text.

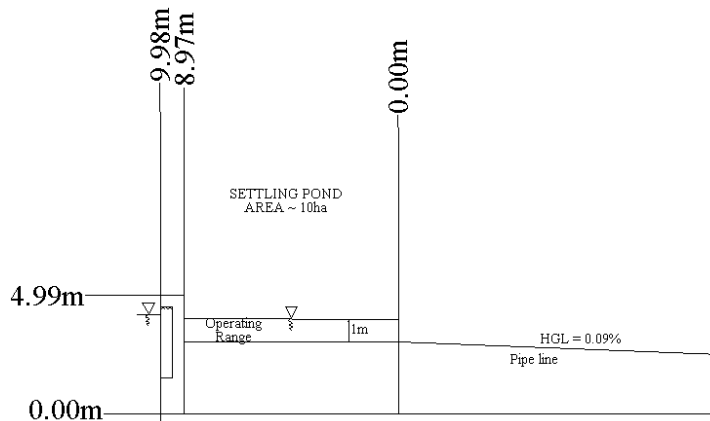


Figure 27

The first text placed will indicate the base point - 0.00ft (m). Now place another click where you wish to dimension and place the text again.

The second dimension is the distance from the base point along the positive axis (vertical if the direction point was placed in a vertical direction). Continue to place origin points until a new dimension or new direction is required (see Figure 27).

2.7.9.4 DATUM / LEADER SETTINGS

DRAWING PROPERTIES

The first part of the dialog deals with the drawing properties. These can be editing as required - changing the layer from the default layer of <DRAWING> to another layer of your choice, changing the color, line type or line width of the dimension line.

VECTOR TEXT SETTINGS

These options only apply to Vector fonts and will not affect any True Type fonts.

Note that Dimension can only have one font. If you select another font to use in a subsequent dimension, all previously placed dimensions will change to the new font selected.

Char Space

Char Space specifies the spacing between characters of a text line as a percentage of the character size. The default is 20%.

Slant Angle

Slant Angle specifies the angle at which vector text is slanted to emulate Italics. The angle must be between -45° and 45° .

Mono Space

Mono Space specifies all characters to be the same width. When unchecked, wide characters (M and W) take up more space than narrow characters (I and L).

Fill Text

When Fill Text is checked, characters are solid filled. When unchecked, characters are displayed in outline, making both redrawing and printing faster (see Figure 28).

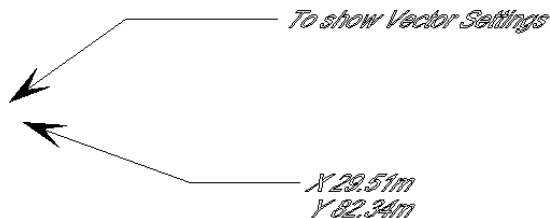


Figure 28

TEXT EDIT FIELD

This field is available to enter any text required with *Draw|Dimension|Leader*. Any text in this field when *Draw|Dimension|Datum* is used will be ignored unless the None option in Datum Dimension is selected. The Vector Text Settings control the properties of any vector text used here.

DATUM DIMENSION

Select the option required when you place a datum - X and Y co-ordinates of the point, X co-ordinates only of the point, or Y co-ordinates only of the point. If None is selected, any text entered in the text edit field will be placed with the datum.

ARROW

This section allows you to specify how you want the arrow to be displayed.

Type

Select an arrow type from the dropdown list.

Size

Change the size of the arrowhead.

Angle

Change the angle of the arrowhead as required.

OFFSET AND SHOULDER

The Offset field is used to describe the distance between the end of the leader or datum and the text placed. Increase or decrease this as required.

The Shoulder field describes the length of the shoulder or horizontal line attached to the end (2nd mouse click) of the leader or datum. See Figure 29).

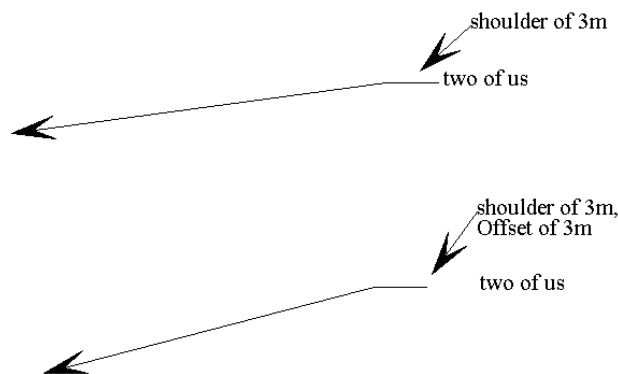


Figure 29

LEADER TEXT

Dimension text deals with the properties of true type text placed. Select the font required, type in the height required - which will be relative to the size of the drawing, type in the aspect ratio required (width relative to height), style required (bold, italics, underlined), and line spacing. The line spacing sets the spacing (as a percentage of one line height) between lines of text. Use Ctrl + Enter to type a second line of text.

2.7.9.5 USING LEADER AND DATUM DIMENSIONS

LEADER DIMENSION

Draw|Dimension|Leader is a useful tool to label items in the design. Text can be highlighted and copied from the Object Info dialog, Show Flow dialog or any of the reports for example.

Type in the text required. The first point placed on the screen will become the arrow point. Draw the arrow as you would a continuous

line, placing points where a change of direction is required. When completed select *Right-Click|Done*. By moving the mouse, select which side the text should be placed - either left or right. A shoulder may be added and an offset placed before the text (see Datum / Leader Settings, Section 2.7.9.4).

Dimensions can be exploded to edit the text separately if needed. Co-ordinates or lengths and angles can be typed in to place the first and subsequent points (see Sizing and Placing Objects Accurately, Section 2.7.2).

DATUM DIMENSION

Datums are used to specify the co-ordinates of a point on the screen. Where the first click is placed defines the datum value.

Datums are placed in the same way as Leaders. The first point placed on the screen will become the arrow point. Draw the arrow as you would a continuous line, placing points where a change of direction is required. When completed select *Right-Click|Done*. By moving the mouse, select which side the text should be placed - either left or right. A shoulder may be added and an offset placed before the (see Datum / Leader Settings, Section 2.7.9.4).

Dimensions can be exploded to edit the text separately if needed. Co-ordinates or lengths and angles can be typed in to place the first and subsequent points (see Sizing and Placing Objects Accurately, Section 2.7.2).

2.8 PRINTING REPORTS AND PLANS

This chapter covers producing reports, creating plot layouts and printing the final plan.

2.8.1 PRODUCING REPORTS

Reports can be produced at different stages in IRRICAD. For example, Bill of Materials reports can be produced after running Computer Selection of Fittings, whereas Design reports can be produced after designing or analyzing the system.

If you require a list of the pipes used in the design, this can be obtained before running Computer Selection of Fittings. As long as these pipes have been manually sized, they will be present in a Bill of Materials (BOM) report. If pipes are to be computer sized, run Design prior to printing out a list of pipes used in the design.

After Computer selection of Fittings has been run all fittings used to solve the junctions are listed in the BOM or Costing reports. If IRRICAD could not find suitable fittings for junctions, these are listed at the end of the report.

IRRICAD allows you to obtain reports either on screen or in printed form. Not all reports produced will need to be printed for the client or contractor.

2.8.2 USING PLOT TEMPLATES TO CREATE PLOT LAYOUTS

For working examples on Plot Templates see the Tutorial on Plot Templates, Section 4.9.

2.8.2.1 OVERVIEW

Plot templates are frames that can be placed around designs.

Normally plot templates consist of the following:

- An active area that defines the printable area on the paper. It is also used together with the entered scale to calculate the required size of the plot layout.
- A pipe legend that shows the pipe sizes and wires used in a particular design.
- A symbols legend showing the valves, outlets, electrical and other miscellaneous hydraulic items used in a particular design.
- Information about the design and the company, e.g., site, scale, date and designer.
- A border inside the paper limits.
- Lines to separate the legends and information.
- Several fills which are areas of a solid color. In plot templates these fills are normally white and are placed in the legend areas and outside the border. They are used to prevent parts of the design from being plotted in these areas. This is particularly useful when a small part of a large design is printed or plotted.

Plot templates are specific to paper sizes. This ensures that the size of text and symbols match the paper size.

New plot templates can be created or existing templates can be edited. Company logos or images can be added if they are available in a vector format, for example DWG, DXF, VCD, GCD or .vcs file format.

Plot templates are created or editing by going to the Plot Template menu. Plot templates are placed on a design by going to the Draw menu and selecting Plot Layout.

2.8.2.2 CREATING A NEW PLOT TEMPLATE

Please refer to the Plot Template Overview, Section 2.8.2.1 for a list of the components in a plot template. The steps involved in creating a new plot template are:

1. Change the background color. In order to see the white fills and black lines, it is best to change the background color so it is neither black nor white. The change in background color will not take effect until you have restarted IRRICAD.
2. Change the distance units to inches (millimetres). Determine the maximum printable area on the paper e.g., on 17" x 11" (420mm x 297mm) paper a margin of 0.3" (8mm) will be assumed around the

perimeter of the paper. If the lower left corner of the paper is assumed have coordinates of 0,0 then the printable area is from 0.3,0.3 to 16.7,10.7 (8,8 to 412,289) To see a table of paper sizes and their dimensions see Paper Sizes, Section 2.8.2.7.

3. Start with a new design and refer to the Plot Template Overview, Section 2.8.2.1 for an explanation of Active Area and Fills.
4. Draw a rectangle to represent the paper size. Draw an inner rectangle to represent the maximum printable area. Define the Active Area using *Plot Template|Active Area*. Drawing a line between the bottom left corner of the inner rectangle and the top right corner can do this. It is a good idea to make start and finish this line just beyond the rectangle's extents.
5. A white fill can be used between the two rectangles to ensure that any part of design that is outside the border (inner rectangle) is not printed. Fills may also be placed under the title block and as part of the legends (see Creating Legends, Section 2.8.2.3).
6. Draw lines to create an area that will be used for the legends, company name and design details. Place literal text as required using *Draw|Text*. Add a company logo or other symbols using *Draw|Symbol* (see Placing Symbols on the Plan, Section 2.7.4). To automatically place information about the job and your company see Using Key Words, Section 2.8.2.6.
7. Create the legends (see Creating Legends, Section 2.8.2.3).
8. Select all the objects making up the template using *Tools|Select|Window* and save it using *Plot Template|Save Template*. The template is saved with the given name in the folder specified in *Settings|Drawing Items* - Plot Layout Path.

2.8.2.3 CREATING LEGENDS

Legends are an area on the plan that lists the hydraulic and electrical items used in a specific design. IRRICAD will automatically place this list of pipes and valves on the plan if the plot template being used has a formatted legend. There are three legend options:

- Pipes
- Symbols
- Combined (Pipes and Symbols)

Each legend is made up of the following items:

- A filled rectangle defining the space that the legend will take up on the plan.

- For pipes and wires, a placeholder line is needed to tell IRRICAD where the first pipe in the list should be and how long it should be.
- For valves and outlets, a placeholder symbol is needed to tell IRRICAD where the first valve in the list should be.
- For combined legends both a placeholder line and placeholder symbol are required. These should normally be placed one on top of the other (the start of the line should be in the center of the placeholder symbol).
- In all legends, placeholder text is needed to tell IRRICAD where to write the descriptions for the pipes and valves.

The placeholders can be any line, symbol or text string since they do not actually form part of the generated plot layout; they are merely used for positioning information and drawing properties. However, the default symbol called Placeholder is found in the \Irricad\symbols\database folder and the default text is #TEXT#.

Place the items making up the legend where appropriate. Make sure the placeholder line is the length and width you want the pipes to be, the placeholder symbol is the size you want the valve and outlet symbols to be and the text is the color, font and size you want the descriptions to be. (The colors of the placeholder line and symbol do not matter as they are replaced by the pipes and valve symbols whose colors come from the database). The fill rectangle will normally be white so that it does not appear on the printed page.

Select everything making up the legend using *Tools|Select|Window* so that everything in the legend is selected. Select *Plot Template|Make Legend* to create a legend object. The dialog box that appears when Make Legend is selected has three fields. The definitions of these fields are:

TYPE

Pipe:	lists the pipes, wires and spraylines used in the design.
Symbol:	lists the outlets, valves, pumps, misc. hydraulic objects and electrical objects used in the design.
Combined:	combines both pipe and symbol legends

ORDER

The Order relates to how the legends are filled. If you are placing three pipe legend areas, you can designate the order in which these areas are filled. The pipe legend area with the lowest number e.g., 1 will be filled first. When this area is full, the area with the next lowest number e.g., 2 will be filled next. Only if an area is filled completely will items be placed in the extra areas designated for that type of legend. If a legend of the same type already exists, type in a higher number.

BETWEEN LINE SPACING

The space between items in the legend as a percentage of the text height.

2.8.2.4 FILLS

Fills are areas of a solid color (see Fill, Section 5.5.10).

In plot templates, fills are normally white and are placed in the legend areas and outside the paper border line. They are used to prevent parts of the design from being plotted in these areas. This is particularly useful when a small part of a large design is printed or plotted.

For notes on fills relating to legends see Creating Legends, Section 2.8.2.3.

To complete the plot template it is necessary to place a fill over the title block section of the template so parts of the design will not be plotted in the area containing the company name, scale, etc.

Set the current color to white in *Settings|Drawing Items*. Select *Draw|Fill|Boundary* and draw the fill boundaries for the legend fills and the title block. As each boundary is closed it will be filled. Select *Draw|Fill|Seed* and click in the area between the outer rectangle representing the paper size and the inner rectangle representing the maximum printable area to create the fill outside the paper border. Once all fills have been created, reset the current color to black (or your previous current color).

2.8.2.5 MOVING FILLS TO BACK

When a fill is placed in a template it will often obscure text and lines that you want to be able to see. The fill can be moved behind these objects so they can be seen. The command to do this is located in *Plot*

Template|Move Fills to Back. It is important to use the Select Window command when selecting the fill to move back. Select Window will ensure that the objects obscured by the fill are also selected. The Move Fills to Back command needs to know what objects to move the fill behind.

2.8.2.6 USING KEY WORDS

Key Words are used to automatically place information on a print or plot. Often, the information changes from design to design and Key Words eliminate the necessity of manually entering this information into each design. An example is date. If the Key Word #CDAT# is placed somewhere in the plot template, IRRICAD will replace #CDAT# with the actual current date when the template is drawn on the design using *Draw|Plot Layout*. When placed within a plot template, key words must have the # sign placed at either end of the word. Key words are placed using *Draw|Text*. The available Key Words include:

KEY WORD	INFORMATION	SOURCE OF INFORMATION
#CONA#	Company Name	<i>Settings Company</i> - Formal Name
#NUMB#	Design Name	Design File Name
#SCLE#	Plan Scale (Number only)	Plot Layout or Print Dialog boxes
#DATE#	Design Date	<i>Settings Design Details</i>
#CDAT#	Current Date	Today's date (computer)
#DESR#	Designer	<i>Settings Miscellaneous</i>
#TITL#	Design Title	<i>Settings Design Details</i> - Site
#CLNA#	Client Name	<i>Settings Client</i>
#NOTE#	Design Notes	<i>Settings Design Details</i> - Notes

See Using Keywords In Plot Templates, Section 6.10 for further Key Words available.

2.8.2.7 PAPER SIZES

The following table gives dimensions in inches (US) or mm (metric) for the standard paper sizes. Most printers and plotters cannot print or plot

to the edge of the paper. For information on printable areas and necessary margins in plot templates, please refer to your printer or plotter manual (or driver information).

PAPER SIZE	X DIMENSION	Y DIMENSION
E	44in	34in
D	34in	22in
C	22in	17in
B	17in	11in
A	11in	8.5in
A0	1189mm	841mm
A1	841mm	594mm
A2	594mm	420mm
A3	420mm	297mm
A4	297mm	210mm

2.8.2.8 EDITING PLOT TEMPLATES

This is a brief overview of how to edit an existing template.

1. Change the background color. In order to see the white fills and black lines, it is best to change the background color so it is neither black nor white. The change in background color will not take effect until you have restarted IRRICAD.
2. Change the distance units to inches (millimetres). Determine the maximum printable area on the paper e.g., on 17" x 11" (420mm x 297mm) paper a margin of 0.3" (8mm) will be assumed around the perimeter of the paper. If the lower left corner of the paper is assumed have coordinates of 0,0 then the printable area is from 0.3,0.3 to 16.7,10.7 (8,8 to 412,289) To see a table of paper sizes and their dimensions see Paper Sizes, Section 2.8.2.7.
3. Start with a new design and refer to the Plot Template Overview, Section 2.8.2.1 for an explanation of Active Area and Fills.

Select *Plot Template|Edit Template*. You will then be able to select a plot template from those available. These plot templates have either come with the program or been converted by you from IRRICAD Version 6 (*File|Convert|Plot Layouts*). Select the plot template to change and click Open.

ADDING NEW ITEMS

To add a logo to your template use *Draw|Symbol* and load the symbol you wish to use. Place this on the layout where required. (See Symbol, Section 5.5.12).

Keywords can be added by placing the keyword as text where required. For a list of keywords see Using Key Words, Section 2.8.2.6.

Literal text can be added using *Draw|Text* and placing the text where required. Lines, rectangles etc. can be added using the appropriate tools from the Draw menu.

MAKING CHANGES TO EXISTING ITEMS

Use the Change tool to change objects individually or Change Type to change groups of objects. E.g. to change the font of all text in the title block (excluding legends) set the selection filter to text (*Tools|Selection Filter* and select Text for the Type and check the Filter check box). Select the text using *Tools|Select|All*. Select *Tools|Change Type* and click on one item of text. Select a new font in the text dialog and click OK.

The Change Type checklist will now appear:

1. Uncheck Text in the Match column. Do not match the text if you wish all text to change not just the text phrase you have clicked on.
2. Keep both the Match and Change columns for the font checked. This means that all text (which has been selected inside the Select Window) which is the same font as the text you clicked on will be changed to the new font you have selected.
3. Click the OK button.
4. Select *Tools|Clear Selection*.
5. Turn off the selection filter (*Tools|Selection Filter* and uncheck the Filter check box)

Note the use of the selection filter to select text on top of a fill. This method can be used to select any type of object on top of a fill e.g. symbols, lines.

Note: The text in a legend will not change. You need to explode the legend area to change this text. Remember to re-make the legend with all its components (line and / or symbol, text and fill) before saving the plot template.

Any object obscured by fills can also be made visible by moving the fills to the back (see *Moving Fills to Back*, Section 2.8.2.5).

EDITING LEGENDS

Before a legend can be edited it must be exploded into its constituent parts. Select *Tools|Select Object* and click on the legend to be changed. Select *Tools|Explode*. Now the fill, placeholder text, line or symbol can be changed as required (see *Making Changes to Your Design or Drawing*, Section 2.4.3).

When all the necessary changes have been made the legend must be recreated. Use *Tools|Select|Window* and drag a window around the legend items. Select *Plot Template|Make Legend* to recreate the legend object.

SAVING THE CHANGED TEMPLATE

When all the necessary changes have been made, select all the objects making up the template and select *Plot Template|Save Template*.

The plot template may be saved with the same name as the original in which case it will overwrite the original or with a new name which will create a new template. The template is saved in the folder specified in *Settings|Drawing Items - Plot Layout Path*.

2.8.3 USING PLOT TEMPLATES

Plot Templates are placed on a design by using *Draw|Plot Layout*. It is best to do this after the design is complete. This will ensure that all the pipes, valves etc., used in the design are listed in the legends.

It is possible at any time to select and delete the layout surrounding a design, so a new layout can be inserted. If you wish to select another layout or change the scale, orientation, etc. of the current layout, you do not need to delete it first, simply select *Draw|Plot Layout* again.

*Note: Select *Draw|Plot Layout* will remove every item on the PLOT_TEMPLATE layer. If items other than a plot layout are on this layer, they will be deleted.*

To place a Plot Layout around a design, work through the following steps.

1. If you want your scale to be presented in the form of 1" =????? feet make sure the *Settings|Units* - Paper field is set to inches.
2. If you want your scale to be presented in the form of 1:????? make sure the *Settings|Units* - Paper field is set to mm.
3. With your design on the screen select *Draw|Plot Layout*.
4. Select the paper size that you want to use, if this size is not listed click the Printer button (bottom right) and change the printer which will update the available paper sizes.
5. Check that the printer margins are correct. Normally they will be default margins from the printer driver. Change them if they appear incorrect for the printer being used.
6. Set the orientation to portrait or landscape.
7. Select the Template from the list. Make sure it matches the paper size and orientation already selected.
8. Click Calculate to obtain a scale. You may change this manually if desired.
9. For laser or inkjet printers you can check the box Keep Fills. Do NOT check this option if you have selected All Colors to Black or if you will use *File|Direct Plot* to plot the plan. The fills will be printed in black or whatever plotter pen color has been assigned to the color white.
10. If this is to be your commonly used configuration, click on Save as Defaults.
11. Click OK and the plot layout will appear on the screen. If you are happy with the result, proceed to printing. If you prefer a different scale, start the process again (select *Draw|Plot Layout*) and use a different scale. You can position the layout over the plan by using *Tools|Move* and clicking on the border of the layout.
12. To print the design go to *File|Print*. Do not change the Print Scale in the dialog box. For scales of 1" =????? feet make sure the English Paper Unit box is checked. For scales of 1:????? make sure the Metric Paper Unit box is checked.

2.8.4 HOW TO PRINT A PLAN

You can plot a drawing from IRRICAD when required, by selecting *File|Print* (uses Windows printer driver) or *File|Direct Plot* (only if a Windows driver is not present).

Before printing, a plot layout may be selected from the Draw menu. Select the paper size then the plot layout and type in a scale for the drawing. The plot layout can be positioned or re-scaled to fit as much or

as little of the design as required. If a plot layout is used, do not change the printer settings in the Print dialog (*File|Print*), as the scale that has been calculated for the plot layout will be altered. Use *Settings|Layers* to turn off any layers not wanted in the printed plan. If some items in the layer are required, create a new layer in *Settings|Layers* and by using *Tools|Change* or *Tools|Change Type* select the new layer for these items.

To edit the plot layout itself, select the layout and use *Tools|Explode*. This allows you to change parts of the layout as required for a specific design. To make permanent changes to the layout for future use see Using Plot Templates to Create Plot Layouts, Section 2.8.2.

See also:

Print
Plot Layout

Section 5.2.12
Section 5.5.14

2.9 ADVANCING

2.9.1 HOW TO SIMULATE TAPES USING SPRAYLINES

Since tapes cannot be telescoped (changing sizes down the lateral) in IRRICAD you will need to simulate tapes as spraylines to achieve this feature.

This is a brief description of how to simulate tapes with suitable spraylines so that analysis and design can be carried out for blocks with tape that have multiple sizes.

2.9.1.1 SUMMARY

- Enter the required data into the database as a sprayline and nozzle
- Duplicate your design, replace existing tapes with spraylines and nozzles
- If using LP Design to size the submain, guess a nominal pressure, analyze and adjust as required so it simulates the tape as close as possible
- If the submain has been manually selected, guess at a nominal outlet pressure and use detailed analysis to analyze

2.9.1.2 SETTING UP DATABASES

Entries to simulate the tape need to be made in the pipe and outlet databases.

In the pipe database add a pipe with the internal diameter as the tape entry (do not forget to give it a unique warehouse code). The roughness for the pipe can be determined from trials to achieve the same headloss through the pipe that the tape gives. To do this, in a clean design, run out a tape a set length (similar to the run length in the design), e.g. 300ft (100m). Then run out your new pipe the same length. Connect with a large submain pipe and a control valve. Analyze the zone and check the Zone Full report. Change the roughness factor for the new pipe until it achieves the same headloss through the pipe that the tape is giving.

In the outlet database, make an entry for the tape outlet. The constant and index for this can be derived in a number of ways:

- Directly from tape manufacturers data
- From manufacturers data using Outlet Flow curve fitting utility
- Assuming the index is 0.5 and calculating the constant by substitution in the equation (this method is normally accurate enough) $\text{Flow (lph)} = \text{Const} * \text{Pressure (m)}^{0.5}$ (for PC emitter the index is 0 and the constant is equal to the flow rate)
- Contact AEI Software

The radius is not important just use a constant of say 1.0 and an Index of 0.0.

2.9.1.3 CREATING THE SIMULATED DESIGN

It is generally better to duplicate your tape design and make the changes required to simulate the tapes on a separate copy.

Make a copy of your design by using *File|Save As* and save the design under new name.

In the copy of your design, replace the existing tapes with connected spraylines using the tape pipe and tape outlet you created for this purpose. To do this select the block and then select *Tools|Tapes to Spraylines* and select you new pipe and new outlet.

Sprinklers are always assumed to be at ground level. If in your design they are not at ground level, you must select an outlet connector with the appropriate height previously entered in the Height field (in the database) to ensure that IRRICAD uses that height in the pressure calculations at the sprinkler. Note the height entered into the database is the height above ground, not the length of the outlet connector from a buried submain to the height of the outlet. For subsurface outlets (e.g. subsurface dripline) the height above ground will be negative (-ve).

If you are going to design the submain with this method, then it is important to determine what nominal pressure you need to assign to the outlets so that the resulting flow for your simulated tape matches the tape specifications. You need to do this because the inlet pressure is specified for tapes and you need to get the average pressure that will normally be less than the inlet. The simplest way to do this is to layout a single simulated tape (with the same length and slope of the tapes in your block) connected to a very short (no headloss) submain and valve. The valve pressure then is fixed (in *Design|Zone Design Configuration*) to the tape inlet pressure you wish to use. Guess a pressure for the outlets (e.g. half way between the minimum pressure allowed and the

inlet pressure) and then analyze the simulated tape (normal analysis, not detailed). You can then adjust your guess and re-analyze until the flow for your simulated tape matches that for a real tape of the same length, slope and inlet pressure.

If you have an existing submain you wish to analyze, then it is unnecessary to go through the above process. Simply make a guess at the nominal pressure of your outlets and then use detailed analysis to analyze the system. This does not apply to normal analysis where you need to use the method outlined above.

2.9.1.4 SIZING / ANALYSIS

The Simulated block can now be sized or analyzed. It is advisable, after sizing, to run detailed analysis (do not forget to set the valve pressure in Zone Design Configuration) as a check.

2.9.2 DETAILED ANALYSIS OF TAPES UNDER FLUSHING

Because IRRICAD cannot have two submains on a block of tapes, the following method must be used to analyse tapes under flushing conditions.

The flushing valves used need to be entered as outlets in the database. The radius equation is unimportant so use a K of 1.0 and an n of 0.0. Values for the pressure / flow equation (Constant and Index) should be derived using the tabulated headloss vs. flow values for the valve in the Outlet Flow curve fitting utility.

Tape needs to be mirrored as a sprayline as tapes cannot have a submain on both ends.

2.9.2.1 SUMMARY

- Simulate the tape as a pipe and outlet
- Use Change Type to change all tapes to spraylines using the pipe and outlet
- Add the flushing main
- Analyze

2.9.2.2 SETTING UP DATABASES

Entries to mirror the tape need to be made in the pipe and outlet databases.

In the pipe database add a pipe with the internal diameter as the tape entry (do not forget to give it a unique warehouse code). The roughness for the pipe can be determined from trials to achieve the same headloss through the pipe that the tape gives. To do this, in a clean design, run out a tape a set length (similar to the run length in the design), e.g. 300ft (100m). Then run out your new pipe the same length. Connect with a large submain pipe and a control valve. Analyze the zone and check the Zone Full report. Change the roughness factor for the new pipe until it achieves the same headloss through the pipe that the tape is giving.

In the outlet database make an entry for the tape outlet. The constant and index (for the Iteration calculation method) for this can be derived in a number of ways:

- Directly from tape manufacturers data
- From manufacturers data using Outlet Flow curve fitting utility
- Assuming the index is 0.5 and calculating the constant by substitution in the equation (this method is normally accurate enough) $\text{Flow (lph)} = \text{Const} * \text{Pressure (m)}^{0.5}$ (for PC emitter the index is 0 and the constant is equal to the flow rate)
- Contact AEI Software

2.9.2.3 CREATING FLUSHING DESIGN

Draw a block of tapes.

It is generally better to duplicate your tape design and make the changes required to carry out the flushing analysis on a separate copy. To do this, use the *File|Save As...* command and save it with a different file name.

In the copy of your design select the tape block and change the tapes to connected spraylines (use *Tools|Select|Window* then select *Tools|Tapes to Spraylines*). Select the tape pipe you entered above then the tape outlet in the dialog.

Sprinklers are always assumed to be at ground level. If in your design they are not at ground level, you must select an outlet connector with the appropriate height previously entered in the Height field (in the

database) to ensure that IRRICAD uses that height in the pressure calculations at the sprinkler. Note the height entered into the database is the height above ground, not the length of the outlet connector from a buried submain to the height of the outlet. For subsurface outlets (e.g. subsurface dripline) the height above ground will be negative (-ve).

Add the flushing main to the tape block using *Zone|Cut Pipe*.

2.9.2.4 ANALYSIS

Set the valve pressure required for the zone in *Design|Zone Design Configuration* (you can get this from the Zone Summary report from the design of the real tape block).

Run *Design|Zone Design|Detailed Analysis*, this will analyze the tape block under normal conditions.

Now insert flushing valves where required (from the Outlet database) onto the flushing main.

You can vary the valve pressure as you wish and examine the results in reports.

***Note:** A word of warning - Do not use a flush valve that is too big, i.e. make sure you use one that has 1.4 - 2.1psi (2m - 3m) of headloss at the flushing flows you expect. If you use a flushing valve that has too low a headloss, you will have problems getting a solution.*

If you do have problems with convergence, there is a detailed analysis factor in *Design|Design Parameters|Analysis Parameters* that you can increase (e.g. use 0.85 rather than 0.75). Remember to return the parameter to its original value after you have finished this design.

The required flushing velocity rule of thumb is 1ft/s (0.305m/s) down the tapes. Set the valve pressure to achieve the correct velocity.

2.9.3 MODELING MULTIPLE DRIPLINES AS A SINGLE LINE

Due to the size constraints in IRRICAD it is sometimes useful to be able to reduce the size of an analysis by combining a number of laterals / driplines into a single notional one. This is especially true in highly

looped systems such as the analysis of tape / lateral blocks with flushing submains.

The following notes show how to accomplish this.

Add a new emitter / emitter nozzle to the database that has the same index as one used on the single lateral / dripline. The constant will be n times the single one, where n is the number of laterals being combined. If you are using a tape / dripline then see the notes on flushing analysis for sources of the emitter equation. Make sure that the warehouse code is different to the normal emitter / nozzle.

A new pipe needs to be added to mirror the hydraulic performance of the required number of laterals / driplines. Make sure that the description identifies what the pipe is for and use a unique warehouse code. The actual diameter is set by the following equation:

$$D_{\text{new}} = (d^{4.871} \times n^{1.852})^{0.2053}$$

where d is the single lateral diameter, n is the number of laterals being combined, and Dnew is the diameter of the combined lateral. For example a 16mm ID combined into 10 laterals gives a new diameter of 38.4mm. This equation will work with any units. Use the same C factor as for the single lateral.

Make a copy of your design and remove the laterals that are going to be combined leaving one for each group. Generally it is best to have the notional lateral approximately in the center of the group of laterals being modeled. This means that you will need a half lateral at the beginning and end of the submain, the diameter and emitter parameters for this lateral will need to be calculated and entered into the database separately. For example if you have 100 laterals that you are splitting up into groups of 10 then you should start and end with a group of 5 and then have 9 groups of 10 laterals in between. Change tapes to spraylines if required and then replace the emitters and pipes with the Multiple items determined above.

2.9.3.1 SUMMARY

- Create an outlet and nozzle to simulate the multiple laterals.
- Create a new pipe.
- Remove a group of laterals and replace with a single lateral

2.9.4 PIPE SIZING NOTES

2.9.4.1 OVERVIEW

These notes explain the factors that IRRICAD takes into account when it sizes pipes. A summary of these factors is shown in Figure 30. They represent the design tolerances that a user can set within IRRICAD.

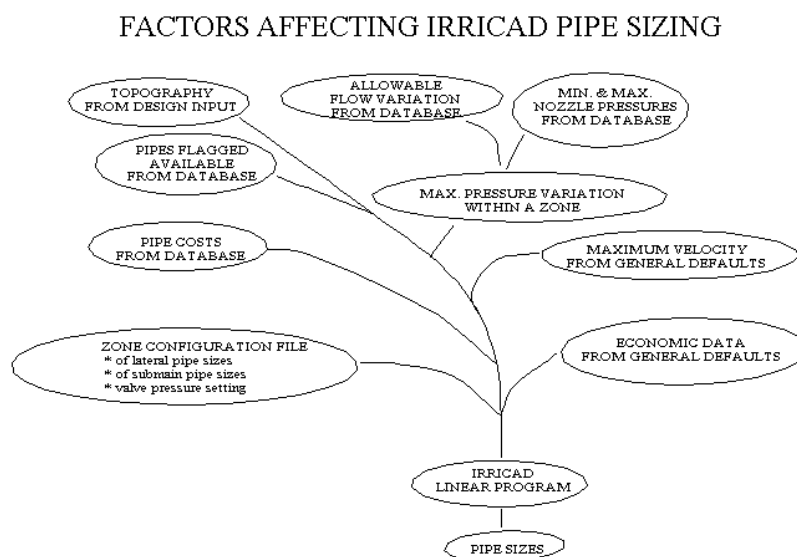


Figure 30

2.9.4.2 TERMINOLOGY

A quick review of terminology will help clarify the following notes.

Operating Pressure: The designer specifies the operating pressure of the emitter when the design is laid out in IRRICAD. For example a sprinkler may be set to operate at 50psi (35m).

Allowable Flow Variation: This is the design tolerance that is set up by the designer in the database for each emitter. A common design standard is +/- 5% of flow. If the example sprinkler delivers 10gpm (38lpm) at 50psi (35m) then the range of the flows within a

zone should be between 9.5 and 10.5gpm (36 and 40lpm).

Exponent (or Index): The exponent for a nozzle is a number that describes how sensitive the flow from the nozzle is to pressure. Exponents are normally close to 0.5 and will vary depending on the style of the nozzle.

Allowable Pressure Variation: IRRICAD converts the allowable flow variation to an allowable pressure variation. If the exponent of the nozzle is 0.5 the relationship between flow variation and pressure variation is double (e.g. 10% variation in flow will equal 20% variation of pressure). In the above example, the allowable pressure variation will be about 45 to 55psi (31.5 to 38.5m). Nozzles with exponents higher than 0.5 will have a narrower band of allowable pressure and nozzles with exponents below 0.5 will have a wider allowable pressure variation for a given flow variation. The table below gives you an idea of how different exponents affect pressure.

Exponent	Flow Variation %	+% Pressure Variation	-% Pressure Variation	Total Pressure Variation
0.47	+/- 5	10.94	10.34	21.28
0.50	+/- 5	10.25	9.75	20.00
0.53	+/- 5	9.64	9.22	18.86

In this example, if the sprinkler operated at 50psi (35m) the allowable variation for the 0.47 exponent would 10.64psi (7.45m). The 0.53 exponent nozzle only gives an allowable pressure variation of 9.43psi (6.6m). This is why IRRICAD uses flow variation as a design standard. It allows you to take advantage of nozzles with better exponents.

Connected Spraylines: A connected sprayline in IRRICAD is treated as a length of pipe with many emitters on it. The pipe is sized using sprayline hydraulic routines. This reduces the task of pipe sizing because each row of emitters is treated as one pipe. Connected sprayline pipes are selected from

those pipes in the database with a flag of L for lateral pipe.

Unconnected Spraylines: An unconnected sprayline in IRRICAD is treated as a series of emitters and separating pipes. Each piece of pipe between each emitter is sized separately using pipes from the database with a flag of Z for zone pipe. A large orchard block of sprinklers cannot be optimized in IRRICAD using unconnected spraylines because the size of the task is too big. It may be analyzed or sized using Velocity Sizing.

Factors affecting IRRICAD Pipe Sizing when using LP Design:

- Topography as entered in the design
- Allowable flow variation for outlet as entered in the database
- Min. & Max. nozzle pressures as entered in the database
- Max. pressure variation within a zone
- Maximum velocity as entered in Design Parameters
- Economic data as entered in Design Parameters
- Pipes flagged available in the database
- Manually selected pipes – fixed pipes
- Pipe costs as entered in the database
- Zone Design Configuration
 - of lateral pipe sizes
 - of submain pipe sizes
 - valve pressure settings

2.9.4.3 DRIP TAPE DESIGN NOTES

The Tutorials go over a drip tape design and this should be reviewed. Here are a few additional comments on drip tape designs.

IRRICAD designs drip tape systems using an allowable pressure variation. This is stored in the tape file in the pipe database. A typical setting may be an allowance of 20% above tape inlet pressure and 30% below tape inlet pressure.

The relationship between pressure variation and EU (emission uniformity) is not clearly defined however figures in the following table will give you some indication. They will vary from tape to tape.

EU %	Pressure Variation
90	30
85	65
80	100

If you design to an allowance of 20% above tape inlet pressure and 30% below tape inlet pressure you will be designing to an EU in the mid-to-high 80's.

Many tape blocks have more rows than the existing IRRICAD limits for a zone. In the Zone Design Configuration table you can limit the selection of pipe sizes in the submain. This will increase IRRICAD's design limits. If the block is still too big the best way to design it is by using Velocity sizing. You may have to do a couple of trial error runs to find the velocity setting that gives you the pressure variation you desire.

2.9.4.4 PRESSURE COMPENSATING DESIGN NOTES

When pressure-compensating emitters are used in IRRICAD, there are no clear upper and lower pressure limits in each block. In theory, the flow out of a pressure-compensating nozzle is the same regardless of pressure. IRRICAD designs to a flow variation so it assumes the pressure variation can be infinite. With non-pressure compensating emitters the pressure window is easily determined because there is a relationship between pressure, the nozzle exponent and flow. Each emitter entered in the database has an allowable flow variation that the IRRICAD designer sets. For example, if a nozzle has an exponent of 0.50 and the designer has set the allowable flow variation to +/- 5%, then IRRICAD will calculate the allowable pressure variation to be +/- 10% of operating pressure.

With pressure compensating emitter designs, the designer often determines the minimum and maximum pressures in a block that he or she is happy with even before the hydraulic calculations are done. This is often related to the minimum and maximum pressures that the designer wants in the lateral pipe. In IRRICAD there are ways to do just that.

When pressure-compensating emitters are used the lower pressure limit in a block is usually the minimum operating pressure in the nozzle properties as entered into the database. So to set the minimum pressure that you want in the design, go the outlet tab in the database editor. Find the emitter in question and double-click on the nozzle that

you are going to use, as shown in the list of associated nozzles at the bottom of the screen. Set the minimum and maximum pressures to the minimum and maximum pressures that you want in the block.

The upper pressure limit in a block for pressure compensating emitters can be determined from a number of factors. It could be the maximum operating pressure in the nozzle file, but often other factors start to have an effect before the maximum operating pressure is reached. These include velocity limits and the energy verses pipe cost calculations. To make sure IRRICAD uses the full pressure window that you have set in the database for the nozzle, go into the Design Parameters. Change the hours of operation to a low figure e.g. 500 hours. Also, set the Zone Velocity Limit a little higher than you would normally have it. Often the best way to set an upper Design pressure limit is to specify the valve pressure you want. This is done in the Zone Design Configuration table, which is in the Design menu.

2.9.5 USING A PUMP IN A DESIGN

The pump must be placed downstream from the water supply and must not be placed in loops. Remember a water supply can only have one connection and this is one end of the mainline pipe. Enter the water supply details to reflect true conditions of the supply – the height of water relative to ground level, or the existing pressure of the water source.

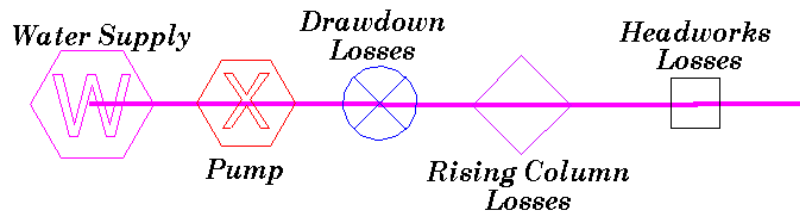
If the water supply is a river or open water source and therefore the pressure may be zero, enter a small number for the water supply design and maximum pressures so that IRRICAD will not calculate the pressure required to run the system (e.g. 0.1).

If the water supply is a tank, enter the height of the water level above ground level as the design and maximum pressures e.g. 2ft (m).

If the water supply is a well, enter the pressure as a negative pressure, indicating the level of the water below ground level e.g. -2ft (m) pressure if the water level is 2 feet (meters) below the ground (i.e. the static water level). If the well is artesian i.e. positive static water level, enter a positive number e.g. 2ft (m).

When a pump is used in a system, there are often more items that result in a headloss. These items such as rising column losses (submersible

pump only), drawdown losses (well only), headworks losses, etc. can be entered in to the design and therefore analysed as close to field results as possible.



If the water supply is a well with a static water level below ground level, there will be a negative pressure in the pipe between the water supply and the pump, which will be reported during analysis. It does not matter in which order the above items are placed on the mainline pipe, only that they are placed so that any losses are accounted for. The items above can be entered at the depth they are at, or left at zero for convenience.

2.9.5.1 MISCELLANEOUS HYDRAULIC ITEMS IN YOUR SYSTEM.

These are items that have a pressure loss in the system. These losses can be based on flow or can be a fixed loss.

If fitting selection is not important, it is convenient to enter the connection type for Misc. Hydraulic items to reflect the description e.g. DD for drawdown. This makes it easier to find them in the Mainline Full Report. Also you can change the connection codes after design but prior to fitting selection easily if required.

DRAWDOWN LOSSES

Drawdown losses are based on well tests. Determine the drawdown for the well (pumping level - static water level).

Solve the formula used for Misc. Hydraulic items: $H = K \times Q^n$ where H is in metres and Q is in m^3/hr .

The drawdown is equal to the headloss in m (e.g. if the dd = 9.6m, then the headloss = 9.6m).

Q is the flow at the well, e.g. $49m^3/h$. I is the exponent.

For alluvial aquifers:

If there is only one well test (Q-dd pair) available estimate the index is around 1.5. For a large flow use 1.7 (> 50 l/s). Find the value of the constant e.g. $K = H/Q^n$.

If there are two points supplied (2 well tests) on the same well can calculate the index (exponent). $N = \log (D1/D2)/\log (Q1/Q2)$. $K = D1/Q1^N$.

For wells that are uncased in rock or limestone use an index (n) close to 1.0

Enter the constant (K) and index or exponent (n) in to the correct edit fields in the Other Hydraulic component group in the database. The intercept (C) is 0.

RISING COLUMN (RISING MAIN) LOSSES IN A SUBMERSIBLE PUMP

This item can also be the suction pipe loss in a surface pump.

Use a friction loss chart for the type of rising column used.

Enter at least three sets of numbers read from the chart for the correct flow and rising column size into the curve fitting utility for valves (same as Misc. Hydraulic but no intercept), making sure the units above each column match the units you are using from the chart. Click the Fit Curve button. The curve fitting generates two numbers to use in the database. This produces constants and intercepts that IRRICAD uses in the Misc. Hydraulic formula to calculate the headloss through the rising column. It is easier to calculate for 100m and then adjust for the actual length.

For galvanised rising columns use the following: These have been calculated for a column 328ft (100m) long

Pipe Size	Constant	Index
8"	0.0001479	1.834
6"	0.00049076	1.84
5"	0.001254	1.810
4"	0.003307	1.852
3"	0.01174	1.855
2 1/2"	0.02448	1.874

Alter the constant relative to the length of the rising column (using the metric)

E.g. $\frac{\text{constant} \times \text{length (m)}}{100\text{m}}$

for an 8" rising column which is 85m long $\rightarrow 0.0001479 \times 85 / 100 = 0.000126$

Enter 0.000126 in to the Constant field in the database. Make sure the description specifies the length.

The rising column of the pump we will be using is 6" (150mm) and is 213ft (65m) long. Calculate the constant relative the length (as above).

HEADWORKS LOSSES

This Misc. Hydraulic item can be used to account for other losses relative to the flow.

$n = 2$

H = for example, if you estimate the pressure loss in the headworks to be 5psi @ 26385gph (3.5m @ 100m³/h) you can assume $n=2$ (in most cases) and solve for K.

Solve for K $H = KQ^n$

There is no intercept so leave the intercept field (C) as 0.

You can calculate the headloss through each of the items in the headworks or expected to be in the headworks at a particular flow and therefore calculate the constant and the index. The headloss will change as the flow increases or decreases. Note that existing systems tend to have high headloss at the headworks.

MISCELLANEOUS FIXED LOSSES

Misc. losses can be added to account for any other possible losses. These can be added into the Other Hydraulics component group by entering an intercept and leaving the constant and index as zero. Use only if you want to include a fixed loss regardless of flow.

2.9.6 MULTIPLE WATER SUPPLIES

IRRICAD can only design one system, so if you have two or more separate systems on one design, you need to connect them together with a temporary pipe. You can delete this pipe once design has been completed. As long as water supplies are connected in some way via the mainline, IRRICAD can complete the design. It doesn't matter where the mainlines are connected just as long as one mainline is connected to the other mainline. The closest point is usually the most convenient. If the water supplies are separate, IRRICAD will only design the first system.

If only one water supply exists in a design you can leave the pressure and flow for IRRICAD to calculate based on each system duty. However, if there are 2 or more water supplies present and you are not concerned about pumps, you must enter at least the pressure in to all water supplies. You can increase or decrease the pressure to achieve the flow you require from each.

If a PRV on the water supply is required, in a design containing multiple water supplies, do the following:

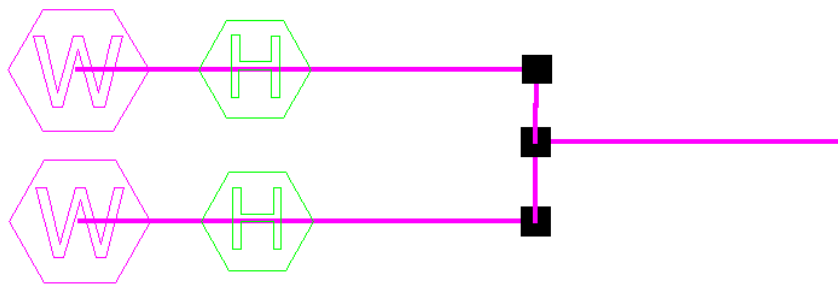
Make the water supply the PRV – enter the water supply pressure equal to the PRV pressure setting e.g. if the PRV is to be set at 70psi (50m), enter the water supply pressure as 70psi (50m). Never put PRVs in loops. Manually check the PRV is able to regulate at that set pressure and at that flow.

Remember, if you have more than one water supply or have a looped system you must use Velocity design to size the pipes.

2.9.7 USING PUMPS IN PARALLEL

If two pumps are in parallel – they are effectively in a loop – NEVER put pumps in a loop. If this is the case, draw two water supplies with a pump each and connect the mainline after the pumps:

E.g.:



Remember using the same pump in parallel doubles the flow.

2.9.8 PUMPS IN SERIES

Pumps can be placed in series. Once again, no pump should be placed within a loop.

Remember using the same pump in series doubles the pressure output.

2.10 TROUBLE SHOOTING PROBLEMS

2.10.1 HOW TO RECOVER A DESIGN AFTER CRASHING

To recover an AutoSave file select *File|Open* and load the ~Irricad~Backup.des file found in the operating systems Temp folder (usually C:\Windows\Temp under Windows 95/98 or C:\Documents and Settings\User\Local Settings\Temp under Windows 2000/XP). While this file is loaded IRRICAD cannot use AutoSave. Use *File|Save As...* to save the file back in the \Irricad\Designs folder under its correct name before continuing. To check the Temp folder for your operating system type SET at the MS-DOS prompt.

2.10.2 FITTINGS SELECTION ERRORS

Fitting Selection errors are recorded in the Bill of Materials or Costing reports after you have run the *Design|Computer Selection of Fittings* option.

2.10.2.1 GENERAL FITTINGS SELECTION ERRORS

Where fitting selection errors have occurred during Fitting Selection, a list of the errors is given in the Bill of Materials and Costing reports. Note that no screen messages are given.

These fitting selection errors include the following information:

- The type of junction it relates to, e.g. a coupler, bend, three or four pipe junction.
- The x and y coordinate of the junction where the fitting selection error occurred.
- Details of the fitting selection error, connection types, sizes and angles required. Note that the fitting connection type is the code for the pipe or fitting that is to be connected to, not the code for the required fitting.

The details reported for the various different components are:

Couplers:	Major fitting type, diameter, minor fitting type, .00, diameter.
Bends:	Major fitting type, diameter, minor fitting type, diameter, bend angle.
Tees:	Major axis fitting type, diameter, minor axis fitting type, .00, diameter.
4-pipe junction:	No information is given due to the possible complexity and variations involved in a cross type junction. If difficulties are encountered with this type of junction, they can usually be resolved by creating two tee junctions a small distance apart.

The most common fitting selection errors are:

- Problem completing end cap selection
- Problem selecting suitable bends
- Problem completing coupler selection
- Fittings for 4 pipe junction incomplete
- Could not find Tee for 4 pipe junction
- Two point objects connected, unable to solve junction
- Not all fittings loaded into memory. Costing may be slowed.
- Too many fittings to display in menu
- Potentially more than the maximum allowable number of fittings could be chosen
- Unable to find required item in database
- Fitting type for item does not exist
- More than the maximum allowable number of items are required to connect objects at this junction

Most error messages relating to Computer Selection of Fittings will be related to the database. Errors occur because hydraulic items have been changed in the database and cannot be found or the required items to solve a junction do not exist or are not enabled for use. See the Fittings Selection Tutorial to aid in helping you solve fitting errors relating to missing items (Section 4.5).

Once your database has been updated with all possible tees, bends, couplers and crosses with the correct inlet and outlet diameters for solving the junctions, error messages become a rare occurrence.

Some common error messages relate to the capacity of the program, physical limitations or the available memory of your computer. Physical

limitations occur when IRRICAD recognizes that there are more than four items at a junction, or that there is not an appropriate selection of fittings for the type of components being used in the design.

You can let the computer select the fittings, but by understanding the rules by which the program chooses them, you can make it select the fittings you want. For example, when selecting fittings for the junction of three pipes the computer will first search the Lateral Take Offs component group of the database for the cheapest single item (assemblies are counted as a single item) which will fit. If it can not find anything to fit between the two pipes being connected, it will then search for the cheapest set from the Lateral Take Offs and Coupler groups. Then the Tee group is searched, the same rules applying. If there is an assembly you would like to use, enter it in the Lateral Take Offs group. Disable (type N in the usage box) any Lateral Take Offs that have the right fitting size at both ends, and may be chosen before the item you would like to be chosen.

A temporary way of fixing fittings errors is to select a junction and use the *Tools|Change* (or *Tools|Change Type*) tool to edit the fittings. Click on the Show Fittings button in the dialog. Note that any changes made are lost if Computer Selection of Fittings is re-run.

2.10.2.2 FITTINGS FOR VALVE-UNDER-HEAD SYSTEMS

Care must be taken in special cases where a separate control valve and an outlet are positioned together to form a valve-under-head system.

When the fitting selection routines encounter a control valve they assume the valve is part of a normal zone configuration and choose the fittings accordingly. For a valve-under-head system this results in the correct selection as long as the outlet is placed within a straight section of pipe. For outlets at the end of a pipe or located at a change of direction the appropriate bend to place the valve and outlet in the vertical position will not be selected.

Two solutions are possible. The first is to create an assembly using the appropriate control valve plus the necessary bend and fittings. This assembly is then selected for use at the appropriate place in the design. Alternatively the required additional fittings can be added after fitting selection by using the *Tools|Change* or *Tools|Change Type* tools.

See also:

<i>Fitting Selection Details</i>	<i>Section 6.8</i>
<i>Pipe Fitting Matching Table</i>	<i>Section 5.11.14</i>
<i>Manually Adjusting Fittings</i>	<i>Section 2.6.5.1</i>
<i>Creating Assemblies</i>	<i>Section 3.4.3.1</i>

2.10.3 LP DESIGN ERRORS

The main problems experienced with LP design are the error messages similar to Fixed pipe sizes too small or Fixed pipe sizes too big.

To avoid these problems, look for the following:

- Make sure that the elevation data is correct and that there are adequate contours or spot heights in and around the design
- Fixed pipe sizes – revert to Computer Selected pipe until an answer is achieved
- Leave the number of submain pipes as zero in *Design|Zone Design Configuration* so as not to limit the number of pipes that IRRICAD can choose for your system
- Leave the valve pressure as zero so as not to limit LP Design by a valve pressure to work to (or the Water Supply pressure as zero if sizing Mainline pipe)
- Make sure that all possible pipes (lateral, zone and mainline) are enabled in the database editor and that all information entered for these pipes is correct
- If you are having trouble trying to get LP to work, then adjust the maximum allowable velocity to 30ft/s (10m/s) and try again. This means that the velocity will not be a limitation as LP tries to find a pipe size. This does not necessarily mean that the resulting velocity in the pipes will be excessively high in the system
- Allow 2 or 3 lateral sizes to be used in *Design|Zone Design Configuration*
- Increase the tolerances on the outlets
- Add a very small pipe e.g. 0.2" (5mm) and a very large pipe e.g. 3ft (1m) to the database so IRRICAD will find a solution and you can see where the problem is. Make changes to the design manually

2.10.3.1 COMMON ERROR MESSAGES RELATING TO LP

- Maximum number of iterations for LP exceeded
- LP sizing failed - unbounded objective function
- LP sizing failed because of the constraints given
- Constraint counts do not match in input data to LP solver
- Negative values appear in LHS of array passed to LP solver
- Only use LP with single water supplies and branched systems
- Your design is too big to use LP pipe sizing
- Large enough pipe not enabled - LP may not achieve solution
- User selected pipe diameter too small - headloss too high
- Use selected pipe diameter too large - headloss too low
- No pipe sizes have been enabled for:
 - Solution not found - fixed pipe sizes too big in path:-
 - Solution not found - fixed pipe sizes too small in path:-

The error messages are to give you some idea why LP failed. While some messages are self-explanatory, following the checklist above (LP Design Errors, Section 2.10.3) will solve most.

Others, however, are a little more complicated and may stem from memory limitations, program limitations or some form of corruption to the Linear Program solver. An error message may also occur if, for a particular design configuration, the Linear Program solver is not converging towards a solution. In this case, Velocity Design should be used, or the design layout changed in some way.

2.10.4 DETAILED ANALYSIS ERRORS

Before running detailed analysis on zones (*Design|Zone Design|Detailed Analysis*) the valve pressures need to be set in *Design|Zone Design Configuration*. When running *Design|Mainline Design|Detailed Analysis*, pressures must be set for each water supply.

Detailed Analysis can fail if it is diverging rather than converging (getting further from than answer, than closer to it).

To avoid this happening, there are several things you can change in *Design|Design Parameters|Analysis Parameters*:

- Flow Close Factor: This determines the accuracy of the required answer. Setting this to a larger value may help Detailed Analysis to converge.
- Maximum Iterations: Some systems may require more iterations to reach a solution. Increase this number.
- Convergence Ratio, Detailed Analysis Factor: The larger the number (closer to 1) the slower the process. Increasing this number may help with convergence problems.

Make a better guess at the nominal pressure for the sprinklers as this may give Detailed Analysis a better starting point.

2.10.5 DATABASE ISSUES

2.10.5.1 OPENING DATABASES IN MICROSOFT ACCESS

It is very dangerous to play around with an IRRICAD database in Microsoft Access when you do not know what you are doing.

The main problem we have with users in this respect is if they create a Replica of the database. A replica cannot have new items added to the database and IRRICAD does not like the database in this form either. Once you have created a replica and moved or deleted the master (original) there is no going back. You will need to start again with a normal database. If you have edited and added a lot of product to your database, this can be a heartbreaking loss of work.

2.10.5.2 UPDATING PRICING / DATABASE REPORTS

Go into Windows Explorer and take a copy of the database you wish to change and place it elsewhere. Now double-click on this copy to open it in MS Access.

In the dialog select the Query tab. Click the New button in this dialog. Select Design View.

In the Show Table dialog select Components and click the Add button. Close the Show Table dialog.

Select Query from the menu bar on the main Access Window. Select the Update Query option from this menu.

In the new dialog select Reals7 from the dropdown list for Field.

For Update to: type $[Reals7] * 1.06$

Note:: Reals7 must be in square brackets, the times sign must be the star above the number 8 on the keyboard, 1.06 says you wish to update the field by increasing the current value by 6%.

In the next column across you can repeat the same for Reals8 e.g.

Field:	Reals7	Reals8
Table:	Components	Components
Update to:	$[Reals7]*1.06$	$[Reals8]*1.06$

For the Criteria you can add things like $[Supplier\ Code]=SUP1$ for example or $[Database\ Number]=1$, where 1 is the pipes database number (see the Components table). E.g. anything listed in the little dialog labelled Components which stays with the Query Table can be used for the Criteria (make sure it is spelled the same and inside square brackets).

Click on the cross to close the query table dialog. It will ask you to save it. If you have written something wrong it will either tell you here or when you run the query - read any messages it gives you.

Highlight Components in the Tables tab and click Open. Note down some prices in Reals7 (Wholesale price) and Reals8 (Retail Price). Click Close (the cross) on the Components table and click on the Query tab. Double click on the query you have just created. Read any messages before clicking Yes or OK. The prices or anything you wished to change has been updated.

2.10.5.3 READ ONLY FILES

IRRICAD cannot open a design if the working database is read only, the internal database is read only, the .des or VCD files are read only or if any of the temporary files in the computer's Temp folder are read only.

The main reason you will get this problem is if you have backed up a design on a CD and are trying to open the design on the CD or have copied the files to your hard drive off the CD. CDs are read-only by definition so when you copy files off a CD you must change the properties so that the file(s) are not read only. Highlight the file or files in Windows Explorer or My Computer. Right click and select Properties. Uncheck the Read Only check box.

2.10.5.4 SKELETON.MDB

The Skeleton.mdb is required when running IRRICAD or starting a new design. If it is not in the Irricad folder or is Read Only you will not be able to run IRRICAD. Make sure the file is present, or if it is not, either re-install IRRICAD or email AEI Software for a new one.

2.10.5.5 MERGING DATABASES

Select *File|Merge* in the Database editor. This option works fairly similar to the old DOS Joindbs. In the first field select the database which is not your working database. This database stays the same. In the second field select your working database. This database is updated with the new product from the database in the first field. IRRICAD generates a text file to tell you the things that were not added to the working database. Items will not be added if the following fields match:

- same name
- same warehouse code

2.10.5.6 GETTING DESIGNS FROM SOMEONE

If a design is sent to you the minimum you require is the .des, VCD and .mdb for that file name. If your database is very different from the database the design was created with, you will also need their working database if you are to continue analysis or design on the system.

A problem may arise if the design was created using Irricad.mdb and you use Irricad.mdb. The databases could be quite different but with the same name. Upon opening the design IRRICAD will find your Irricad.mdb (if it is in the same place as the one used to create the design). If you are aware of this and you have been sent the Irricad.mdb which belongs to the design and have saved it elsewhere, select *Settings|Irrigation – Design Specific* and browse for the required database. Save the design and re-open it. It will remember which database it is to use.

To avoid confusion it is a good idea to re-name this database before setting it as the database to be used with the design.

2.10.5.7 CHANGING HYDRAULIC ITEM DRAWING PROPERTIES

In *Settings\Irrigation Items* there is a check box named Update Entities From Database. If you change a symbol, colour or line type for a database item e.g. pipe, valve, outlet, etc. You need to re-load the design (select *File|New*, then *File|Open*) for these visual changes to take place. However, if this check box is not checked, the existing items in the design will not be updated with the changes. All new items placed, however, will have the new colours, symbols or line type.

2.10.5.8 UPDATING INTERNAL

When you make a change to your working database while you are doing a design, the internal database (where all the items in that design are stored) needs to be updated also.

If the database editor is open when you load a design, it will automatically update the internal database.

The design keeps a time / date stamp of the working database so if the time / date stamp on the working database is now newer than the one the design remembers, the internal database will be updated.

If the design (and hence the internal database) is open at the time, the internal database will be updated during Design.

2.10.6 MANAGEMENT ISSUES

Management is the process of assigning run times to zones, assigning zones to system flows or assigning run times to water supplies.

2.10.6.1 WHAT CAN I DO IF MANAGEMENT HAS BECOME CONFUSED?

If you make many changes to the water supplies, valves or mainline outlets (changing zone names, water supply names or deleting items) it is possible that internally IRRICAD has become confused. If running Management again (Assign System Flows... or Zone Operating Times) does not resolve the problem then the Management files must be deleted and re-created.

Files which are produced during Management are:

- .stn - where the system flows assigned to zones information is stored
- .wsp - where the water supply data is stored
- .ztn - zone times file

You can safely delete any of the above files (normally deleting the .stn and / or the .wsp file will fix the problem). These files will be found in the Irricad\Design folder (commonly found in C:\Program Files\AEI Software\Irricad) and will have the same name as the design name, e.g. Farm.des, Farm.stn, Farm.wsp, Farm.ztn.

Be very careful you do not delete the three main files required to open a saved design – the .mdb, the .des and the VCD files are VERY important.

Run the Management options again to re-create these files before running Design. Any assigning of zones to system flows have now been lost with the deletion of the files.

2.10.6.2 MANAGEMENT (ASSIGN SYSTEM FLOWS... OR ZONE OPERATING TIMES) ALWAYS TELLS ME THE TIMES ARE WRONG?

IRRICAD did not like the time / date separators to be anything other than (:) or (/). Go into the *Start|Control Panel|Regional Settings* and select the Date tab. Change the date separator to : or /, then go into the Time table and do the same. This problem has been fixed in V7.37.

2.10.7 CONNECTIVITY PROBLEMS

If you are having problems connecting pipes, outlets and other items consider the following:

2.10.7.1 MAINLINE OR ZONE ITEMS

Check that zone items are trying to connect to zone items only, and mainline items to mainline items only. The only exception is Control Valves. You can use Object Info (highlight the item using *Tools|Select Object* and the *Right-Click|Object Info*. The layer will tell you if the pipe is MAINLINE_PIPE or ZONE_PIPE, or the object definition as SIMP

MNLN MCNT (Mainline Misc. Hydraulic), SIMP_ZONE MCNT (Zone Misc. Hydraulic), SIMP_MNLN_OUTL (Mainline Outlet) or SIMP_ZONE_OUTL (Zone Outlet). It is an easy mistake to make if you are not aware of which menu you selected the existing item from.

2.10.7.2 DEFAULT SNAP MODE

Check that the snap mode in *Settings|Snap* is set to Connect. If the snap mode is Place, an hydraulic item will never connect to an exiting hydraulic item. If the snap mode is Snap to Grid an hydraulic item will not connect to an exiting hydraulic item unless Cut Pipe is used.

2.10.7.3 LIMIT OF FOUR ITEMS CONNECTING AT A JUNCTION

Check that there are not more than 4 items already connecting to the item you are trying to connect to. You can check this by using *Tools|Select Window* to highlight the items and immediately surrounding area, then *Right-Click|Object Info* to view the highlighted items.

If the item is a junction you should see something like this:

SIMP_ZONE_JUNC

Object ID=5 Elevation=NONE Connections=1,6,4,8, Depth=0.00 m

This junction has four pipes connecting here. Each item has an Object ID or UID. The four pipes connecting at this junction are 1, 6, 4 and 8.

If you see other items included in the Object Info dialog, they might be a small length of pipe or something else. If you close Object Info and press the Delete key, this will delete everything within the select window except for the junction connecting the existing pipes. Remember that an item has to be completely within the select window to be highlighted and deleted, and pipes cannot exist without their end junctions. If the item at this point is not a junction, but a valve or outlet, you may need to delete the item to fix the problem and then re-insert the item.

2.10.7.4 SNAP TOLERANCE

You may not be clicking close enough to the existing item for IRRICAD to connect to it. Zoom in closer or further away. In *Settings|Snap* you can alter the snap tolerance and the minimum and maximum tolerances. Do not alter these unless you need to.

3 Database Editor Manual

3.1 INTRODUCTION

IRRICAD Databases have three primary functions:

1. To define the range of components and their sizes for use in a design;
2. To provide technical information, allowing IRRICAD to calculate pressure losses, outlet flows, radius of throw for sprinklers etc; and
3. To provide unit prices that can be used to select components when cost is a consideration or to produce bills of materials with prices.

The databases are fundamental to the operation of IRRICAD. Every care should be taken to ensure they are accurate and contain sufficient information to complete designs.

It is recommended that only items used in most designs be in the database. Although there are no limits on the number of items that can be entered, including items that are not likely to be used clutters up the database. This makes updating more difficult and slows IRRICAD operation.

Users are advised to take advantage of the Usage facilities in the database screens. These determine whether a particular item may be employed in a design and, in the case of assemblies, whether or not they are reported as a single item or as a list of components.

A good example of the application of Usage fields concerns Outlets. Having a large number available will have two consequences. The design process will be slowed down when IRRICAD searches through the different outlets. Also when selecting outlets for inclusion in a design, it will take longer for the dialog to appear, and you may need to scroll down through a large number before reaching the required outlet.

When databases are modified, a dated copy should be taken. The name of the database used for a design is automatically saved with the design.

3.2 USING THE DATABASE EDITOR

The editor allows you to add and delete items, create assemblies, and change symbols, line types and colors.

If you installed IRRICAD in the default folder, you will find the shortcut to the database editor in *Start|Program Files|Irricad|Irricad Databases*.

Alternatively, if you have placed a short cut on the desktop, double-click on the icon and the database editor window will appear. It shows the current default database. The default database can be changed in the main IRRICAD program by selecting from the menu: *Settings|Irrigation – Design Specific*.

In order to change the default you must select the database of your choice **and save the setting by clicking the Save As Defaults button**. If the chosen database is not saved as the default, the Database Editor will not open with the desired database. However, you may close the default database and open one of your choice by selecting *File|Open* in the database editor menu.

You will see at the top of the screen, a series of tabs. These tabs are labeled according to the component group associated with the tab. There are eighteen component groups that make up the entire database. These component groups hold all the technical and physical descriptions of the items used for designing and analyzing the irrigation system.

Component groups consist of a complete list of all items and the characteristics for each item entered in the database. The tabs will list all the items in the group, the item descriptions, warehouse codes, supplier code, and usage. The usage field enables or disables use of the item in IRRICAD.

At the bottom of the description list there is a field indicating the line number where you have placed the cursor (a small arrow is placed in the margin of that line, indicating the selected item). If you require line number 250, but you are currently on line number 40, simply highlight the line number in this field and type the required number. The cursor will automatically find the line you require. If you enter a number greater than the number of items available in the list, the cursor will simply stop at the end of the list. Arrows on either side of this field can be clicked to move up and down the screen as required. You can also move through

the list by using the up / down arrow keys and the scroll bar on the right hand edge of the main list.

Underneath the item descriptions is a table labeled Assembly Items. If an item in the list is an assembly, the components will be listed in this table when the assembly is selected.

3.3 DATABASE STRUCTURE

The following component groups are available in the database editor:

Pipes:	All descriptive, technical and price data for the types and classes of pipe used in IRRICAD.
Tapes:	Contains all descriptive, technical and price data for all driptapes used in IRRICAD.
Valves:	All descriptive, technical and price data for items used as zone control valves. These may be automatic or manually operated.
Other Hydraulics:	Is similar in structure to the Control Valve component group and contains information describing technical specification and price for in-line valves and on-line items such as air release valves. Can contain Pressure Reducing Valves in this group.
Lateral take off:	All descriptive, technical and price data for connectors used to join laterals to submain pipes or outlets to lateral pipes.
Couplers:	Any fitting used to join pipes, components or other fittings in a straight line.
Elbows / Bends:	Used where any two pipes or components to be joined are not in a straight line.
Tees:	Used to join three pipes or components regardless of the angles between the items.
Crosses:	Any fitting which is used to join four pipes or components together at a junction.
Pumps:	All descriptive, technical and price data for pumps. The performance of pumps is automatically calculated from this data.
Outlets:	Along with the associated nozzle component group, this contains descriptive, technical and price data for items used as outlets. The performance of outlets is automatically calculated from this data.
Outlet Connections:	Items or assemblies of items used to connect outlets to a pipeline. Swing joint assemblies and riser pipes are common examples.
Wires:	The descriptive, technical and price information for electric cable. Any wire types may be entered. There is no distinction between wire

	used for electrical control or for lighting and other applications.
Controllers:	Descriptive and price information for any type of controller.
Lights:	Garden or landscape lighting in a design.
Other Electrics:	Electrical components that do not fall into one of the other electrical group categories. Examples are transformers and circuit breakers.
Miscellaneous:	Items that do not belong in other component groups, but may be required for other purposes, such as components of assemblies.
Nozzles:	Along with the associated outlet component group, this contains descriptive, technical and price data for items used as outlets. The performance of outlets is automatically calculated from this data.

3.3.1 COMMON CONTROLS

These commands are common to all component groups.

3.3.1.1 NEW ..

This button allows you to add a new item to your component group. Initially the new item will be added at the end of the list, but after the list has been refreshed, it will appear in order, along with the other components.

1. Click the New ... button. A details dialog will appear in which data is entered. The dialog may be different from one component group to another.
2. Select a usage code. This is a Y for yes, if you wish to use the item in a design. For Pipes and Assemblies the usage codes are:
 - L, Z, or M or any combination for pipes
 - X and A have been added to the Assembly usage for the type of listing in the reports
3. Enter a name / description for the item.
4. Enter a warehouse code – this can be up to 12 characters.
5. Select a supplier cost code from the dropdown list.
6. Select a plotting line type from the drop down list or enter the symbol size required (see Database Codes, Symbols & Line Types, Section 3.4.2 for more information).

7. Click on the plotting color field to change the plotting color of the item from the default plotting color (black) if desired.
8. When all fields are filled in to your satisfaction, click the Save button. If you do not wish to continue inserting this item into the database, click the Cancel button.
9. To save the changes to the database click the Save Changes button on the main screen. If you do not wish to save the changes, click the Quit button to exit the current database.

3.3.1.2 EDIT / VIEW ..

Allows you to view and, if necessary, edit the characteristics of an existing item.

1. Highlight the item to edit or view and click the Edit / View ... button. Edit as necessary.
2. See the New button description for instructions.

3.3.1.3 DELETE ..

Allows you to delete any existing item. If the item is part of an assembly, you will be warned before the item is deleted from the database.

1. Highlight the item to delete.
2. Click the Delete ... button.
3. A warning message will appear, asking if you wish to permanently delete the item from the database.
4. Click the Yes button to proceed, or the No button to not delete the item. If you click Yes, this command cannot be undone.
5. To save the changes to the database click the Save Changes button on the main screen when you are ready to exit. If you do not wish to save any changes, click the Quit button to close the current database.

Note: If a component is deleted and this component is part of an assembly, the component will also be deleted from the assembly. A warning will appear asking if you are sure you wish to delete this item.

3.3.1.4 SAVE CHANGES

Used when you wish to save any changes made to the database. This button also closes the current database. Pressing the Enter key is the same as clicking the Save Changes button.

3.3.1.5 QUIT

This button will close the current database without saving any changes; hence it is the same as a Cancel button or Escape key.

3.3.1.6 X

This is located at the top right hand corner; it is the same as clicking the Quit button. The database will be closed without saving changes.

3.3.2 ABOUT ASSEMBLIES

An assembly is a set of components grouped together to function as a single entity.

IRRICAD uses assemblies as if they are a single component with the characteristics given in the database.

Assemblies are commonly used in situations where:

1. IRRICAD requires more than three fittings to solve a direct connection. An example is a large reduction in pipe size where the number of standard reducers required is greater than three.
2. You wish to enter components that individually have no particular purpose for a design, but together provide a distinct function. Swing joint connectors that are made up of a range of fittings, provide an example of this.
3. You want to include associated items with a component and have all components listed separately, e.g. stake, tube and take-off with a minisprinkler.
4. A component requires additional items to change its orientation, connection type or diameter.
5. You require a particular set of items to be selected during fittings selection.

An assembly can be created in all component groups except the pipe, tape and wire groups. You can select components for your assembly from any component group.

Assemblies can be made up of other assemblies. The assembly being created must not be selected as part of itself.

The reporting of assemblies is controlled by the usage codes given to the assemblies in the database.

- Where the usage code **Y** is used, any assemblies in a design will be broken down into their individual components and these components will be listed in the reports.
- Where the usage code **A** is used, the assemblies will be listed in the reports as an assembly description and not be broken down into individual components.
- Where the usage code **X** is used, the assemblies will be listed in the reports as in A above but will also be listed at the end of each report with a list of their components.
- Where the usage code is **N** (or blank), the assembly cannot be selected.

Details of how to create assemblies is given in the Database Details / Assemblies section. (See Creating Assemblies, Section 3.4.3.1).

3.3.3 NOZZLES

The manufacturer supplies data used to define nozzle performance. A Curve Fitting Utility is provided (see Section 3.8.1) to convert pressure and flow data for outlets into a coefficient and an exponent. These two numbers are used in the calculations IRRICAD undertakes internally for design and analysis. The Curve Fitting Utility is also used to convert pressure and radius of throw into a constant and index (K and n values) for the nozzle Outlet Radius. The Outlet Radius is the wetted radius of the nozzle for a given pressure.

3.4 DATABASE DETAILS

This chapter looks at the fields within the database especially those that are common throughout the component groups. It also looks at creating and modifying assemblies.

3.4.1 DATA COMMON TO ALL DATABASES

The different types of components have a number of common entries. These are:

- item number
- item description
- warehouse code
- supplier cost code
- usage
- wholesale cost
- retail price

These items are described below. Any exceptions are explained under the description of the particular component type.

3.4.1.1 ITEM DESCRIPTION

Each item requires a description. It might include one or more of the manufacturer's name, model, size and any special characteristics.

The item description is the primary means of identifying an item during the design process, in costing reports, in bills of materials and on the plot layout legend. For this reason, it is important that the item is adequately described. Please note that abbreviated descriptions may not be suitable for the customer.

Up to 40 characters may be used.

3.4.1.2 WAREHOUSE CODE

This is a user-defined code of up to 12 characters. It is usually a part number used in a manufacturer's catalog or your company's stock accounting system.

The warehouse code has no design function, and can be left blank. However, it is used by IRRICAD to identify items during the design process. For this reason, it is recommended that warehouse codes, whether actual codes or not, be used for all items.

3.4.1.3 SUPPLIER CODE

This is a user-defined, four-character code that allows the designer to group items from a common supplier and to distinguish that group of items from other groups. It may be desirable to subdivide item groups further, if, for example, items from the same supplier require different price multipliers.

The Supplier Code is used to modify item prices using the supplier code multipliers. These can be accessed in IRRICAD through the Reports menu. Retail or wholesale prices can be entered as the base price. This will make the supplier code multipliers act on the wholesale (or retail, if selected) cost for the selected suppliers.

The Supplier Code also allows a bill of materials to be produced on a supplier code basis. Supplier codes must be inserted into the Supplier Code Multiplier table in IRRICAD before they are available to the database editor.

You can edit or add to the Suppliers list in *Reports|Supplier Code Multipliers*. For the Supplier Code Multipliers to be used in the Costing Reports and the BOM with Costs report, you must set the Default Pricing Type to Multipliers in *Design|Design Parametres|Economic Parametres*.

See also:

Supplier Code Multipliers

Section 5.12.9

3.4.1.4 USAGE CODE

This code tells IRRICAD whether an item is available for use. The options are (in most cases) a Y for Yes, meaning the item can be selected or specified, or N (or blank), meaning the item cannot be selected or specified.

If an item has been enabled for use in a design, it will appear in IRRICAD in the dropdown list from which items are selected in the dialog relating to that component group. For example if the 50mm Gate Valve has been enabled in the Control Valve component list in the database, you will be able to select this control valve from the dropdown list when you select

Zone|Control Valve in IRRICAD. For fittings, if an item has been enabled, the item can be selected during Computer Selection of Fittings.

The usage codes are different for pipes and assemblies. For pipes the usage codes are L, Z and M. L refers to a lateral pipe (placed using the *Zone|Sprayline* or *Zone|Block* options), Z to other Zone pipes (downstream from a control valve) and M to mainline pipes (upstream from a control valve). Each pipe can have one usage code or a combination of any or all three usage codes assigned. If no usage code is assigned to a pipe it can not be selected or used in the design. For assemblies two extra usage codes have been assigned - X and A. These describe the type of listing required in the Bill of Materials and Costing reports. See About Assemblies, Section 3.3.2.

3.4.1.5 WHOLESALE COST

This is the wholesale or cost price of the item. You can enable this to be the base price through the IRRICAD menu *Reports|Supplier Code Multipliers*. This will make the supplier code multipliers act on the wholesale cost for all the selected suppliers.

You can set the Wholesale cost to be the cost used in the Costing Reports and the BOM with Costs report by setting the Default Pricing Type in *Design|Design Parametres|Economic Parametres*.

3.4.1.6 RETAIL PRICE

The retail or selling price of the item before any discounts or cost multipliers have been applied. You can enable this to be the base price through the IRRICAD menu *Reports|Supplier Code Multipliers*. This will make the supplier code multipliers act on the retail cost for all the selected suppliers.

You can set the Retail price to be the cost used in the Costing Reports and the BOM with Costs report by setting the Default Pricing Type in *Design|Design Parametres|Economic Parametres*.

3.4.2 DATABASE CODES, SYMBOLS & LINE TYPES

The database editor uses codes for pipe types, and inlet and outlet connection types in order to determine the fittings required at a junction.

3.4.2.1 PIPE TYPES

These are chosen from the dropdown list that is available from the Pipes, Tapes and Lateral Take Offs details dialogs. The list of pipe types can be edited in the *Design|Pipe Fitting Matching Table* in the main IRRICAD program. However, you are unable to delete a pipe type that is in use in the database.

You may use any consistent set of pipe codes. Any code containing up to four characters may be entered in the Pipe Fitting Matching Table, Section 5.11.14 for use in the pipe database. A pipe type can only be entered once, but a connection code can connect to more than one pipe type.

See also:

<i>Pipe Fitting Matching Table</i>	<i>Section 5.11.14</i>
<i>Connection Codes</i>	<i>Section 3.4.2.2</i>
<i>Gender Codes</i>	<i>Section 3.4.2.3</i>
<i>Connection Types</i>	<i>Section 3.4.2.4</i>

3.4.2.2 CONNECTION CODES

These consist of a four-letter type code, a gender code, and a connection type. Common type codes used in the IRRICAD supplied database are:

LDP:	polyethylene fittings
PVC:	PVC fittings
COMP:	compression fittings
NPT:	national pipe thread
FLA:	flanged
NONE:	no fitting required (Outlets and Outlet Connectors only)
BSP:	British standard pipe thread

Connection codes are used to inform IRRICAD which fittings can be connected to which pipe type. This means that if a fitting has the connection type FLA it cannot be selected to connect to a PVC pipe. To connect to an item the connection code and type need to be the same and the gender needs to be opposite. The fitting will not be selected if the connection codes are not the same as the item it is being selected for.

3.4.2.3 GENDER CODES

There are only two choices in the dropdown list in the component dialog – male and female (M, F). For IRRICAD to select a fitting it must have the opposite gender to the item it is being selected for.

3.4.2.4 CONNECTION TYPES

These specify how items are joined together. You can enter any connection type you desire. Common fitting types are:

S:	slip connection
T:	threaded connection
B:	bolted

For IRRICAD to select a fitting it must have the same connection type as the item it is being selected for.

3.4.2.5 DATABASE SYMBOLS

The default set of database symbols are stored in a folder called database. Typically this is installed as C:\Program Files\AEI Software\Irricad\symbols\database. Currently there are 124 symbols for you to choose from for hydraulic items. Symbols for hydraulic items can only be changed or specified in the Database Editor, not through IRRICAD.

When selecting or changing the symbol for an item, you can choose from the dropdown list, or click the browse button (...) to select a new symbol from the symbols\database folder. When creating a new database symbol it must be saved in the symbols\database folder in order to be selected for use in the database (see Creating New Database Symbols, Section 2.7.5). Click the Database option in the *Tools|Create Symbol* dialog.

***Note:** You can create your own database symbols in IRRICAD by using the Create Symbol command in the Tools menu; it is important to create them 100 x 100 inches in dimension for the symbol sizes to remain consistent. IRRICAD saves the symbols using the .vcs file format. Other .vcs files (Visual CADD symbol files) can also be used as database symbols.*

Symbol sizes range from 1 to 9. These numbers are relative to each other, e.g. size 6 is larger than size 5. When used in IRRICAD, a size 5 symbol has the world size designated in *Settings|Miscellaneous - Design*

Size. If the Base Database Symbol Size here is 5ft (5m) a size 5 symbol will be displayed on the screen with a diameter of 5ft (5m).

3.4.2.6 SYMBOL AND PIPE COLORS

In the item dialog there is a color field for the hydraulic item. This color can only be edited in the database editor, and not through Properties in IRRICAD as you can for geometric items.

By clicking on the default or current color, you can choose any color or shade from the pop-up screen.

3.4.2.7 LINE TYPES

Line types can be chosen for line hydraulic items. From the drop down list select the desired line type. There are 50 line types to choose from for line hydraulic objects. (See Available Line Types, Section 6.5.1).

3.4.3 ASSEMBLIES

Assemblies are described in About Assemblies, Section 3.3.2.

3.4.3.1 CREATING ASSEMBLIES

Select the tab associated with the type of assembly you want to create, e.g. Valve.

On the right hand side of the screen, you will notice a series of buttons. These are:

- New Assembly
- Add to Assembly
- Select
- Remove Item
- Finish Assembly

NEW ASSEMBLY

Used when you wish to create a new assembly.

1. Select the item to create an assembly with, e.g. Gate Valve 50mm and click the New Assembly button.

2. Edit the details in the dialog, particularly the name and warehouse code, e.g. Gate Valve 50mm Assembly. Select a usage code (Y,X, A).
3. Click the Continue button, or, if you do not wish to proceed with creating an assembly, click the Cancel button.
4. Select the component your assembly is based on, e.g. Gate Valve 50mm. Remember that when you begin to create an assembly, the item you initially selected to begin your assembly is **not** automatically selected as part of the assembly, but is the item the details are copied from. Select this item if required.
5. Click the Select button on the right hand side of the screen.
6. Enter the number of the item in the assembly, e.g. for 1 Gate Valve 50mm in this assembly, type 1 in the highlighted field in the pop-up dialog.
7. Select the component group tab you require, and select the item to add to your assembly.
8. Click the Select button on the right hand side of the screen.
9. Enter the number of the item in the assembly, e.g. for 3 x 10mm joiners in this assembly, type 3 in the highlighted field in the pop-up dialog.
10. Repeat steps 7 to 9 as needed, until all items have been selected for the assembly.
11. Click the Finish Assembly button on the right hand side.

The screen will return to the database in which you created the assembly. When an assembly is highlighted, the assembly items will be listed in the table at the bottom of the screen.

To save the changes to the database click the Save Changes button on the main screen when you are ready to exit. If you do not wish to save any changes, click the Quit button to close the current database.

3.4.3.2 MODIFICATION OF ASSEMBLIES

ADD TO ASSEMBLY

For adding items to an existing assembly:

1. Select the existing assembly.
2. Click the Add to Assembly button.
3. Select the component group tab you require, and highlight the item to add to your assembly.
4. Click the Select button on the right hand side of the screen.

5. Enter the number of the item in the assembly, e.g. for 3 x 10mm joiners in this assembly, type 3 in the highlighted field in the pop-up dialog.
6. Repeat steps 4 to 6 as needed, until all items have been selected for the assembly.
7. Click the Finish Assembly button on the right hand side.

The screen will return to the component group in which the assembly belongs. When an assembly is highlighted, the assembly items will be listed in the table at the bottom of the screen.

To save the changes to the database click the Save Changes button on the main screen when you are ready to exit. If you do not wish to save any changes, click the Quit button to close the current database.

Tip: When selecting items, click on the left-hand margin, to automatically pop up the dialog box for the number of items.

SELECT

Used when creating or adding to assemblies.

To add the highlighted item to the assembly click the Select button or click on the left-hand margin (see New Assembly or Add to Assembly).

REMOVE ITEM

Used to remove the selected item from an existing assembly.

To remove any item from the assembly, highlight the item in the table at the bottom of the screen and click the Remove Item button.

To save the changes to the database click the Save Changes button on the main screen when you are ready to exit. If you do not wish to save any changes, click the Quit button to close the current database.

FINISH ASSEMBLY

Click this button to finish creating or adding to an assembly.

To save the changes to the database click the Save Changes button on the main screen. If you do not wish to save any changes, click the Quit button to close the current database.

3.4.3.3 EXAMPLE OF ASSEMBLY CONSTRUCTION

To further illustrate the creation of assemblies, a step by step account of how to construct a valve assembly is presented.

The Rainspray 40mm Model 6 QCV Assembly will consist of the following items:

- 40mm Class 9 PVC
- Rainspray 40mm Model 6 QCV
- 40mm x 1 ½" Valve adapter
- 40mm PVC plain 45 Elbow
- 250mm round valve box
- Twist lock gel connector 1.0, 1.5, 2.5

Note: This assembly is to demonstrate the construction of assemblies and should not necessarily be used as a final design for a valve assembly.

1. As the required assembly performs the function of a valve, select the Valve component group.
2. Find and highlight the existing Rainspray 40mm Model 6 QCV. Click the New Assembly button.
12. In the Valve Description edit box change the name to Rainspray 40mm Model 6 QCV Assembly. Select a usage code (Y,X, A).
3. Enter a warehouse code. Make one up if an actual code does not exist.
4. If the inlet and outlet diametres and the inlet and outlet types are correct for the assembly, leave these entries as they are. Make sure the inlet and outlet reflect the items which will be on either end of the assembly. If they are not, change them as required. As costs will automatically be calculated for the assembly, make no changes to the costs.
5. Click the Continue button, and select the Rainspray 40mm Model 6 QCV valve to include one valve in the valve assembly.
6. Select the Pipe component tab. In this group, select the 40mm Class 9 PVC. Enter 1 into the pop-up dialog to select a 1ft (1m) length of pipe for the assembly. Click the OK button.
7. From the Coupler component group, select the 40mm x 1½" valve adapter and enter 2 in the pop-up dialog.
8. From the Elbows / Bends component group, select three of the 40mm PVC plain 45 elbow by entering 3 in the edit box in the pop-up dialog after selecting the item.

9. Select the Miscellaneous components group and select a 250mm Round Valve Box.
10. Still in the Miscellaneous component tab, select 2 Twist Lock Gel Connector 1.0, 1.5, 2.5.
11. Click the Finish Assembly button.

This completes the construction of the assembly. The items selected for the assembly, and the quantities of each are displayed at the bottom of the screen. To delete items from the assembly, highlight the item and click the Remove Item button.

An important point to remember when creating an assembly is to select the item you are creating the assembly with (e.g. in a valve assembly), select the valve required, as a valve is not automatically entered as an assembly item.

It is important to note that although IRRICAD does not connect together fitting types of the items within the assembly, it is beneficial to you to make sure that all the items can be connected. Hence, selecting the correct fittings, such as adapters and couplers, will ensure that this assembly can be installed.

3.5 IRRIGATION COMPONENTS – DETAILS OF INDIVIDUAL GROUPS

This chapter looks at each component group and the specific fields for each type of hydraulic item.

3.5.1 PIPES

The pipe group consists of a list of all pipes and their characteristics. For pipes, the main dialog lists the pipe descriptions, warehouse codes, supplier codes and usage for all pipes in the database.

3.5.1.1 PIPE USAGE CODES

The usage field enables or disables use of pipes. To enable a pipe for use the choices are L, Z and M.

L means that the pipe can only be selected for use as a lateral for a sprayline and will appear only in the dropdown list when you have selected *Zone|Sprayline* or *Zone|Block*.

Z enables the pipe for use as a zone pipe only, and will appear in the dropdown list when *Zone|Pipe* or *Zone|Cut Pipe* is selected.

M enables the pipe for use as a mainline pipe only, and will appear in the dropdown pipe selection list when *Mainline|Pipe* or *Mainline|Sprayline* is selected.

You can enable a pipe for more than one option if required. For example, you can enable a pipe for use as LZ or for use in all three fields (LZM). Pipes can be disabled by selecting the blank option in the dropdown list or, deleting the current usage code so that this field is empty.

Beneath the pipe table is a table labeled Assemblies. This table will remain blank when in the pipe tab, because pipe assemblies are not permitted.

Common buttons are explained in Common Controls, Section 3.3.1 and Database Details, Section 3.4. Some fields are particular to pipes or have a specific explanation when used in the Pipes dialog.

Nominal Diameter:	Enter a nominal diameter for the pipe. This diameter is used for fitting selection and is usually used in the name of the item e.g. ½" (16mm)
Actual Diameter:	Enter the actual internal diameter for the pipe. This is the diameter of the pipe used in the hydraulic calculations. For example, a nominal 50mm diameter pipe may have an actual diameter of 56.55mm.
Pipe Roughness:	Enter a pipe roughness. If unsure, see Appendix C: Hazen-Williams C Values, Section 6.3.1. The pipe roughness is used in the hydraulic calculations for friction loss in the pipe.
Allowable Pressure:	Enter in the maximum working pressure rating for the pipe, e.g. for PVC Class B, 60m, Class C, 90m, Class D, 120m etc.

See also:

Line Types

Section 3.4.2.7

3.5.2 TAPES

The tape component group consists of a list of characteristics for each tape. Laterals with built-in emitters are referred to as tapes and are treated as single items rather than as individual pipes and outlets.

The tape data required in the database is necessary for IRRICAD to calculate the friction loss in the tape as water flows through the tape, and past the emitters.

The main screen lists the item descriptions, warehouse codes, supplier codes, and usage for all tapes in the database. The usage field determines whether a particular tape will appear in the dropdown list for selection in IRRICAD. The usage code choices are L or blank.

Underneath the tape descriptions is a table labeled Assemblies. This table will remain blank when in the tape tab, as tape assemblies are not permitted.

Common buttons are explained in Common Controls, Section 3.3.1 and Database Details, Section 3.4. Some fields are particular to tapes or have a specific explanation when used in the Tapes dialog.

Nominal Diameter:	Enter in a nominal diameter for the tape.
Actual Diameter:	Enter in the actual internal diameter for the tape. This is the diameter of the tape used in the hydraulic calculations e.g. a nominal 13mm diameter pipe may have an actual diameter of 13.4mm.
Tape Roughness:	Enter in a tape roughness.
Allowable Pressure:	Enter in the working pressure rating for the tape as recommended by the manufacturer.
Default Inlet Pressure:	Enter a default inlet pressure for the tape.
Minimum Pressure:	Enter a minimum pressure for the tape. This is the manufacturer's data for the minimum recommended operating pressure.
Maximum Pressure:	Enter a maximum pressure for the tape. This is the manufacturer's data for the maximum recommended operating pressure.
Tolerance % Above:	Enter the zone pressure tolerance % above. This indicates the upper limit of the pressure window that the tape is to operate in.
Tolerance % Below:	Enter the lower limit of the pressure window the tape is to operate in.
Nominal SDR:	Enter the nominal specific discharge rate. This is calculated by dividing 100ft by the emitter spacing (ft) and multiplying this by the emitter flow rate (usgph) (dividing 100m by the emitter spacing (m) and multiplying this by the emitter flow rate (lph)). This is an indication of the flow out of the tape over any 100ft (m). This number is only used in the Show Flow function and in the Management reports.
Flow Calc. Type:	Check the Flow Calculation Type box for the iteration method. This method is precise and requires values for the Emitter Barb Factor, Emitter Constant, Emitter Index and Spacing of the emitters.

The values required for the iteration flow calculation can be obtained from manufacturer's data or from your Technical Support. The previously used flow calculation type (leave the iteration check box unchecked) is valid only for DOS IRRICAD databases. Tapes require to be updated to the new iteration method.

The iteration calculation type is a very accurate method of calculating the friction loss in tapes. It requires what is called an Emitter Barb Factor (Kd). This value is normally between 0 and 2, and is a function of the headloss caused by the presence of the emitter in the tape wall.

A constant (coefficient) is also required, along with the index (exponent) and the spacing of the emitters in the tape. The iteration calculation type (when the iteration check box is checked) is the default calculation type for entering new tapes.

If the iteration check box is unchecked (as in the case of old IRRICAD tape databases), then the old method, which uses a constant, length factor, pressure factor and slope factor will apply. Do not use this method when entering new tapes into the database. Note that simply checking or unchecking the iteration check box does not change the values in the edit fields. You will need to use the correct data as supplied by the manufacturer.

The Kd, constant and index are supplied by the manufacturer, though if you are unable to secure this information, please contact your technical support person.

WARNING: You can check the iteration check box, but this will not change the values in the edit fields, only the names of the edit fields. DO NOT USE OLD TAPE DATA WITH THE ITERATION METHOD, AS THE RESULTS WILL BE INCORRECT.

3.5.3 VALVES

Valves are zone control valves - used to control the operation of the various zones. A control valve separates zone pipe from mainline pipes.

Common buttons are explained in Common Controls, Section 3.3.1, Assemblies, Section 3.4.3 and Database Details, Section 3.4. Some fields are particular to valves or have a specific explanation when used in the Valves dialog.

Inlet Diameter:	Enter an inlet diameter for the valve, i.e. the upstream end of the valve (nominal diameter).
Outlet Diameter:	Enter an outlet diameter for the valve, i.e. the downstream end of the valve (nominal diameter).

Constant:	Enter the value calculated from Valve Curve Fitting Utility for the Headloss equation Constant.
Index:	Enter the value calculated from Valve Curve Fitting Utility for the Headloss equation index.
Minimum Flow:	Enter the minimum allowable flow through the item. You can obtain this from the manufacturers data for the item.
Maximum Flow:	Enter the maximum allowable flow through the item. You can obtain this from the manufacturers data for the item.

3.5.4 OTHER HYDRAULICS

Other Hydraulics are called Misc. Hydraulic Items in the main IRRICAD Zone and Mainline menus. These items can be pressure regulating valves, valves to place on a mainline pipe or on a zone pipe, rising column losses, well drawdown, or any other minor losses that require calculation within a system.

Common buttons are explained in Common Controls, Section 3.3.1, Assemblies, Section 3.4.3 and Database Details, Section 3.4. Some fields are particular to other hydraulic items or have a specific explanation when used in the Other Hydraulics dialog.

Inlet Diameter:	Enter an inlet diameter for the item, i.e. the upstream end of the hydraulic item (nominal diameter).
Outlet Diameter:	Enter an outlet diameter for the item, i.e. the downstream end of the hydraulic item (nominal diameter).
Constant:	Enter the value calculated from Misc. Hydraulic Curve Fitting Utility for the headloss equation Constant.
Index:	Enter the value calculated from Misc. Hydraulic Curve Fitting Utility for the headloss equation Index.
Intercept:	Enter the value calculated from Misc. Hydraulic Curve Fitting Utility for the headloss equation Intercept.
Fitting Type:	For pressure reducing valves, where you wish to specify the downstream pressure of the

	valve, enter PRV in the Fitting Type field, otherwise leave this field blank.
Minimum Flow:	Enter the minimum allowable flow through the item. You can obtain this from the manufacturers data for the item.
Maximum Flow:	Enter the maximum allowable flow through the item. You can obtain this from the manufacturers data for the item.

***Note:** For on-line components such as air release valves (as distinct from in-line components), the inlet connection type and diameter must be entered. The outlet connection type must be left blank and the outlet diameter entered as zero.*

3.5.5 LATERAL TAKE OFFS

Lateral Take Offs are connectors that rely upon piercing submain or lateral pipes rather than cutting the pipe in half as a tee does. Lateral Take Offs are used to connect outlets to laterals and laterals to submains.

Common buttons are explained in Common Controls, Section 3.3.1, Assemblies, Section 3.4.3 and Database Details, Section 3.4. Some fields are particular to Lateral Take Offs or have a specific explanation when used in the Lateral Take Offs dialog.

Major Pipe Type:	Select the pipe type from the dropdown list to define the type of pipe the LTO can connect to on its largest end. Typically the major pipe is a submain for a submain / lateral connection or a lateral for a lateral / outlet connection.

***Note:** If a Lateral Take Off is able to be connected to more than one pipe type, separate Lateral Take Offs must be entered for each type.*

Minor Connection Type:	A three-element code (matching code, gender, joint type) used to describe the connection on the small end of the LTO, i.e. the lateral end of a submain / lateral connection or the outlet end of a lateral / outlet connection.

Min Submain Diameter:	The minimum size of the major pipe the LTO can successfully connect to.

Lateral Diameter: The nominal pipe or fitting size on the minor end of the LTO connection.

Note: When selecting fittings for a three pipe junction, IRRICAD first searches the LTO component group for a suitable connector regardless of the sizes and types of pipes at the junction. If the required LTO cannot be found in the LTO tab, tees with the required reducers will be selected according to the three pipes routines described in the Technical Reference, Appendix G: Fitting Selection Details.

See also:

Fitting Selection Details

Section 6.7.1

3.5.6 COUPLERS

Couplers are used to connect two hydraulic items together. Couplers may be reducers, adapters or plain connectors.

Common buttons are explained in Common Controls, Section 3.3.1, Assemblies, Section 3.4.3 and Database Details, Section 3.4. Some fields are particular to couplers or have a specific explanation when used in the Couplers dialog.

Major Diameter: Enter the major diameter (nominal diameter).
Minor Diameter: Enter the minor diameter (nominal diameter)

The terms major and minor are applied to both connector type and diameter. For couplers the major connection type and diameter can be applied to the larger diameter of the fitting, with minor referring to the smaller diameter.

If all diametres in the fitting are the same, the data entry for the major and minor diametres will also be the same.

3.5.6.1 END CAPS

In the IRRICAD program, Computer Selection of Fittings in the design menu will automatically select end caps or end closers for pipes with open ends. Common uses include automatic selection of end closers with polyethylene laterals, or caps or flushing assemblies for PVC laterals or submains. These fittings are entered in the Coupler component group with a connection type and diameter specified for the first (or inlet) end

only. The second connection type is left blank and the second diameter is entered as zero.

End assemblies may comprise of a number of fittings. This can be achieved by creating a suitable assembly in the coupler tab.

3.5.7 ELBOWS / BENDS

IRRICAD uses elbows and bends when selecting Fittings. They can also be selected for use in user-created assemblies.

Common buttons are explained in Common Controls, Section 3.3.1, Assemblies, Section 3.4.3 and Database Details, Section 3.4. Some fields are particular to elbows and bends or have a specific explanation when used in the Elbows / Bends dialog.

Major Diameter:	Enter the major diameter (nominal diameter).
Minor Diameter:	Enter the minor diameter (nominal diameter).
Bend Angle:	The change in angle experienced by flow through the fitting (°).

The terms major and minor are applied to both connector type and diameter. For bends and elbows the major connection type and diameter can be applied to the larger diameter of the fitting with minor referring to the smaller diameter.

If all diameters in the fitting are the same, the data entered for the major and minor diameters will be identical.

3.5.8 TEES

Tees are used by IRRICAD to connect three hydraulic items together.

Common buttons are explained in Common Controls, Section 3.3.1, Assemblies, Section 3.4.3 and Database Details, Section 3.4. Some fields are particular to tees or have a specific explanation when used in the Tees dialog.

Major Diameter:	Enter the major diameter (nominal diameter).
Minor Diameter:	Enter the minor diameter (nominal diameter).

The terms major and minor are applied to both connection type and diameter. For Tees the major connection type and diameter is applied to the straight through section of the Tee and the minor is applied to the branch, regardless of diameter.

If all diameters in a fitting are the same, the data entered for the major and minor diameters will be the same.

3.5.9 CROSSES

Crosses are used to connect four hydraulic items together.

Common buttons are explained in Common Controls, Section 3.3.1, Assemblies, Section 3.4.3 and Database Details, Section 3.4. Some fields are particular to crosses or have a specific explanation when used in the Crosses dialog.

Major Diameter:	Enter the major diameter (nominal diameter).
Minor Diameter:	Enter the minor diameter (nominal diameter).

The terms major and minor are applied to both connector type and diameter. For crosses the major connection type and diameter can be applied to the larger diameter of the fitting with minor referring to the smaller diameter.

If all diameters in the fitting are the same, the data entered for the major and minor diameters will be the same.

3.5.10 PUMPS

The A, B and C coefficients that are calculated from the Pump Curve Fitting Utility specify pump performance data. This information is used to determine the actual flow and pump pressures according to the hydraulics of the rest of the system.

Common buttons are explained in Common Controls, Section 3.3.1, Assemblies, Section 3.4.3 and Database Details, Section 3.4. Some fields are particular to pumps or have a specific explanation when used in the Pumps dialog.

Inlet Diameter:	Enter the nominal diameter of the inlet or suction side of the pump.

Outlet Diameter:	Enter the nominal diameter of the outlet or discharge side of the pump.
H / Q Curve Factors:	A, B and C are three numbers used to describe the pressure-discharge characteristics of the pump. These values are obtained from the pump Curve Fitting Utility.
Minimum Flow:	Enter the minimum allowable flow through the pump. This can be obtained from the manufacturer's data for the pump.
Maximum Flow:	Enter the maximum allowable flow through the pump. This can be obtained from the manufacturer's data for the pump.

3.5.11 OUTLETS

Nozzles and outlets are used together. Nozzles can be selected for a particular outlet from the Outlet tab. Note nozzles should be added to the nozzle component group prior to adding nozzles to an outlet.

The outlet group provides the technical and descriptive information related to outlets that IRRICAD requires for design and costing.

The database has been designed primarily for sprinklers with a range of nozzle sizes, but can be used equally well for other outlets such as drippers, constant flow outlets, demand points or irrigators.

Common buttons are explained in Common Controls, Section 3.3.1, Assemblies, Section 3.4.3 and Database Details, Section 3.4. Some fields are particular to outlets or have a specific explanation when used in the Outlets dialog.

On the right-hand side of the dialog additional buttons available for use in the Outlets tab are:

- Add Nozzles
- Select Nozzle
- Remove Nozzle

Inlet Connection Code: A three-element code consisting of a matching code, a gender code and a joint type code. IRRICAD uses this code to determine which fittings, if any are needed to connect the outlet to other components. If the outlet is a sprinkler, it will often be connected to an outlet connector.

If the outlet does not have a threaded connection and fittings are not required to connect the outlet to the pipe (such as for drippers or microjets connected directly to a lateral pipe), the NONE matching code should be used. The NONE code instructs IRRICAD not to select any connecting fittings. For most turf sprinklers, the connection type used is the NPT / BSP female inlet diameter.

Default Nozzle:

The first ten characters of the description of the nozzle that is most often used with this outlet. The Default nozzle is automatically the first nozzle you select when Adding Nozzles. You may select any of the other nozzles associated with the outlet from a drop down list available in this field. A default nozzle cannot be selected for this field until you have added nozzles associated with the outlet - click Save when creating a new outlet and then proceed to add the required nozzles. After clicking Finish Adding for nozzles re-select the outlet and click Edit / View Outlet. Select a default nozzle and click Save. When an outlet is being selected for use in design, the default nozzle with its supporting information will be displayed on the screen first. This can save time when the same sprinkler / nozzle combination is used frequently. It should be noted that up to 40 characters might be used to describe the nozzle in the nozzle tab. The first 10 characters are used to match with the default nozzle. To be sure that the required default nozzle is selected, these 10 characters should be unique for any body / nozzle combination. If the 10 characters can be matched to more than one nozzle, the nozzle selected may not be the one expected.

Inlet Diameter:

The nominal diameter of the outlet inlet. For outlets that do not have a nominal diameter, a notional diameter is entered.

Type:	Used to indicate whether the arc of the sprinkler is fixed or adjustable, or whether the outlet is a demand point: • Fixed:fixed arc type, constant flow • Variable:variable arc type, constant flow • Matched:variable arc type, variable flow • Demand Point:used for demand points
Default Pressure:	The operating pressure that is most often used for the particular outlet.
Default Watering Arc:	The most commonly used arc for the particular outlet. Enter as 360° for drippers.
Flow Tolerance % Above:	The percentage allowable flow above the nominal flow for the outlet.
Flow Tolerance % Below:	The percentage allowable flow below the nominal flow for the outlet.

Flow tolerance above and below the nominal flow for the outlet defines the range of flows within which the outlet should operate.

***Note:** When entering outlet and nozzle data you need to know whether an outlet is Fixed, Matched or Variable. If you enter data and decide the outlet is fixed you cannot change the arc because it is made to be a fixed angle. If you choose Variable, then the flow does not change as the arc changes i.e. the same flow is emitted regardless of the arc you select upon placement. However, for matched outlets, IRRICAD assumes that the data you input is for 360°. If you change the arc, the flow is matched and is decreased accordingly. Therefore if you use 180° as the arc you will get half the flow. If the said outlet is indeed Matched, then you will need to enter the data for 360° so that when you change the arc you will achieve the correct flow according to the manufacturers data.*

3.5.11.1 DEMAND POINTS

Demand points are pseudo outlets that require a user-specified pressure and flow at a particular location in a design. Typical examples of their use are designing mainlines with specified pressure and flow requirements at various locations; and to allow for additional flow in a zone or mainline which is not normally entered as an outlet. Demand points are stored in the outlet tab as emitters without nozzles. To create a demand point, insert a new item in the outlet tab and change the Type to DEMAND POINT. When the arc type is DEMAND POINT, the default nozzle field becomes non-editable since it does not apply. The default-watering arc

field becomes the default flow and the flow tolerances fields become pressure tolerances.

3.5.11.2 LINKING NOZZLES TO OUTLETS

ADD NOZZLES

Used to add existing nozzles to an outlet. After invoking this tool, the Add Nozzles button is replaced by the Finish Adding button.

After adding a new outlet to the database, click the Add Nozzles button to select existing nozzles for the new outlet. This will take you to the nozzle tab. Note that new nozzles must be added to the nozzle component group prior to adding nozzles to an outlet (see Nozzles, Section 3.5.12).

1. Click the Select Nozzle button to select a highlighted nozzle for the outlet.
2. Click the Finish Adding button when you have completed selecting all the nozzles to be associated with the selected outlet.

***Tip:** You can quickly select a nozzle by clicking on the gray box at the left of the nozzle description. You do not need to click the Select Nozzle button using this method.*

SELECT NOZZLE

Used when adding a nozzle to an outlet.

To add the highlighted nozzle to the outlet click the Select Nozzle button or click on the left-hand margin. See Add Nozzle.

FINISH ADDING

Use this button to finish selecting nozzles for an outlet. It exits the Nozzle dialog and returns to the outlet dialog.

REMOVE NOZZLE

Used to remove selected nozzles from an existing outlet. Highlight the required nozzle in the Nozzles area at the bottom of the Outlets group dialog.

To remove selected nozzles from the database use the Delete Nozzle button on the Nozzles tab.

3.5.12 NOZZLES

In IRRICAD, any type of sprinkler, big gun, travelling irrigator or dripper is given an outlet body and a nozzle, even if the outlet does not physically have nozzles e.g. a dripper, or if the outlet we represent has many nozzles e.g. a travelling irrigator. The outlet body contains the description of the outlet, the arc type, price and some default values as those most commonly used when the outlet is selected. When you select an outlet from the dropdown list, the default nozzle for that sprinkler (as specified in the database, normally the most commonly used) is initially selected. The required nozzle can be selected from the dropdown list. Other default values can also be changed depending on the arc type of the outlet.

The nozzle part of an outlet can be the actual nozzles supplied with an outlet body, or simply hold the technical data for the outlet, such as a dripper's hydraulic characteristics. Nozzles contain the minimum and maximum recommended pressures from the manufacturer, and parameters to calculate the flow and radius at a given pressure.

Common buttons are explained in Common Controls, Section 3.3.1 and Database Details, Section 3.4. Some fields are particular to nozzles or have a specific explanation when used in the Nozzle dialog.

Minimum Pressure:	Enter the minimum pressure range recommended for the nozzle.
Maximum pressure:	Enter the Maximum pressure range recommended for the nozzle. This pressure range should not be confused with the pressures corresponding to the design flow tolerance. The range specifies the absolute minimum and maximum allowable operating pressure for the nozzle.
Radius Equation:	A and B - two numbers used to describe the pressure / radius characteristics of the nozzle. This allows to calculate the maximum radius of throw (wetted radius) of the sprinkler for any pressure. The constants A and B can be obtained by using the Outlet Radius Curve Fitting Utility. For each individual nozzle, the wetted radius / pressure relationship is assumed constant for all arcs.
Arc:	A number between 0 and 360 to describe the arc of the sprinkler. For fixed arc sprinklers a nozzle entry must be made for each arc, one of

	which must be selected as the default arc for the outlet.
Constant / Index:	Two numbers used to describe the pressure / flow characteristic of the nozzle at the given arc. These can be obtained from the Outlet Flow Curve Fitting Utility by entering the flow at any given pressure as given with the manufacturer's data.

Data required for nozzles has to be calculated from pressure / flow, and pressure / radius information supplied by the manufacturer. Use the Curve Fitting Utility - Outlet Flow or Outlet Radius to calculate the Constant, Index, Radius Equation A and Radius Equation B.

The Constant and Index values are used to calculate the pressure-flow characteristics of the nozzle, where as Radius Equation A and B values are used to calculate the wetted radius of the nozzle at any given pressure.

3.5.13 OUTLET CONNECTIONS

An outlet connector is a component or an assembly of components that is used to connect an outlet to a lateral or supply pipe.

Examples of outlet connectors are:

- Swing joints
- Risers - for overhead sprinkler applications
- Distribution tube and stake for micro-sprinklers

Common buttons are explained in Common Controls, Section 3.3.1, Assemblies, Section 3.4.3 and Database Details, Section 3.4. Some fields are particular to outlet connectors or have a specific explanation when used in the Outlet Connections dialog.

Inlet Diameter:	Enter an inlet diameter for the connector (nominal diameter). The diameter is used in the matching of fittings or components to the connector.
Outlet Diameter:	Enter an outlet diameter for the connector (nominal diameter). The diameter is used in the matching of fittings or components to the connector.

Height Above Ground: The height of the outlet and the connector above ground level. Where the outlet is at ground level or close to ground level (as in most turf situations) the height above ground can be zero. Where the outlet is significantly above ground level as in the case of sprinklers on riser pipes, the height of the sprinkler above ground level (which may be different to the riser length) should be entered.

Equiv. Length Diameter: The equivalent length diameter is the diameter of smooth pipe which together with the HL Equivalent Length is used to calculate the connector pressure loss. Do not include the pressure loss due to height above ground in this, as the loss due to change in height will be taken in to account elsewhere.

HL Equiv. Length (ft or m): The length of smooth pipe of diameter equal to the equivalent length diameter of the connector that will result in a pressure loss (in feet or metres) equal to that of the connector.

IRRICAD determines whether or not the outlet connector will connect directly to the sprinkler and what fittings, if any, are required to make the connection.

If an outlet connector is not used, the fittings required to connect the sprinkler directly to the lateral will be selected. Note that a connection code of NONE can be used to connect an outlet connector to an outlet.

3.5.14 WIRES

The wire component group contains the descriptive, technical and price information for various types of electric cable used in designs. Any wire types may be entered. There is no distinction between wire used for electrical control or for lighting and other applications.

Common buttons are explained in Common Controls, Section 3.3.1 and Database Details, Section 3.4. Some fields are particular to wires or have a specific explanation when used in the Wires dialog.

Wire Type: A code containing up to three letters, similar to the pipe type code, which is used to identify particular kinds of wire.

Nominal Size:	The nominal or descriptive diameter of the wire.
Resistance:	The internal resistance of the wire used in voltage drop calculations.
Voltage Rating:	The maximum voltage rating for the wire.

3.5.15 CONTROLLERS

Controllers are electrical items that program the sequence of operation of the electric solenoid valves that are used to control the flow into the various zones.

Common buttons are explained in Common Controls, Section 3.3.1 and Database Details, Section 3.4. Some fields are particular to controllers or have a specific explanation when used in the Controllers dialog.

Number of Stations:	This refers to the maximum number of stations (or system flows) the controller can be wired to control. A station or system flow may consist of one or many electric solenoid valves.

This information is purely descriptive and is not used by IRRICAD in the design process apart from costing and bill of material reports.

3.5.16 LIGHTS

The lights component group contains items for garden or landscape lighting.

Common buttons are explained in Common Controls, Section 3.3.1 and Database Details, Section 3.4. Some fields are particular to lights or have a specific explanation when used in the Lights dialog.

Rating:	The power rating of the lights in watts.
Nominal Voltage:	The nominal voltage rating of the light in volts.
Volt tolerance % above:	The percentage voltage increase above the nominal voltage allowed for the light.
Volt tolerance % below:	The percentage voltage drop below the nominal voltage allowed for the light.

This information is purely descriptive and is not used by IRRICAD in the design process apart from costing and bill of material reports.

3.5.17 OTHER ELECTRICS

A miscellaneous Electrical component group contains items that are considered to be part of the electrical requirements, but do not belong in the wire, lights or controller component groups.

Common buttons are explained in Common Controls, Section 3.3.1 and Database Details, Section 3.4. Some fields are particular to other electrics or have a specific explanation when used in the Other Electrics dialog.

Rating:	The power rating of the item in watts.
Voltage:	The voltage rating of the item in volts.

This information is purely descriptive and is not used by IRRICAD in the design process apart from costing and bill of material reports.

3.5.18 MISCELLANEOUS

The Miscellaneous component group is used to store items such as concrete, locking clamps, sealing plugs, valve boxes etc. so that these items can also be included in the total cost of the project. To include these items in the reports, select from the database using the Show Fittings button found on the Change or Change Type dialog.

Common buttons are explained in Common Controls, Section 3.3.1, Assemblies, Section 3.4.3 and Database Details, Section 3.4. Some fields are particular to miscellaneous items or have a specific explanation when used in the Miscellaneous dialog.

Size / Diameter 1:	Where relevant, the size and / or diameter of the component.
Size / Diameter 2:	Where relevant, the size and / or diameter of the component.

This information is descriptive and only appears in the relevant reports.

3.6 FILE MENU

This menu is found on the menu bar. To see the menu bar you may have to close the current database by clicking the Save Changes or Quit button, or move the database window down until the menu bar can be seen.

3.6.1 NEW

Select *File|New* to create a new database.

A message will appear to help you through the steps required - they are outlined below.

To create a new database:

1. Select *File|New*.
2. Click the Save Changes button to save the new database. A Save As dialog will appear. Enter the name for the new database and Click Save.
3. Run IRRICAD. Select the newly created database in *Settings|Irrigation - Design Specific*.
4. Select *Design|Pipe Fitting Matching Table*. Enter pipe types and the necessary characteristics. (See Section 5.11.14)
5. Select *Reports|Supplier Code Multipliers* and enter supplier codes and the necessary characteristics (see Section 5.12.9).
6. Exit IRRICAD.
7. Re-open the new database using *File|Open* and select the database you have just created.
8. Enter the components. See Using the Database Editor (Section 3.2), Database Structure (Section 3.3), Database Details (Section 3.4) and Irrigation Components – Details of Individual Groups (Section 3.5).
9. Click Save Changes to save the components added to the database.

3.6.2 OPEN

Select *File|Open* to open a database of your choice.

To open a database:

1. Select *File|Open*.
2. Browse for the required database.
3. Click the Open button.

3.6.3 MERGE

The *File|Merge* option allows you to add one database to another. The merge function checks for matches before adding any items.

To merge a database:

1. Select *File|Merge*.
2. Select the database you wish to have items added from - this database is opened but will remain as it is.
3. Select the database you wish to add items to - this database will have items added. If you wish to keep a copy of the original database before merging, make a copy in Windows Explorer or My Computer.
4. Click the Merge button.

A file is created (DBMergeReport.txt) in the \Irricad folder directory. Check this file to see a report on the components that were merged.

3.6.4 EXIT

Select *File|Exit* to close the database editor.

3.7 VIEW MENU

This menu is found on the menu bar. To see the menu bar you may have to close the current database by clicking the Save Changes or Quit button, or move the database window down until the menu bar can be seen.

The View menu contains the following options:

- Toolbar
- Status bar
- Database

3.7.1 TOOLBAR

The toolbar contains shortcuts to the File menu options New and Open.

To hide the toolbar select *View|Toolbar* and click to uncheck the option.

To show the toolbar if it is off, select *View|Toolbar* and click to check the option.

3.7.2 STATUS BAR

The status bar is placed along the bottom of the database editor window.

To hide the status bar, select *View|Status Bar* and click to uncheck the option.

To show the status bar if it is off, select *View|Status Bar* and click to check the option.

3.7.3 DATABASE

The Database option will open the default database when selected.

To open the default database:

1. Select *View|Database*.

3.8 UTILITIES MENU

This menu is found on the menu bar. To see the menu bar you may have to close the current database by clicking the Save Changes or Quit button, or move the database window down until the menu bar can be seen.

The Utilities menu contains the following options:

- Curve Fitting

3.8.1 CURVE FITTING

The curve fitting utilities are provided to allow the user to calculate the necessary constants, coefficients and exponents for entering in the databases. These numbers are used by IRRICAD to determine outlet flow and radius for any pressure, pressure loss for valves and other hydraulic items at a given flow, and the pressure / flow relationship for pumps.

The parameter values generated can be inserted into the required component group, which is then used by IRRICAD to calculate the hydraulic characteristics of the item.

In the case of miscellaneous hydraulic items or valves, where the resulting pressure / flow curve does not pass through (0,0) (i.e. requires a startup pressure), then an intercept is also calculated. (Select Valve with Intercept or Misc. Hydraulic option).

This information is rarely provided by manufacturers in the required form, most of the data that is available will be presented in graphical or tabular form.

Options are available for the following component groups:

- Pumps
- Outlet Flow
- Outlet Radius
- Valves
- Valves With Intercept
- Misc. Hydraulic

Although default units for pressure and flow or pressure and radius are shown in the table headings, these can be altered by the user to match the particular data available.

The options are:

Pressure	Metres
	Feet
	Kilopascals
	Kilograms/centimetre ²
	Pounds/square inch
	Atmospheres
	Bars
Flow	Litres/second
	Litres/minute
	Litres/hour
	Cubic metres/hour
	US gallons/minute
	US gallons/hour
	Imperial gallons/minute
Radius	Imperial gallons/hour
	Metres
	Millimetres
	Feet
	Inches

Having selected the required units at least three pairs of values must be entered to allow IRRICAD to fit the data to the appropriate equation.

For accuracy, select a range of values that represent the likely operating range of the device. Do not use extreme values if the device will never be required to operate at those values.

Negative data values cannot be used. Zero entries for pressure and flow will be ignored. If either pressure or flow (or radius) is zero, the entry is not valid (put in 0.01 or something instead of zero). Warning messages will inform the user of these conditions.

Click Fit Curve after the required data has been entered. The parameters required by IRRICAD will now be calculated and displayed at the bottom of the dialog.

The value of r^2 , which is an indicator of the accuracy of fit of the calculated equation to the data, is also displayed.

If the value of r^2 is less than 90% for the outlet or radius power curve, IRRICAD attempts to fit a horizontal straight line to the data. If the r^2 for the straight line is greater than 90%, then the straight line option is used and the index is set to zero. If the r^2 for the straight line is less than 90%, then the type of curve used is that which gives the best fit. The straight line option gives better results for outlets that are pressure compensated.

If the final value of r^2 is less than 90% for any of the options, a warning will be displayed. Usually this is caused by errors in data entry, although for some radius calculations irregular data will sometimes result in a poor fit. If r^2 is less than 90% **Do Not** use the results in IRRICAD unless you know why the fit is poor **and** you understand the consequence of using the results in the design.

3.9 HELP MENU

This menu is found on the menu bar. To see the menu bar you may have to close the current database by clicking the Save Changes or Quit button, or move the database window down until the menu bar can be seen.

The Help menu contains the options:

- About DB Editor
- Contents
- Setup Options

3.9.1 ABOUT DB EDITOR

This option shows the version of the database editor.

To find the version of the database editor:

1. Select *Help|About DB Editor*.

The dialog shows the version number of the database editor and the year copyright was registered.

3.9.2 CONTENTS

Help|Contents opens the database editor manual on-line help. It is the same as the printed manual.

The help file can be loaded as WinHelp or HTML Help. If you do not have Internet Explorer 3.04 or later, you can choose to install Internet Explorer 4.0. The installation files for Internet Explorer 4.0 are available on the CD (CD Drive:\Install\IE4\iesetup.exe).

3.9.2.1 HTML HELP

This window can be resized as required. Click the maximize button (middle button at the top right of the dialog window) or move the cursor to any edge until the cursor becomes a two-headed arrow and drag the dialog to the required size. The right hand side of the dialog adjusts the text to fit the right hand window.

At the top of the help dialog are icons: Hide, Back, Print, and Options.

HIDE / SHOW

If the left hand side of the help dialog, containing the contents, index and search option is visible; clicking Hide will hide the left hand side. If the left hand side is hidden, clicking Show will show the left hand side of the dialog.

Contents

If this tab is selected, the manuals content page is displayed. Each heading with a + sign can be opened to reveal its sub-headings. The sub-headings can be hidden by clicking on the - sign.

Clicking any heading will take you directly to that section of the manual. The text is displayed on the right hand side of the help window.

Index

Use the Index tab to select an indexed keyword. These words have been selected to aid you in finding topics. Select a topic and click the Display button.

Search

Use Search to find a topic. Search lists all the places the word is found in the on-line help.

To use Search:

1. Enter the word you wish to find. Make the word as specific as possible e.g. enter X to find the meaning of this usage code for assemblies.
2. Click the List Topics button.
3. Select a topic from those listed.
4. Click the Display button. The selected topic will be displayed on the right hand side.

BACK

Back takes you back to the last topic accessed, whether you have selected the topic by using Contents, Index or Search or used the yellow arrows at the end of each topic to navigate.

Click Back as many times as required - this function will move back through all your previous selections.

PRINT

Select *Print* to print any part of the on-line help. A print dialog will appear. Fill in the print dialog accordingly.

OPTIONS

Options include:

- Hide Tabs / Show Tabs (See above)
- Back (See above)
- Forward
- Home
- Stop
- Refresh
- Internet Options
- Print (See above)
- Search Highlight On / Off

Forward

Select *Options|Forward* if you have used *Options|Back* and wish to return to the previous document.

Home

Select *Options|Home* if you wish to connect to our website www.IRRICAD.com.

Stop

Select *Options|Stop* to stop searching for topics or loading a page.

Refresh

Select *Refresh* to reload the current HTML help page

Internet Options

Select *Options|Internet Options* to change your internet options.

Search Highlight On / Off

Toggle the search highlight on or off to highlight the keyword found in the text.

3.9.2.2 WINHELP

CONTENTS

If this tab is selected, the contents of the manual are displayed. Each heading containing a sub-heading can be opened by double clicking on the book icon to the left of the heading name. Double-clicking on the book icon can hide the sub-headings.

Clicking on any heading will take you directly to the appropriate section of the manual. The text is displayed on the right hand side of the help window.

INDEX

Use the Index tab to select an indexed keyword. These words have been selected to aid in finding topics. Select a topic and click the Display button.

FIND

Use Find to search for a topic. Find lists all the places the word is found in the on-line help.

To use Find:

1. Enter the word you wish to find. Make the word as specific as possible e.g. Enter X to find the meaning of the usage code for assemblies.
2. Select a topic from those listed.
3. Click the Display button. The selected section will be displayed on the right hand side.

3.9.3 SETUP OPTIONS

Setup Options allow you to choose whether or not the database editor displays some warning messages.

Display warning messages when changes to a component have not been updated

When this option is checked, a message will appear if you are editing a component (e.g. on the main dialog screen) and attempt to select another function (e.g. New...). The message will ask if you wish to save the changes. Answer Yes, No or Cancel.

If this option is not checked, the message does not appear and the changes are automatically saved.

Display warning messages before editing a component

When this option is checked a message is displayed when an item is selected and the Delete button is clicked. The message is a check to make sure you want to delete the item permanently. This allows time to check the correct item is selected.

If this option is not checked, the selected item will be deleted without displaying a message.

Show errors in the internal structure when they are noticed

This option should always be checked. A message will be displayed if errors in the internal structure are encountered.

3.10 DEFAULT DATABASE ORDER

The databases have an in-built ordering system that determines the order items are displayed in the Database Editor and drop down list in IRRICAD. This is set out in Default Database Order, Section 6.4.1 to help you understand the ordering of items in each component group. Items in each component group are ordered alphabetically or numerically in ascending order based upon each of the fields below in turn. For example, Controllers are ordered numerically by the [Order] field then alphabetically by [Description] and so on.

Note that the [order] field is an internal one that is not available in the IRRICAD Database Editor. It can, however, be accessed via Microsoft Access. By default, the order field for all items is the same and therefore has no effect. If you wish to give the order field another number to change the ordering, you can do so in the column labeled Order Number. To do this follow the steps below:

1. Open the database in Microsoft Access (you must have MS Access installed). You can do this by double-clicking on the mdb file in Explorer.
2. Select Components and click Open
3. Scroll to the right-hand side. This last column is titled Order. All items have the same order number (10,000).
4. Find the item you require to be at the top of the items in your component group. Give this item an order number less than 10,000 (e.g. 1, 2, 3 etc). You can start at the same re-numbering for each of the component groups.
5. Close the database and exit MS Access.

The order of the fields can be changed in the registry of IRRICAD. Select *Start|Run* and type Regedit. Open HKEY_CURRENT_USER and then Software. Open AEI Software and then IRRICAD. Open Database Settings and double-click on Sort Order. On the right-hand side you will see the component groups and their ordering. If you double-click on the icon to the right of the component group a dialog will appear and the fields can be re-ordered. Be careful to retain the square brackets and commas in the correct place when moving the fields.

For example:

Pipes are ordered by:

"[Order],[Major1],[Reals1],[Reals4],[Description]"

The order number is the same for all items unless you have modified this number in MS Access. I suggest you leave [Order] in first place. However, if you wish pipes to be ordered on Description next, copy and cut the [Description] (Ctrl+X) and paste (Ctrl+V) after [Order] so now the value will read:

[Order],[Description],[Major1],[Reals1],[Reals4]

Click OK and close the Registry Editor.

3.11 GLOBALLY UPDATING PRICES IN THE DATABASE

Go into Windows Explorer and take a copy of the database you wish to change and place it elsewhere as a backup. Now double-click the database to open it in MS Access.

In the dialog select the Query tab. Click the New button in this dialog. Select Design View. In the Show Table dialog select Components and click the Add button. Close the Show Table dialog.

Example: Increase wholesale costs and retail prices by 6%.

Select Query from the menu bar on the main Access Window. Select the Update Query option from this menu. In the new dialog select Reals7 (Wholesale Cost) from the dropdown list for Field. For Update to: type `[Reals7] * 1.06`

Note: Reals7 must be in square brackets, the times sign must be the star above the number 8 on the keyboard, 1.06 says you wish to update the field by increasing the current value by 6%

In the next column across you can repeat the same for Reals8 (Retail Price) e.g.

Field:	Reals7
Table:	Components
Update to:	<code>[Reals7]*1.06</code>

Field:	Reals8
Table:	Components
Update to:	<code>[Reals8]*1.06</code>

For the Criteria you can add things like `[Supplier Code]=SUP1` for example or `[Database Number]=1` where 1 is the pipes database number (see the Components table).

Note: Anything listed in the little dialog labeled Components which stays with the Query Table can be used for the Criteria (make sure it is spelled the same and inside square brackets)

Click on the cross to close the query table dialog. It will ask you to save it. If you have written something wrong it will either tell you here or when you run the query - read any messages it gives you.

Highlight Components in the Tables tab and click Open. Note down some prices in Reals7 (Wholesale Cost) and Reals8 (Retail Price). Click Close (X) on the Components table and click on the Query tab. Double-click on the query you have just created. Read any messages before clicking Yes or OK. The prices have been updated.

3.11.1.1 FIELDS:

Major1	pipe type (pipes) or inlet / major connection type
Minor1	outlet / minor connection type
Reals1	nominal diameter, min submain diameter (LTOs), inlet / major diameter (valves, misc. hyd., couplers, tees, pumps, outlets), radius equation constant (nozzles), size/diameter 1 (misc. items)
Reals2	actual (internal) diameter, lateral diameter (LTOs), outlet / minor diameter (valves, misc. hyd., couplers, tees, pumps) bend angle (elbows & bends), radius equation index (nozzles), size/diameter 2 (misc. items)
Reals3	pipe roughness or constant (valves, misc. hyd.) minor diameter (elbow & bends), A factor (pumps), arc (nozzles)
Reals4	allowable pressure (pipes, tapes) or index (valves, misc. hyd.) B factor (pumps), constant (nozzles)
Reals5	intercept (valves, misc. Hyd.) C factor (pumps), index (nozzles)
Reals7	wholesale cost
Reals8	retail price
Rextra1	minimum flow m ³ /h (valves, misc. hyd., pumps), default pressure (outlets), minimum pressure (nozzles)
Rextra2	maximum flow m ³ /h (valves, misc. hyd., pumps), default watering arc (outlets), maximum pressure (nozzles)
Rextra3	flow tolerance above (outlets)
Rextra4	flow tolerance below (outlets)

4 Tutorials

4.1 INTRODUCTION TO DESIGN TUTORIALS

The purpose of these tutorials is to have you enter a small, yet complete irrigation system, have it designed and costed, and the plans prepared. You will simply be asked to do things. Explanation as to "why?" will be limited - enough to let you know what is going on without getting involved in alternatives. The intention is to illustrate how IRRICAD works and to do this as simply as possible. Consequently, the layout used has been devised with this in mind and the siting of some componentry may not be ideal from an irrigation designer's viewpoint.

There is no rigidly prescribed method of carrying out IRRICAD designs; you should use these examples as a guide only and try to develop a procedure which best suits your situation.

Only those options needed to produce these designs are described. References to the user guide are made where appropriate.

The exercises in this manual are set up to show specific features of IRRICAD, so please complete each section even if the type of design is not in your general line of work. Work through the exercises at your own pace and please feel confident with each exercise before moving on to the next one. These exercises can be completed at an IRRICAD training course or at your own computer in your office.

The databases that are necessary for the tutorials are supplied with the program.

When directed to select a command from a menu, the menu name, menu option and sub menu option (if applicable) will be listed. For example, select *Settings|Digitizer|Scale*. This refers to selecting the Scale option from the Digitizer submenu that is found in the Settings menu. The Settings menu is found on the Menu bar at the top of the IRRICAD window.

4.1.1 HELPFUL HINTS

Before you begin any designs on your own, please note the following.

4.1.1.1 TERMINOLOGY

Designs in IRRICAD consist of Mainline Pipes (pipes connecting a water supply or water supplies to Zone Valves), Zone Pipes (pipes connecting Zone Valves to laterals or outlets, e.g. submains), and Spraylines (equivalent to laterals).

Block (an option in the Zone menu) is an option for laying out an area of equally spaced spraylines, nothing more. Use of Block does define an irrigation block.

A Zone becomes defined when a Zone Control Valve is entered and Zone Pipes, Spraylines and / or Outlets are connected to it, i.e. it depends on what is connected downstream of the Zone Control Valve.

This means that Block may be used to layout all of the spraylines for a design at one time. The Spraylines may then be modified using *Tools|Cut Lasso* to remove areas that are not required, *Tools|Delete* to take out unwanted rows and so on. The Zones only become defined when these Spraylines are connected to Zone Control Valves.

The tutorials have been written in US units. Metric units have been supplied in brackets. When a measurement appears in US units it will be followed by the metric units for the task e.g. 825 (250) where 825 is the measurement in feet and 250 is the measurement in meters. Sometimes the units will also be specified e.g. 825ft (250m) but only the number should be entered not the units.

4.1.1.2 ON-LINE HELP

The on-line Help is available through the Help menu. Select Help Topics. It contains all the topics and chapters available in the manual and is divided into five main divisions:

- The Overview contains the differences between Version 6 and 7. As each option in Version 6 is listed, a corresponding reference is given to find the option in Version 7.
- The User Manual describes how approach a particular task, using IRRICAD tools and options.

- The Database Editor section describes the function of the database and how to enter hydraulic items into the database.
- The Tutorials section contains tutorials you can run through to help you become familiar with the program.
- The Tool and Command Reference goes through each menu item and describes how to mechanically use the tool. Each menu is a chapter heading.

The Help menu may also contain an option called Release Notes. This will contain all features added to later versions of IRRICAD 7 since the manual was printed. It is laid out in the same format as the Tool and Command Reference, with each menu being a Chapter heading. If an explanation of how to use an item is not present in the Help Topics, refer to the Release Notes.

Use Search or Find to enter a key word and find the sections the key word appears in.

4.1.1.3 TUTORIALS

It is a good idea to run through a few of the tutorials when first learning IRRICAD 7. The tutorials will describe a number of the new tools and options using a step by step process. Though you may know how to use IRRICAD for design purposes, the tutorials help you to navigate around the new program and help you to develop a process for the new version. There are more tutorials available in the manual and the on-line help. The tutorials may also give you a fuller picture of IRRICAD's capabilities and introduce new features and functions for you to try.

4.1.1.4 USING THE INTERNET

Upgrades are currently available from our website (www.IRRICAD.com). You are able to download and upgrade your current version of IRRICAD if you have Version 7.165 or later. If you have an older version of IRRICAD please contact your distributor for the upgrade.

Email contact is available on the website. Email us any requests of what you would like to see in IRRICAD in the future.

For any support, please contact your distributor.

4.1.2 THE FIRST STEPS

To start a design:

1. The first thing to do is to select the database to use for this design. Go to *Settings|Irrigation - Design Specific* and browse for the Version 7 database you want to use for the design. When you save the design, IRRICAD remembers what database was used to create it, so if the database is moved, IRRICAD will warn you when you reload the design. If you want to set this database as the default database (that is, it will be the databases IRRICAD will always start up with) then click the Save as Default button in the *Settings|Irrigation - Design Specific* dialog.
2. Design headings can be entered at any time. However, it is a good idea to include these at the beginning to avoid confusion if several copies of the base design are made. Select *Settings|Design Details* and *Settings|Client*.
3. Your company information is also important and can be saved for use with future designs. Select *Settings|Company* and after entering your company details click the Save As Default button.
4. Customize IRRICAD for future designs. Select *Settings|Irrigation - Design Specific* if to customize the pipe line widths. Select *Settings|Irrigation Items* to customize other hydraulic symbols. If a Save As Default button is present, you need to click this to retain the settings for all future designs.
5. Select *Settings|Units* to select the units to use for each dimension.
6. If you know how large your design will be, you can select a Design size from *Settings|Miscellaneous*. This option gives the symbols on the screen an appropriate symbol size relative to the area the design covers. It can be altered at any time during the design by selecting another design size or typing in a base database symbol size. Note if the Update database Symbols checkbox is checked, all symbols currently on the screen will be updated to the new size. Select a size where the symbols are recognizable in the design.
7. You are now ready to enter your design. All Management and Design options are available from the Design menu. All Zooms are available from the View menu. Remember if you cannot find something, use Find or Search in the *Help|Help Topics* to locate which menu it is in.

Remember that you can enter items and information at any time and in any order. Make sure only Mainline items are used upstream from a

control valve, and only zone items are used downstream from a control valve.

You must tell IRRICAD how the system is to operate before you can design the system. Select one of the management options from the Design menu: Assign System Flows to Zones (or one of the two partly automated options) or Zone Operating Times.

Design the zones first (*Design|Zone Design|...*) then analyze the valve (*Design|Valve Analysis*) before designing the mainline (*Design|Mainline Design|...*).

Happy Designing!

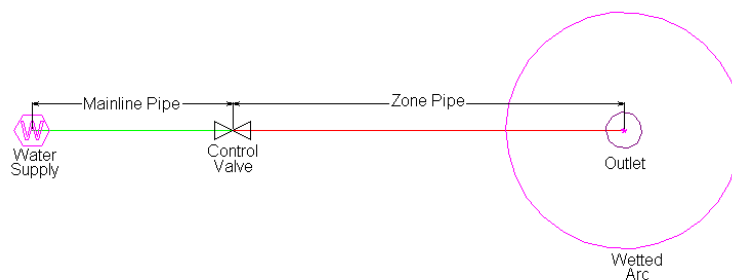
4.2 BASIC START

4.2.1 VERY BASIC INITIAL DESIGN

Tasks covered in this tutorial:

- Zone and mainline items
- Drawing a simple system
- Turning valves on
- Sizing pipes based on required pressures
- Reading reports

This design takes you through the very basic concepts of an IRRICAD design. Understanding these concepts and principles and applying them to larger more complex designs means that you can now use IRRICAD for any type of design you wish to.



4.2.1.1 STARTING THE TUTORIAL

Double click on the Irricad icon or select *Start|Programs|Irricad|Irricad* to start IRRICAD. If already running IRRICAD select *File|New* to start with a clean screen. In *Settings|Irrigation – Design Specific* browse for the tutorial database Tutorial.mdb. This should be found in the \\Irricad\\database folder. Highlight Tutorial.mdb and click Open. Go to the Units click the US (Metric) button to restore the default units for this tutorial. Select the Miscellaneous tab (Misc) and click select the Medium Design Size (centre of dialog). Click OK.

4.2.1.2 DRAWING THE LAYOUT OF THE SYSTEM

Select *Mainline|Water Supply* and place the water supply on the screen, near the left-hand side. Leave the entries as 0, so that IRRICAD will calculate the system duty for the system you draw. Click OK to accept and close the dialog.

Select *Mainline|Pipe*. Leave the pipe as Computer Selected so that IRRICAD will select the pipe size for you. Click OK and click in the centre of the water supply to place the start point of the pipe (left click on the screen). The pipe will rubberband with the cursor until you place the end point or next point of a pipe (if the pipe is bent). The pipe tool is like a continuous line tool and will rubberband between points until you end the pipe by selecting Restart from the right click menu (*Right-Click|Restart*).

Between mainline and zone items there always needs to be a control valve – upstream from the control valves are always Mainline items and downstream from the control valve are always Zone items. You can select a control valve from either the Mainline or the Zone menu (*Mainline|Control Valve or Zone|Control Valve*). Select the ¾" (20mm) Electric Valve, click OK and place it on the black junction at the end of your mainline pipe. Once placed, IRRICAD will assign a default name of Zone no. 1 to this control valve because valves need to be identified. This can be changed if required. Click OK.

Now select *Zone|Pipe*. Leave the pipe as Computer Selected, click OK and place the start point on the control valve. Click to place the end point of the zone pipe. When you have completed your zone pipe, select *Right-Click|Restart*.

Select *Zone|Outlet*. Select the Big Impact Drive Sprinkler. In the Nozzle field you can select the nozzles associated with this sprinkler. Select the 4.9 nozzle. Leave the pressure and flow as the default values. Click OK and place the outlet on the end of the zone pipe in the center of the black junction. The black junction will disappear when the outlet connects to it.

We have drawn the layout of the system, selected valves and sprinklers and allowed IRRICAD to select pipe sizes and calculate the required system duty.

4.2.1.3 THE DESIGN PROCESS

You are now ready to proceed with Design.

CHECKING CONNECTIONS

First, select *Design|Check Outlet Connectivity*. If everything is connected, proceed with Design. This tool is optional but is recommended for new users and for complex designs.

If you are receiving messages that outlets are not connected to valves, check you cannot see a black junction where the outlet, control valve or water supply connects to the pipes (use *View|Zoom Window* and drag a window where you want to zoom in). If you see a black junction at either of these points, it is because the valve, water supply or outlet is not connected to the pipe. Select the valve, water supply or outlet (*Tools|Select Object* and click on the item) and move the item to the centre of the junction (*Tools|Move* and click on the item). The junction will disappear when the item is connected to a pipe. If you are still having trouble with the connection, check the default snap mode in *Settings|Snap* is 'Connect'. Another reason items might not connect is that you are trying to connect zone items on to mainline items or vice versa. Remember a control valve is required between zone and mainline items.

MANAGEMENT

IRRICAD needs to know how the system is to run. We call this Management and there are several ways to do this task. Management gives us the ability to turn valves on and off. To turn one valve on the simplest option is to select *Design|Assign All Zones to One System Flow*. This option is automatic. IRRICAD assigns Zone no. 1 to operate on System Flow 1. Click OK.

ZONE DESIGN

Now we can analyse the zone and size the zone pipe. You will see that the Zone Design menu has four options in it. *Analyse* is used when you have selected the pipe sizes or after you have made further changes to the design. *LP Design* is used when you wish to size zone pipes based on the pressure required at the outlets. *Velocity Design* is used when you wish to size pipes based on the maximum velocity allowed or when the pipes are looped. *Detailed Analysis* is used at the end of design as IRRICAD adjust the flow at each sprinkler based on the pressure at

each sprinkler to give a more accurate picture than nominal calculations can.

Select *Design|Zone Design|LP Design*. You should see the pipe change colour. The colour for pipes is stored in the database. If the pipe selected has the same colour as the computer selected pipe you will not see a colour change.

VALVE ANALYSIS

Now we need to calculate the pressure loss through the control valve. Select *Design|Valve Analysis*. This is usually very quick, and though it doesn't seem to do anything, it has! IRRICAD also checks the flow through the valve is within the manufacturers' specification for that valve.

MAINLINE DESIGN

We can now size the mainline. You will notice the same four options here are the same as were available in the Zone Design submenu. The only differences are that LP Design will size pipes based on the control valve required pressure and that Velocity Design must be used if the system has more than one water supply.

Select *Design|Mainline Design|LP Design*. You should see the pipe change colour. The colour for pipes is stored in the database. If the pipe selected has the same colour as the computer selected pipe you will not see a colour change.

4.2.1.4 REPORTING

Select *Reports|Design Reports|Zone Summary*. This report summarises what is happening in the zone – from the outlets to the control valve as seen in Figure BB1.

Possibly the most useful reports are the Full and Pipe reports. The Full report will tell you the length of a pipe, its head difference and its velocity (as seen in Figure BB2) whereas the Pipe report will tell you the pressure in the pipe and elevation of the start and end point. Both reports will tell you the size of pipe and flow in the pipe.

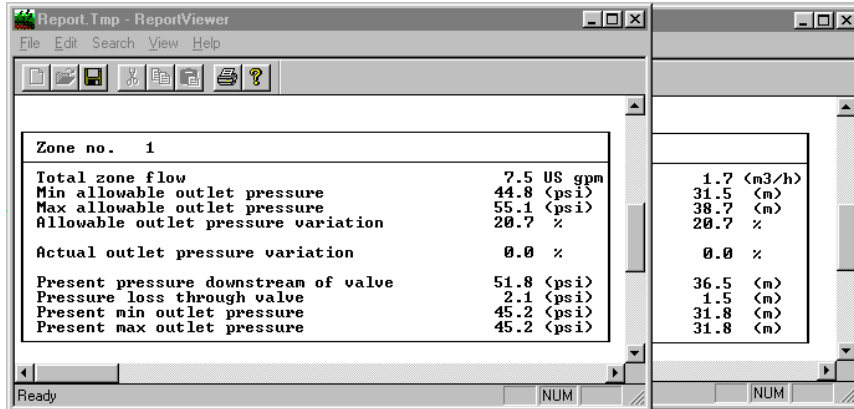


Figure BB 1

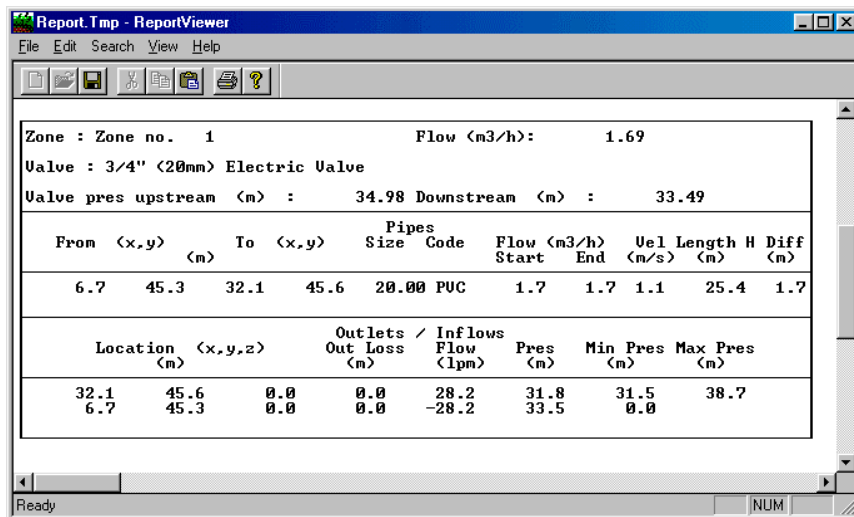


Figure BB 2

Now open the *Reports|Design Reports|System Duty* report. Here we see the system duty IRRICAD calculated for running the system you have designed (Figure BB3).

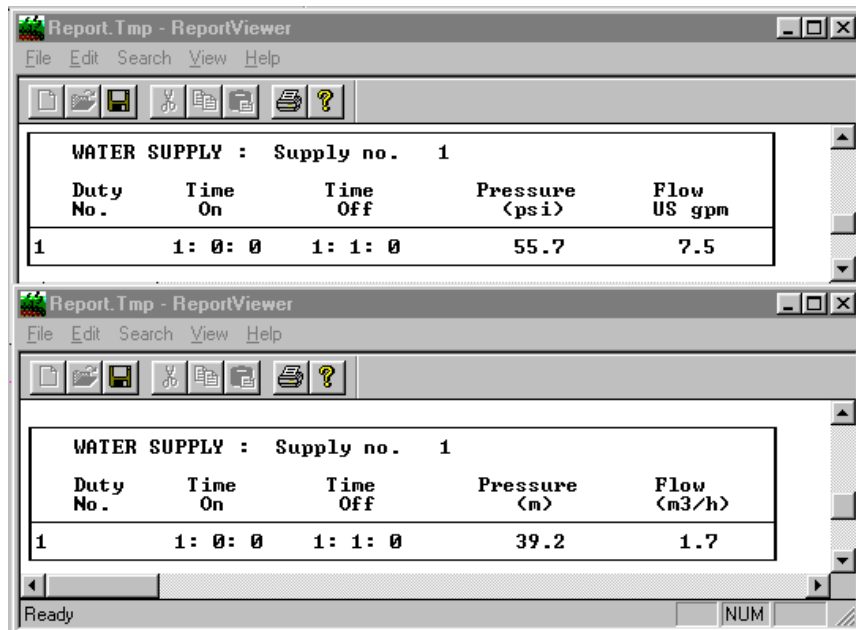


Figure BB 3

Tasks completed during this tutorial:

- Zone and mainline items
- Drawing a simple system
- Turning valves on
- Sizing pipes based on required pressures
- Reading reports

4.2.2 IMPORTANT RULES TO REMEMBER

There are two main rules for IRRICAD. Neither can be broken, and if you remember them then designing with IRRICAD is made easier.

1. You cannot connect zone items to mainline items. Only a control valve can join zone and mainline
2. The order in which you draw items is flexible but Design is not. You must first tell IRRICAD how the system is to run, then design the zone, analyse the valves and then design the mainline as listed below:

4.2.2.1 LISTING THE PROCESS FOR DESIGNING WITH IRRICAD

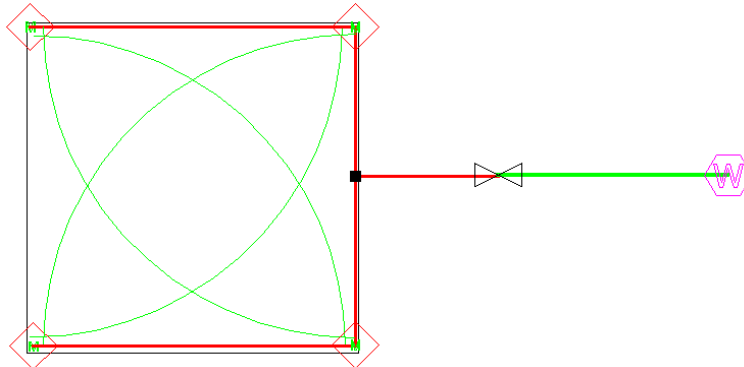
1. Enter background information
2. Layout the irrigation system
3. Management – tell IRRICAD how the system is to run – what zones are operating when
4. Design and Analyse – Zone, Valve and Mainline
5. Reports

4.2.3 A SIMPLE TURF DESIGN

Tasks covered in this tutorial:

- Zone and mainline items
- Drawing simple background information
- Setting pipe line widths
- Drawing a simple turf system
- Setting required outlet pressures
- Selecting outlet connectors (risers)
- Resizing symbols to suit design size
- Using the Change tool
- Orientating arcs manually
- Turning valves on
- Sizing pipes based on pressure
- Reading reports

This tutorial is to show a simple method for laying out several sprinklers and connecting them to the water supply. It is for demonstration purposes only and hence is of a small size.



4.2.3.1 GETTING STARTED

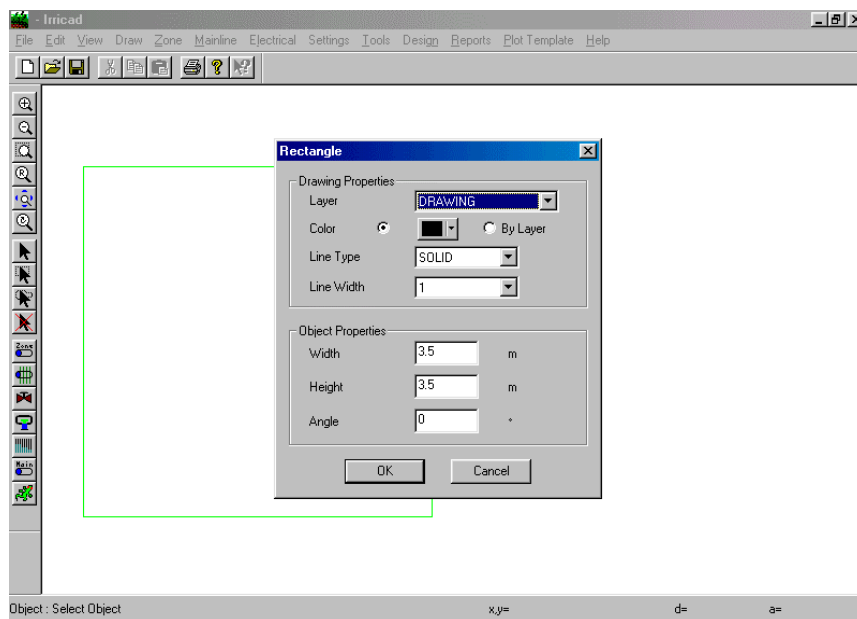


Figure ST 1

Double click on the Irricad icon or select *Start|Programs|Irricad|Irricad* to start IRRICAD. If IRRICAD is already running select *File|New* to start with a clean screen. In *Settings|Irrigation – Design Specific* browse for the Tutorial database in the database folder. Highlight Tutorial.mdb and click Open. In the same dialog change the zone pipe width to 2 and the mainline pipe width to 3. Go to the Units click the US (Metric) button to

restore the default units for this tutorial. Note Metric measurements are displayed in brackets.

In the previous tutorial we did not draw in any background information. This is not usual, as in most cases you need to have the area, fence lines etc laid out before you can draw the system. We will enter some basic background information in this design. Select *Draw|Rectangle|2 Point* and place the first point on the screen by left clicking. Draw the cursor out and click again to place the opposite corner of the rectangle (the second point). Select *Tools|Change* and click on the boundary of the rectangle. In the dialog change the width and height to 11.5ft (3.5m) as in Figure ST1. Click OK. Select *View|Zoom All* then *View|Zoom Out*.

4.2.3.2 LAYING OUT THE SYSTEM

Select *Mainline|Water Supply* and place the water supply to the far right of the square, some distance away. Left click to place. In the dialog leave all the fields as 0. Click OK. Select *Settings|Miscellaneous* and type in 1.6 (0.5) for the Base Database Symbol Size. Click OK. The symbols on the screen will now appear smaller.

Select *Zone|Outlet*. In the dialog select the Garden Spray Sprinkler as the Sprinkler by clicking on the down arrow and highlighting the required item. The Nozzle field will show the 10 garden Nozzle. Change the pressure to 28psi (20m) and the arc to 90°. In the Riser field select the ½" x ½" (15 x 15mm) Flexible Swing Joint. This is how the sprinkler is to connect to the pipe. Click OK. Place an outlet at each corner of the square by left clicking. You will notice that the arcs are not oriented to water inside the square. We will manually fix this by selecting *Tools|Change* and clicking on a wetted arc. In the dialog change the Start Angle to be 0, 90, 180 or 270 (bottom left = 0, top left = 270, top right = 180 and bottom right = 90). Click OK. Repeat for each arc so that it looks similar to Figure ST 2.

Connect the outlets by using *Zone|Pipe* and clicking on each item to connect to the pipe. Start at the top left outlet then the top right, then the bottom right and last the bottom left. Select *Right-Click|Restart*. Select *Right-Click|Snaps|Midpoint* and click on the pipe joining the top right sprinkler and the bottom right sprinkler. Draw this pipe out a little to the right about half way towards the water supply. Left click to place the end point of this pipe then select *Right-Click|Restart*.

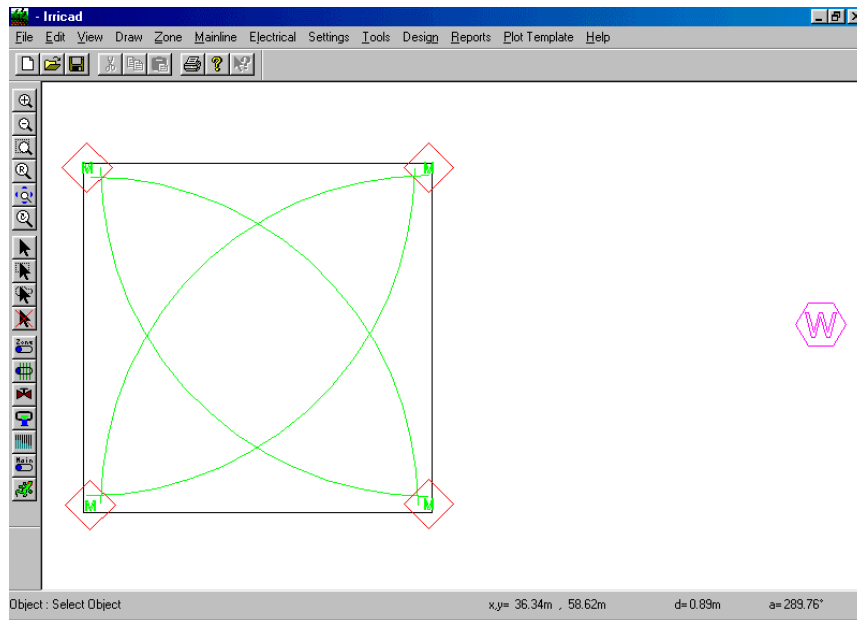


Figure ST 2

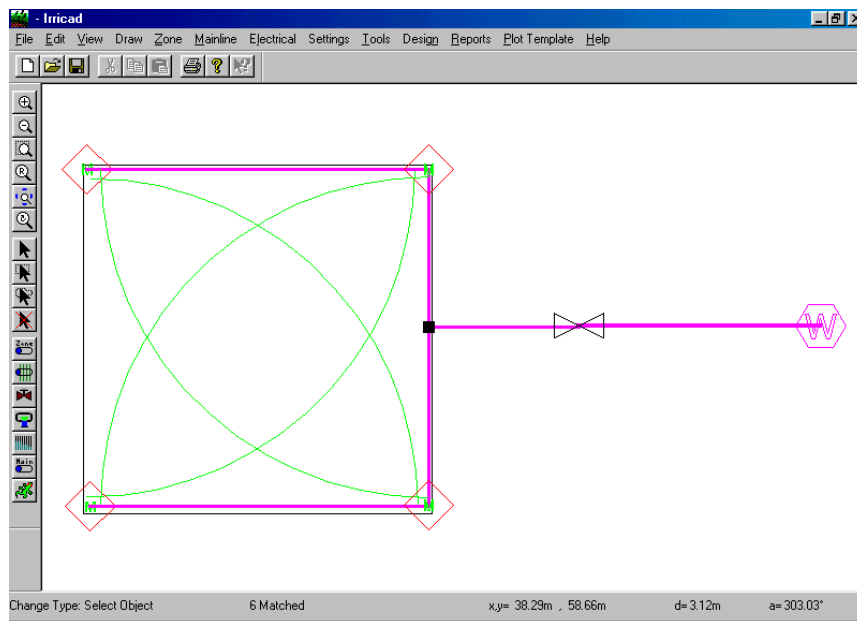


Figure ST 3

Select *Zone|Control Valve* and select the 1" (25mm) Electric Valve. Place the valve on the zone pipe end. Select *Mainline|Pipe* and left click on the valve, then left-click on the water supply. Select *Right-Click|Restart*. See Figure ST 3.

4.2.3.3 THE DESIGN PROCESS

You are now ready to proceed with Design.

CHECKING CONNECTIONS

First, select *Design|Check Outlet Connectivity*. If everything is connected, proceed with Design.

If you are receiving messages that outlets are not connected to valves, check you cannot see a black junction where the outlet, control valve or water supply connects to the pipes (use *View|Zoom Window* and drag a window where you want to zoom in). If you see a black junction at either of these points, it is because the valve, water supply or outlet is not connected to the pipe. Select the valve, water supply or outlet (*Tools|Select Object* and click on the item) and move the item to the centre of the junction (*Tools|Move* and click on the item). The junction will disappear when the item is connected to a pipe. If you are still having trouble with the connection, check the default snap mode in *Settings|Snap* is 'Connect'. Another reason items might not connect is that you are trying to connect zone items on to mainline items or vice versa. Remember a control valve is required between zone and mainline items.

MANAGEMENT

IRRICAD needs to know how the system is to run. We call this Management and there are several ways to do this task. Management gives us the ability to turn valves on and off. To turn one valve on the simplest option is to select *Design|Assign All Zones to One System Flow*. This option is automatic. IRRICAD assigns Zone no. 1 to operate on System Flow 1. Click OK.

ZONE DESIGN

Now we can analyse the zone and size the zone pipe. Select *Design|Zone Design|LP Design*. You should see the pipe change colour. The colour for pipes is stored in the database. If the pipe selected has the same colour as the computer selected pipe you will not see a colour change.

VALVE ANALYSIS

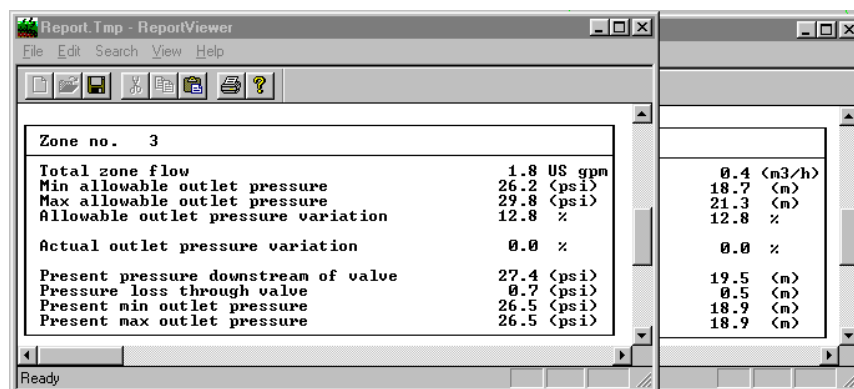
Now we need to calculate the pressure loss through the control valve. Select *Design|Valve Analysis*. This is usually very quick, and though it doesn't seem to do anything, it has! IRRICAD also checks the flow through the valve is within the manufacturers' specification for that valve.

MAINLINE DESIGN

We can now design the mainline. Select *Design|Mainline Design|LP Design*. You should see the pipe change colour. The colour for pipes is stored in the database. If the pipe selected has the same colour as the computer selected pipe you will not see a colour change.

4.2.3.4 REPORTING

Select *Reports|Design Reports|Zone Summary*. This report summarises what is happening in the zone – from the outlets to the control valve as seen in Figure ST4.



Zone no. 3	
Total zone flow	1.8 US gpm
Min allowable outlet pressure	26.2 (psi)
Max allowable outlet pressure	29.8 (psi)
Allowable outlet pressure variation	12.8 %
Actual outlet pressure variation	0.0 %
Present pressure downstream of valve	27.4 (psi)
Pressure loss through valve	0.7 (psi)
Present min outlet pressure	26.5 (psi)
Present max outlet pressure	26.5 (psi)

Figure ST 4

The total zone flow is reported. The minimum and maximum allowable outlet pressures are calculated based on the pressure entered in the Outlet dialog and the flow tolerance specified for the Garden Spray Sprinkler in the database. This tolerance allows a pressure variation of 12.8%. The actual outlet pressure variation in this system is 0%. IRRICAD calculates the required valve pressure (downstream from the valve) and the resulting minimum and maximum outlet pressures in the zone.

Tasks completed in this tutorial:

- Zone and mainline items
- Drawing simple background information
- Setting pipe line widths
- Drawing a simple turf system
- Setting required outlet pressures
- Selecting outlet connectors (risers)
- Resizing symbols to suit design size
- Using the Change tool
- Orientating arcs manually
- Turning valves on
- Sizing pipes based on pressure
- Reading reports

4.2.4 METHODS TO LAY OUT SPRINKLERS

These tutorials take a look at the different methods of laying out sprinklers. There are three main methods.

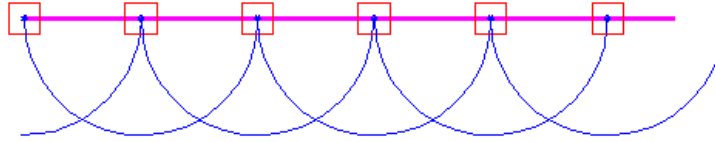
- Placing sprinklers singly (as shown in the previous tutorial – A Simple Turf Design)
- Placing sprinklers at a fixed spacing or even spacing along a pipe length
- Automatically placing sprinklers in irregular areas

Before we look at these methods it is handy to point out that you do not need to orientate each part circle arc manually. The previous tutorial showed the manual method of orientating the arcs after placement as there were few sprinklers and the required orientation was easy to work out. The method to automatically orientate arcs is to use the hydraulic tool Area (short for Irrigation Area). This tool will be explained when we look at the different ways to layout sprinklers.

4.2.4.1 PLACING SPRINKLERS AT A FIXED SPACING

Tasks covered in this tutorial:

- Drawing simple background information
- Orientating arcs automatically
- Drawing pipe and fixed spaced sprinklers in one action
- Snapping to a point



This method allows pipe and sprinklers to be placed in one action, and the spacing to be set for the sprinklers.

Draw a rectangle 82 x 49ft (25 x 15m) on the screen using *Draw|Rectangle|2 Point*. You can draw out the rectangle any size and then select *Tools|Change* and click on the border of the rectangle. Edit the Width to be 82ft (25m) and Height to be 49ft (15m).

Select *Mainline|Water Supply* and place the water supply to the right of the rectangle. Leave the fields at 0. Click OK. Select *View|Zoom All*.

Select *Zone|Area* and draw a lasso around the outside of the rectangle by clicking at each point you wish to change direction. To close the boundary select *Right-Click|Close*. In the dialog make sure the Set Arc Orientation Using Area check box is checked. See Figure M1.

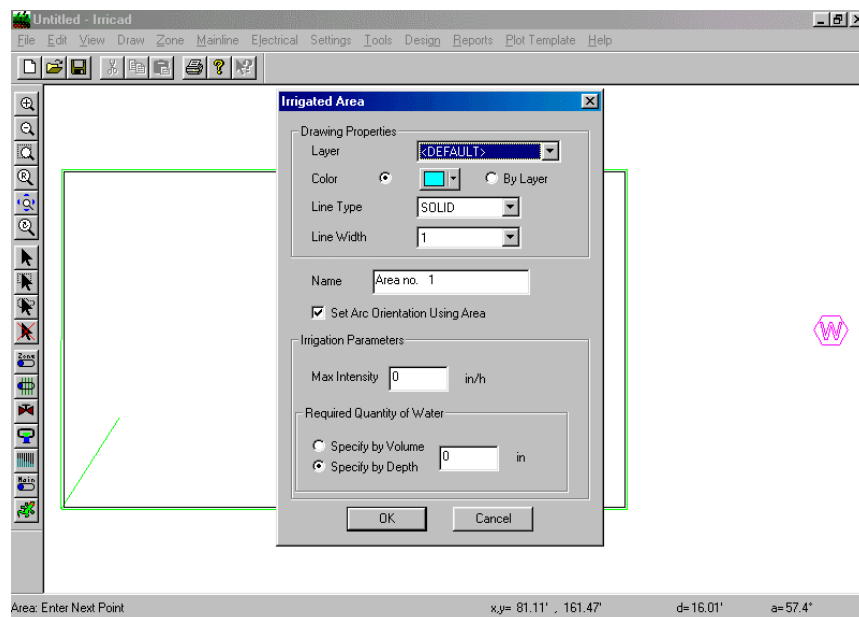


Figure M 1

Select *Zone|Sprayline* and leave the pipe as Computer Selected. Select the Low Flow Garden Sprinkler as the sprinkler. This sprinkler has only one nozzle (Low Flow Nozzle) which will automatically appear in the Nozzle field. Leave the pressure as the default pressure of 29.869psi (21m). Leave the Riser field as No Component Selected and enter 14.5ft (4.5m) as the Outlet Spacing (for head-to-head spacing). Uncheck the Connected check box, as we want these items to be treated as separate outlets and pipes. Click OK.

Select *Right-Click|Snaps|Endpoint* and click on the top left corner of the rectangle. Select *Right-Click|Snaps|Endpoint* again and click on the top right corner of the rectangle. Select *Right-Click|Restart*. A line of pipe has been drawn with the sprinklers at fixed spacing. Starting from the left-hand side draw another line so that the pipe will touch the extents of the wetted radii from the previous line of outlets as in Figure M2.

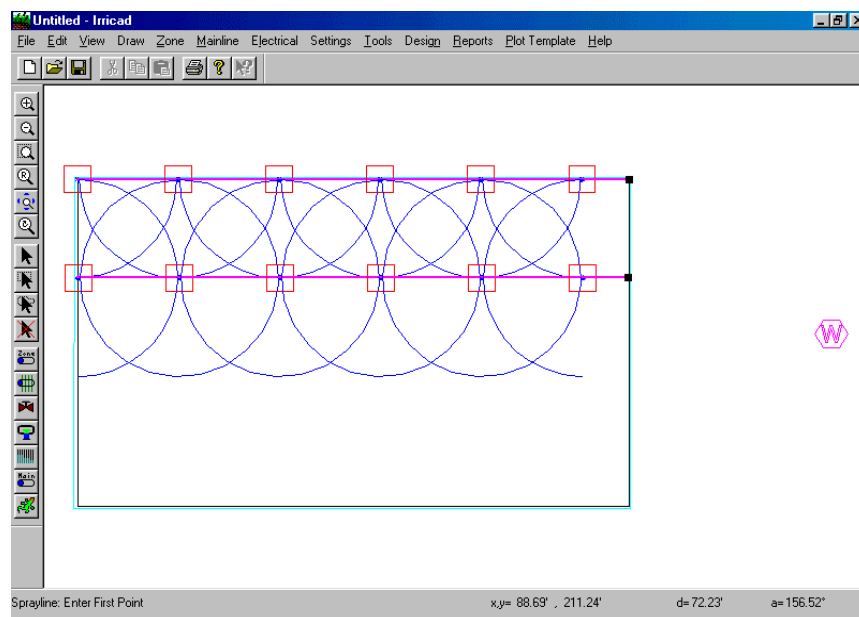


Figure M 2

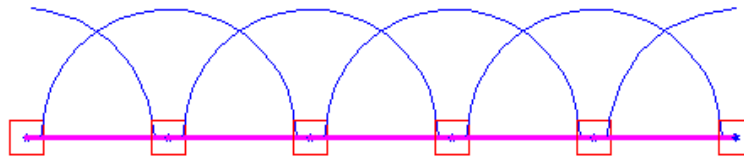
Tasks completed in this tutorial:

- Drawing simple background information
- Orientating arcs automatically
- Drawing pipe and fixed spaced sprinklers in one action
- Snapping to a point

4.2.4.2 EVEN SPACING ALONG A PIPE LENGTH

Tasks covered in this tutorial:

- Drawing simple background information
- Orientating arcs automatically
- Drawing pipe and spaced sprinklers in one action
- Snapping to a point



This method is similar to above but allows the sprinklers to be the same distance apart but not at a fixed spacing. This method uses the length of the sprayline drawn (i.e. the length of pipe) and places a sprinkler at the start of the line and a sprinkler at the end of the line with other sprinklers the same distance apart aiming to be approximately the spacing you have specified.

Start the above tutorial (Placing Sprinklers at a Fixed Spacing). Select *Zone|Sprayline*. This tool should remember the sprinkler, nozzle, pressure and outlet spacing from before. Click the Options button and uncheck the Fixed Spacing check box. Click OK on both dialogs.

Select *Right-Click|Snaps|Endpoint* and click on the bottom left corner of the rectangle. Select *Right-Click|Snaps|Endpoint* again and click on the bottom right corner of the rectangle. Select *Right-Click|Restart*. A line of pipe has been drawn with the sprinklers at fixed spacing. Starting from the left-hand side draw another line so that the pipe will touch the extents of the wetted radii from the previous line of outlets as in Figure M3.

IRRICAD determines that the sprinklers can only water within the Area lasso, which is outside the rectangle boundary. IRRICAD will select the appropriate arc in most cases, depending on placement of the sprinkler. Any arcs watering outside the Area can be altered by using *Tools|Change*. Click on the wetted radii and adjust the Include Angle as described in the above tutorial (A Simple Turf Design).

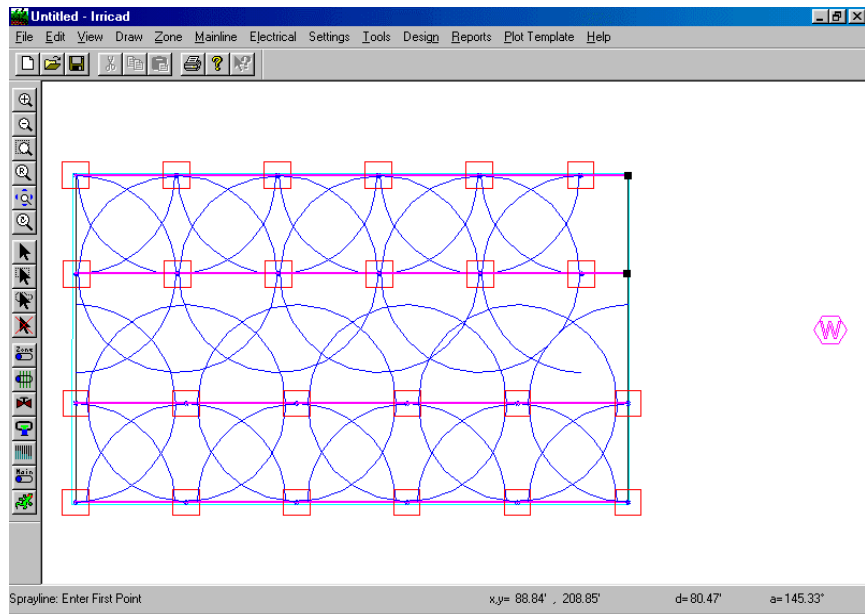


Figure M 3

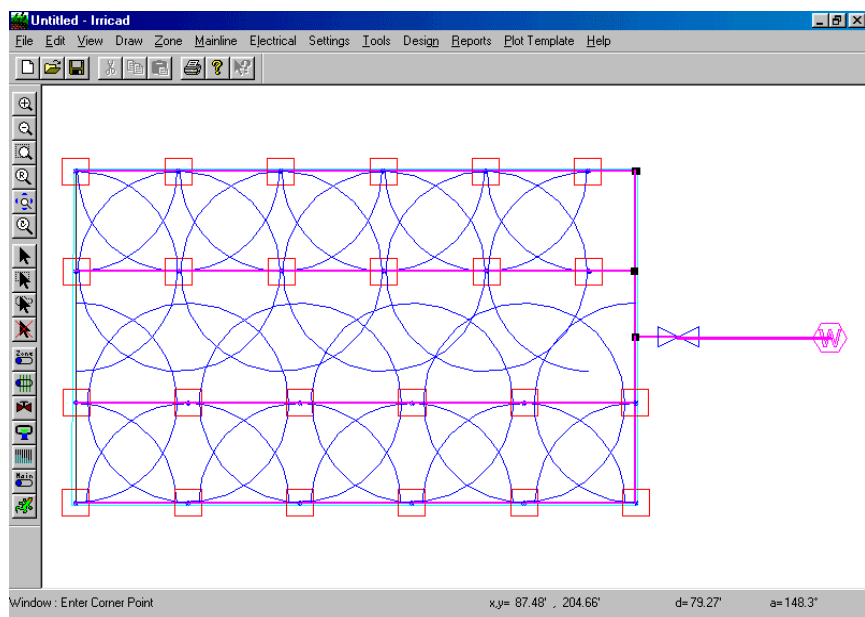


Figure M 4

Connect the spraylines together with zone pipe. Select a 1" (25mm) valve and connect the valve to the zone pipe end. Select *Mainline|Pipe* and connect the valve to the water supply to complete the system. See Figure M4. Follow the same design procedure as in the previous tutorials.

The sprayline method can be used as a tool to place sprinklers evenly and the pipes deleted if the pipes are required to run a different way. This tool can also be used without the Area tool, without having the arcs or wetted radii showing, without using Snaps and can be used in any application where even spacing or fixed spacing of outlets is required. It can be used in conjunction with Grid, Snap to Grid or Circular Cursor as placement aids.

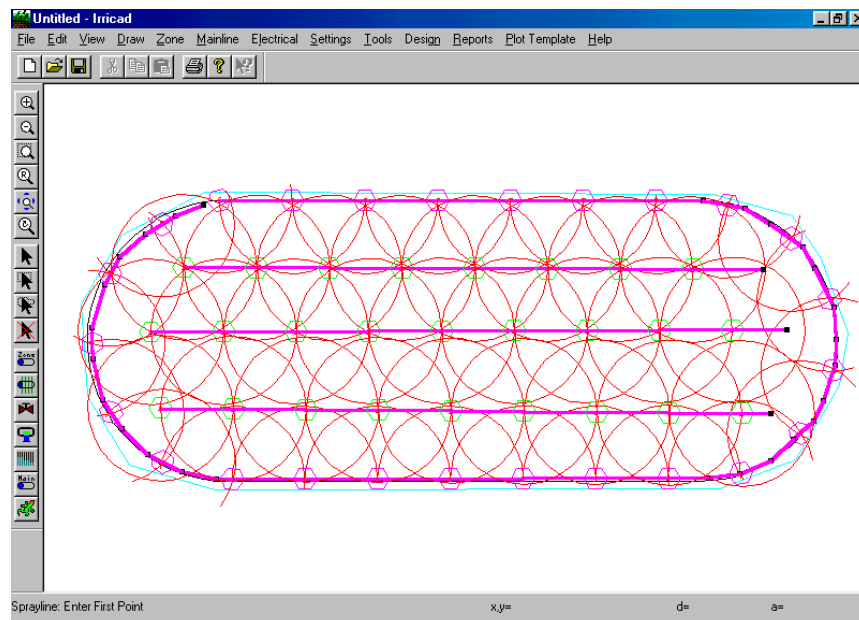


Figure M 5

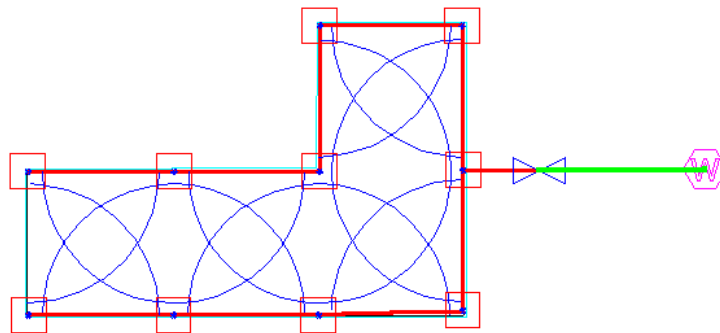
Tasks completed in this tutorial:

- Drawing simple background information
- Orientating arcs automatically
- Drawing pipe and spaced sprinklers in one action
- Snapping to a point

4.2.4.3 AUTOMATICALLY PLACING SPRINKLERS IN IRREGULAR AREAS

Tasks covered in this tutorial:

- Drawing simple background information
- Orientating arcs automatically
- Automatically determining spacing and arcs in an area
- Moving an item
- Connecting pipe to more than one item quickly



The third method for placing sprinklers is using a tool called Autohead. Autohead is normally used for small irregular areas.

Autohead tries to maintain a uniform precipitation over the area. Because of this best results are achieved when matched precipitation sprinklers or fixed sprinklers with a combination of nozzles for the different arcs are used. *Zone|Area* is used alongside Autohead to orientate the wetted arcs.

Select Draw|Polygon|Irregular. Place the first point in the lower left of the screen. Hold the Control key down and move the cursor upwards. Let go of the mouse and type 16 (5) on the keyboard and press Enter. Now hold the Control key down again and move the cursor to the right to achieve a straight horizontal line. Let go of the mouse and type 33 (10) and press Enter on the keyboard. Using this method continue to draw another line upwards for 16ft (5m), to the right for 16ft (5m), down for 33ft (10m). Now select *Right-Click|Done* to finish the polygon. Select *View|Zoom All*.

Select *Zone|Area* and draw a lasso around the outside of the rectangle by clicking at each point you wish to change direction. To close the boundary select *Right-Click|Close*. In the dialog make sure the Set Arc

Orientation Using Area check box is checked. It should look something like Figure M5. *Select View|Zoom Out.*

Select *Mainline|Water Supply* and place the water supply to the right of the polygon. Leave the fields as 0. Click OK.

Select *Zone|Autohead* and select the Sprinkler as the Low Flow Garden Sprinkler. This sprinkler has only one nozzle (Low Flow Nozzle) which will automatically appear in the Nozzle field. Leave the pressure as the default pressure of 29.869psi (21m). Leave the Riser field as No Component Selected. Click OK.

Draw the Autohead lasso around the inside border of the rectangle. To close the lasso select *Right-Click|Close*. Upon closing the rectangle will fill with sprinklers. See Figure M6.

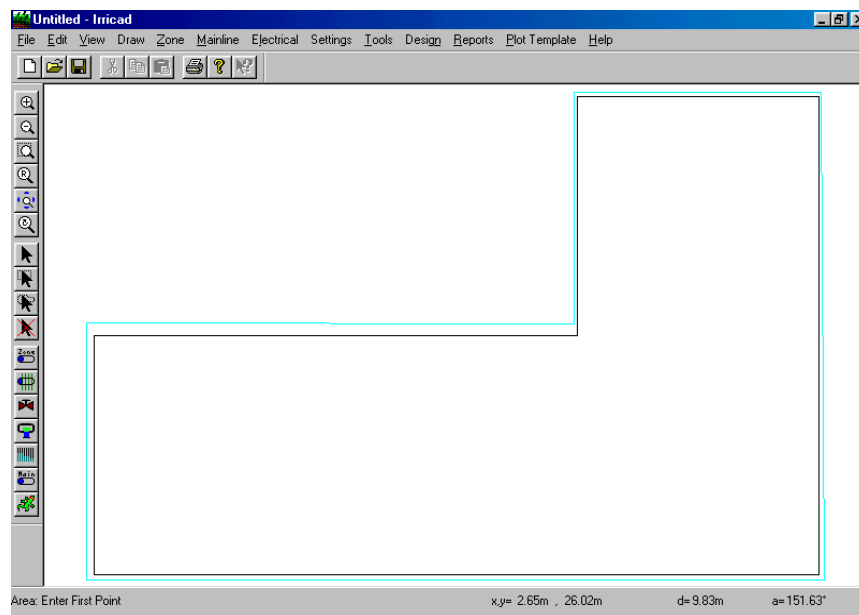


Figure M 6

Select *Tools|Move* and click on the bottom right sprinkler. To move the sprinkler click to place it in its new position in the bottom right corner.

Select *Zone|Cut Pipe*. This tool is the same as *Zone|Pipe* and is a tool to put in a straight line with quick connections to each zone item the pipe crosses without having to click on each item to connect to it.

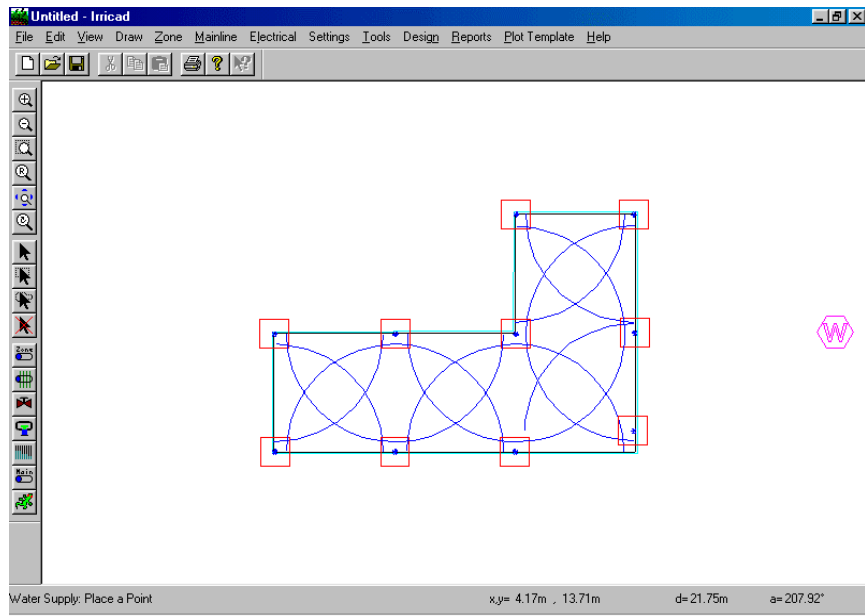


Figure M 7

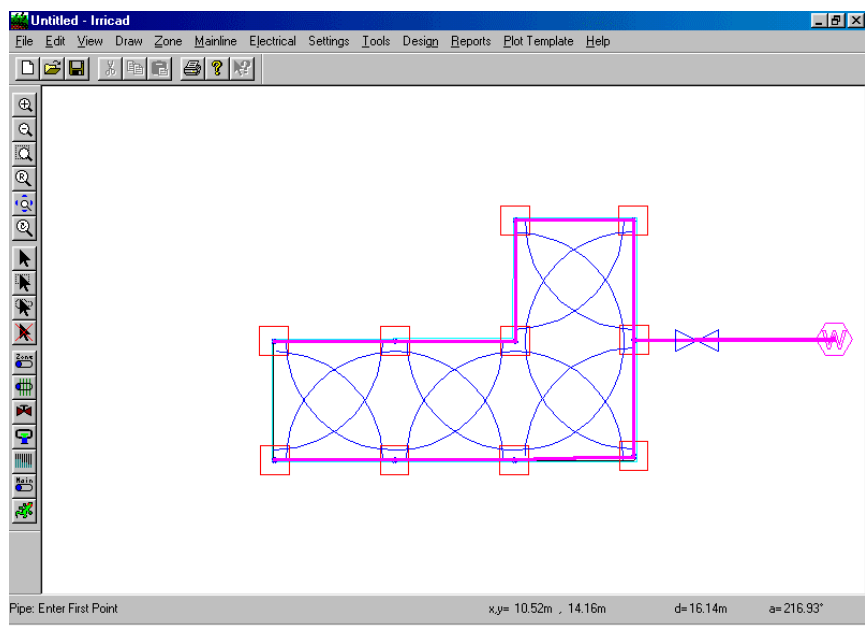


Figure M 8

Click on the top far left sprinkler. Now click on the sprinkler where the area goes up. Click on the top left sprinkler then the top right sprinkler. Now click on the bottom right sprinkler and then the far-left sprinkler. Select *Right-Click|Restart*. Your design should look like Figure M7.

Follow the same design procedure as in the previous tutorials.

Tasks completed in this tutorial:

- Drawing simple background information
- Orientating arcs automatically
- Automatically determining spacing and arcs in an area
- Moving an item
- Connecting pipe to more than one item quickly

4.2.5 APPLYING A SPECIFIC AMOUNT OF WATER TO AN AREA

Tasks covered in this tutorial:

- Changing an item
- Using Irrigation Areas
- Determining run times
- Determining water application

In many cases a certain amount of water is required. This may differ depending on the type of plant, the type of soil, lawn, garden, shady and sunny.

We have used the Irrigation Area tool (*Zone|Area*) to simply orientate wetted radii within a boundary previously. This same tool allows us to specify the amount of water we wish to apply and will calculate the run time for us. The Area tool has two purposes that are unrelated. You do not need to have arcs to use the Area tool for water requirements.

An Area lasso can be drawn around an entire section which has the same water requirements even if there are different sprinklers or several zones (control valves) in this section.

If you have not completed the above tutorial (Automatically Placing Sprinklers in Irregular Areas) do so now. If you have, open the saved design.

Select *Tools|Change* and click on the Area lasso. The Area dialog will appear. See Figure A1.

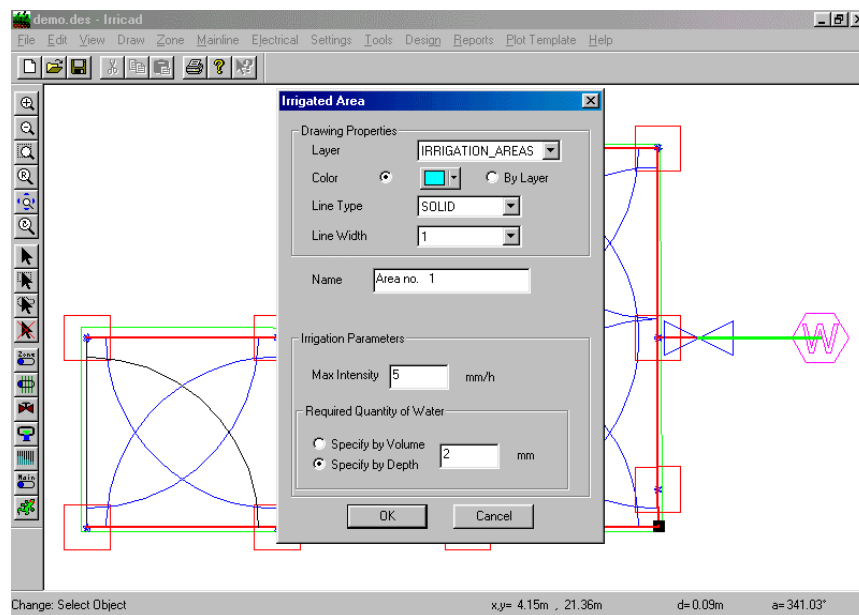


Figure A 1

4.2.5.1 THE AREA DIALOG

The maximum intensity can be specified in in/hr (mm/hr). This is the maximum amount of water per hour that can be applied to that area or soil type. Enter 0.2 (5) as the maximum allowable intensity.

The required quantity of water to be applied can be expressed by volume (US gallons or litres) or depth (inches or mm). Select depth and enter 0.08in (2mm). See Figure A 1. Click OK.

4.2.5.2 CALCULATING ZONE RUN TIMES

When Areas are used you can still use the default running time of 1 hour in *Design|Assign System Flows* options (Management). After zone design has been completed the Zone Flows report (*Reports|Management Reports|Zone Flows*) will specify the time we need to run the zone in order to achieve the required depth or volume entered in the Area dialog. This report has 28 minutes as the required running time.

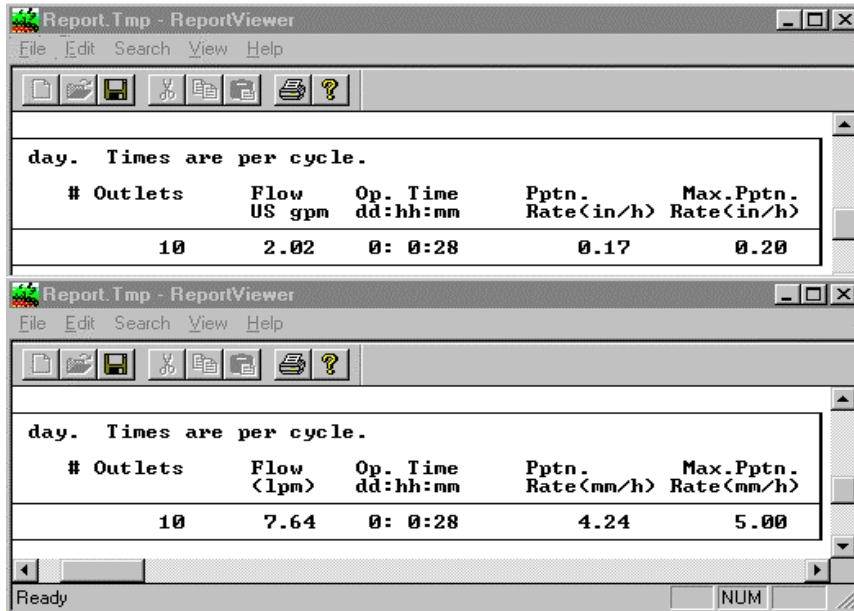


Figure A 2

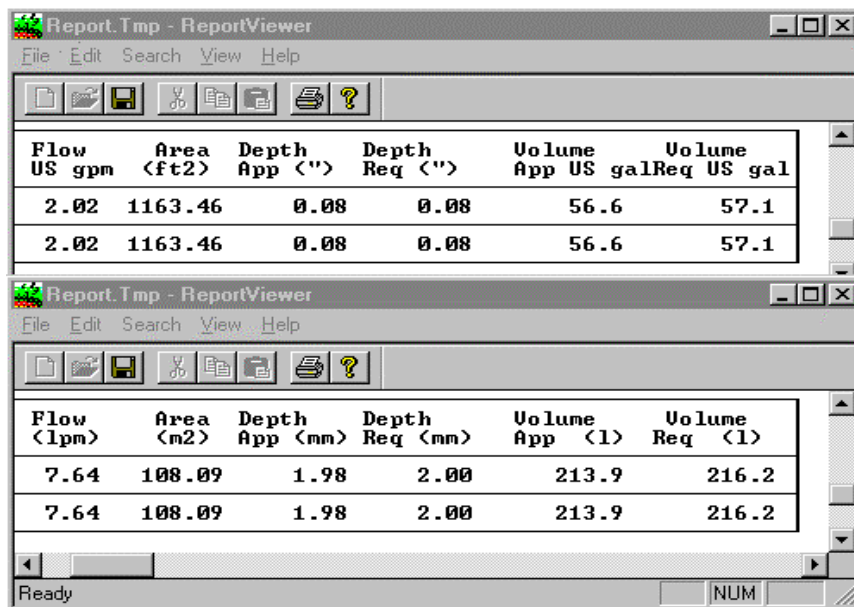


Figure A 3

The Zone Flows report will report the run time and the applied precipitation to the area per zone. The Water Requirements report will list the applied volumes and depths based on the current run time. See Figures A2 (Zone Flows Report) and A3 (Water Requirements Report). You can set the run time in Assign System Flows to be that which is reported in the Zone Flows report (28 minutes). Open the Water Requirements report with the updated run time of 28 minutes.

Complete Valve Analysis and Mainline Design.

Tasks covered in this tutorial:

- Changing an item
- Using Irrigation Areas
- Determining run times
- Determining water application

4.2.6 PLACEMENT AIDS AND TIPS

Here are listed and explained a few placement aids provided by IRRICAD to help make some tasks quicker and easier.

• Circular Cursor	<i>Settings Drawing Items - Circular Cursor</i>
• Direct Entry	<i>Keyboard</i>
• Grid	<i>Settings Grid</i>
• Snap to Grid	<i>Settings Snap</i>
• Ortho Mode	<i>Settings Drawing Items - Ortho</i>
• Snaps	<i>Right-Click Snaps</i>

4.2.6.1 CIRCULAR CURSOR

Circular cursor is a placement tool used to position items a particular distance from an existing item. A radius is entered at the required distance and the cursor used as such to place the next item.

This tool can be used for all geometric and hydraulic tools.

Main uses:

- placement of individual sprinklers at a known spacing
- as a distance tool
- placing an item a fixed distance away from an existing item

4.2.6.2 DIRECT ENTRY

Distances, angles and co-ordinates can be entered directly by using the keyboard. You will see the characters entered on the left-hand side of the status bar. Press the Enter key to execute the command.

A single number is always a distance, angles require a distance and co-ordinates are two numbers divided by a comma. E.g.:

Distance	34	<enter>
Distance & angle	34,<90	<enter>
Co-ordinates	0,0	<enter>

Can be used for all geometric objects. Co-ordinates may work for first point entry of hydraulic objects.

4.2.6.3 GRID / SNAP TO GRID

A grid can be set up to be any spacing desired along the X and Y-axis. Enter a value for the spacing along the X-axis (horizontal) and the Y-axis (vertical). Check the Display Grid Points if you wish to see the grid points on the screen. If you have an existing item on the screen and you wish grid points to be positioned on this item (or corner of the item) enter the co-ordinates on the item (or corner) in to the X and Y fields for Origin on the right-hand side.

Snap to Grid

Once a grid has been set you have to option to use Snap to Grid. Once Snap to Grid is on, the cursor can only move between grid points.

This is a great tool for drawing straight pipelines, positioning sprinklers at a specific spacing without using the Sprayline tool and for positioning and drawing geometric objects.

4.2.6.4 ORTHO MODE

Ortho mode allows straight lines to be drawn at 90-degree angles. If Ortho mode is set at 0° then lines can be drawn at 0° (horizontally to the right), 90° (straight up), 180° (horizontally to the left) and 270° (straight down).

Ortho mode only works for geometric items and not for hydraulic items.

Holding down the Ctrl key on the keyboard while Ortho mode is on will turn Ortho mode off. Alternatively if you wish to turn Ortho mode on for an action hold down the Ctrl key while carrying out the action (or mouse click).

4.2.6.5 SNAPS

Snap ensure a tidy finish to lines joining and completely closes an object.

When using geometric tools there are eleven snaps that can be used. When using hydraulic tools there are three snaps available. Select the snap tool before placing first or subsequent points in a tool. The snap tool is only active for the next mouse click.

When drawing hydraulic items on the screen (including Contours and Spot Height), the Place snap tool is the same as setting the default snap mode to Place (rather than Connect) but is only active for the next mouse click. Very useful if placing hydraulic items close the existing hydraulic items and not wishing them to connect.

The Snap tools work in much the same way as Connect does. IRRICAD uses a tolerance range. If an item is within this range then IRRICAD assumes you wish to snap / connect to this item. The tolerance range is determined by zoom factor, distance on the screen and world distance.

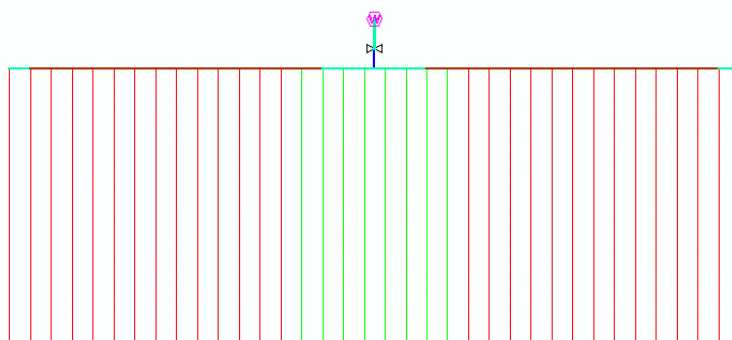
Try the above tools to see how they work.

4.3 DESIGN TUTORIALS

4.3.1 A SIMPLE ORCHARD DESIGN

Tasks covered in this tutorial:

- Drawing simple background information
- Creating sprayline outlets
- Drawing a block of connected spraylines (laterals)
- Specifying lateral and outlet spacing
- Using Circular Cursor as a placement aid
- Connecting up multiple zone items
- Saving a design
- Specifying the maximum allowable velocity
- Limiting number of pipe sizes selected by computer sizing



4.3.1.1 STARTING THE TUTORIAL

Double click on the Irricad icon or select *Start|Programs|Irricad|Irricad* to start IRRICAD. If already running IRRICAD select *File|New* to start with a clean screen. In *Settings|Irrigation – Design Specific* browse for the tutorial database Tutorial.mdb. This should be found in the \Irricad\database folder. Highlight Tutorial.mdb and click Open. Go to the Units click the US (Metric) button to restore the default units for this tutorial. Note Metric measurements are displayed in brackets.

Select the Misc tab and click the Medium design size as in Figure SM 1. Change the Base Database Symbol Size to 10ft (3m). This determines

the size of the symbols according to the size of the design. When you are finished click OK.

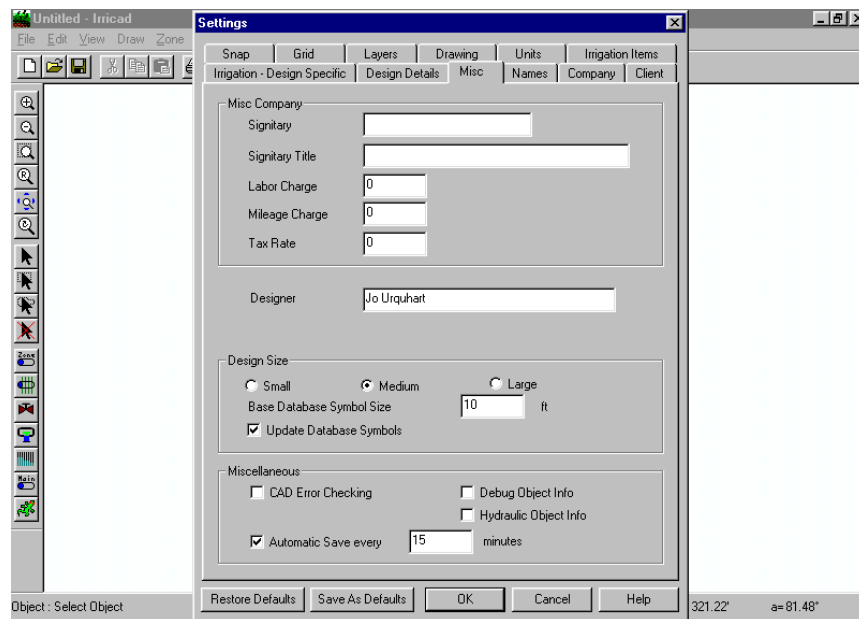


Figure SM 1

4.3.1.2 ENTER BACKGROUND INFORMATION

This is information required to position the irrigation system. Examples include boundaries, roads, buildings, perhaps text and symbols. For this tutorial we will put in a 490 x 200ft (150 x 60m) rectangle for the block boundary.

Select *Draw|Rectangle|2 Point* and move the cursor to the bottom left of the screen and click the left mouse button to start the rectangle. You will notice that the status bar will ask you to enter the corner point of the rectangle prior to you clicking the mouse and for you to enter the opposite corner after you have placed the first. Drag the cursor away from the first point and left click to place the second point. Now select

Tools|Change (or click on the Chameleon  on the left-hand tool bar) and click on the border of the rectangle. Edit the width to be 490 (150) and the height to be 200 (60). Click OK. Select *View|Zoom All*.

Your design should look like Figure SM 2.

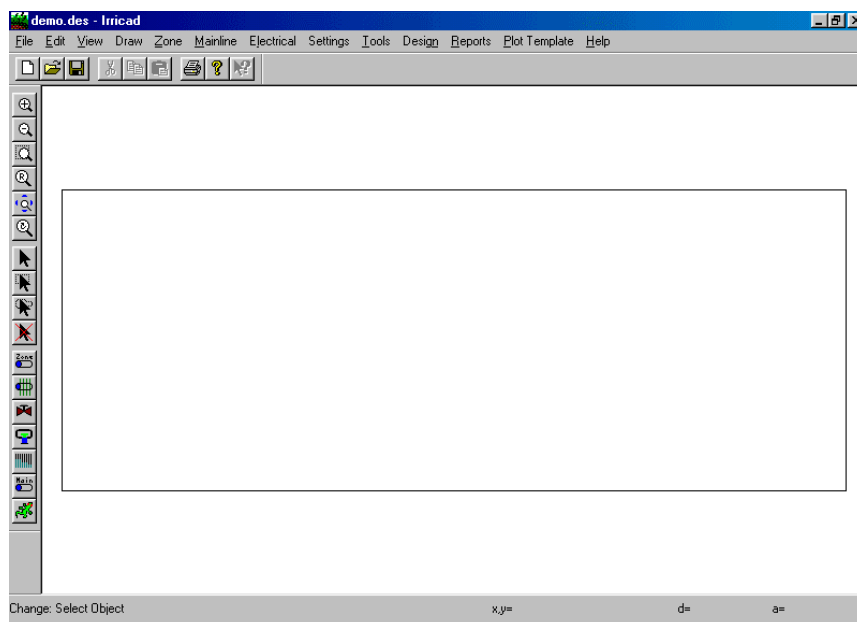


Figure SM 2

4.3.1.3 PLACING THE BLOCK

Before placing any laterals select *Settings|Irrigation – Design Specific*. Check the Create Wetted Radii and Create Sprayline Outlets check boxes (under normal circumstances Create Sprayline Outlets should be off as the number of outlets is high and will slow down the redrawing of the design). Click OK.

It will be tedious work to draw in each sprayline required. To enter a block of spraylines (laterals) with a specified lateral spacing select *Zone|Block*. A dialog for setting block and sprayline properties will be displayed. As you are completing a new design you may want IRRICAD to size the laterals so leave the pipe as Computer Selected. The laterals will be placed at ground level so the depth field can remain at 0.0.

In the same dialog, select a sprinkler by pressing the down arrow. Highlight the Microsprinkler 360 degrees and left mouse click to select it. Select the WHITE 360 as the nozzle by pressing on the down arrow of the Nozzle field, highlighting the required nozzle and left clicking the mouse. Enter a pressure of 18.5psi (14m).

Selecting an outlet connector or riser is optional but for this example we will use a Microsprinkler stake and tube 3/8" (10mm). In the same dialog, select the Microsprinkler stake and tube 3/8" (10mm) from the dropdown list.

Enter the Lateral Spacing as 13ft (4m). Enter the Outlet Spacing as 11.5ft (3.5m).

Leave the Outlet Spacing Properties as Rectangular for a rectangular layout. Leave the Offset as 0%, and make sure that the Connected check box is checked for connected spraylines. The dialog should look like Figure SM 3. Click OK.

You are now able to position the block boundaries.

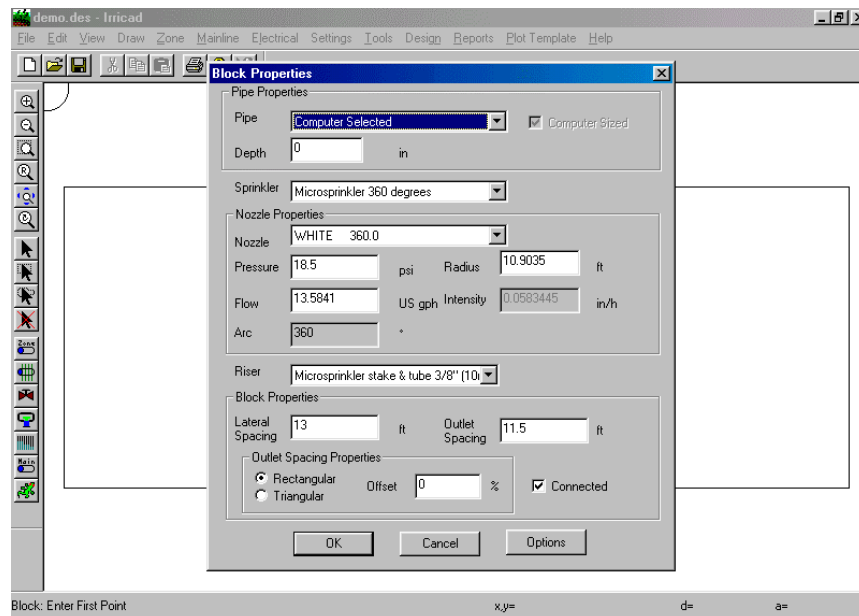


Figure SM 3

Draw a block boundary on top of the rectangle by using *Settings|Drawing Items – Circular Cursor*. We require headlands and sidelands of 13ft (4m). Set the radius for circular cursor to be 13ft (4m). Check the Display Circle check box. Click OK. Start from the bottom left and move to the top left. Remember the distance from the edge of the circle to the centre crosshairs is 13ft (4m). Continue moving from the top left to the top right, clicking at each change of direction.

Continue to the bottom right and finish by selecting *Right-Click|Close*. Select *View|Redraw* to refresh the screen. If you wish to see the outlets on the laterals, select *View|Sprayline Outlets* to turn the layer on. Your design should look like Figure SM 4. Turn off Circular Cursor by unchecking the Display Radius check box in *Settings|Drawing Items – Circular Cursor*.

4.3.1.4 PLACING VALVES AND PIPES

The placement of laterals is now complete.

As you want to connect a submain pipe to a number of laterals at once select *Zone|Cut Pipe*. The Cut Pipe tool will connect to every zone item it crosses. In the pipe dialog that is displayed leave the pipe as Computer Selected. Leave the depth as 0. Leave the Layer as <DEFAULT> and the line width as 3. Click OK.

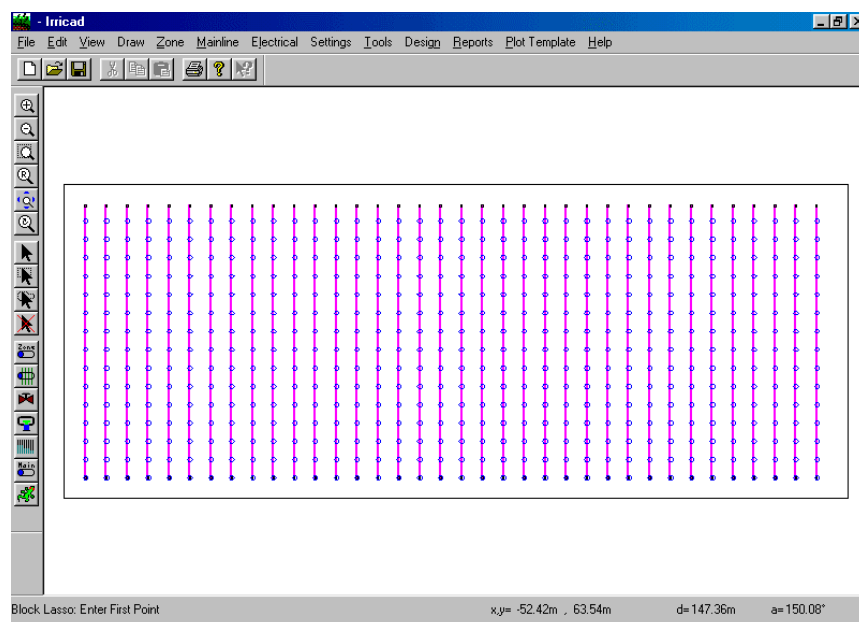


Figure SM 4

Click on the top left junction and then click on the top right junction and then select *Right-Click|Restart*. IRRICAD will automatically cut the laterals (or any other zone pipes that this line crosses). Click on a central point of the submain and draw upwards for approximately 13ft (4m) (see d= on the status bar). Select *Right-Click|Restart*.

Select *Zone|Control Valve* and select the 3" (80mm) Electric Valve from the dropdown list. Leave the Orientation as 0° and the depth as 0. Leave the Layer as <DEFAULT> as this will automatically place the control valves in the Control valves layer. Click OK.

Place the control valve on the end of the pipe just drawn, at the top of the block. As you place the control valve a dialog will show you the default name for the zone as Zone No. 1. Leave Zone no. 1 as the zone name.

Once you have connected the laterals via the submain to the control valve, select *Mainline|Pipe*. Leave the pipe as Computer Selected, the depth as 0 and the line width as 4. Click OK. Connect the pipe to the control valve by clicking on it then draw the mainline pipe out upwards for approximately 10m as seen on the status bar where d is the distance travelled since the last left-click. Left click and then right-click and select Restart.

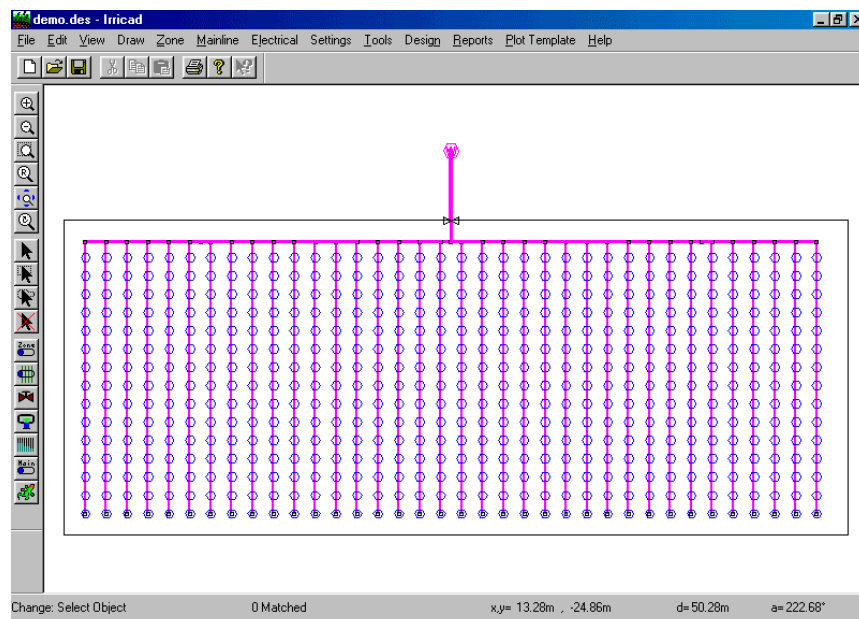


Figure SM 5

Select *Mainline|Water Supply*. Connect to the junction on the left end of the mainline pipe. Leave the name as the default Supply No. 1. Do not enter any flow or pressure requirements, as IRRICAD will determine these during design and analysis and assumes that the water supply is

unrestricted. Click OK. Select *File|Save* and save the design as demo.des. Your design should look like Figure SM 5. This completes the entry of the hydraulic components of the design.

4.3.1.5 ENTERING MANAGEMENT REQUIREMENTS

The primary purpose of management is to allow you to specify an operating sequence for the zone control valves to set up a series of flow conditions in the mainline so that the mainline can be correctly sized and analysed. You have the option of specifying a simple worst case scenario for valve operation or of specifying a full operational sequence for all valves.

Select *Design|Check Outlet Connectivity* to make sure that all the outlets are connected to the zone control valve and that the valve is connected to the water supply.

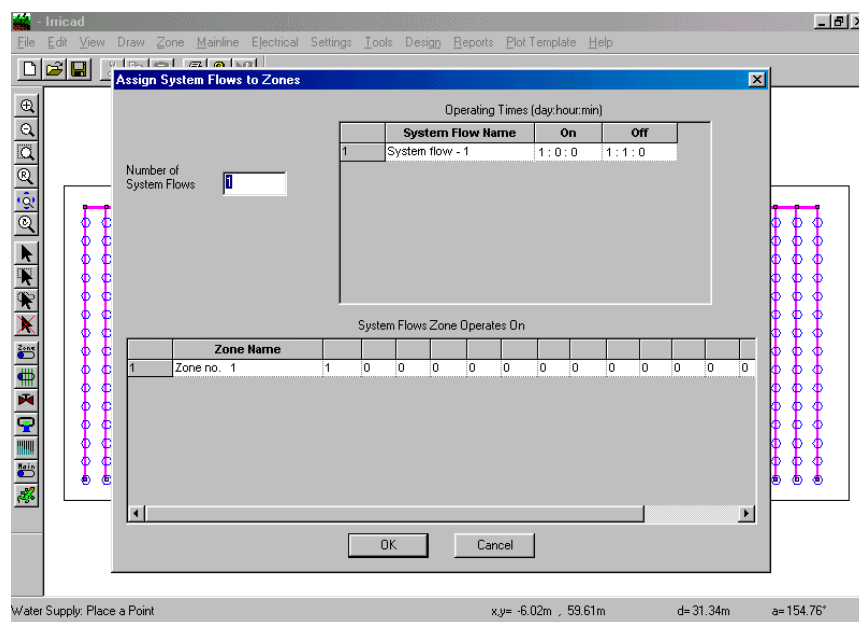


Figure SM 6

If IRRICAD does not report any unconnected items you can continue. If items are reported as not connected, their location will be displayed.

Select *Design|Assign All Zones to One System Flow*. IRRICAD assigns Zone no. 1 to operate on System Flow 1 as in Figure SM 6. The

sequential operating times (one hour) for the system flow is automatically listed. Click OK. We are now ready for the design process.

4.3.1.6 THE DESIGN PROCESS

Select *Design|Design Parameters|Hydraulic Parameters* and enter the Maximum Zone Pipe Velocity as 5ft/s (1.5m/s). Click OK.

Select *Design|Zone Design|LP Design*. This method of computer sizing takes into account the maximum allowable velocities (in *Design|Design Parameters|Hydraulic Parameters*) and the pressure requirements of the sprinklers. Select this option to have IRRICAD size the laterals and submain for the zone.

You will notice that 6 pipe sizes have been selected for the submain. To make installation easier, we will limit the number of pipe sizes IRRICAD can select for the submain. Select *Design|Zone Design Configuration* and enter 2 in the Number of Submain Sizes column. Click OK and re-run *Design|Zone Design|LP Design*.

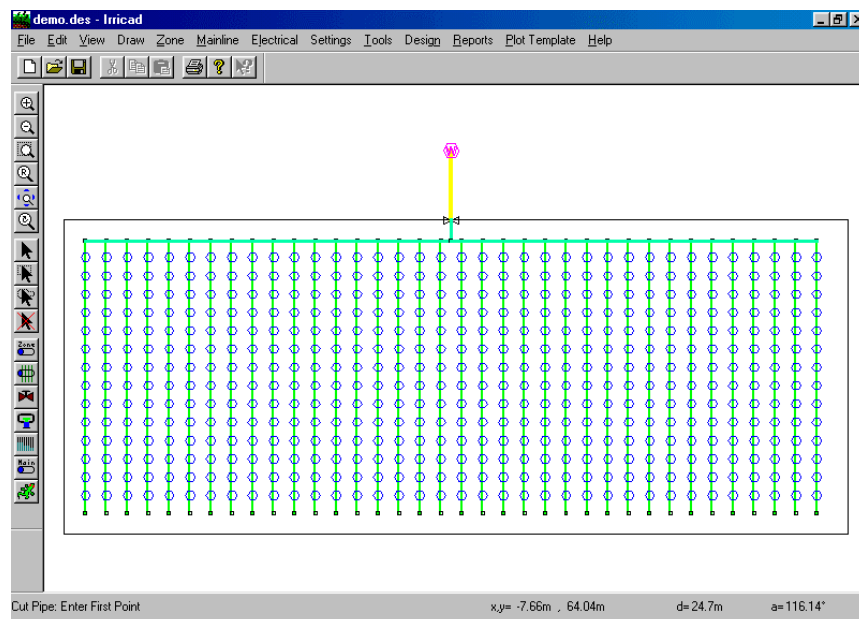


Figure SM 7

Select *Design|Valve Analysis* to have IRRICAD calculate the pressure losses through the zone control valve. This usually runs very quickly.

It is advisable to check the data in the zone reports after zone design (*Reports|Design Reports*). At this stage the Zone Summary report gives a good indication of the overall design of the zone. Click on the X to close the report window.

Having completed the valve analysis, you can now have IRRICAD size the mainline for the design. Select *Design|Mainline Design|LP Design*; IRRICAD will then size the mainline for the design and calculate the water supply pressure so that the zone control valve receives the required pressure. You should have results similar to Figure SM 7.

4.3.1.7 DISPLAY REPORTS

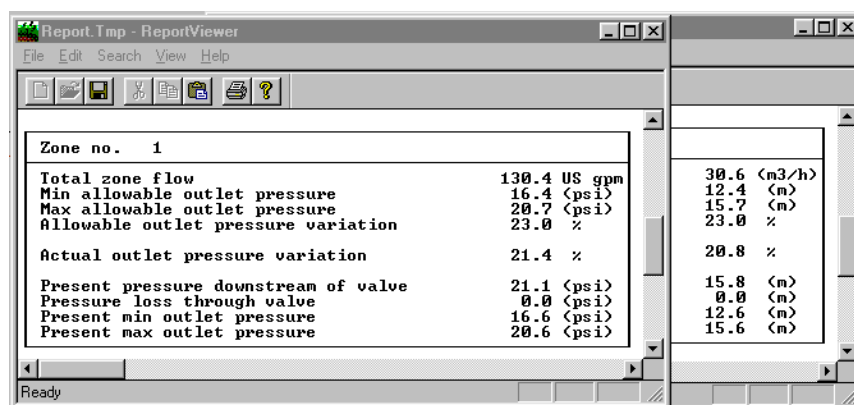


Figure SM 8

You may wish to select and view some of the design reports. As seen previously, the Zone Summary Report (*Reports|Design Reports*) as seen in Figure SM 8 gives you a summary of the pressure variation in the block. The System Duty Report gives you the duty required at the water supply. The Mainline Summary Report gives a summary of actual and required pressures at the zone control valve.

If you have had trouble doing this design, please check the following:

Size of the rectangle – select Change and check the height and width are 490 x 200ft (150 x 60m).

Tasks completed in this tutorial:

- Drawing simple background information
- Creating sprayline outlets
- Drawing a block of connected spraylines (laterals)
- Specifying lateral and outlet spacing
- Using Circular Cursor as a placement aid
- Connecting up multiple zone items
- Specifying the maximum allowable velocity
- Limiting number of pipe sizes selected by computer sizing

4.3.2 WORKING WITH MULTI-VALVE DESIGNS

Tasks covered in this tutorial:

- Deleting items
- Running more than one valve
- Managing multi-valves in Design
- Limiting the number of pipes selected
- Valves running at the same time

Complete the above tutorial (A Simple Orchard Design) if you have not done so already.

We wish to break this block up into more zones, as the flow of the entire block is too great for the water supply. Wish to break the block in to 3, so we need to add two more valves.

Break the block into 3 even parts. Delete the section of submain where the break is to be. See Figure SM9.

Select *Zone|Pipe* and draw a pipe at right angles to the existing main, centrally to the two new blocks. The dialog may initially have a pipe selected. This does not matter as long as the Computer Sized check box is still checked. Select *Zone|Control Valve* and select the 3" (80mm) Electric valve. Place on the ends of the two new pipes you have drawn.

Now connect the valves up with mainline pipe so that you design looks like Figure SM10.

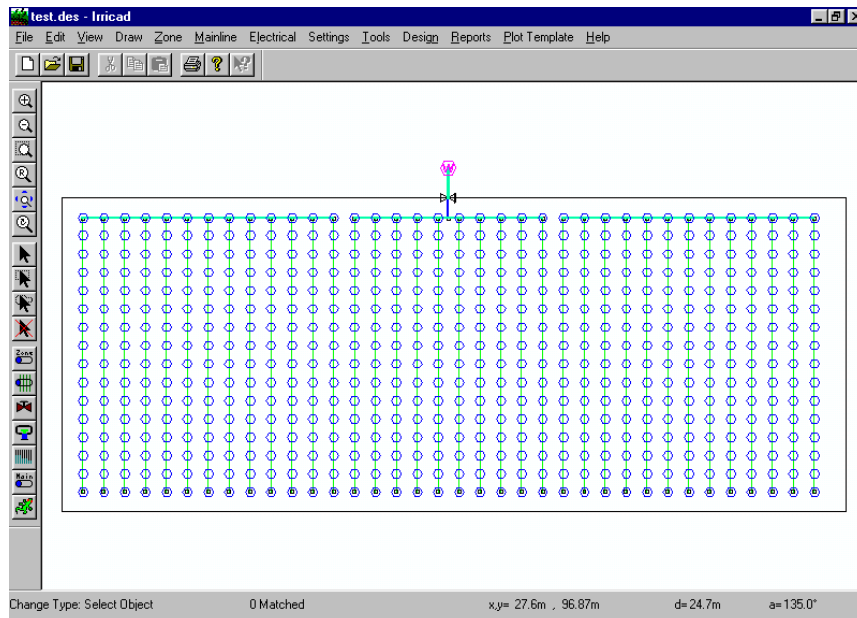


Figure SM 9

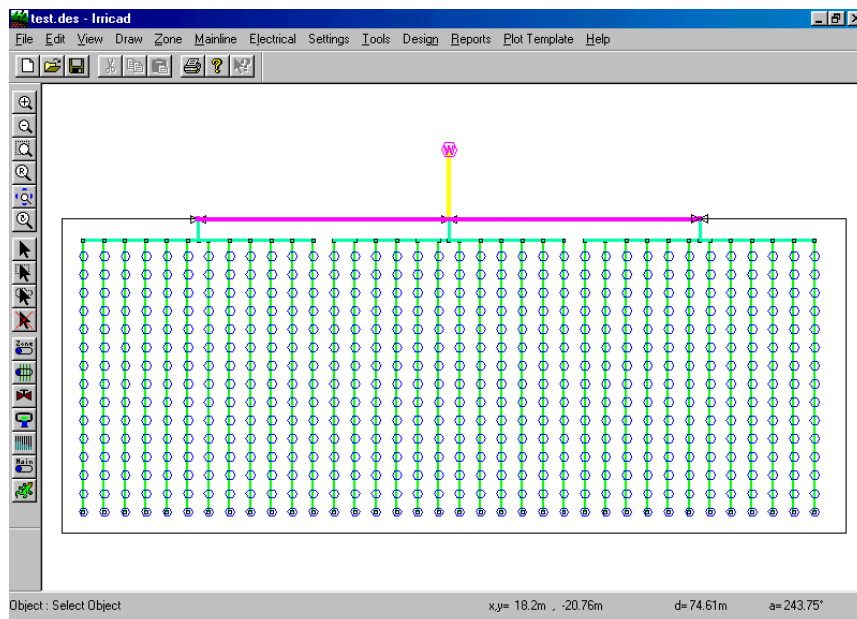


Figure SM 10

We are now ready to set up management and re-size the pipes. Select *Design|Assign Each Zone to a Unique System Flow* as all valves will be operating separately in this scenario. The dialog will automatically set up 3 system flows, each for a default time of 1 hour, and assigning each zone to a different system flow (3 valves hence 3 system flows) as in Figure SM11.

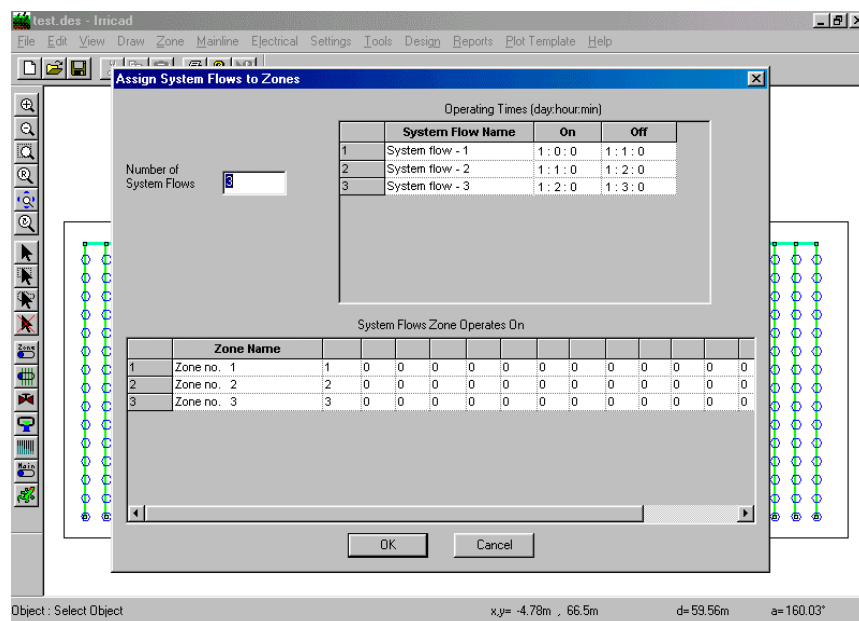


Figure SM 11

Select *Design|Zone Design|LP Design*, the *Design|Valve Analysis*. You will notice that the middle zone only has 1 submain size whereas the two new zones have 3 submain sizes. Select *Design|Zone Design Configuration*. You will notice that Zone 1 has retained its settings from the previous tutorial but since Zones 2 and 3 are new, they have the default number of submain sizes as unlimited. Change the number of submain sizes to 2 for all zones. Rerun *Design|Zone Design|LP Design*.

Run *Design|Mainline Design|LP Design* and view the System Duty report when complete (*Reports|Design Reports|System Duty*). Your results should look like Figure SM12.

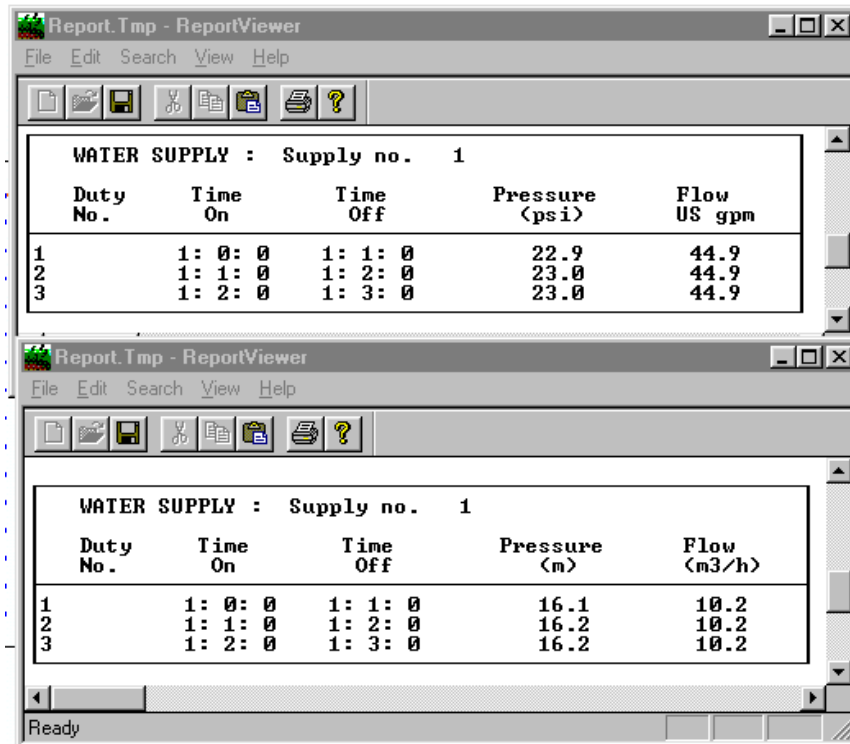


Figure SM 12

4.3.2.1 VALVES RUNNING TOGETHER

Through the above the tutorials we have usually run a valve by itself regardless of whether there were only one valve or more valves in the system. We will now look at different scenarios where more than one valve is running at the same time.

Select *Design\Assign System Flows to Zones*. Increase the total number of system flows to 4. You will need to fill in the on / off times manually. Click the mouse in the Operating Times table for IRRICAD to refresh the screen and create the field for the new system flow. As running time is unimportant in this case but what is happening when the valves are running is very important, we will use a default running time of 1 hour.

Start System Flow 4 at 1:3:0 and stop it at 1:4:0. In the lower part of the dialog, assign Zones 1 –3 to operate together on System 4 by entering 4 in to the second column for all zones as in Figure SM13. Click OK.

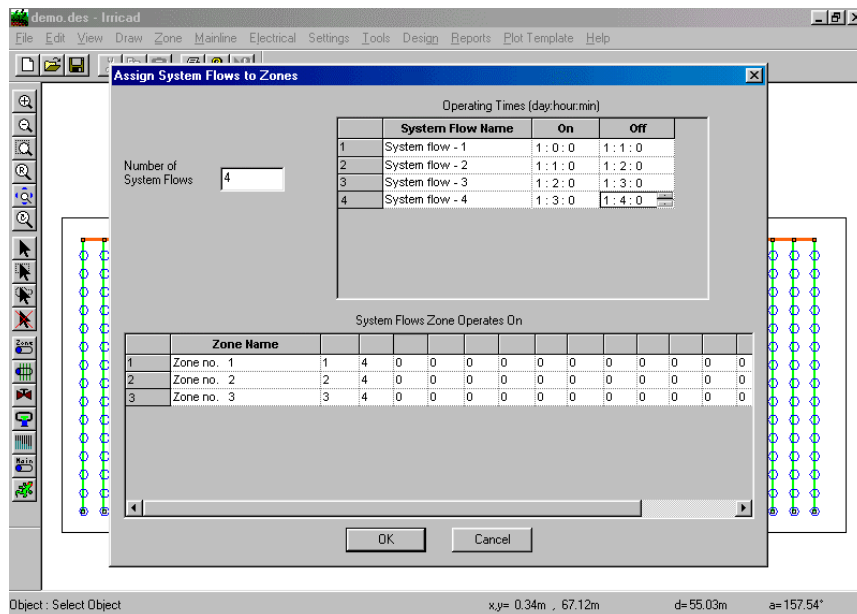


Figure SM 13

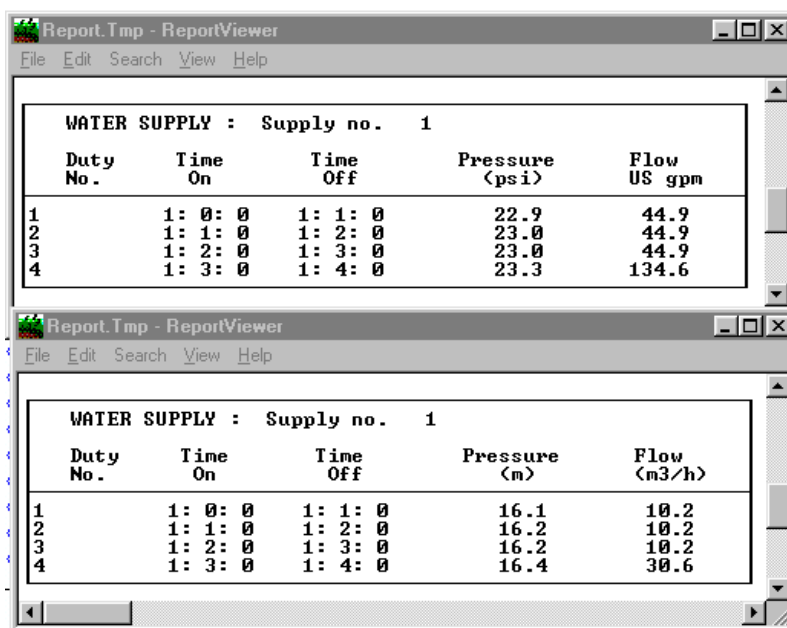


Figure SM 14

Re-run Zone Design, Valve Analysis and Mainline Design. You do not need to run LP Design for Zone Design as nothing has changed here. However, it is a good idea to run LP Design for Mainline Design as the pipe sizes may well change with the different flows. Now open the System Duty report (*Reports|Design Reports|System Duty*). Your results should look like Figure SM14.

Tasks completed in this tutorial:

- Deleting items
- Running more than one valve
- Managing multi-valves in Design
- Limiting the number of pipes selected
- Valves running at the same time

4.3.3 SIMPLE DRIP TAPE DESIGN

Tasks covered in this tutorial:

- Drawing a block of tapes
- Changing symbol size on the screen
- Connecting to multiple zone items quickly
- Snapping to the midpoint of an object

This tutorial shows the steps required for drawing and designing a drip tape irrigation scheme. Read the notes below and then proceed with the exercise. This exercise will run through a drip tape block with no pressure regulation within the block.

4.3.3.1 TAPES - AN OVERVIEW

A drip tape is a thin walled pipe tube with emitters built into the wall of the pipe. Tapes are treated differently in IRRICAD because their hydraulic characteristics are different to a standard pipe with a sprinkler or dripper attached. Reasons for this are primarily because of the low operating pressures and the extent of flow variations down a tape run with varying lengths and input pressures. Some hard wall tubing products are also treated as tapes because of these reasons.

4.3.3.2 STARTING THE TUTORIAL

Double click on the Irricad icon or select *Start|Programs|Irricad|Irricad* to start IRRICAD. If already running IRRICAD select *File|New* to start with a clean screen. In *Settings|Irrigation – Design Specific* browse for the tutorial database Tutorial.mdb. This should be found in the

\\irricad\database folder. Change the pipe Line Widths to 2 for Lateral, 4 for Mainline and 3 for Zone. Go to the Units click the Metric button to restore the default units for this tutorial.

Select the Misc tab and click the Medium design size. Change the Base Database Symbol Size to 10ft (3m). This determines the size of the symbols according to the size of the design. When you are finished click OK.

Select *Zone|Tape Block* and select the Drip tape from the dropdown list of tapes. Leave the depth as 0, as the tapes will be at ground level.

Leave the default inlet pressure as 12psi (8.5m) and make sure the Regulated check box is unchecked.

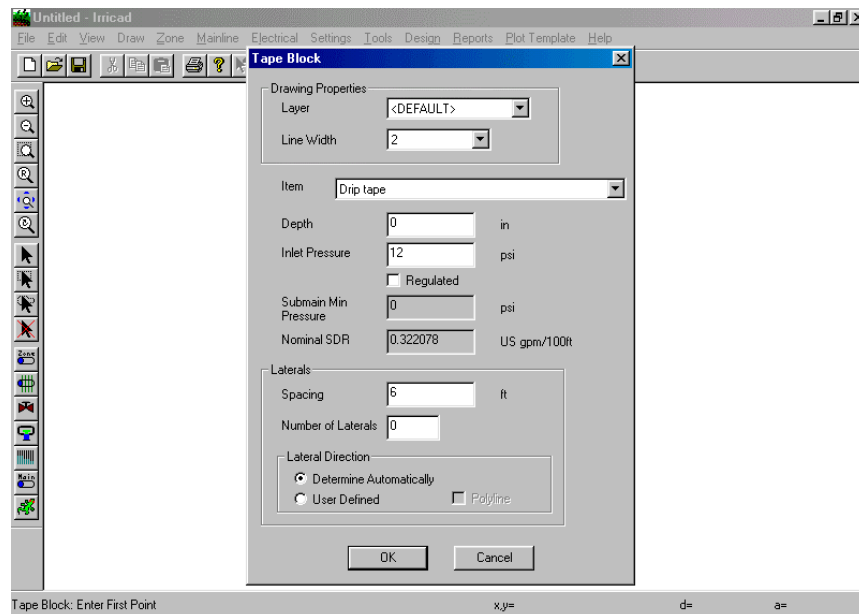


Figure SD 1

Type in 6ft (2m) for the lateral spacing and leave the number of laterals as 0. Make sure the Determine Automatically option for the lateral direction is selected as in Figure SD 1. Click OK.

Now move the cursor to the bottom left of the screen and draw the outline of the block: left click then draw a line upwards for 165ft (50m) as seen on the status bar d=165 (50) (approx.). Left-click the mouse to

place the line at this point, and then continue drawing the block area by going 200ft (60m) to the right and left click. Now proceed downwards for 165ft (50m) left click then select *Right-Click|Close* after the third point has been placed. This will close the lasso, and complete the tape block. The block will automatically fill with tapes 6ft (2m) apart. Select *View|Zoom All*. The block should look similar to Figure SD 2.

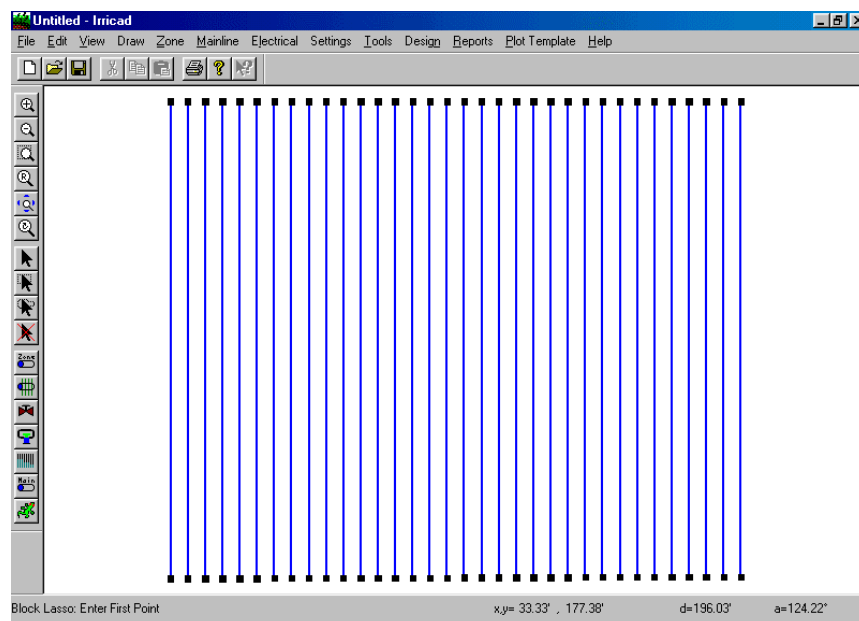


Figure SD 2

Now select *Zone|Cut Pipe*. We wish to place a submain through the middle of the block. In the Cut Pipe dialog leave the layer as <DEFAULT>. Make sure the pipe selected is Computer Selected. Leave the depth as 0, and click OK.

Select *Right-Click|Snaps|Midpoint* and click on the left outer lateral near the middle of the lateral. Now select *Snaps|Midpoint* again and click on the right outer lateral near the middle of the lateral. Continue the pipe for approx. 13ft (4m). Select *Right-Click|Restart* to finish the pipe.

Select *Zone|Control Valve*. From the dropdown list select the 1" (25mm) Electric Valve, leaving the depth as 0, and place this on the end of the submain on the right side of the screen. Accept the default zone name.

Now select *Mainline|Pipe*. Leave the pipe as Computer Selected at 0 depth. Click OK. Connect the mainline pipe to the control valve with a left click and draw upward for approx. 33ft (10m). Left click to place the end then select *Right-Click|Restart*. Select *Mainline|Water Supply* and place on the end of the mainline pipe with a left click as in Figure SD 3. Leave the Water supply details as the default; simply click OK.

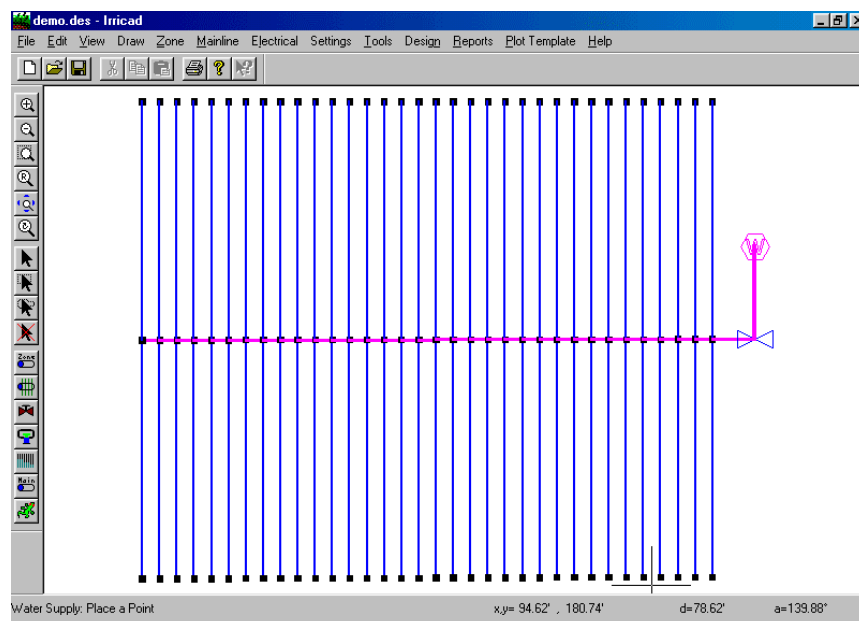


Figure SD 3

4.3.3.3 MANAGEMENT

Run *Design|Check Outlet Connectivity*. If no error messages appear, continue. If you do get an error message regarding an unattached item, go to the co-ordinates noted in the error message and connect the item to the pipe.

Now we wish to assign the zones to system flows. Select *Design|Assign All Zones to One System Flow* as we only have one Zone (control valve or block). You will notice that Zone no. 1 will operate on System Flow 1 as in Figure SD 4. Click OK.

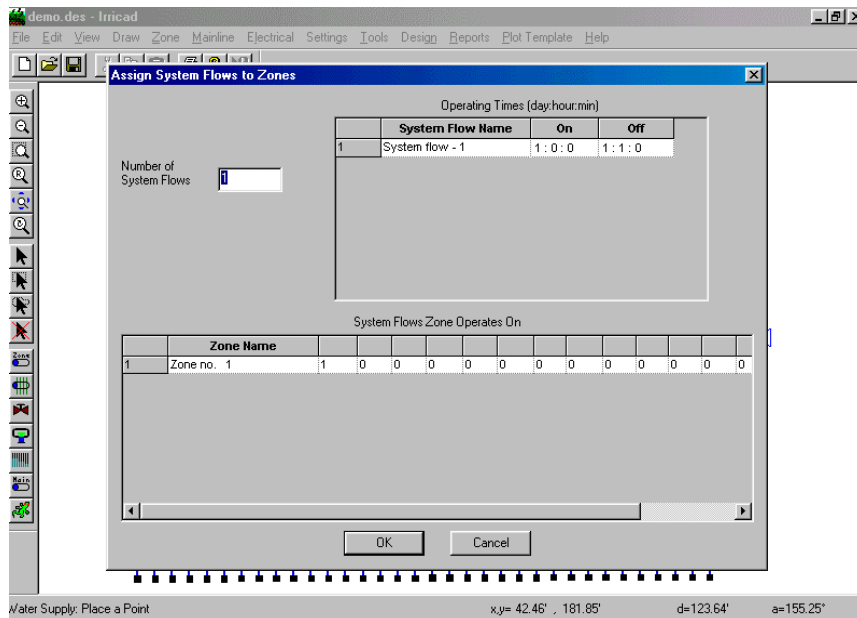


Figure SD 4

4.3.3.4 DESIGN

Select *Design|Design Parameters|Hydraulic Parameters* and enter the Maximum Zone Pipe Velocity as 5ft/s (1.5m/s). Click OK.

The first step is to size the submain pipes. Select *Design|Zone Design|LP Design*. It is always a good idea to look at some reports before continuing. Look at the *Reports|Design Reports|Zone Summary*. The Zone Summary report gives a good indication of what is happening in the zones. It should look something Figure SD 5. The present maximum dripper pressure is 12.3psi (8.7m) and the minimum is 10.8psi (7.6m). The actual pressure variations in the zone are calculated from the actual minimum and maximum outlet pressures relative to the nominal inlet pressures are 12.9%. This pressure variation includes the submain friction loss as well as the loss in the tapes. Close the report window by clicking the X.

Run *Design|Valve Analysis*. This is usually very quick. Now we wish to size the mainline. Run *Design|Mainline Design|LP Design*.

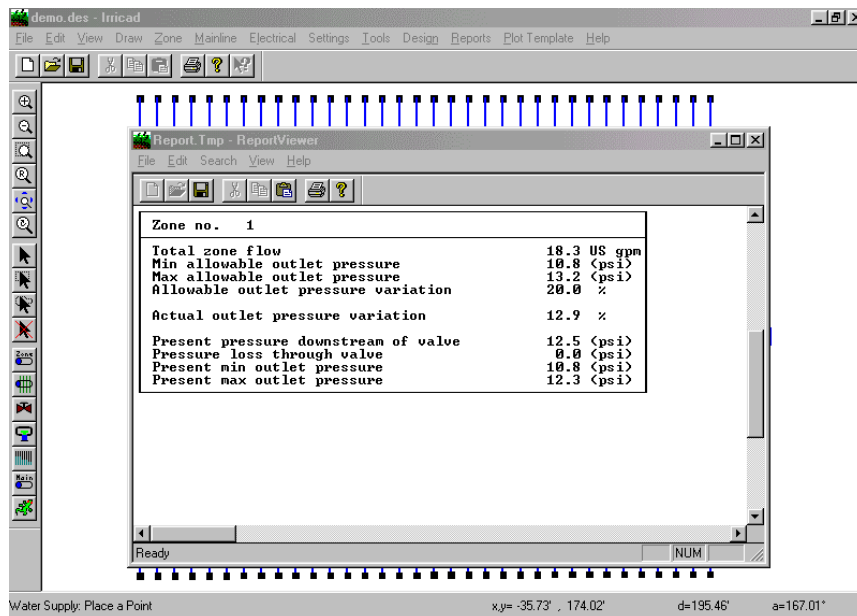


Figure SD 5

Look at reports such as *Reports|Design Reports|System Duty* to see the demands on the water supply for each system flow. Save the design as demo.des.

Tasks completed in this tutorial:

- Drawing a block of tapes
- Changing symbol size on the screen
- Connecting to multiple zone items quickly
- Snapping to the midpoint of an object

4.3.4 MANAGING LARGER DRIP TAPE BLOCKS

4.3.4.1 INTRODUCTION

This tutorial will outline the steps used to break a large block into smaller blocks based on available flow.

4.3.4.2 DRIP TAPE DESIGN

This exercise will run through a drip tape block with no pressure regulation within the block.

The first step is to set up the database to enable the drip tape to be used. Run IRRICAD Databases either from your desktop or from the *Start|Programs|Irricad|Irricad Databases*. When IRRICAD Databases has finished loading the current default database if it is not Tutorial.mdb, press the Save Changes button (particularly if IRRICAD is running at the time). In the screen that remains, select *File|Open*. Browse for the Tutorial.mdb database in the Irricad\database folder. Click the Open button.

Now select the Tapes tab at the top of the screen. Highlight the Drip Tape 0.44gph (1.65lph) and select the Edit / View button. Change the Usage to L and the spacing at the bottom of the dialog from 4.1ft (1.25m) to 1.6ft (0.5m). Press the Save button on this dialog, and then the Save Changes button on the main dialog. Exit IRRICAD Databases.

Start IRRICAD. In *Settings|Irrigation - Design Specific* select the Tutorial.mdb database by pressing the Browse button and searching for the database in the Irricad\database folder. In the same dialog, select the line widths as follows:

Laterals:	2
Mainline:	4
Zone:	3
Wire:	1

In *Settings|Miscellaneous*, select Medium design size and change the base database symbol size to 13ft (4m). Click OK.

Select *Zone|Tape Block*. In the dialog, leave the layer as <DEFAULT> as this will ensure that the tapes are placed in the SPRAYLINES layer. Leave the line width as 2.

Select the Drip Tape 0.44gph (1.65lph) from the dropdown list of tapes. Leave the depth as 0, as the tapes will be at ground level.

Leave the default inlet pressure as 12psi (8.5m) and make sure the Regulated check box is unchecked.

Type in 3ft (1m) for the lateral spacing and leave the number of laterals as 0. Make sure the Determine Automatically option for the lateral direction is selected as in Figure DD 1. Click OK.

Now move the cursor to the bottom left of the screen and draw the outline of the block: left click then draw a line upwards for 300ft (90m) as

seen on the status bar $d = 300$ ($d=90$) (approx.). Left-click the mouse to place the line at this point, and then continue drawing the block area by going 325ft (100m) to the right and left click. Now proceed downwards for 300ft (90m) left click then select *Right-Click|Close* after the third point has been placed. This will close the lasso, and complete the tape block. The block will automatically fill with tapes 3ft (1m) apart.

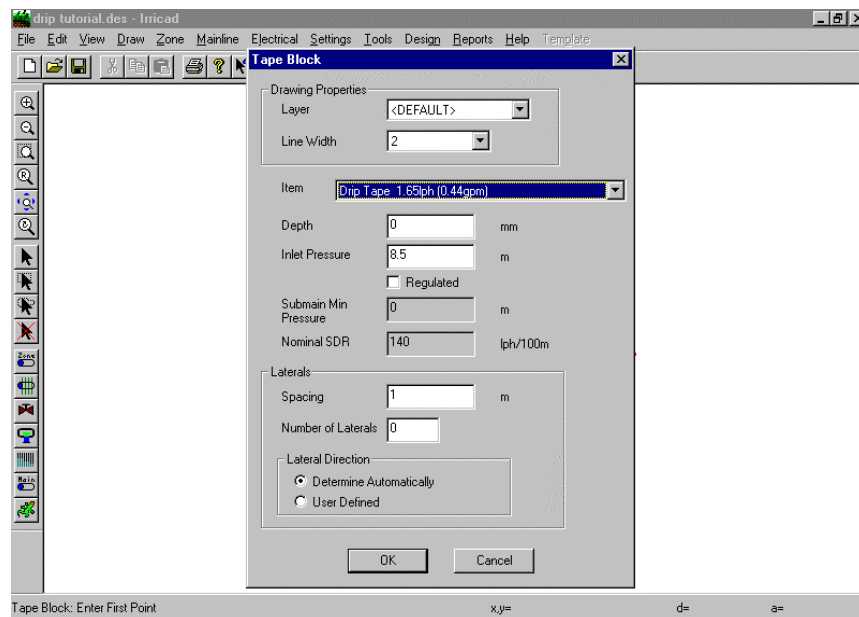


Figure DD 1

Select *View|Zoom Out*. Draw another block area starting a short distance away about 15ft (5m) from the bottom right corner of the previous block. Start drawing the block by going up for 150ft (45m) then right for 325ft (100m), down for 150ft (45m). Select *Right-Click|Close* to complete the lasso. The two blocks should look similar to Figure DD 2.

Select *View|Zoom All*. Now select *Settings|Irrigation Items* and check the Enable check box for the Flow Check (top right). Enter 28.5gpm (6.5m³/h) as the maximum flow.

Now select *Zone|Cut Pipe*. We wish to place a submain through the middle of the larger block, and along the top edge of the smaller block. In the Cut Pipe dialog leave the layer as <DEFAULT>. Make sure the pipe selected is Computer Selected. Leave the depth as 0, and Click OK.

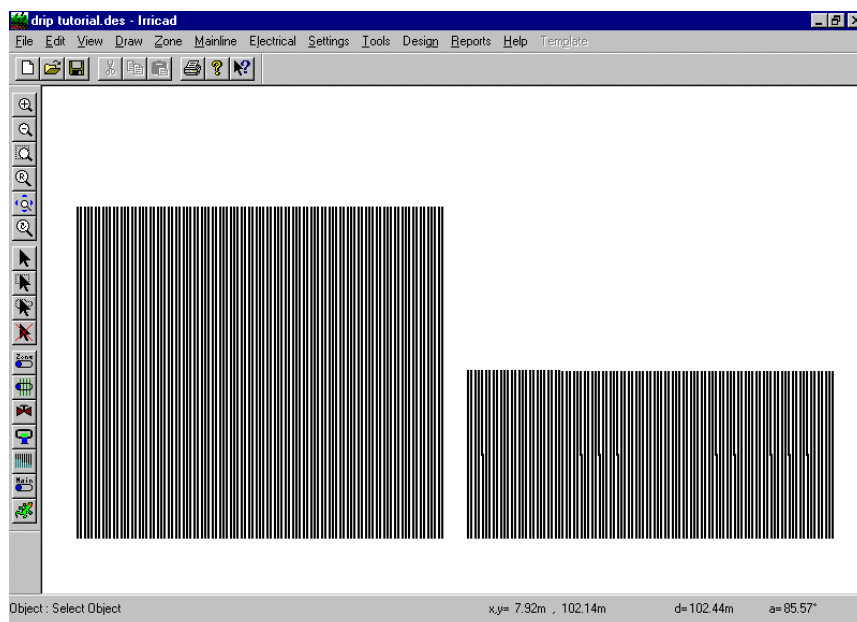


Figure DD 2

Draw a straight line across the top of the smaller block, starting at the right hand edge. Select *Right-Click|Restart* to finish Cut Pipe at the left-hand edge of the smaller block, leaving a small piece of pipe beyond the last lateral. Start a new Cut Pipe at the right-hand edge of the large block, through the center. You will notice f= and m= as laterals are connected via the submain. The f indicates the flow already connected, and the m indicates the maximum flow you can connect without receiving a warning. A warning will be issued when you have connected too many laterals so that the maximum allowable flow is exceeded. You can select No (go back to the last lot of laterals successfully connected) or Yes (include these laterals, even though the maximum flow is exceeded). It is advised to do small groups of laterals at a time, instead of the whole thing, knowing that the whole block definitely exceeds the maximum flow. This larger block should end up being two blocks, have a gap between the two 2 submains – where one ends and the other starts. Leave a small piece of pipe beyond both blocks (use *View|Zoom Window* to achieve this when the first block is complete to avoid the piece of pipe connected to the next lateral). When finished drawing in the submains, select *Right-Click|Restart*.

Select *Zone|Control Valve*. From the dropdown list select the 3" (80mm) Electric Valve, leaving the depth as 0, and place this on the ends of the

small piece of protruding pipe for all three blocks (use *View|Zoom Window* to zoom in to the pipe ends, particularly the one in the center of the large block. Accept the default zone name.

Now select *Mainline|Pipe*. Leave the pipe as Computer Selected at 0 depth. Click OK. Draw the mainline above the submain, teeing off to connect to each valve. Left click to place the end then select *Right-Click|Restart*. Select *Mainline|Water Supply* and place on the end of the mainline pipe with a left click. Leave the Water supply details as the default; simply click OK. Select *Settings|Miscellaneous* and change the Design Size to Medium. Click OK. Select *View|Zoom All* to see the whole design. See Figure DD3.

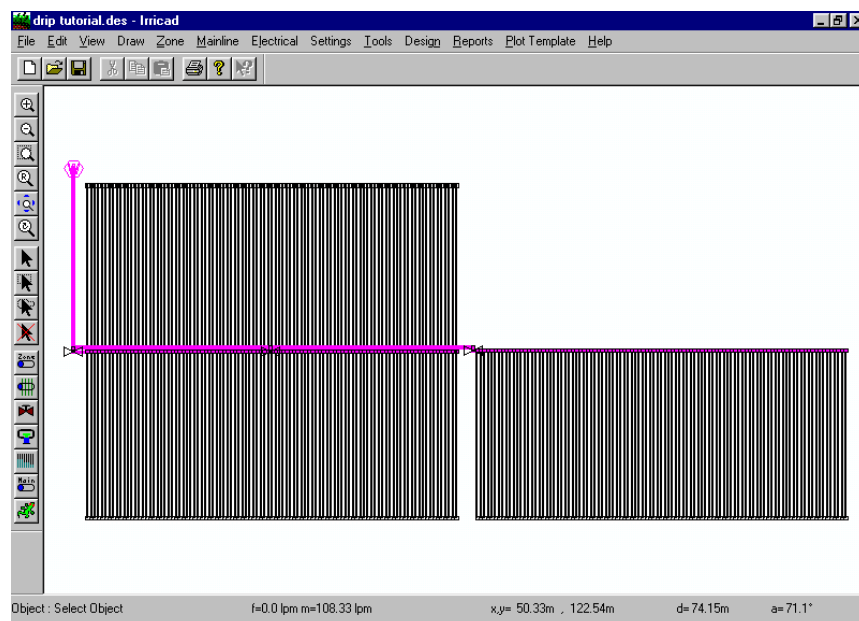


Figure DD 3

4.3.4.3 MANAGEMENT

Run *Design|Check Outlet Connectivity*. If no error messages appear, continue. If you do get an error message regarding an unattached item, go to the co-ordinates noted in the error message and connect the item to the pipe. Now we wish to assign the zones to system flows. Select *Design|Assign Each Zone to a Unique System Flow*. We want to run each zone separately, so IRRICAD fills in table with 3 system flows, where each zone operates on a different system flow. Each system flow

operates for a default time of 1 hour, as running time is not important here, but what is happening when each zone is running is important.

You will notice that Zone 1 will operate on System Flow 1, and Zone 2 will operate on System Flow 2 and Zone 3 will operate on System Flow 3 as in Figure DD 4. Click OK.

	System Flow Name	On	Off
1	System flow - 1	1 : 0 : 0	1 : 1 : 0
2	System flow - 2	1 : 1 : 0	1 : 2 : 0
3	System flow - 3	1 : 2 : 0	1 : 3 : 0

	Zone Name	1	2	3	4	5	6	7	8	9	10	11	12
1	Zone no. 1	1	0	0	0	0	0	0	0	0	0	0	0
2	Zone no. 2	2	0	0	0	0	0	0	0	0	0	0	0
3	Zone no. 3	3	0	0	0	0	0	0	0	0	0	0	0

Figure DD 4

4.3.4.4 DESIGN

The first step is to size the submain pipes. Go to *Design|Zone Design Configuration*. Change the number of submain sizes from 0 to 3 for both zones. 0 in this column means an unlimited number of submain sizes. We wish to limit the number chosen to 3. Click OK.

Select *Design|Zone Design|LP Design*. If Zone 3 gives the message Maximum number of iterations exceeded for LP, select *Design|Design Parameters|Analysis Parameters* and increase the Max. Iteration for Velocity and LP from 200 to 300 (bottom left). Click OK and run *Design|Zone Design|LP Design* again.

It is always a good idea to look at some reports before continuing. Look at the *Reports|Design Reports|Zone Summary*. The Zone Summary report gives a good indication of what is happening in the zones. It should look something Figure DD5. The present maximum dripper pressure is 12.4psi (8.7m) and the minimum is 11psi (7.6m). The actual pressure variations in the zones calculated from the actual minimum and maximum outlet pressures relative to the nominal inlet pressures are between 12% and 14% for all zones. This pressure variation includes the submain friction loss as well as the loss in the tapes. Close the report window by clicking the X.

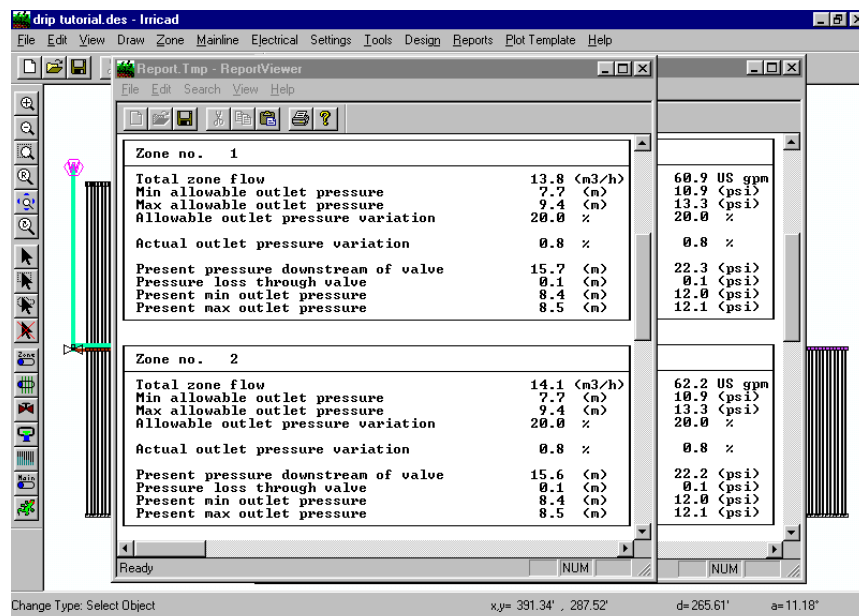


Figure DD 5

Run *Design|Valve Analysis*. This is usually very quick. Now we wish to size the mainline. Run *Design|Mainline Design|LP Design*.

Look at reports such as *Reports|Design Reports|System Duty* to see the demands on the water supply for each system flow. Make a note of the pressures and flows in this report.

4.3.4.5 COMPLETING ANOTHER OPTION

We will now change the drip tape block so it has pressure regulation (for example Spaghetti Tubing) at the inlet of each tape.

We first need to make a copy of the existing design so that we do not have to start from the beginning again. Save the current design as Tape Design.des by selecting *File|Save* or *File|Save As...* Remember to save the second option we are about to do under a different design name.

Select *Settings|Design Details* edit the Notes line to add the words Regulated option.

Select *Tools|Select Object* and by clicking on the submain pipes then select *Right-Click|Object Info*, see what pipe sizes are present. Make a note of these pipe sizes as they are the submain sizes for the non-regulated option. We will compare these with the pipe sizes IRRICAD selects for the regulated option.

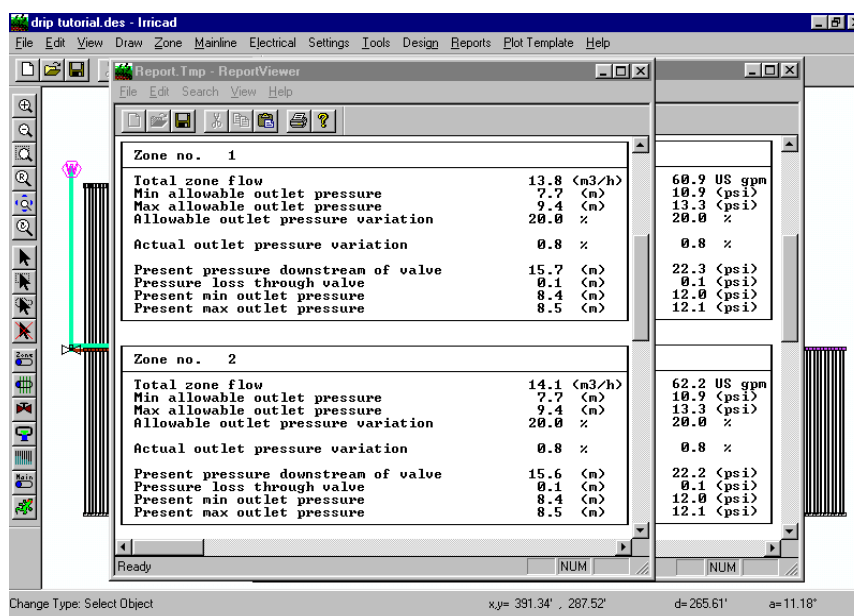


Figure DD 6

Now select *Tools|Select|All*. Select *Tools|Change Type* and click on a drip tape lateral. A dialog will appear with the Tape description. Check the Regulated check box and enter the submain pressure as 21psi (15m), leaving all other data as before. Click OK. Another dialog will appear asking for data to be matched and / or changed. Accept the defaults and Click OK. All tapes will now be changed to pressure regulated tapes (note the status bar will indicate how many items

matched the criteria and therefore were changed. In my case 303 tapes were changed). Select *Tools|Clear Selection*.

Select *Design|Zone Design|LP Design*. When this has finished, run *Design|Valve Analysis* and *Design|Mainline Design|LP Design*.

When Design is complete select *Reports|Design Reports|Zone Summary*. The results should be similar to this in Figure DD6. Compare these results with the unregulated design.

The results should be similar to the following:

Unregulated Pressure (psi):	Flow (gpm):	Regulated Pressure (psi):	Flow (gpm):
13.2	60.9	22.9	60.9
13.6	62.2	23.3	62.2
14.3	61.5	24.2	61.5

Unregulated Pressure (m):	Flow (m³h):	Regulated Pressure (m):	Flow (m³h):
9.3	13.8	16.1	13.8
9.5	14.1	16.4	14.1
10.0	14.0	17.0	14.0

Now see what pipe sizes this design has used in the submain by using Object Info (the regulated option should have larger pipe sizes and uses 3 pipe sizes whereas the non-regulated option used 2 pipe sizes in each submain and these were generally smaller).

The method of duplicating a design is very useful to design and price two options. It is a very useful step in the design of a large system. If the design is duplicated (saved under different file names) at several stages you can always go back to a stage and build the design in a different way. When the preferred option is completed all the unwanted duplicates can be deleted.

4.3.4.6 NOTES

Tools|Cut Lasso can be used to cut out sections you do not require, if you draw the whole property using *Zone|Block* or *Zone|Tape Block*. Then use Cut Pipe and Flow Check to divide into smaller blocks.

4.3.5 MICRO IRRIGATION DESIGN

This tutorial will take you through the steps required to design a Micro Irrigation scheme. The tutorial is intended to introduce you to the procedure required to design systems containing blocks of laterals as would normally be found in an orchard for example. Although the tutorial is based on a micro-sprinkler system the procedure applies equally well to drip and solid set systems. Although this tutorial shows a regular shaped system, irregularly shaped systems can be designed just as easily. There are many ways of doing such a design; this tutorial outlines only one of the ways.

4.3.5.1 STARTING THE TUTORIAL

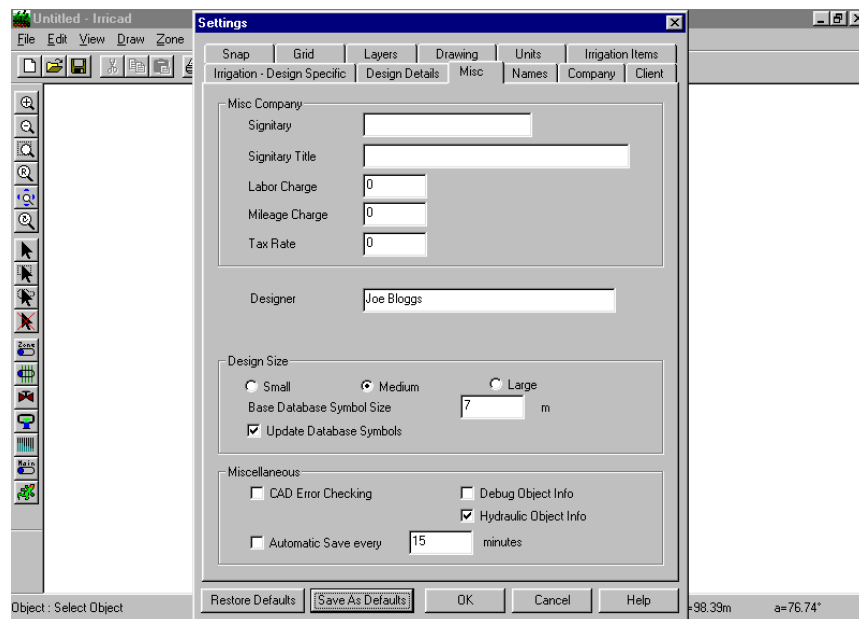


Figure MI 1

Double-click on the IRRICAD icon or select *Start|Programs|Irricad|Irricad* to run IRRICAD. If already running IRRICAD select *File|New* to start with a clean screen. In *Settings|Irrigation - Design Specific*, browse for the tutorial database Tutorial.mdb. This should be found in the Irricad\database folder.

If you prefer to work in Metric units, go to *Settings|Units* and click the Metric button (Metric unit users only). Note Metric measurements are displayed in brackets.

Go to the Misc. tab and select the Medium design size as in Figure MI 1. Change the Base Database Symbol Size to 23 (7). This determines the size of the symbols according to the size of the design. Enter your name in the Designer field. When you are finished Click OK.

4.3.5.2 ENTERING BACKGROUND INFORMATION

This is information required to position the irrigation system. Examples include boundaries, roads, buildings, perhaps text and symbols. For this tutorial we will put in an 1155ft x 825ft (350m x 250m) rectangle for the block boundaries. We will use a grid to help position things, though this is optional. Select *Settings|Grid* and enter the X and Y spacing as 15ft (5m). Tab between the fields. Check the Display Grid Points checkbox. Now select *Settings|Snap* and check the Snap to Grid option. Click OK.

Select *Draw|Rectangle|3 Point* and move the cursor to a grid point at the bottom left of the screen. Click the left mouse button to start the rectangle. You will notice that the status bar will ask you to enter the first point of the rectangle prior to you clicking the mouse and for you to enter the second point after you have placed the first. Because we know precisely the size of the area our client wishes to irrigate, type in 1155,<0 (350,<0) on the keyboard and press Enter. The first number is the length of the line, the second number following a < (less than) sign is the angle of the line. Now move the mouse up at right angles then type in 825 (250) and press Enter.

Select *View|Zoom All* to get the whole area in view on the screen. Inside this area are four blocks that we are going to design an irrigation system for. We need to place four more rectangles inside the current boundary rectangle and then move them into position. To do this place the first point inside the existing boundary 45ft (15m) - 3 grid points - from the top and left boundaries. Notice that only every 2nd grid point along the X-axis is shown at this zoom. Draw the cursor out towards the middle along the top. Now type 495,<0 (150,<0) and press Enter. Move

the cursor down at right angles and type in 330 (100) and press Enter. Select *Tools|Copy|Array* and click on the inner rectangle to select it, then enter 1 for the number of copies and 2 for the number of rows. Click on the bottom right corner of the inner rectangle then move the ghosted rectangle to three grid points from the right boundary, in-line with the original. Click to place. Move the ghosted rows to 3 grid points from the bottom and right boundaries. Click to place.

You need to enter site data if elevation changes over the plan are likely to affect the hydraulics of the system. If the design area is essentially flat you do not need to enter any elevation data and all objects will be given a default height of 0.

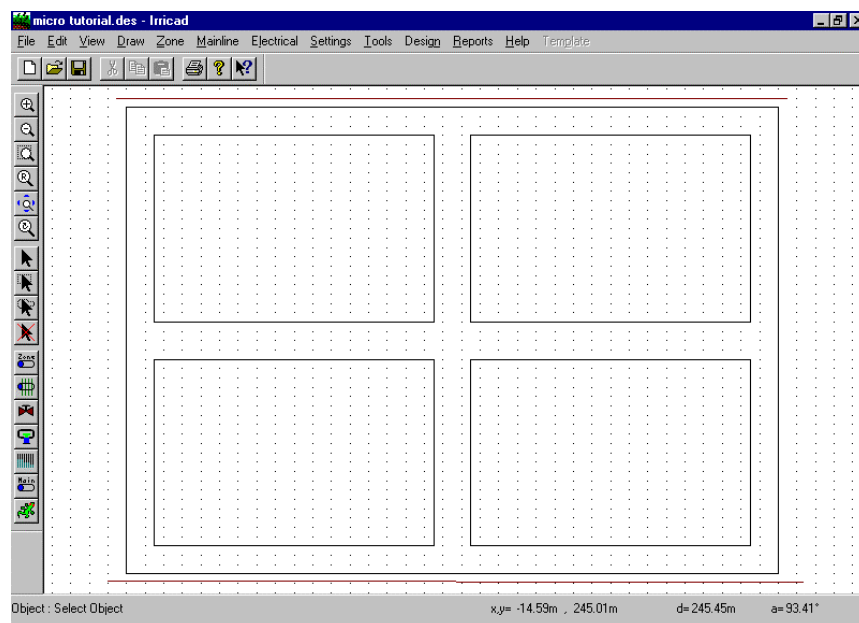


Figure MI 2

In this example there is a 5ft (1.5m) fall from the top to the bottom of the screen. To allow for this, select *Draw|Contour* and enter one contour line at the top of the screen. Move to the top left of the screen just above and to the left of the boundary rectangle. Click the left mouse button then drag the rubberband horizontally to the right until it is above and to the right of the boundary rectangle and click the left mouse button. Select *Right-Click|Done*. In the dialog, type 33 (10) as the contour height. Click OK. Now draw a contour similarly along the bottom of the screen below the boundary rectangle. Select *Right-*

Click *Done* and type 28 (8.5) in the dialog as the contour height. Click OK.

If you can still see the green rubberband color, select *View|Redraw*. Your design should look something like Figure MI 2.

4.3.5.3 PLACING THE BLOCKS

Before placing any laterals select *Settings|Irrigation - Design Specific* and uncheck the Create Sprayline Outlets checkbox. While you are in this dialog change the line widths of the pipes to Laterals 2, Mainline Pipes 4, Zone Pipes 3 and Wires 1. Now select the *Settings|Irrigation Items* tab, and uncheck the Flow Check Enabled box if it is checked. Click OK.

The laterals are to run the full length of the smaller block rectangles but be about 15ft (5m) inside the side boundaries. To make this easier to do it is useful to use grid points.

To enter a block of spraylines (laterals) select *Zone|Block*. A dialog for setting block and sprayline properties will be displayed. As you are completing a new design and may not know what pipe size to use you will get IRRICAD to size the laterals the pipe as Computer Selected. The laterals will be placed at ground level so the depth field can remain at 0.0. In the same dialog, select a sprinkler by clicking the down arrow. Highlight the Micro-sprinkler 360 degrees and left mouse click to select it. Select the WHITE 360 as the nozzle by clicking on the down arrow of the Nozzle field, highlighting the required nozzle and left clicking the mouse. Enter a pressure of 18.5psi (13m). Selecting an outlet connector or riser is optional but for this example we will use a Micro-sprinkler stake and tube $\frac{3}{8}$ " (10mm). If the micro-sprinkler is an assembly already containing a stake and tube you would not need to select another connector. In the same dialog, select the Micro-sprinkler stake and tube $\frac{3}{8}$ " (10mm) from the dropdown list. Enter the Lateral Spacing as 13ft (4m). Enter the Outlet Spacing as 11.5ft (3.5m). Leave the Outlet Spacing Properties as Rectangular for a rectangular layout. Leave the Offset as 0%, and make sure that the Connected checkbox is checked for connected spraylines.

Click the Options button and in the dialog that appears leave the number of laterals as 0 so that IRRICAD fills the blocks completely with laterals. Leave the Lateral Direction as Determine Automatically, so that IRRICAD will use the first segment of the block boundary lasso as the reference lateral. Leave the Extra Outlets box unchecked so that

IRRICAD does not put additional sprinklers on the ends of the lateral lines when the distance from the last sprinkler to the end of the line is greater than half the outlet spacing. Leave the Outlet Orientation at 0° and the Reference Outlet as Determine Automatically. Leave the Layer as <DEFAULT> so the spraylines will be entered into the Spraylines layer. Leave the lateral line width as 2. The dialogs should look like Figure MI3.

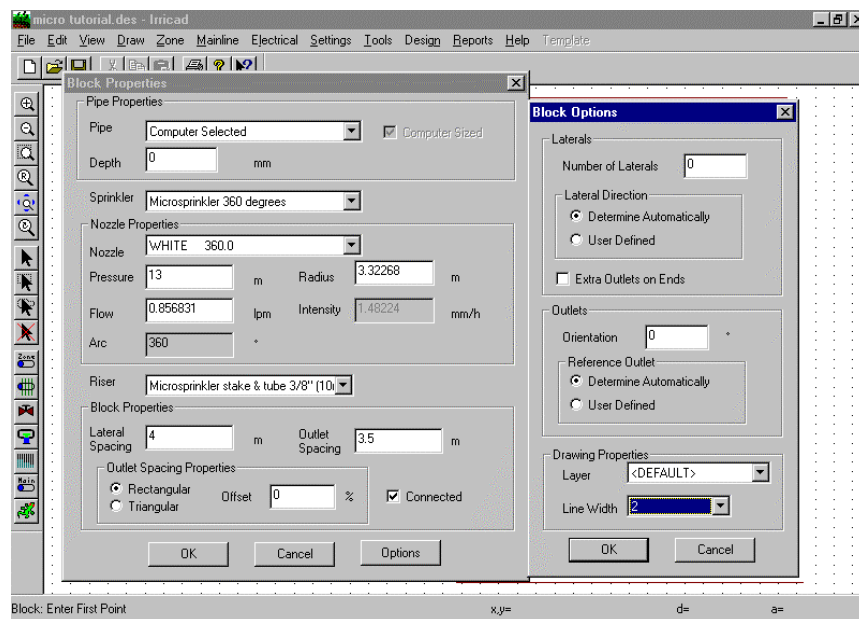


Figure MI 3

Click OK on both dialogs. A warning message will appear to indicate the lateral spacing maximum is 3.987m (this applies to metric users only). Click the Yes button to continue, as the value of 4m is very close to 3.987m.

You are now able to position the block boundaries.

Draw a block boundary 15ft (5m) (one grid point) within the top left rectangle using the grid points. You may wish to zoom in for this task. Select *View|Zoom Window* and drag a window around the top left rectangle. Start at the top-left by left-clicking on the first grid point in from the small rectangle boundary and move to the top-right and left click on the last grid point inside the small rectangle boundary, then bottom right, finally bottom left then select *Right-Click|Close*. Select

View|Zoom All. Repeat for the block at the top right. For the bottom two blocks start the lasso at the bottom left and move to the bottom right then top right, finally top left and close. Your design should look like Figure MI 4. Select *Settings|Snap* and check the Connect option.

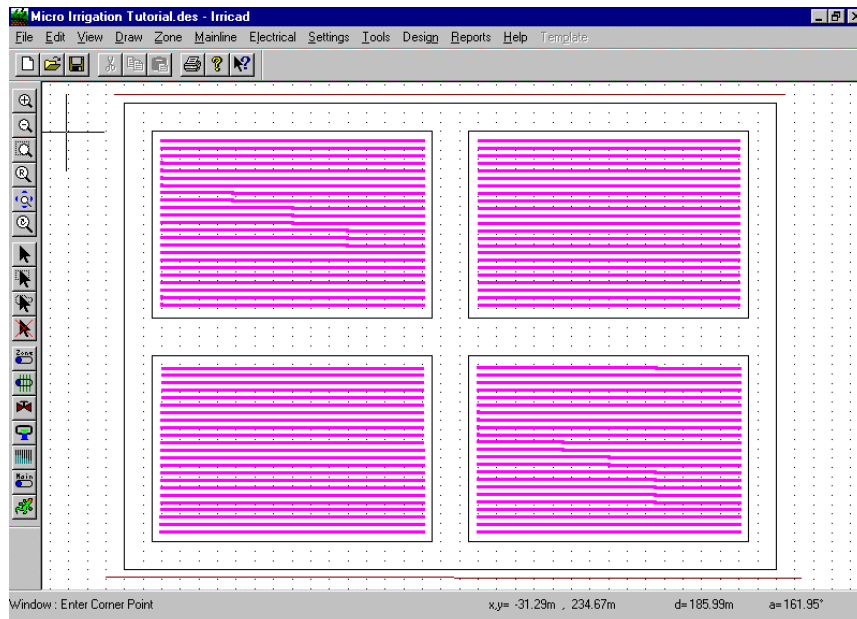


Figure MI 4

4.3.5.4 PLACING VALVES AND PIPES

The placement of laterals is now complete. As you want to connect a submain pipe to a number of laterals in one action select *Zone|Cut Pipe*. In the pipe dialog that is displayed leave the pipe as Computer Selected. Enter the depth as 24" (600mm) to place the submain 24 (600) below ground level. Leave the Layer as <DEFAULT> and the line width as 3. Click OK.

Select *Right-Click|Snaps|Midpoint*. Click on the top lateral in the top left block to connect to it. Select *Right-Click|Snaps|Midpoint* again. Click on the bottom lateral in the top left block to connect to it. IRRICAD will then automatically cut the laterals (or any other zone pipes that this line crosses). Pipe junctions (small black squares that you will need to zoom in on to see) will indicate these connections. Now continue the cut pipe down in a straight line until one grid point below the small rectangle boundary. Left click to place the end of the pipe then select *Right-*

Click|Restart. Repeat for the other three blocks so all four pipe ends are in the center, one grid point beyond each rectangle boundary.

Select *Zone|Control Valve* and select the 3" (80mm) Electric Valve from the dropdown list. Leave the Orientation as 0° and type in -12 (-300) for the depth. This places the valve at 12" (300mm) above the ground. Leave the Layer as <DEFAULT> as this will automatically place the control valves in the Control valves layer. Click OK.

Before placing the control valves select *Right-Click|Default Name*. Change the words Zone no. to Block so that the field will now read Block ~~~. Now each control valve you place will be named Block 1, Block 2, etc automatically and will save time from changing each zone name as each control valve is placed. Place four control valves on the end of each cut pipe previously drawn at the bottom of the top two blocks and at the top of the bottom two blocks just outside the block boundaries by left clicking on each pipe end.

Once you have connected the laterals and submains to the control valves, select *View|Zoom Window* and drag a window that will encompass all four control valves and by placing the top left corner and the bottom right corner of the zoom window by left clicking. Select *Mainline|Pipe*. Leave the pipe as Computer Selected. Enter the depth as 24 (600), and leave the line width as 4. Click OK. Connect the pipe to the top left block control valve by clicking on it then connect to the bottom left block control valve similarly. Select *Right-Click|Restart*. Repeat to connect the two right block control valves.

Select *Right-Click|Snaps|Midpoint*. Click on the left mainline pipe, then move across and select *Right-Click|Snaps|Midpoint*. Click on the right mainline pipe. Select *Right-Click|Restart*. Finally connect to the middle of this horizontal mainline pipe by selecting *Right-Click|Snaps|Midpoint*; run a short length of pipe up for 15ft (5m). Left click to place then select *Right-Click|Restart*.

Select *Mainline|Water Supply*. Connect to the junction on the end of the short piece of pipe by left clicking on it. Leave the name as the default Supply No. 1. Do not enter any flow or pressure requirements, as IRRICAD will determine these during design and analysis and assumes that the water supply is unrestricted. Click OK.

Select *Draw|Spot Height* and place a spot height on the water supply. Make the height 28.5 (8.75). This is to ensure that the position of the water supply will be allocated the correct elevation at that point. If spot

heights are available for a client's property, these can be used in conjunction with contour lines. If you have the information it is a good idea to use it. Select *View|Zoom All*. Your design should look like Figure MI 5. This completes the entry of the hydraulic components of the design.



Figure MI 5

4.3.5.5 ENTERING MANAGEMENT REQUIREMENTS

Select *Design|Check Outlet Connectivity* to make sure that all the outlets are connected to the zone control valve and that the valve is connected to the water supply. If IRRICAD does not report any unconnected items you can continue. If items are reported as not connected, their location will be displayed.

Note: Outlets do not have to be connected. Zone Control Valves, however, must be connected to the water supply before designing the mainline.

We now need to enter some management requirements. The primary purpose of management is to allow you to specify an operating sequence for the zone control valves, which set up a series of flow conditions in the mainline so that the mainline can be correctly sized and

analyzed. You have the option of specifying a simple worst case scenario for valve operation or of specifying a full operational sequence for all valves.

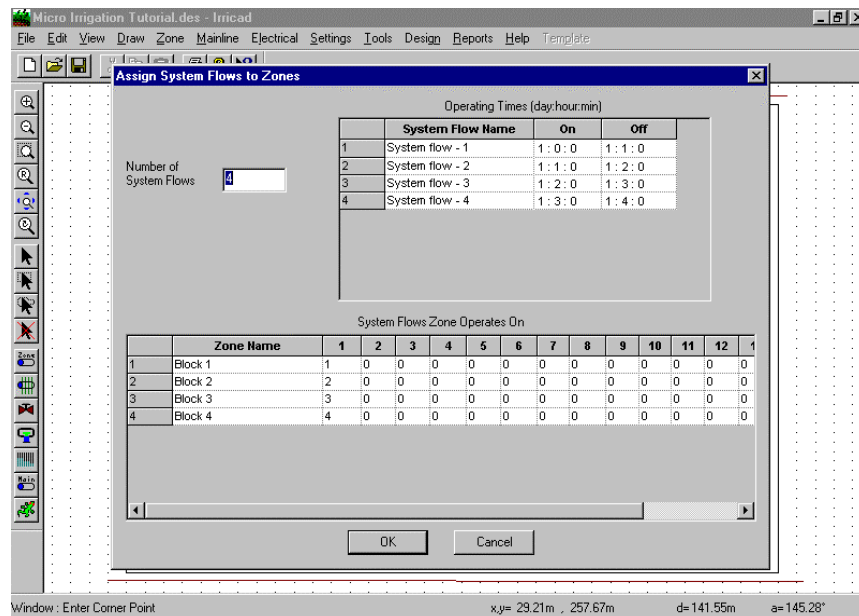


Figure MI 6

Since we will be operating each zone separately, on different system flows, *select Design\Assign Each Zone to a Unique System Flow*. A system flow is a zone or group of zones operating at the same time. The resulting dialog will have automatically allocated the four system flows to different time slots and each zone to a different system flow. This table can be edited if required so check the data is correct. Note the number of system flows is 4. The sequential operating times (one hour) for each system flow is listed. If actual start and stop times are not important (and this is the case for this system) the default times should be accepted. System flow operating times cannot overlap. Now note that Block 1 will operate on system flow 1, Block 2 on system flow 2, and so on as in Figure MI 6.

Click OK. We are now ready for the design process.

4.3.5.6 THE DESIGN PROCESS

Select *Design|Zone Design Configuration*. In the dialog you will see all four blocks listed down one side. For each block you can decide if you wish to design / analyze that zone. Leave this box checked for all blocks. The next column allows you to turn on or off the ability to allow for minor losses - leave this checked for all blocks. Change Diameter at Outlet only applies to zones with telescoping laterals. A check will ensure that a change in lateral diameter will take place at an outlet location. It is not normally used for dripper or micro-sprinkler systems, so leave this option unchecked for all blocks.

Number of Lateral Sizes allows you to specify the maximum number of pipe sizes used in each lateral (maximum 3). The default is 1. Change this to 2 for this design. Number of Submain Sizes allows you to specify the maximum number of pipe sizes to be used in the submain. Enter this as 2 for all blocks (if this number is left at 0 IRRICAD is unlimited in the amount of submains it can use to solve the design). Valve pressure is used when you wish to specify a valve pressure for a zone. A 0 entry means that IRRICAD is required to calculate a suitable pressure, so leave this as 0.0 as in Figure MI 7. Click OK.

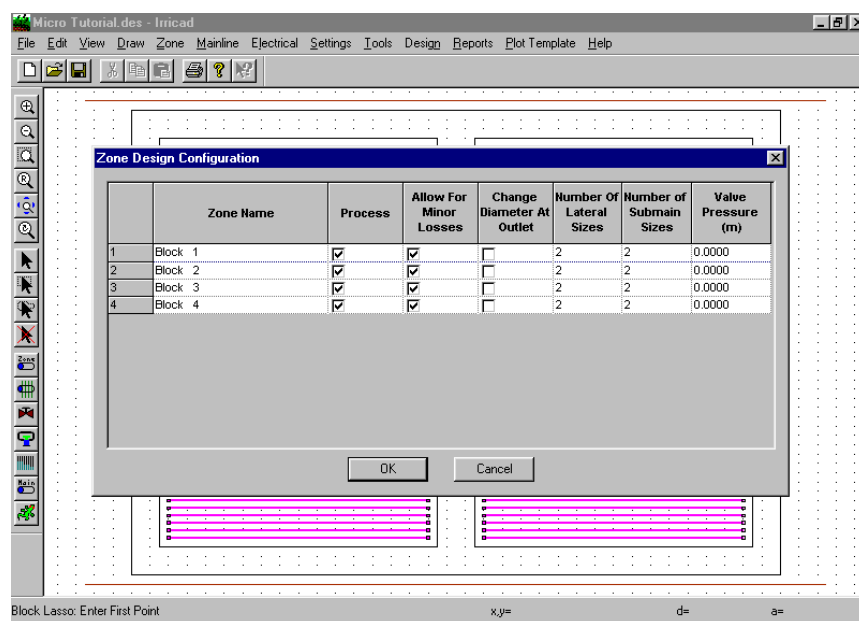


Figure MI 7

Select *Design|Design Parameters|Hydraulic Parameters* and enter the Maximum Zone Pipe Velocity as 5ft/s (1.5m/s). Click OK.

Select *Design|Zone Design|LP Design*. This method of computer sizing takes into account the maximum allowable velocities (in *Design|Design Parameters|Hydraulic Parameters*) and the pressure requirements of the sprinklers. Select this option to have IRRICAD size the laterals and submains for the zones. You will get some warning messages during LP Design indicating that some of the blocks have nozzle pressures outside the specified operating range. You should have results similar to Figure MI 8.

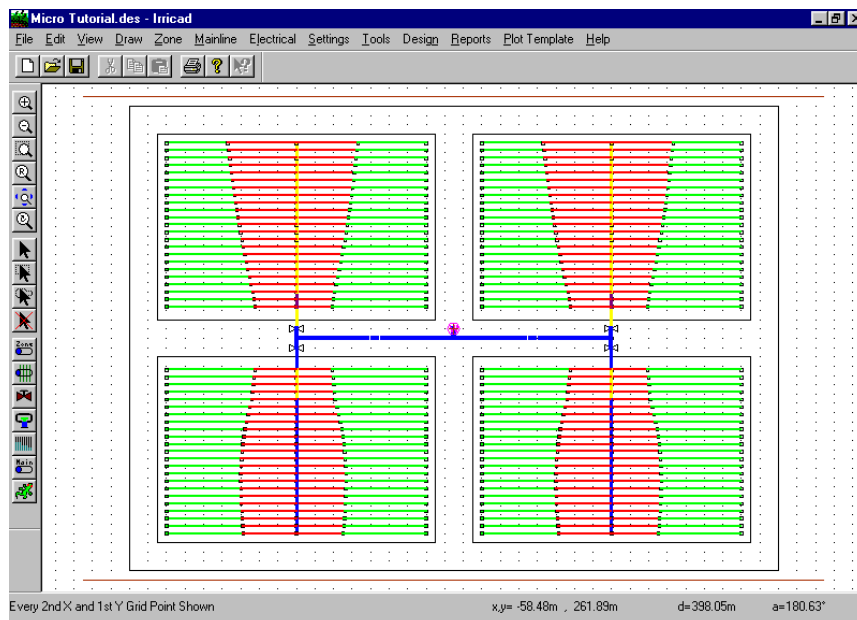


Figure MI 8

It is advisable to check the data in the zone reports after zone design (*Reports|Design Reports*). At this stage the Zone Summary report gives a good indication of the overall design of the zones. As you will see, the minimum present outlet pressure is 0.2psi (0.2m) below the allowable minimum outlet pressure. We will not worry about this at this stage. Note down the present downstream pressure of the valve that IRRICAD has calculated for each zone as this will be used later for analysis. It should be between 17-21psi (12m and 15m). Click on the X to close the report window.

Select *Design|Valve Analysis* to have IRRICAD calculate the pressure losses through the zone control valves. This usually runs very quickly.

Having completed the valve analysis, you can now have IRRICAD size the mainline for the design. Select *Design|Mainline Design|LP Design*; IRRICAD will then size the mainline for the design and calculate the water supply pressure so that the zone control valves receive the required pressure.

We now want to tidy up the design as the position where the laterals change size varies. In order to make the system easier to install it is desirable, in this example, though optional, to straighten up the size change positions. This will also fix the warning message about some nozzle pressures being outside the specified operating range.

Select *Tools|Move Sizes*. On the left side of the submain in the first block find the junction furthestmost from the submain where the laterals change size. Draw a line vertically through the laterals such that it passes through this junction by left clicking above the block and then left clicking at the bottom of the block, so that the line passes fully through all the laterals. Use grid points as a guide to help you with this. When you select *Right-Click|Done* a dialog will give you the choice of whether you want the lateral size change to take place at a sprinkler or not and which size you want to move. Uncheck the Nearest Outlet checkbox so that the lateral will change size on the line. Select the Close option, so that the junction closest to the line will be moved. Click OK and IRRICAD will move the junctions to the line. Repeat for both sides of the submain in all blocks. Your design should now look like Figure MI 9.

The system can now be analyzed to assess the effect of the modifications. Select *Design|Zone Design Configuration* and type in the valve pressures you noted previously as the Valve Pressure for the respective zone control valves. You can specify the same pressure at each valve - choose the highest pressure to enter for all. Click OK.

Now select *Design|Zone Design|Detailed Analysis*. This will analyze each block without making any changes to the pipe sizes already selected. Detailed Analysis also shows you exactly what is happening at the outlets. When Detailed Analysis is completed, re-run *Design|Valve Analysis* and *Design|Mainline Design|Analyse*.

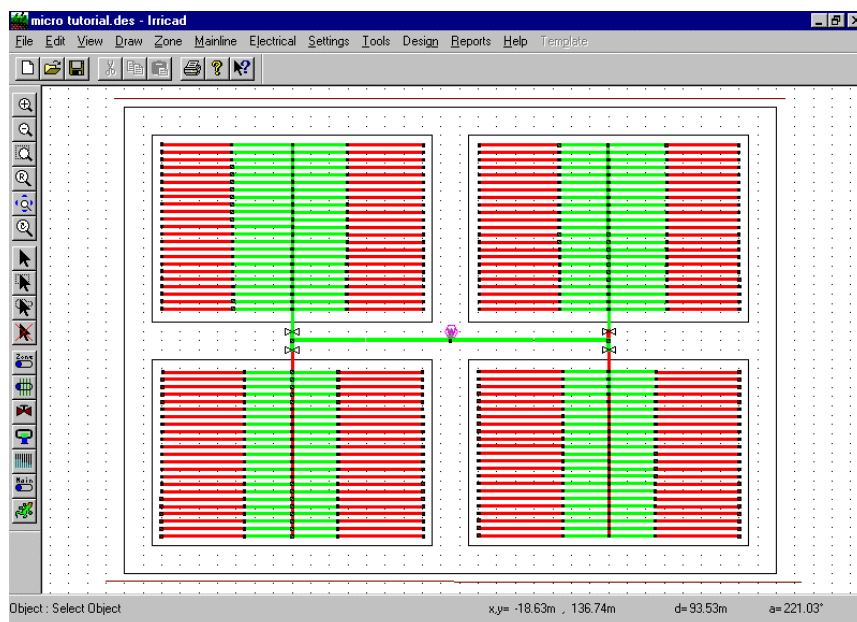


Figure MI 9

4.3.5.7 DISPLAY REPORTS

You may wish to select and view some of the design reports.

As seen previously, the Zone Summary Report (*Reports|Design Reports*) gives you a summary of the pressure variation in the block. The System Duty Report gives you the duty required at the water supply for each system flow. The Mainline Summary Report gives a summary of actual and required pressures at the zone control valve.

Check that the outlet pressure variations (as seen in Figure MI 10 in the Zone Summary Report) are within requirements. Note the changes since you have moved the lateral pipe sizes and run Detailed Analysis.

If you wish to narrow the pressure variation, there are several things you can do:

- Move the change of pipe sizes of the laterals as described previously using *Move Sizes* so that there are longer lengths of the larger pipes.
- Manually change the submain pipe sizes using *Tools|Select Object* and *Tools|Change* or *Tools|Change Type*.

- Change the nominal pressure required at the outlets to a value closer to the actual pressure calculated by using *Tools|Select|All* and *Tools|Change Type* and selecting a representative sprayline.

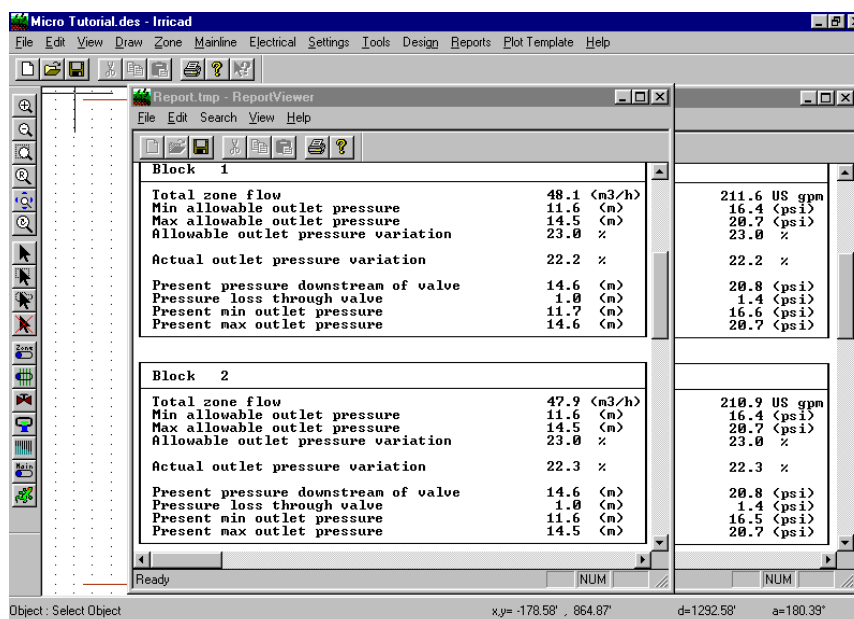


Figure MI 10

For details on how to use these tools see the Tool & Command Reference.

To have IRRICAD automatically select the pipe fittings required for the design you need to select *Design|Computer Selection of Fittings*. IRRICAD will look at each pipe or component junction in the design and from the database select the fittings needed to join these pipes or components together. The internal junction numbers will be displayed on the status bar as it does this.

After running Computer Selection of Fittings it is a good idea to look at one of the Bill of Materials reports, e.g. *Reports|Bill of Materials Reports|BOM* to find out if IRRICAD was able to select all the fittings required for the job. If fittings could not be found to solve particular junctions details of those junctions will be listed at the end of the report.

4.3.6 SOLID SET SPRINKLER DESIGN

4.3.6.1 INTRODUCTION

This tutorial will take you through the steps of a setting up a solid set sprinkler design. To achieve the purpose of this tutorial we will proceed to set up a sprinkler system for frost protecting a stone fruit orchard. Although it is a regular shaped system irregular shapes can be just as easily. There are many ways of doing such a design, this tutorial outlining only one of the ways.

4.3.6.2 OVERVIEW

A solid set system is one that is non-movable, tends to be unconnected spraylines (though pipes and sprinklers are placed in one action, they remain separately pipes and sprinklers) and has a low number of sprinklers. Because we wish to place water on trees to protect from frost, we require a riser to place the sprinkler 16.5ft (5m) above the pipe in the ground.

4.3.6.3 STARTING THE TUTORIAL

Double-click on the IRRICAD icon, or select *Start|Programs|Irricad|Irricad*. If already running IRRICAD select *File|New* to start with a clean screen.

In *Settings|Irrigation - Design Specific*, browse for the database Tutorial.mdb. This should be found in the Irricad\database folder. Click the Open button. In the same dialog select the pipeline widths for laterals 2, mainlines 4, zones 3 and wires 1.

Note that at the top of the dialog is a series of tabs. Select the Design Details tab. Edit the design details for this design. For the site type Stone Fruit Orchard and for the notes type Solid Set Sprinkler Tutorial. If you prefer to work in Metric units, go to *Settings|Units* and click the Metric button (Metric unit users only). Note Metric measurements are displayed in brackets. Select the Misc. tab and select the design size as Medium. Change the Base Database Symbol Size to 26 (8). This determines the size of the symbols according to the size of the design. When you are finished, click OK. Select *File|Save* and save the design.

4.3.6.4 ENTERING BACKGROUND INFORMATION

First we will enter the background or base information which is required in order to position the irrigation system. Examples include property

boundaries, roads, buildings, perhaps text and symbols. This client has an area of 37 acres (15ha) in nectarine trees. For the tutorial we will put in an orchard boundary 1640ft (500m) x 980ft (300m) to cover the blocks of trees, water supply, house and some sheds. The rest of the client's property does not concern us for this project.

We will use a grid to help position things, though this is optional. Select *Settings|Grid* and set up a grid 20x20ft (6x6m). Check the Display Grid Points checkbox.

Select the Snap tab and select the Snap to Grid option. Click OK. Select *Draw|Rectangle|3 Point*. Place the cursor at the bottom left and left mouse click. Draw a horizontal line to the right, and then without clicking, type (500,<0) on the keyboard and press Enter. Move the mouse upwards and, without clicking the mouse, type 980 (300) on the keyboard and press Enter. Select *View|Zoom All*. You now have a rectangle 1640x980 (500x300) on the screen.

This small orchard is divided into blocks 330ft (100m) x 700ft (210m). Draw a 3-point rectangle in the same manner as above, so the smaller rectangle is inside the larger one. Start the top right corner of this rectangle 120ft (36m) (6 grid points) from the right boundary and 60ft (18m) (3 grid points) from the top boundary. Notice that only every 2nd grid point along the X-axis is shown at this zoom. Type 330,<180 (100,<180) for the width and 700 (210) for the length of the rectangle. Select the rectangle, then select *Tools|Copy|Linear* and enter 3. Click OK. Select the top right corner as the reference point then drag the 3 copies to the left until the left most copy is about 120ft (36m) (6 grid points) from the orchard left boundary, i.e. the 4 rectangles are evenly spaced across as in Figure SS1, and left click. The block rectangles are only 20-40ft (6-12m) apart. This distance between blocks represents a shelterbelt; the grid represents tree spacing within the block.

Using *Draw|Rectangle|2 Point*, draw a house and farm building towards the bottom left of the orchard boundary. Make the house 40x60ft (12mx18m) and the buildings 20x20ft (6mx6m). Use grid points to size the rectangles.

Select *Settings|Snap* and select Connect to turn Snap to Grid off. Now place a road name at the top of the boundary by selecting *Draw|Text* and typing Luke Road. Change the Height to 32ft (10m). If you wish, change the font to another true type font. Click OK, and drag the label above the top property boundary line and left click to place. Select *Draw|Text* again and type Tyre Road, and change the orientation to 90°.

Click OK and place at the left boundary. Label the house and buildings in the same way, changing the orientation of the text back to 0°.

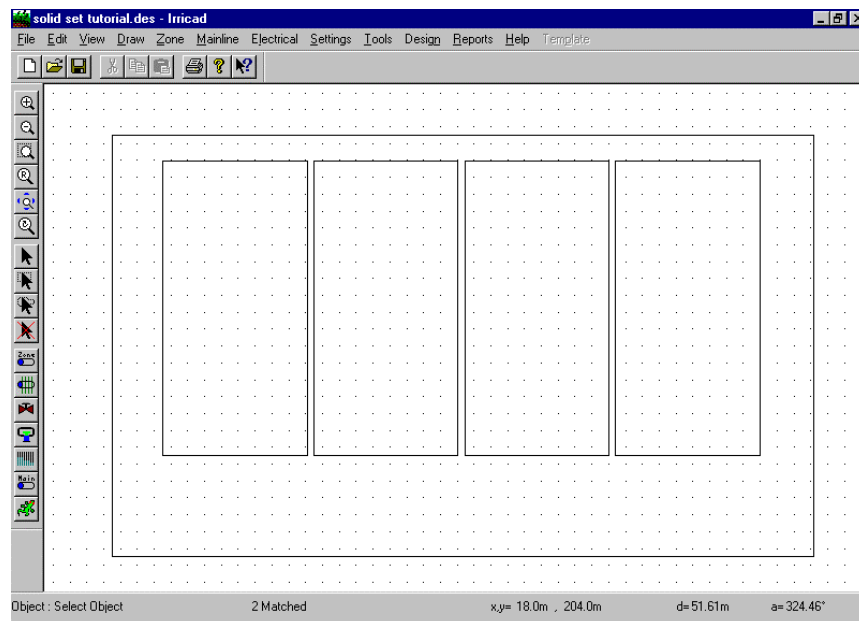


Figure SS 1

4.3.6.5 LAYING OUT FIXED SPACED OUTLETS

Now select *Zone|Block*. Leave the pipe as Computer Selected. Select the Big Impact Drive Sprinkler and the 4.4 nozzle. Change the pressure for the nozzle to 64psi (45m). The radius will change to 59.05ft (18m). Select the 3/4" x 16ft (20mm x 5m) Galvanized Pipe Riser and change the lateral and outlet spacing to 60ft (18m) each. Leave the Outlet Spacing Properties as Rectangular and 0% offset. Uncheck the Connected checkbox. Click the options button and check the Extra Outlets on Ends checkbox as in Figure SS 2. Click OK on both dialogs.

Select *Settings|Snap* and turn Snap to Grid on. This tool will help you position the blocks of spraylines within each block boundary. Proceed to draw the block lasso from the upper most grid point in the top left corner of the left block (within the rectangle) by clicking on the grid point. Move across to the right-hand border of the far right rectangle, in line with the previous point, click, and down to the bottom grid point of the far right rectangle, drawing the lasso along the right border, click to place. Now move across to the bottom left grid point in the first box, click, and up to

the starting point by selecting *Right-Click|Close*. The lasso will encompass all four blocks. When you close the lasso (*Right-Click|Close*) IRRICAD will automatically start to place the spraylines within the lasso.

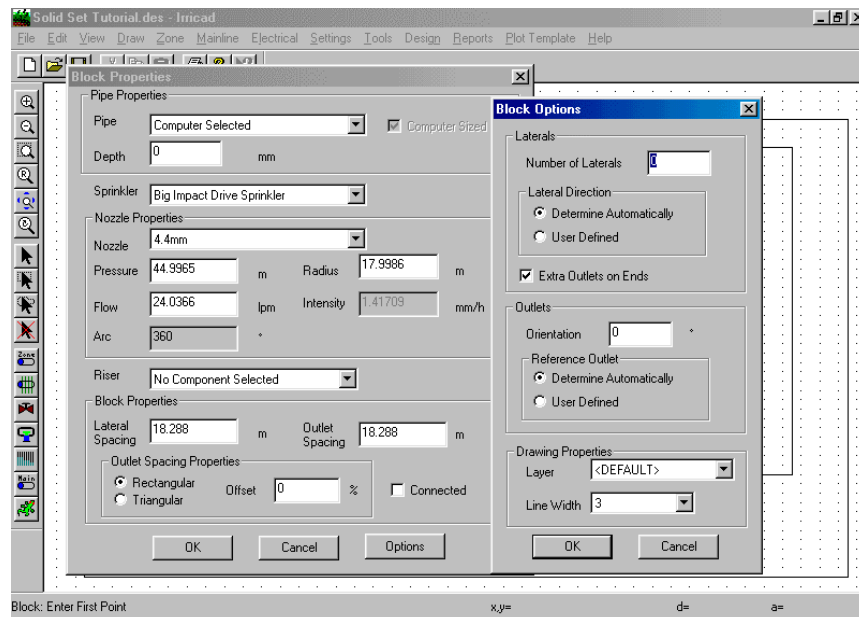


Figure SS 2

To make it easier to see what is happening we will hide the sprinkler wetted radius arcs. Select *View|Wetted Radii* to turn off the wetted radii and select *Settings|Snap* and turn on Connect. See Figure SS 3. Zoom in to the left-hand row of sprinklers - the first placed on each sprayline. Check if a junction can be seen where the first sprinkler connects to the pipe. If a junction is seen, the sprinkler is not connected to the pipe. This can be rectified either by moving each of these sprinklers until they connect to the pipe (no junction is seen when connected) or by deleting the block and turning off Snap to Grid (*Settings|Snap* and select Connect) before drawing the block boundaries.

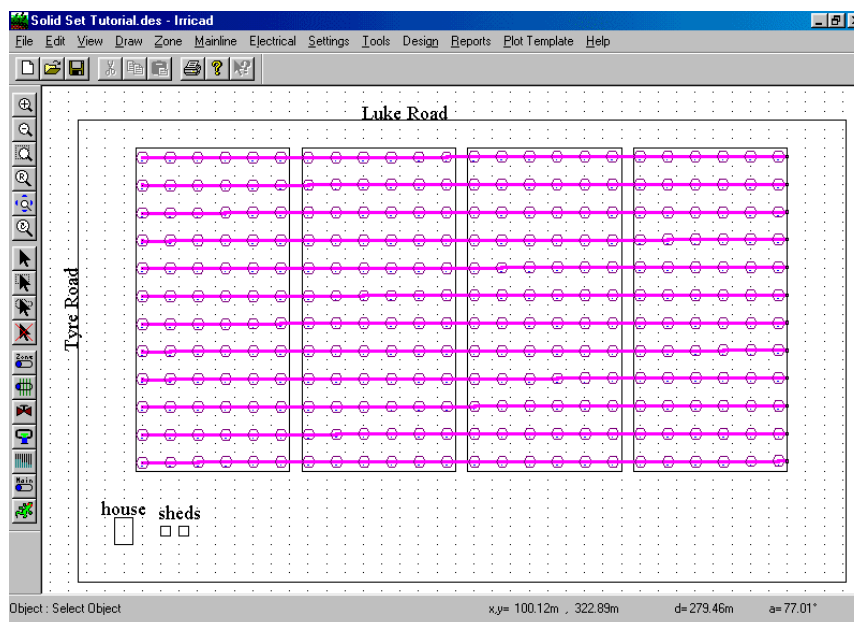


Figure SS 3

4.3.6.6 DIVIDING INTO ZONES

Now we wish to separate the four blocks into 4 zones, and connect to a water supply. By using the Select Window tool we can select the pieces of pipe between each block. Select *Tools|Selection Filter*. Select *Zone Pipes* in the Layer and check the filter checkbox. Make sure all the other fields in this dialog say <ALL>. Draw a window around the gap between the first and second blocks using *Tools|Select|Window*, including the blocks outer most outlets. Repeat for all pipe between the blocks so that the pipes we wish to remove are highlighted, including the pipe ends after the last sprinkler to the far right. Select *Tools|Delete*. Select *Tools|Selection Filter* and uncheck the Filter checkbox.

Select *Zone|Cut Pipe* and click OK on the dialog. Select *View|Zoom Window* and drag a window around the first block so that the block is enlarged on the screen. Place the first point of Cut Pipe on the top line of the rectangle, directly above the outlet on the right end of the lateral in the left block. Draw a pipe down the ends of the laterals to the bottom line of the rectangle and left click. Cut Pipe will connect to each pipe end or pipe it crosses. Repeat for the left side of the second, third and fourth blocks.

From *Zone|Control Valve* select the 4" Gate Valve (Flanged) and click OK. Place a control valve on the bottom end of the submains you have just drawn and left click. Accept the default zone names.

Now use mainline pipe to connect the control valves to a water supply as in Figure SS 4.

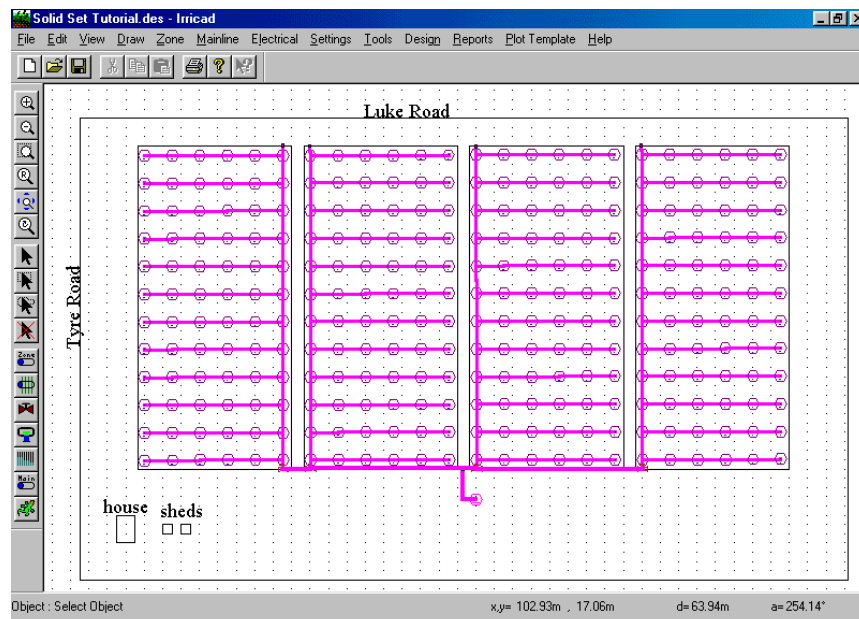


Figure SS 4

Select *Mainline|Pipe* and click OK on the dialog. Connect the four control valves by left clicking on each one then select *Right-Click|Restart*. Because control valves cannot be in-line on a mainline tee-off a short piece of mainline on which to place the water supply by moving to the center of the pipe between the first 2 valves and left clicking, moving down about 65ft (20m) and left click again. Move right about 16ft (5m) and left click again then select *Right-Click|Restart*. The water supply can be positioned by selecting *Mainline|Water Supply*. Click on the end of the mainline pipe just created. Leave the Water Supply details at the default values. Click OK. We are assuming an unlimited water supply, so IRRICAD will work out the pressure and flow required from the water source. If the water supply is limited (e.g. resource restrictions), these would be entered here. See Figure SS4.

4.3.6.7 MANAGEMENT

Management data must now be entered. Select *Design|Zone Operating Times*. Enter the On times for each zone as 5am and the Off time for each zone as 7am (e.g. 1:5:0 - 1:7:0). Click OK. This type of management is more commonly used for small irrigation systems that have blocks starting and stopping at different times.

4.3.6.8 DESIGNING

Now select *Design|Design Parameters|Analysis Parameters*. At the bottom left of the dialog is a section headed Iterations. In the box titled Max. for Velocity & LP is a default of 200. Increase this value to 250 for this exercise. Under normal circumstances, if LP or Velocity Design is having problems solving the design, increase this value by 50 at a time. In Hydraulic Parameters check the Max. Zone Pipe Velocity is 6.5ft/s (2m/s). Click OK.

Select *Design|Check Outlet Connectivity*. If no error messages occur, proceed. If items are detected as unconnected, check the outlet, sprayline or control valve connections.

Before selecting the design process run the Database Editor by clicking on the *Start|Programs|Irricad|Irricad Databases*. If the Tutorial database is not your default database, it will not automatically be opened (check the file name at the top of the Database Editor window). If the opened database is not Tutorial.mdb, click Save Changes and use *File|Open* to open the Tutorial database from in the \Irricad\database folder. The first component tab is the Pipe tab. Find the 4" (100mm) Class 125 PVC Pipe and type ZM in the usage column (or highlight the pipe and select Edit / View Pipe. Select ZM from the dropdown list in the Usage field). Save Changes and close the Database Editor.

Select *Design|Zone Design|LP Design*. As LP is running, you will see the pipes being selected for the design. When this has been completed run *Design|Valve Analysis*. This is usually very quick. Now run *Design|Mainline Design|LP Design*.

You will notice that the pieces of pipe above the top laterals have not been sized, due to having no flow. They are yellow in color and if you select one of these and then select *Right-Click|Object Info* or *Right-Click|Modify|Change*, the pipe description will be ****No Pipe Selected**** or **Computer Selected** respectively. Use *Tools|Select Window* and drag a window around the top part of the design so that all four non-sized pipes

are selected. Select *Tools|Change Type* and click on one of the selected pipes. You may wish to zoom in to do this using *View|Zoom Window*. Select the pipe to be the same pipe size as the immediate upstream pipe, e.g. 2" Class 125 PVC Pipe. In the Match / Change dialog, keep Match Pipe in case any other pipe was accidentally selected. Make sure Change Pipe is also checked. The status bar will display the number of items matched and changed. This should be 4.

Select *Settings|Miscellaneous*. Check the Hydraulic Object Info checkbox and click OK. Use Select Object to click on a pipe. Select *Right-Click|Object Info*. This info gives you the layer the pipe is on, the pipe size and the hydraulic information for the pipe since design has been run. This is a quick summary for the hydraulic object selected. More than one item can be selected at a time, however, there is a limit to how many items Object Info can display.

Select *View|Zoom All*. Go to *Design|Zone Design Configuration* and enter the Valve pressure as 78psi (55m) for all zones. Run *Design|Zone Design|Detailed Analysis*. This will analyze each block without making any changes to the pipe sizes already selected. Detailed Analysis uses an iterative process to exactly match the flow of an emitter, sprayline or control valve to the pressure at that point and therefore allows a designer to more accurately gauge how a system would perform in practice. This is especially so when the resulting pressures are substantially different from those specified. In the standard analysis mode IRRICAD uses the selected nominal flows for emitters and spraylines to calculate the flow and resulting pressures in a system. In most circumstances this method is slightly conservative. Detailed Analysis gives us a better picture of what is happening at the outlets. Detailed analysis can be used for zone drippers, sprinklers, and spraylines, tapes and also VIH sprinklers in mainline. There is obviously no advantage in running a detailed analysis for systems that only contain pressure compensated emitters. For using *Zone Design|Detailed Analysis*, valve pressures must be specified. For running *Mainline Design|Detailed Analysis*, a water supply pressure must be specified. Re-run *Design|Valve Analysis* and *Design|Mainline Design|Analyse*.

4.3.6.9 REPORTING

Look at the reports. Useful reports which tell you the basics of what is happening in the system at a glance are the *Reports|Design Reports|Zone Summary* and *Reports|Design Reports|System Duty*.

Your Summary Report should look something like Figure SS 5, where each zone flow is approximately 459gpm (104m³/h), the actual outlet pressure variation is 14% and the pressure loss through the valve is 0.

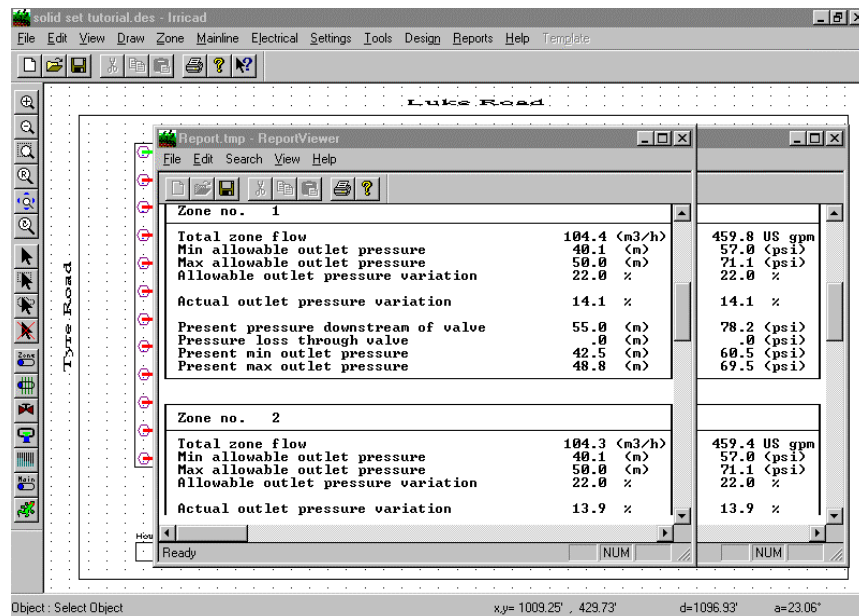


Figure SS 5

Look at some of the other reports for more results on the system.

To acquire a full costing report, we will want to price all the fittings as well as the design we have just laid out. Select **Design|Computer Selection of Fittings**. IRRICAD will automatically find fittings for the junctions. When this is complete, look at any of the Costing or Bill of Materials reports in the Reports menu to find any fittings selection errors. Any junctions that could not be solved with the items currently in the database, or flagged for usage will be listed at the end of the report.

See the Database Tutorials - Fittings Selection to find out how to fix these by updating the database.

4.3.7 RESIDENTIAL DESIGN

This tutorial design involves siting sprinklers in a garden, and connecting them up to a zone control valve and water supply.

4.3.7.1 STARTING THE TUTORIAL

The first step is to start a new design. Run IRRICAD or select *File|New*.

Now select *Settings|Irrigation - Design Specific* and browse for the database Tutorial.mdb. You should find this database in the Irricad\database folder.

While in this dialog make sure that the Create Wetted Radii checkbox is checked and change the line widths to the following:

Laterals:	2
Mainline:	4
Zone:	3
Wire:	1

Select the Misc. tab and select the Small design size. Enter the symbol size as 1.7ft (0.5m). Click OK.

4.3.7.2 BACKGROUND INFORMATION

We need to enter some details about the house and garden we are designing the irrigation system for. The L-shaped house is created with rectangles, and has a 5-sided conservatory on one end. We will use a grid to help us position things, though this is optional. Select *Settings|Grid* and enter the X spacing as 16ft (5m) and the Y spacing as 10ft (3m). Check the Display Grid Points checkbox. In the Snap tab select the Snap to Grid option. Click OK. Select *View|Zoom In* twice.

Select *Draw|Polygon|Center* and enter 10 in the Number of Sides field. Select Inscribe and click OK. Click on a grid point in the top left quadrant of the screen and then move the cursor up a grid point and left click. The polygon boundary should cover 3 grid points vertically, one point at the center and one each at the top and bottom of the boundary. Select *Draw|Rectangle|2 point*. Click on the bottom of the polygon then draw the rectangle up and to the right until it covers 4x3 grid points and is therefore 48x20ft (15x6m). Left click.

Select *Settings|Snap* and turn off Snap to Grid by selecting Connect. Click OK.

Select *Draw|Rectangle|3 Point*. Select *Right-Click|Snaps|Endpoint* then click on the bottom right corner of the rectangle. Select *Right-Click|Snaps|Object* then move the cursor horizontally to the left and type 23 (7) and press Enter. Move the cursor down and type 23 (7) and press Enter.

Because we wish the house and conservatory to be one object, we wish to delete the line where the two rectangles join and the polygon sides inside the rectangle. If we were to select this line or a polygon side, the whole rectangle or polygon would be selected. If we explode the objects we can delete a line at a time as required. Select *Tools|Select|All*. Both rectangles and the polygon should be green in color - meaning they are selected. Now select *Tools|Explode*.

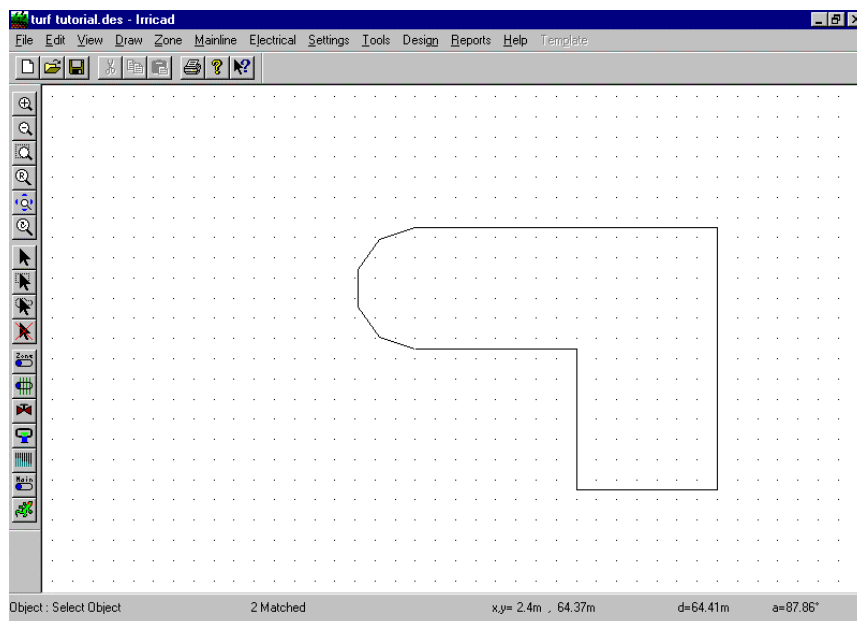


Figure TD 1

Select *Tools|Select Object*. Select the five polygon sides inside the rectangle and the rectangle side inside the polygon by clicking on them and press Delete. Click Yes to confirm deletion of the selected objects. Click on the rectangle line where the rectangles meet and press Delete. One line will be deleted. The second line is the complete side of the

horizontal rectangle. Select *Tools|Break*. Click on the line. Select *Snaps|Endpoint* and click where the line meets the right-hand side vertical line of the two rectangles. Select *Snaps|Endpoint* and place the cursor on the inner corner where the second rectangle starts and left click. The line between has been erased. The house should look like Figure TD1.

The bottom right hand side of the house is a garage. The driveway runs from here straight down to the road. A path continues from the drive up the side of the house to the front door. To draw these items in, we will use a double line for the driveway, and a single line to continue the path.

The width of the house at this point is approximately 23ft (7m). The path will be 3ft (1m) wide. Select *Draw|Line|Double*. The left offset will be 0; the right offset will be 26ft (8m). Click OK. Select *Right-Click|Snaps|Endpoint*. Place the cursor at the bottom right hand corner of the house, left click and draw the double lines downward. Type 11.5,<270 (3.5,<270) and press Enter. Select *Right-Click|Done*.

Select *Draw|Line|Single* then select *Right-Click|Snaps|Endpoint*. Place the cursor on the top of the left-hand double line you have just drawn and left click. Type 23,<90 (7,<90) and press Enter.

A sidewalk runs along the road at the bottom of the drive. Using double lines again, draw a sidewalk 3ft (1m) wide. Select *Draw|Line|Double*, leave the left offset as 0, but change the right offset to 3ft (1m), select *Right-Click|Snaps|Endpoint*. Place the cursor at the bottom right-hand side of the drive left click and type 6,<0 (2,<0) and press Enter. Select *Right-Click|Done*.

Now select *Draw|Line|Double* again, and reverse the left and right offsets, making the left offset 3ft (1m) and the right offset 0. Click OK. Select *Right-Click|Snaps|Endpoint* and place the cursor at the bottom right-hand side of the drive, left click, type 66,<180 (20,<180) and press Enter. If you cannot move this far to the left without going off the edge of the screen select *View|Pan* and then left click towards the left of the screen about half way up. Select *Right-Click|Done*. Select *View|Zoom All*. Using *Draw|Line|Continuous* specify the property boundary so that it looks like Figure TD 2. Select *Right-Click|Snaps|Endpoint*. Place the cursor at the left top of the sidewalk left click and type 69,<90 (21,<90) and press Enter. Select *View|Zoom All*. Now type 98,<0 (30,<0) and press Enter. Select *Right-Click|Snaps|Endpoint* then left click near the sidewalk to place the line the sidewalk on the right hand side of the

house. Select *Right-Click|Restart*. Select *File|Save* and save the design.

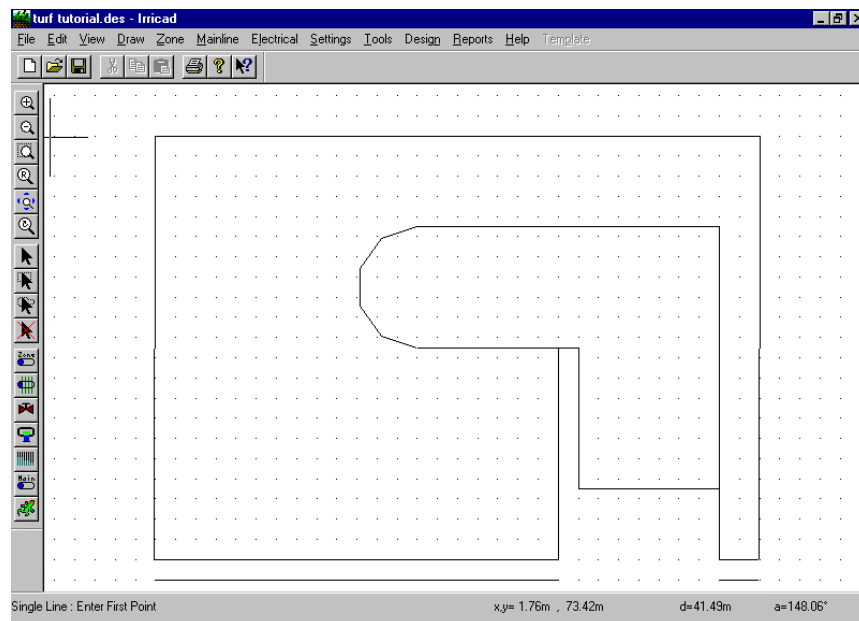


Figure TD 2

Along the right-hand side of the house and drive is a row of shrubs. Select *Draw|Symbol*. In the dialog you will see a Load button. Click this button and select BROWN SHRUB and BROWN TREE from the list of symbols (hold the Ctrl key down to enable multiple selection). Click Open. Leave the Maintain Shape checked but uncheck the Dynamically Size box and enter the width as 5ft (1.5m). Click OK. Move to the bottom right of the property and left click to place a shrub between the house and the boundary. Select *Tools|Copy|Linear* and click on the shrub symbol. Enter 7 as the number of copies and click OK. Click the center of the symbol and drag the copies vertically upwards to evenly space them along the boundary next to the house. Left click to place. Select *Draw|Symbol* and select BROWN TREE from the drop down list. Check the Dynamically Size box. Click OK. Place a tree in the top right corner of the property by clicking on the corner of the boundary, and dragging the symbol size out until it is a suitable size. Left click to place.

By using *Draw|Curve|Continuous Bezier* draw a garden area around the bottom and left sides of the property boundary. Make the garden approximately 10ft (3m) wide. By clicking the cursor on the screen, you

can place the curve as required. When finished, select *Right-Click|Done*. In the same way, draw a garden area around the conservatory about 7ft (2m) wide. You will probably find it useful to use the grid to help you with this. Place some BROWN SHRUB symbols 3ft (1m) in size (*Draw|Symbol*), as described above, along the garden boundary parallel with the sidewalk. See Figure TD 3.

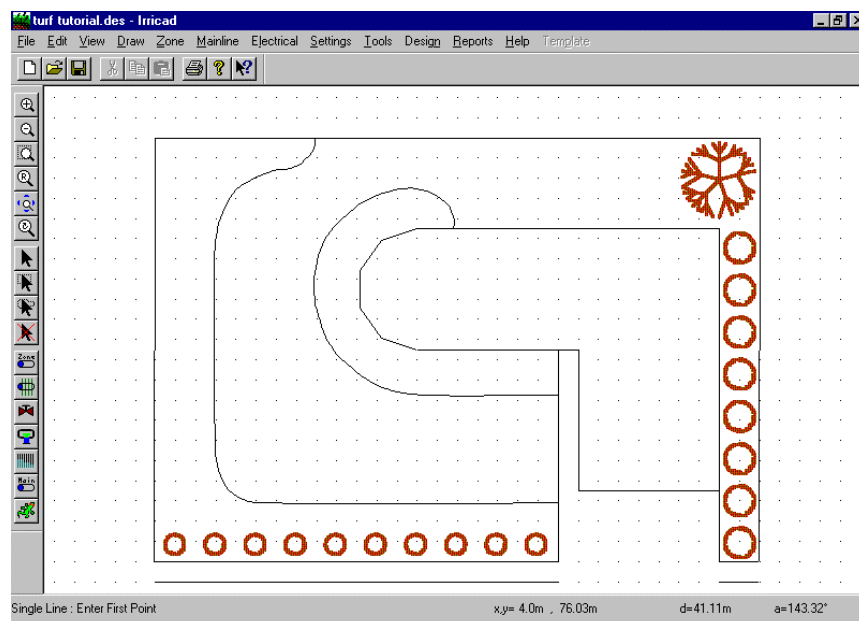


Figure TD 3

4.3.7.3 PLACING SPRINKLERS AND DIVIDING INTO ZONES WITHIN THE AVAILABLE WATER RANGE

The requirements for irrigating the garden involve irrigating the lawn and the garden.

To help orientate the sprinklers, select *Zone|Area* and draw two area boundaries, one around each piece of garden. To draw an area place the cursor at a boundary point, left click, then trace over the lines and curves, left clicking where required. Close the area by selecting *Right-Click|Close*. Ignore the Max. Intensity and Depth / Volume values as we are using areas only for orientating arcs. Make sure the Set Arc Orientation Using Area checkbox is checked. Click OK.

Select *Zone|Sprayline*. In the Sprinkler edit box, leave the pipe as Computer Selected and enter a depth of 12in (300mm). Select the Garden Spray Sprinkler from the dropdown list. The default nozzle (10 garden) is the only nozzle available with this outlet. Change the pressure to 20psi (14m). Note that the radius 11ft (3.3m) will adequately water the garden. Change the arc to 180°. Do not select a Riser for the outlet, as this is optional and not required in this case. Enter the outlet spacing as 10ft (3m). Uncheck the Connected box. Click the Options button and uncheck the Fixed Spacing box so IRRICAD will adjust the sprinklers to fit the required area. Click OK on both dialogs.

Move to the bottom right corner of garden area, just within the area boundary on the driveway side. Click to place the start of the sprayline. Move just inside the bottom left corner and click again. Go to the top left corner and click, then extend the sprayline along the top boundary about 10ft (4m). Click to place, then select *Right-Click|Restart*. If the sprayline is snapping to the area boundary and the arc is not being orientated to inside the area, select *Right-Click|Snaps|Place* before left clicking to place each point inside the area.

Place a sprayline around the conservatory garden starting next to the path along the garage, placing the sprayline next to the house, again, just inside the area. Several of the wetted radius arcs of the sprinklers in the conservatory garden do not touch the area. Although this is physically correct since the sprinklers cannot spray water around corners we will change the arcs to make the drawing look better. This is purely cosmetic. Using *Tools|Change* click on an arc that needs changing. Arcs are measured anti-clockwise from the horizontal (0°) so if the start of the arc needs adjusting edit the Start Angle field. If the end of the arc needs adjusting edit the included angle field. Click OK. You may need to do this several times to get the arc positioned correctly. Repeat for any other arcs that need adjusting. Your design should look something like Figure TD 4.

We are now ready to place the lawn sprinklers. Delete the Areas around the gardens. You can use *Tools|Selection Filter* to do this. Select Area as the Type and check the Filter checkbox. Select *Tools|Select|All* and press the delete key. Go back to *Tools|Selection Filter* and uncheck the Filter checkbox. Select *Zone|Area* and draw an area that will encompass all the lawn area. Check the Set Arc Orientation Using Area checkbox. Click OK.

Select *Zone|Sprayline*. Leave the pipe as Computer Selected and enter a depth of 12" (300mm). Choose the Lawn Pop-Up Sprinkler. Select

the 13 nozzle from the dropdown list and change the pressure to 25psi (17.5m). Type in 180° for the Arc. Do not select a Riser. Enter the outlet spacing as 13ft (4m).

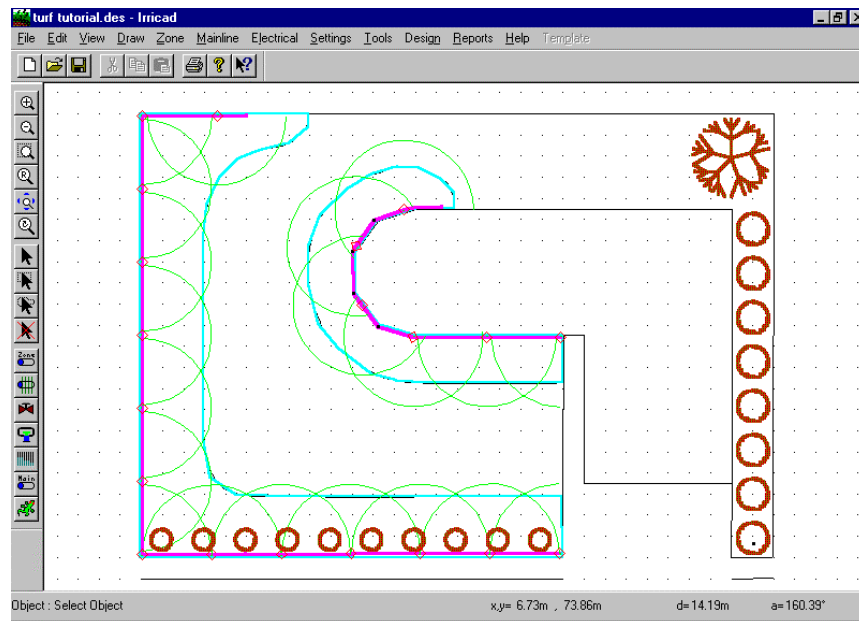


Figure TD 4

Make sure the Connected checkbox is unchecked and also the Fixed Spacing box in the Options dialog. Click OK. Place spraylines as before just inside the lawn boundary. Start about 10ft (4m) to the right of the end of the top conservatory garden. Follow the edge of the house, then the right boundary, top boundary and the garden edges (within the Area you have drawn), clicking at each change of direction to place the sprayline. Select *Right-Click|Restart* at the top end of the conservatory garden. Delete the pipe back to the last sprinkler (do not do this elsewhere, only back to the last lawn sprinkler placed).

Adjust any arcs as required. Note, depending on the actual dimension of your design and the placement of the house etc, select outlets with the required radius as needed. If you have a larger area of lawn, select a different nozzle that gives you a larger radius of throw. The above is a demonstration of how to achieve good coverage. Note that any outlet can be deleted, placed (select *Zone|Outlet*) or moved to achieve better coverage. See Figure TD 5.

We wish to place a tape to water the shrubs at the side of the house. The first step is to set up the database to enable the drip tape to be used. Run the IRRICAD database editor either from your desktop or from the *Start|Programs|Irricad|Irricad Databases*. When the database editor has finished loading the current default database, Click the Save Changes button. In the screen that remains, select *File|Open*. Browse for the Tutorial.mdb database in the Irricad\database folder. Click the Open button.

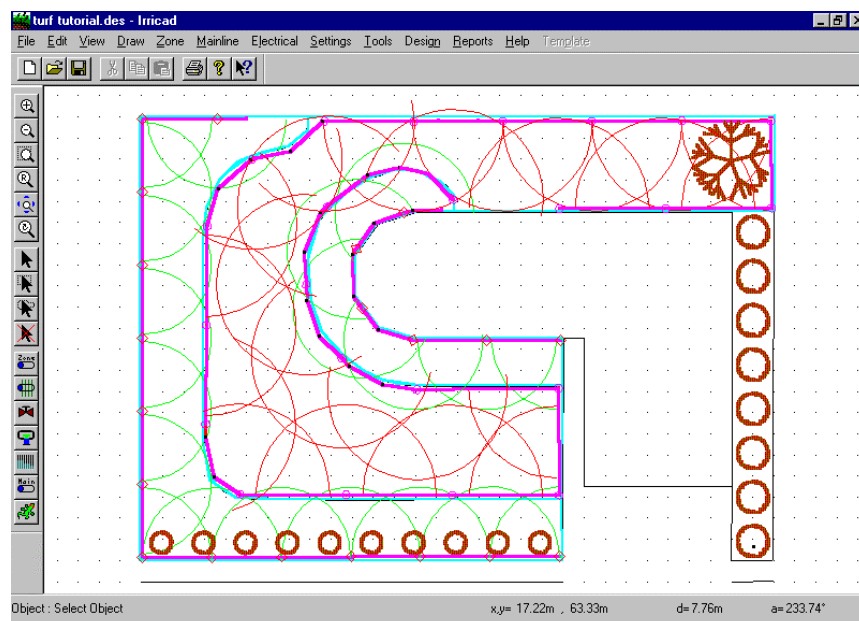


Figure TD 5

Now select the Tapes tab at the top of the screen. Highlight the Drip Tape 1.65lph (0.44gph) and select the Edit / View button. Change the Usage to L and the spacing at the bottom of the dialog from 4.1ft (1.25m) to 1.6ft (0.5m). Click the Save button on this dialog, and then the Save Changes button on the main dialog. Exit the database editor. Select *Zone|Tape* and from the dropdown list select the Drip Tape 1.65lph (0.44gpm). Set the inlet pressure to 14psi (10m). Do not check the Regulated checkbox as this tape is not pressure regulated at the inlet. Click OK and draw a tape through the line of shrubs at the right-hand side of the house, from about the middle of the bottom shrub up to the middle of the top shrub. Select *Right-Click|Restart*. See Figure TD 6.

Select *Zone|Pipe*, and leaving the pipe as Computer selected, enter a depth of 12" (300mm). Connect this pipe to the start of the tape and draw it upward to just below the sprayline. Do not connect to the sprayline. You may wish to use *Right-Click|Snaps|Place* to avoid connecting to the sprayline.

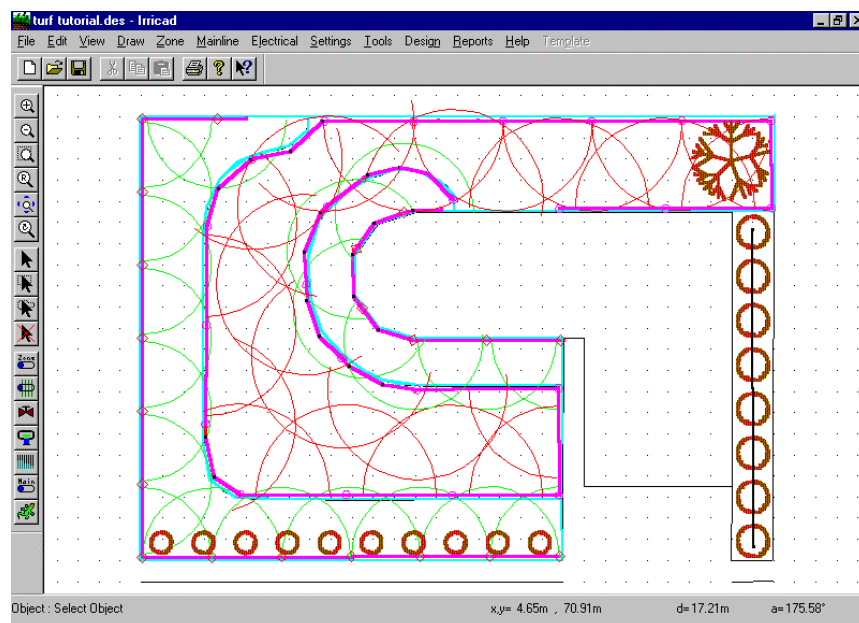


Figure TD 6

Because we have a maximum flow rate of 6gpm ($1.4\text{m}^3/\text{h}$), this limits how many sprinklers we can have running at any one time. Because the garden and lawn sprinkler zones have a water requirement greater than the maximum available flow, we are required to create more zones.

To do this we will be cutting out sections of existing zone pipe, adding control valves and mainline pipes to join to the water source. When we have completed the changes, there will be six zones on this property: The lawn to the right of the water supply, the shrubs with drip tape, the conservatory garden, the front garden piece, the left side garden, and the main lawn piece.

First we will enter a water supply to signify the tap that will supply the sprinklers. *Select Mainline|Water Supply* and place the water supply on the house wall boundary close to the end of the conservatory garden. It should be approximately mid way between but vertically below two

sprinklers of the top most lawn boundary. Click to place the water supply (see Figure TD 7). In the Water Supply dialog enter the name as Mains Supply 1, the Design Head of 35psi (25m) and Maximum Head as 50psi (35m), the Design and Maximum Flow as 6gpm (1.4m3h). Though the tap will be above ground level we have not worried about that in this example.

Select *Zone|Control Valve*. Select a 1" (25mm) Electric Valve from the dropdown list and click OK. Click on the zone pipe end after the top conservatory garden sprinkler to connect the valve.

Use *Tools|Select Object* and click on the pipe between the second and third garden sprinkler from the left on the bottom boundary. Press the delete key. Select *Zone|Pipe* and connect a Computer Selected pipe at 12" (300mm) depth to the third sprinkler mentioned above. Extend this pipe approx. 5ft (1.5m). Click to place then select *Right-Click|Restart*. Select *Zone|Control Valve*. The 1" (25mm) Electric Valve should still be selected. Place a valve on the end of the pipe you have just drawn as in TD 7.

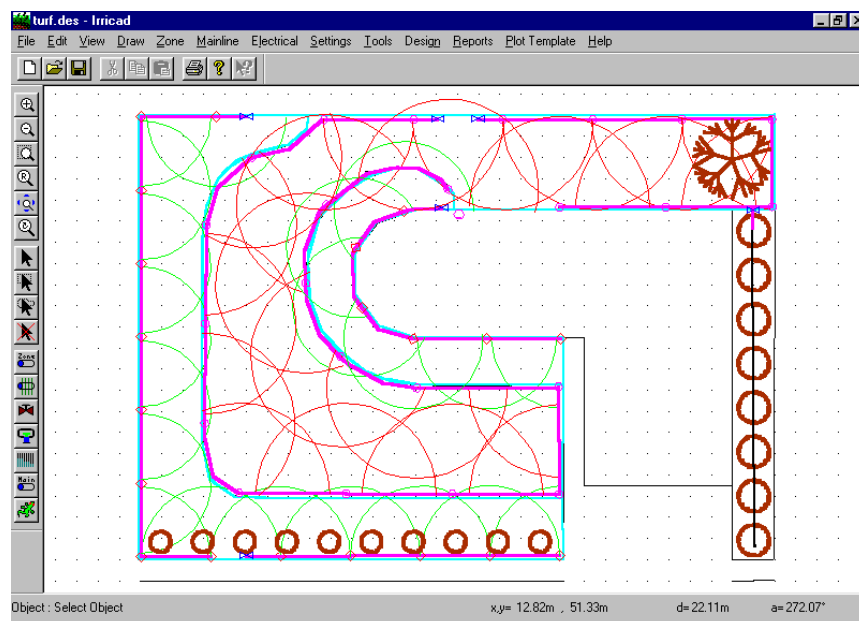


Figure TD 7

If the rightmost garden sprinkler at the top left of the property is vertically above or to the right of this valve we need to move it to the left as we will

place another valve vertically above the bottom one. Select the sprinkler (*Tools|Select Object*) by clicking on it then select *Tools|Move* and move it slightly to the left of the point vertically above the bottom valve. Left click to place. Select *Zone|Pipe* and click OK. Extend a short length of pipe from the rightmost garden sprinkler at the top left of the property to the right by connecting to the sprinkler with a left click and moving to the right and left clicking again. *Select Right-Click|Restart*. The end of the pipe should be roughly vertically above the valve at the bottom of the property. Select *Zone|Control Valve* and click OK and connect a valve to the end of this short piece of pipe.

Now connect two valves to the pipe above the water supply. Place them opposite the water supply, one a little to the left and one a little to the right. Select the piece of pipe between them and delete.

Lastly, connect a valve to the top of the pipe connecting to the tape. See Figure TD 7.

4.3.7.4 CONNECTING THE SYSTEM

We will now connect the valves with mainline pipes. Select *Mainline|Pipe* and select the 1" Class 125 PVC Pipe and enter a depth of 12" (300mm). Because we know what pipe size we want to use, we have selected. Click OK. We need to zoom in near the water supply. Select *View|Zoom Window* and draw a window around the valves near the water supply and the water supply itself. Connect a mainline pipe between the two valves at the top of the design above the water supply by left clicking on them then select *Right-Click|Restart*.

Left click on the water supply and draw the pipe vertically up to connect to the pipe you have just drawn between the valves. Left click on the pipe then select *Right-Click|Restart*. Left click on the valve in the conservatory garden near the water supply and draw the pipe horizontally to connect to the mainline pipe from the water supply. Make sure the pipe does not snap to the center of the water supply itself, as only one pipe can connect to the water supply. If this happens, select the pipe and delete it. Start again, but this time before connecting to the mainline pipe coming from the water supply select *View|Zoom Window* and zoom in on the water supply. Not connect to the existing mainline pipe. Left click on this pipe then select *Right-Click|Restart*. Select *View|Zoom All*.

Connect a pipe between the two garden valves at the top and bottom by left clicking on them then select *Right-Click|Restart*. Select *View|Zoom*

Window and draw a window around the three valves along the top boundary. Tee off the left-hand side vertical mainline pipe by left clicking on it about 1.5ft (0.5m) below the valve and draw the pipe horizontally to connect to the right-hand side vertical mainline pipe, left click then select *Right-Click|Restart*. Select *View|Zoom All*.

Select *View|Zoom Window* and drag a window to encompass the water supply and the tape valve. Select *Mainline|Pipe* again and connect to the valve by left clicking on it. Left click again to connect the valve to the mainline pipe above the water supply. Your garden design should look like Figure TD 8.

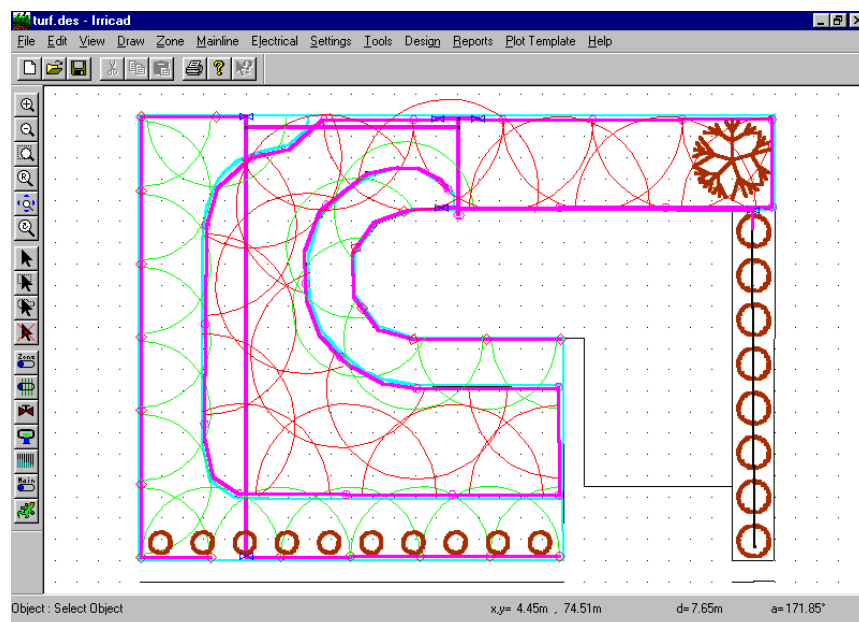


Figure TD 8

4.3.7.5 DESIGN

We are now ready for the design process. Select *Design|Check Outlet Connectivity*. It is always a good idea to check that everything is connected to the water supply.

Now select *Design|Assign Each Zone to a Unique System Flow* and check that there are 6 system flows and each zone is operating on a separate system flow, like Figure TD 9 shows. Click OK.

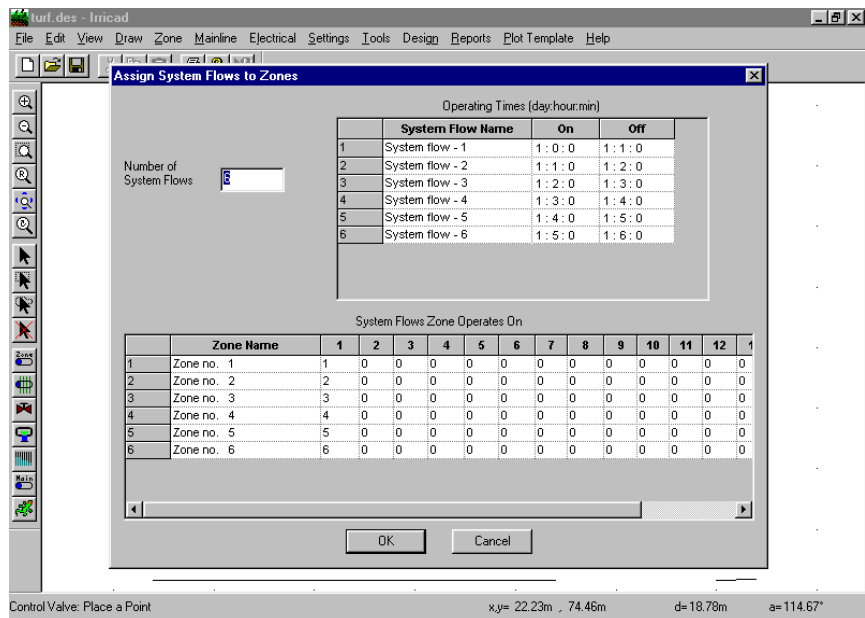


Figure TD 9

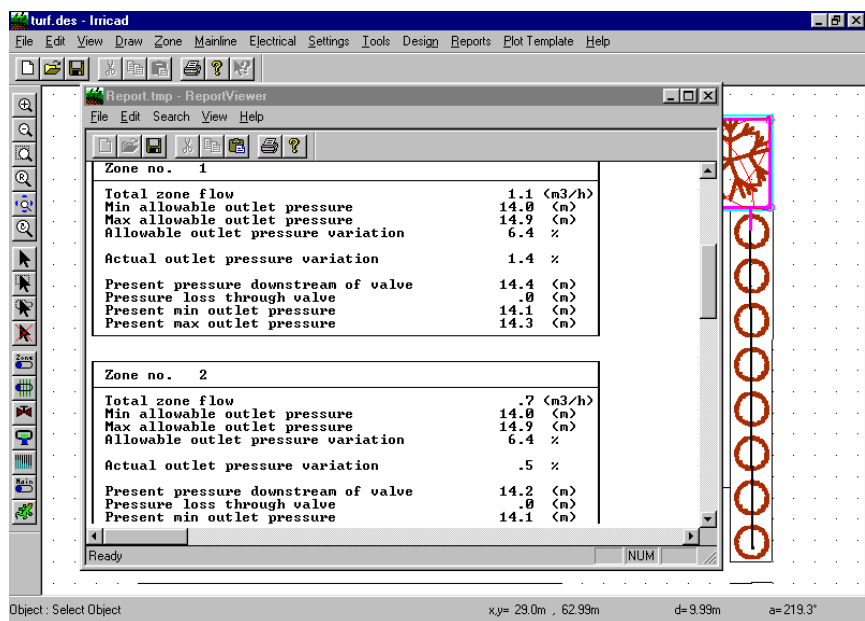


Figure TD 10

We wish to size the zone pipes, so select *Design|Zone Design|LP Design*. Look at the *Reports|Design Reports|Zone Summary* report to see what is happening in the zones.

The results should be similar to Figure TD 10. You will notice that the zone flow for the tape zone is 0m³/hr. This is due to the low flow and the rounding of the numbers in the report. Click the X to close the report window.

Now select *Design|Valve Analysis*. This usually runs very quickly. If no problems have been reported, select *Design|Mainline Design|Analyse* to analyze the mainline pipes.

To have IRRICAD select fittings for the design, select *Design|Computer Selection of Fittings*. Select a Bill of Materials report to view any fitting selection errors. For information on how to fix fittings selection errors, see Fitting Selection Errors.

4.3.8 WHEEL LINE DESIGN

This tutorial explains how to configure IRRICAD to design a Wheel Line irrigation system with a complete bill of materials.

The IRRICAD functions in this type of design include:

- Spraylines
- Database assemblies
- Demand points
- Assign system flows in management

An understanding of these functions is necessary for this exercise. If you are not familiar with these functions, please read the relevant sections of the on-line help (*Help|Help Topics*).

This example will go over the design of a typical quarter mile (400m) wheel line.

4.3.8.1 OVERVIEW

An example wheel line system is shown in Figure WL1. In IRRICAD the wheel line is entered in the Zone layer as a control valve and the idle hydrants are entered as demand points in the Mainline layer. Each hydrant becomes a zone. If a system has two wheel lines, they would

both be entered as spraylines and there would be two active hydrants. See Figure WL 1.

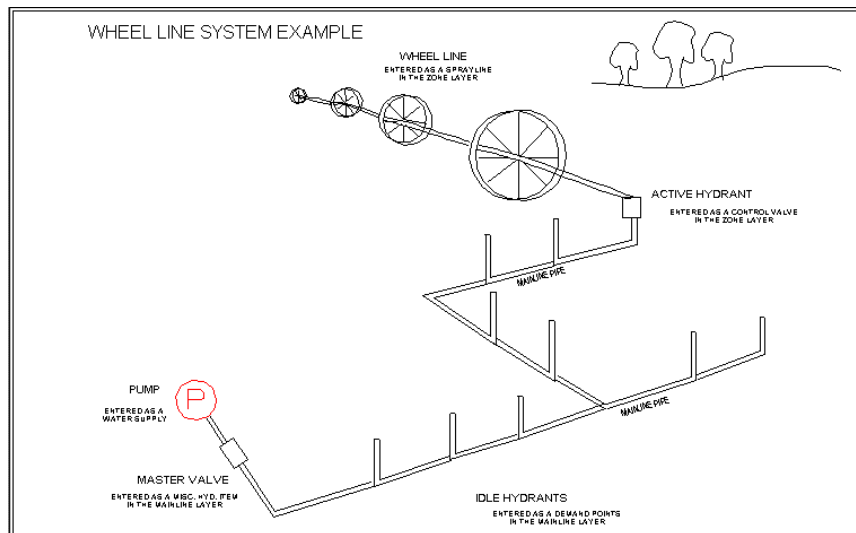
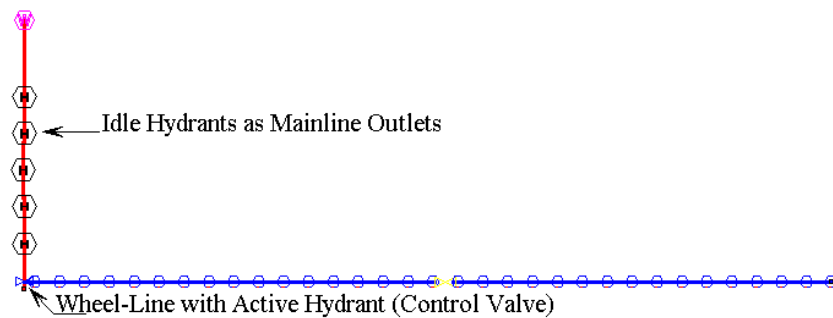


Figure WL 1

The Assign System Flows option in the Design menu is used to tell IRRICAD which zones will operate together. Any combination of hydrants can be analyzed.



The layout of the typical quarter mile (400m) wheel line that will be used for this exercise is shown in Figure WL2.

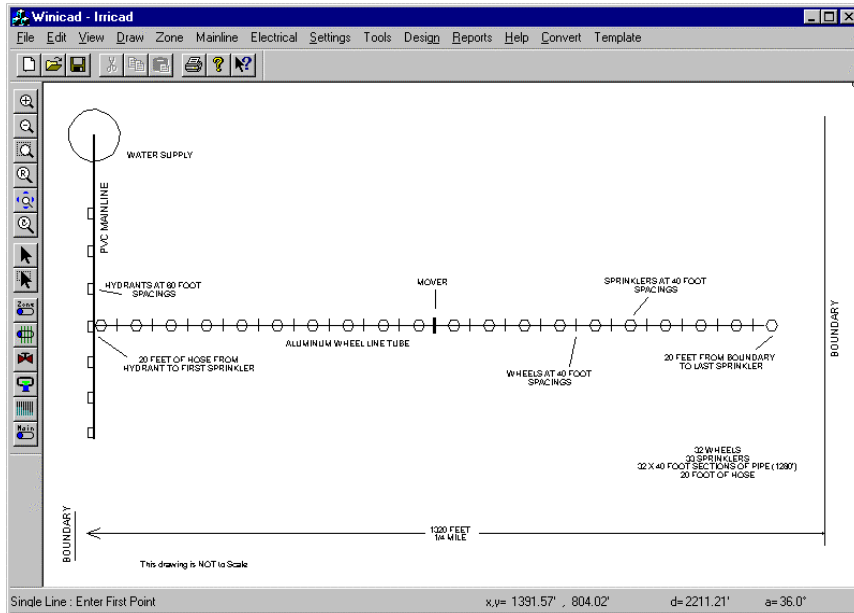


Figure WL 2

4.3.8.2 STARTING THE TUTORIAL

Run IRRICAD or start a new design by selecting *File|New*.

Select *Settings|Miscellaneous*. Select the Medium design size, which will change the Base Database Symbol Size to 16.4ft (5m). Click OK.

Select *View|Zoom Out* twice to ensure that the sprayline can be entered in one action.

4.3.8.3 PLACING THE WHEEL LINE

Select *Settings|Irrigation Items - Design Specific*. Make sure the Create Wetted Radii and Create Sprayline Outlets check boxes are checked. Click OK. Select *Zone|Sprayline*. Select the 4" (100mm) Aluminum wheel line tube from the list of pipes by pressing the down arrow, moving the cursor down the list and clicking the left mouse button when the required item is highlighted. Uncheck the Computer Sized check box and leave the depth at 0.

For the sprinkler, select the Impact Drive Sprinkler from the dropdown list. Now select the $\frac{5}{32}$ IMPACT 360 nozzle from the nozzles that are

associated with this sprinkler. Enter the pressure as 50psi (35m) as in Figure WL3.

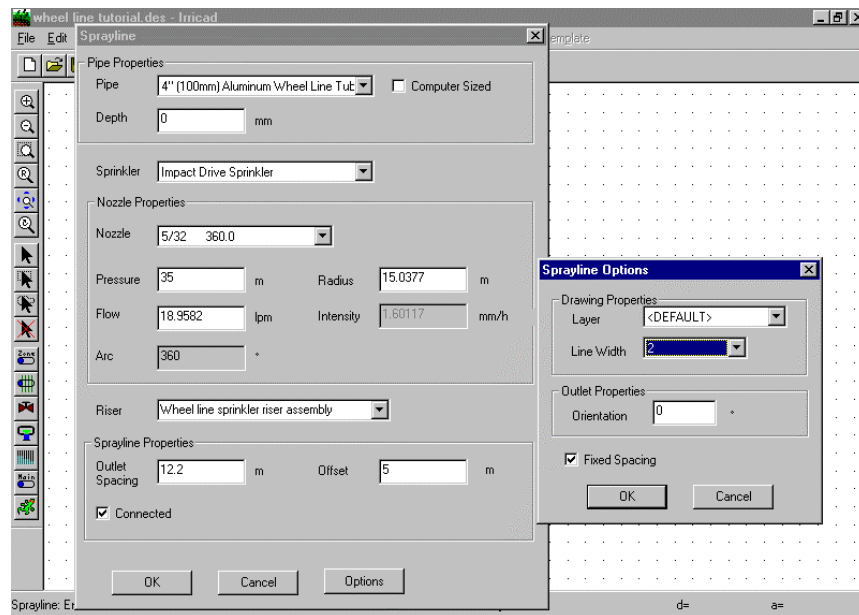


Figure WL 3

Select the Wheel Line Sprinkler riser assembly as the Riser. Now type in 40ft (12m) for the outlet spacing and leave the offset as 0. Leave the Connected check box as checked.

Now click the Options button at the bottom of the dialog. In the next dialog, leave the layer as <DEFAULT> and change the line width to 2. Leave the orientation as 0 and make sure that the Fixed Spacing check box is checked.

Click OK on both dialogs.

Move your mouse to the far right of the screen about half way up. Place the start of the wheel line by clicking the left mouse button. Move the mouse horizontally across the screen and watch the distance at the bottom of the screen. When d= 1298ft (396m) position the other end of the wheel line by clicking the left mouse button, and then selecting Restart from the right mouse menu.

The distance of 1298ft (396m) is significant. It can be anywhere between 1290ft (393m) and 1300ft (397m) but must not be greater than 1300ft (397m) or less than 1280ft (390m). The reason for this is that aluminum pipe is in 40ft (12m) lengths and there will be 1280ft (390m) in this design. There is normally 20ft (7m) of hose from the hydrant to the wheel line so the total length is about 1300ft (397m). This hose is not drawn on the plan, but is included in an assembly. If you draw the wheel line in at 1298ft (396m), the plan will show pipe from the sprinkler to the hydrant. IRRICAD will round this distance up to 1300ft (397m) in the bill of materials and we will use Show Fittings to add in -20ft (-7m) to trim it back to the required 1280ft (390m). This makes the plan look right and the bill of materials right.

The wheel line with sprinklers is now drawn on the screen. Use *Reports|Show Flow* to confirm the flow rate. Select *Reports|Show Flow* then draw a lasso around the wheel line by left clicking near one end then moving near the other end and left clicking again then moving down / up and left clicking then to near the first point and left clicking then selecting *Right-Click|Close*. There should be 33 outlets and a flow of about 165gpm (37.5m³/h). Click the Close button to close the dialog.

4.3.8.4 PLACING THE HYDRANTS

To place the hydrant on the end of the wheel line select *Zone|Control Valve* and select the Wheel line 4" (100mm) active hydrant assembly. Leave the orientation and valve depth as 0. Click OK. Place the control valve on the left hand end of the wheel line by left clicking the mouse and give the zone a name such as Active Hydrant 1.

The other idle hydrants will be spaced 60ft (18m) apart on a mainline. These hydrants are entered in the mainline layer as demand flows. To make it easier to place them 60ft (18m) apart a grid can be set up. We need to align the grid with the hydrant valve. Place the cursor exactly on the valve and note down the coordinates (x,y =) displayed on the status bar. Select *Settings|Grid* and enter the X and Y spacings as 60ft (18m). Check the Display Grid Points check box. Enter the X and Y origin as the coordinates of the hydrant valve. In the Snap tab select the Snap to Grid option. Click OK.

Select *Mainline|Outlet* and find the Demand Flow sprinkler in the drop down list. Select it and change the pressure to 58psi (40.8m) and the flow to 165gpm (37.5m³/h). Select a Capital H for the hydrant symbol. These are the pressures and flows that you want available in the mainline at the hydrants. The pressure is an upstream pressure not a

downstream pressure. A pressure of 58psi (40.8m) will allow for any losses through the hydrant and still give adequate pressure at the start of the wheel line. The pressure that you set here is really up to you, but on flat ground it should be higher than the sprinkler pressure that you have set in the sprayline.

Select the Wheel line 4" (100mm) idle hydrant riser assembly in the Riser field. Leave the orientation as 0, and Click OK.

Now position your mouse on one grid point above the wheel line hydrant by left clicking. Because mainline outlets are valve-in-head sprinklers, you will asked to enter a zone name. Enter a zone name such as Idle Hydrant 1. Move one grid point above that one and place another hydrant (Idle Hydrant 2).

4.3.8.5 PLACING THE MAINLINE AND WATER SUPPLY

Select *Mainline|Water Supply* place on the screen two grid points above your top hydrant with a left click. Leave the water supply data as the default. Click OK.

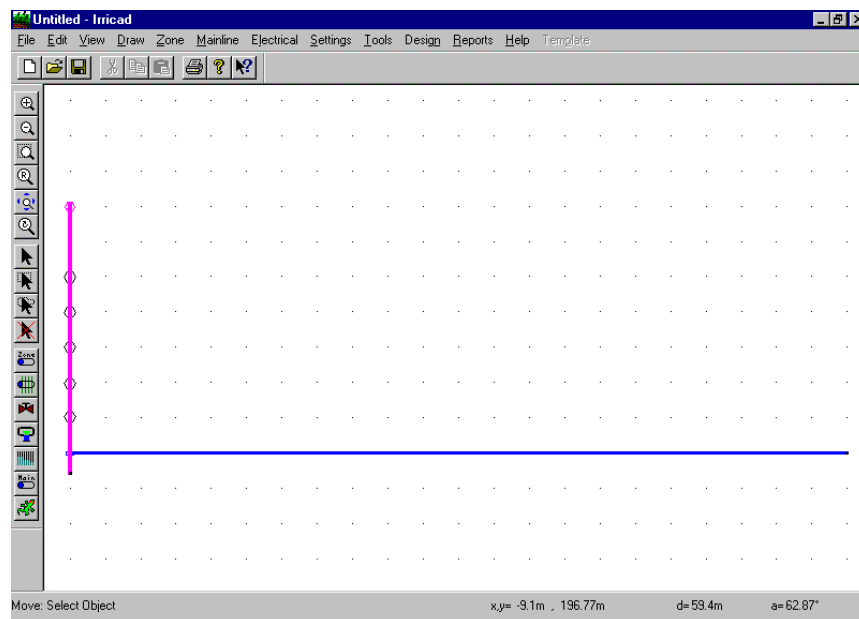


Figure WL 4

Select *Settings|Snap* and turn off the Snap to Grid option by selecting Connect. Click OK.

Select *View|Zoom Window* and draw a window around the water supply and the hydrants. Select *Mainline|Pipe*. Leave the selected pipe as Computer Selected and the depth as 0. Click OK and go to the water supply on the screen. Connect the pipe to the water supply and to all the hydrants by left clicking the mouse each time the pipe passes over a hydrant, and draw a straight line through all the hydrants ending with the active hydrant. Connect about 10ft (3m) of mainline pipe past the last hydrant. This will allow IRRICAD to tee the mainline into the last hydrant rather than elbow into it. Select *Right-Click|Restart*. See Figure WL4.

4.3.8.6 MANAGEMENT

Select *Design|Check Outlet Connectivity*. IRRICAD checks to make sure that outlets are connected to a water supply.

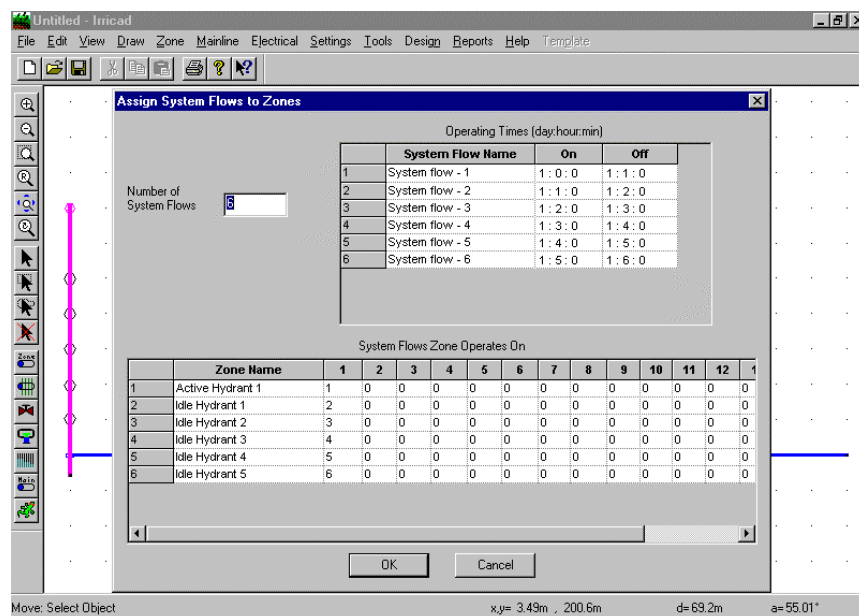


Figure WL 5

Select *Design|Assign Each Zone to a Unique System Flow*. You have placed 3 hydrants in total so there will be 3 system flows. Each hydrant will operate on its own. IRRICAD automatically gives each system flow

one hour and assigns each hydrant to its own system flow. Leave the times at one hour as in Figure WL5. Click OK.

4.3.8.7 DESIGN

Now select *Design|Zone Design Configuration*. In the far column set all the valve pressures to 58psi (40.8m). This means you are fixing the valve pressures rather than letting them find their own levels. Click OK.

Select *Design|Zone Design|Analyse*. You set the sprayline to 4" (100mm) Aluminum pipe so you just have analyzed it rather than computer size the pipe. When Analyse is complete run *Design|Valve Analysis*. Lastly select *Design|Mainline Design|LP Design*. The pipes are now sized and analyzed.

Zoom into the end of the mainline by selecting *View|Zoom Window* and dragging a window around the area including the end of the mainline. Notice that the piece of pipe past the last hydrant has not been sized. IRRICAD will not size pipes with 0 flow. Select *Tools|Select Object*. Now click on the piece of pipe that has not been sized. Select *Tools|Change* and change the pipe to the same as the sized mainline (4" Class 125 PVC Pipe). Click OK.

Select *View|Zoom All*. Now select *Zone|Misc. Hydraulic* and find the Wheel Line Mover assembly in the dropdown list. Click OK. Select *View|Sprayline Outlets*. Place the misc. hydraulic item on the wheel line between two sprinklers half way along the sprayline.

Since some changes have been made, the hydraulics need to be recalculated. Select *Design|Zone Design|Analyse*. Now run Valve Analysis and then *Mainline Design|Analyse*.

To look at the pressures and flows in the system, look at the Design reports. Select *Reports|Design Reports|System Duty*, which will show you the pressure and flow required from the water supply to met each system flows needs. The *Reports|Design Reports|Zone Summary* report will show you the minimum and maximum pressures in the wheel line and also the pressure loss through the hydrant. Close the reports by clicking on the X.

The *Reports|Design Reports|Zone Full* report gives a more detailed list of pressures and flows in the wheel line. Scroll down in this report until you find the section titled Spraylines and Tapes. Notice on the far right the O/Loss is listed. This is the pressure that is caused by the factors

set up in the Wheel line sprinkler riser. Remember the sprinkler is 3½ft (1m) off the ground and the riser loss was equivalent to 5ft (1.5m) of ½" (12mm) pipe. Close this report and look into as many other reports as you like.

4.3.8.8 COMPUTER SELECTION OF FITTINGS

Select *Design|Computer Selection of Fittings*. When that is complete, select *Tools|Change* and by clicking on junctions and clicking on the Show Fittings button check to see what fittings are used. Close dialogs by clicking on Hide Fittings and Cancel. To correct the length of aluminum tube listed click on one of the two spraylines, click Show Fittings and Add. Select the 4" (100mm) Aluminum Wheel Line Tube from the list of pipes by clicking on the left most (number) column or by clicking on the description column then clicking Select. Click Close. The fitting will be added to the list of fittings for the sprayline with a Quantity of 3.28ft (1m). Click on the quantity and change it to -20ft (-7m) and click Hide Fittings. You will get a warning message that the quantity is less than the recommended minimum because quantities are usually greater than 0. Click Yes to continue and OK to close the junction dialog. See the notes under Placing the Wheel line for an explanation. Look at a BOM report.

4.3.8.9 DATABASES

Database assemblies play a key role in this type of design. There are five assemblies in this example. They are listed below.

Wheel line sprinkler riser assembly

Outlet Connector component database:

Item	Database	Part Number	Qty
Sprinkler leveler	Miscellaneous	L-75	1
Leveler elbow	Miscellaneous	SLE 1-12S	1
4" (100mm) Band-lock set	Couplers	58-4FWTD	1
76" (1930mm) wheel 4" hub	Miscellaneous	27-4-76	1
Inlet connection details	NONE, 1.00" (25mm)		
Outlet Connection details	F T, 0.75" (18.75mm)		
Height Above Ground	3.5' (1.05m)		
Equivalent length diameter	0.50" (12.5mm)		
HL equivalent length	5.00' (1.5m)		

Leave the plotting symbol blank

Usage Code Y

The sprinklers on a wheel line are approximately 3.5ft (1.05m) above the ground. IRRICAD will take this into account when it determines pressures. To allow for the friction loss in the leveler and leveler elbow, an equivalent length and equivalent pipe diameter are used. If a 5gpm (19lph) nozzle is used, the friction loss that IRRICAD will calculate using the equivalent of 5ft (1.5m) of ½" (12mm) pipe is approximately 2psi (1.4m).

Wheel line 4" idle hydrant assembly

Outlet Connector component database:

Item	Database	Part Number	Qty
4" (100mm) AI hydrant valve	Valves	7-4 PT	1
4" (100mm) Class 160 PVC pipe	Pipe	4 160 SW	0.91m
4" (100mm) PVC male adapter	Coupler	436-040	2

Note: Though can enter a length of pipe in an assembly in feet if you have selected US units, the assembly itself will display the length in meters, e.g. if you had entered 3' of PVC pipe, 0.9144m will be displayed as present in the assembly.

Inlet connection details	NPT M T, 4.0" (100mm)
Outlet Connection details	NONE, 4.0" (100mm)
Height Above Ground	0.00
Equivalent length diameter	0.00
HL equivalent length	0.00
Leave the plotting symbol blank	
Usage Code	Y

Wheel line 4" active hydrant assembly

Valves component database:

Item	Database	Part Number	Qty
4" (100mm) AI hydrant valve	Valves	7-4 PT	1
4" (100mm) AI valve opener	Valves	3-6-4 EH	1
4" (100mm) Class 160 PVC pipe	Pipe	4 160 SW	0.91m

4" (100mm) PVC male adapter	Coupler	436-040	2
4"x20' (100mm x 6.1m) hose	Miscellaneous	49-20-4 CD	1
4" (100mm) female end adapter	Coupler	58-5-4 PRF	1

Inlet connection details	NPT M T, 4.0" (100mm)
Outlet connection details	ALUM F S, 4.0" (100mm)
Headloss constant	0.002579
Headloss index	1.17682

The headloss constant and index were calculated using IRRICAD's curve fitting utility. The flows and pressure losses used are listed below. The pressure losses include the losses in the hydrant, valve and hose.

PSI Loss	Flow gpm
2.2	164
4.0	230
6.4	300

Wheel line Mover assembly

Other Hydraulics component database:

Item	Database	Part Number	Qty
Mover 70-76	Miscellaneous	70-76	1
Plastic engine cover	Miscellaneous	70-404	1
4" (100mm) hub adapter set	Coupler	70-11-4	1
1" ZAMAC plug	Coupler	11503	1
76" (1930mm) wheel 4" hub	Miscellaneous	27-4-76	3

Inlet connection details	ALU F S, 4.0" (100mm)
Outlet connection details	ALU F S, 4.0" (100mm)

Wheel line 4" plug assembly

Couplers component database:

Item	Database	Part Number	Qty
4" (100mm) end plug	Coupler	59-5PRM	1
Wheel line Band-lock	Miscellaneous	58-2-2S	1

The reason for the assemblies are as follows:

The wheel line is set up using *Zone|Sprayline*. A sprinkler is selected from the Outlet component database, e.g., the Impact Drive Sprinkler. The **Wheel line sprinkler riser assembly** is then selected from the Outlet Connections component database. This means that for every sprinkler, a leveler, elbow, band-lock coupler and wheel are included.

The idle hydrants are laid out in the mainline layer by selecting a demand flow from the Outlets component database. The riser to that demand flow is then selected from the Outlet Connections component database. Selecting the **Wheel line 4" idle hydrant assembly** will ensure that for every idle hydrant a 4" (100mm) hydrant valve, 3ft (0.91m) of 4" (100mm) PVC pipe and 2 PVC male adapters are included.

At the upstream end of the wheel line a zone valve is positioned. The **Wheel line 4" (100mm) active hydrant assembly** should be selected for this valve. This ensures the valve opener, hose and fittings listed above are included.

The **Wheel line Mover assembly** is selected and positioned mid way along the wheel line. Note the assembly has only three wheels when the mover actually requires four wheels. This is because the mover displaces one wheel on the wheel line so the total in the bill of materials will be four.

IRRICAD will look for an end cap for the aluminum pipe during Computer Selection of Fittings. The **Wheel line 4" (100mm) plug assembly** will be selected and it will include the 4" (100mm) end plug and the band-lock.

4.4 MAINLINE DESIGNS

A mainline design can be any pipe delivery system from a rural water supply, stock water reticulation, etc. The difference between a mainline design and the design we have looked at previously is that a mainline design has the valve and outlet in one. Normally a system is laid out with a water supply, some mainline pipe, control valves, some zone pipe and then zone outlets, where the control valves are the connection between zone and mainline items and the on / off control for each zone. In a mainline design we have a water supply, mainline pipe and mainline outlets. Each mainline outlet is seen by IRRICAD as a valve-in-head outlet – i.e. has its own on / off control. Therefore each mainline outlet is the zone and control valve all in one. The principals behind IRRICAD design have not changed; it is simply that the zone items and control valve are condensed into one object.

In terms of the designs and analysis of a mainline design, zone design and valve analysis are still required before running mainline design options.

These tutorials assume you have completed at least the Basic Start chapters and the Simple Design Tutorials. These tutorials assume you know how to select items, connect items, and select the working database and the units of preference.

4.4.1 USING DEMAND POINTS

Demand points are used most often in mainline designs. The common use of demand points may be in large golf designs where it is known how much pressure and flow is required at certain points, or large agricultural designs where a hydrant is required to have a specific pressure and flow.

Demand points are only useful if you know the pressure and flow required at a particular point. Remember a hydraulic analysis is only as correct as the information you put in. Demand points can be used to make a quick mainline analysis.

4.4.2 A RURAL WATER SUPPLY

Double click on the Irricad icon or select *Start|Programs|Irricad|Irricad* to start IRRICAD. If already running IRRICAD select *File|New* to start with a clean screen. In *Settings|Irrigation – Design Specific* browse for the tutorial database *Tutorial.mdb*. This should be found in the *\Irricad\database* folder. If you prefer to work in US units, go to the *Units* tab and click the *US* button. If you prefer to work in Metric units, click the *Metric* button to restore the default units for this tutorial. Note Metric measurements are displayed in brackets. For this tutorial select *lph* as the flow and *m* as the pressure.

DRAWING THE LAYOUT OF THE SYSTEM

Select *Mainline|Water Supply* and place the water supply on the screen, near the left-hand side. Leave the entries as 0, so that IRRICAD will calculate the system duty for the system you draw. Click *OK* to accept and close the dialog.

Select *Mainline|Pipe*. Leave the pipe as *Computer Selected* so that IRRICAD will select the pipe size for you. Click *OK* and click in the centre of the water supply to place the start point of the pipe (left click on the screen). The pipe will rubberband with the cursor until you place the end point or next point of a pipe (if the pipe is bent). The pipe tool is like a continuous line tool and will rubberband between points until you end the pipe by selecting *Right-Click|Restart*.

Select *Mainline|Outlet* and select *Demand Flow*. This type of outlet is called a *Demand Point*. It does not have a pressure / flow relationship but simply allows us to specify the flow and pressure required a particular point. Click *OK*.

Left click on the mainline pipe where you wish to place a demand point or node. The outlet will automatically connect to the pipe. You will need to assign each outlet a zone name. Accept the default names for each node placed.

MANAGEMENT

Once all outlets are placed we must tell IRRICAD how the system is to run. We call this *Management*. If all nodes are to run at one time (as is assumed the usual or the worst case scenario for rural water supply systems) select *Design|Assign All Zones to One System Flow*. IRRICAD will automatically fill out the table with 1 system flow running

for a default time of 1 hour (the running time is not important, we just want to know what happens when it is running) and all zones assigned to run on system flow 1. Click OK.

DESIGN

First, select *Design|Check Outlet Connectivity* to make sure that all outlets are connected to the water supply via mainline pipes. If you receive no messages, continue with design. If you do receive messages, check you cannot see a black pipe junction where the water supply or outlets connect to pipes. Pipes require pipe junctions, but where point objects connect, the junction should disappear. If an outlet is not connected, highlight the outlet by selecting *Tools|Select Object* and clicking on the outlet. Then select *Tools|Move* and move the outlet until the centre of the outlet is central to the black junction and left-click. The black junction will disappear when the outlet is connected. If you are still having problems, make sure the default snap mode in *Settings|Snap* is set to Connect.

Even though we only have mainline items present in the design, we will still need to analyse the zones. Select *Design|Zone Design|Analyse*. This should be quite quick. Now select *Design|Valve Analysis*. This should also be very quick. Now select *Design|Mainline Design|LP Design*. LP design a computer design option that will select pipes based on the pressure required at the outlet.

Now view the reports. Because this is a mainline design, the last 4 design reports will be most useful. Select *Reports|Design Reports|System Duty*. IRRICAD reports the pressure and flow required at the water supply to run the system you have designed. A pump can be sized from this data. The Mainline Full report is useful if you wish to know the velocity in the pipes, length of pipes and head difference. The Mainline Summary report gives a summary of actual and required pressures at the zone control valve. The Mainline Pipe report lists the pressures in the pipes, and also lists the elevations of start and end point so the pipes.

VARIATIONS

1. Draw some contours or spot heights on the design. Elevation information can also be imported using *File|Import Contours*. Keep in mind that the elevation information needs to span all hydraulic input. Now redesign the system and view the reports.

2. Size the pipes using *Design|Mainline Design|Velocity Design*. You can set the maximum mainline velocity in *Design|Design Parameters|Hydraulic Parameters*. Keep in mind that Velocity design does not know about the pressure that you are trying to achieve at the outlet. It is simply choosing a pipe size which will achieve a velocity as close as possible to the maximum allowable velocity set.
3. Run *Design|Computer Selection of Fittings*. IRRICAD will find fitting for each junction.
4. Note you do not have to layout a design in a specific order. You can place the nodes first, then pipe than water supply if you wish. IRRICAD is very flexible until the design section where management is required, then zone design, then control analysis, and then mainline design in that order. Remember the items available in the tutorial database are only a small set of items available in full IRRICAD databases. Databases are also easily changed or added to in the complete retail version.

4.5 DATABASE AND FITTING SELECTION

Fitting Selection is a great tool to save time and produce a complete Bill of Materials without tearing your hair out! IRRICAD uses rules to solve junctions with fittings so if it can't find the fittings it needs it will list the unsolved junctions at the end of any Bill of Materials report.

4.5.1 CUSTOMISING YOUR DATABASE

Using the Irricad database editor, new items can be added to the database, deleted from the database, turned on or off for selection or edited. The on-line help or the hard copy manual explain the fields in database item dialogs so you can easily enter your own items or customise the existing items.

Enter a new pipe by running the database editor (*Start|Programs|Irricad|Irricad Databases*) and clicking on the New Pipe button. (Note the database the editor opens with is your default database – set in IRRICAD in *Settings|Irrigation – Design Specific* and clicking the Save As Default button.

A usage code is required for all items in the database if you want to be able to select this item in IRRICAD, either manually or during design or fitting selection. Most items have a Yes, No usage code, but pipes are designated to be used for either Laterals, Zone pipes or Mainline pipes. Laterals are connected spraylines, zone pipes are any pipes (other than laterals) used downstream from a control valve, and mainline pipes are all pipes used upstream from a control valve. Pipes can have more than one usage code; any combination of L, Z or M you wish. If the usage code is blank then this item cannot be used or selected.

Enter a name for your pipe, describing its basic qualities e.g. 2" (50mm) PVC Class 6.

Now enter a unique warehouse code for the pipe. This can be your ordering code or a inventory code.

Enter a supplier code (you can make your own in IRRICAD – *Reports|Supplier Code Multipliers*).

Enter a pipe type for your pipe, e.g. PVC, LDP etc. You can make your own in IRRICAD – *Design|Pipe Fitting Matching Table* but be warned IRRICAD uses this pipe type to select fittings.

The nominal diameter is the size the pipe is usually referred to by, e.g. 2" (50mm).

The actual diameter is very important to be entered precisely as this is the diameter IRRICAD uses in its pipe friction loss calculations.

The pipe roughness is the Hazen-Williams C factor, which can be found in Appendix B for all smooth pipes.

Enter the maximum allowable pressure as per manufacturers' specifications for that pipe.

Enter a wholesale cost and retail price and select a plotting colour and line type for this pipe. Click the Save button and then Save Changes on the database.

You now have a new pipe to use in a design.

The other item dialogs do not differ too much from this format. However, you can find information on this in the IRRICAD Database Editor section of the manual.

Probably the most future time saving task will be to create separate databases for the different types of designs you do. This is particularly true if you do quite different design work which all use different materials. One database may be Residential.mdb, another Vineyard.mdb, and another Stockwater.mdb. Now instead of turning items on and off in the database depending on the type of design you are doing today, you will only have the items you use for that particular system. This means your databases are smaller and you have more of them, and that you do not have multitudes of extraneous items you will never use present.

After you have either split up your databases to be design specific, or have deleted all the extraneous items out of them, you will either have the exact fittings you use or a range of fittings for IRRICAD to choose from. If you only use saddles instead of tees (both available in the Tees component group) then you will only have saddles available. If you decide to use saddles in a particular design, instead of tees, you can

turn the tees off in the database (select N) before running Computer Selection of Fittings.

4.5.2 HOW IRRICAD SELECTS FITTINGS AND UNDERSTANDING THE FITTING SELECTION RULES

Read Appendix G: Fitting Selection Details in the online Help Topics (*Help|Help Topics*). This chapter covers the rules that IRRICAD uses to solve the different types of junctions.

4.5.2.1 QUICK NOTES ON MAKING IRRICAD SELECT THE FITTINGS YOU WANT

IRRICAD will select the items you want if you keep in mind the rules that are used during Fitting selection.

In summary IRRICAD will always search the Lateral Take-Off component group first, then move search the cross, tee, bend and coupler groups as needed. IRRICAD always looks for the single cheapest item which has the correct connection codes required. An assembly is seen as a single item. Hence an assembly containing all the fittings required will be chosen if it is the only item that has the correct inlet and outlet connections. If a single item can not be selected, IRRICAD will chose the cheapest option of multiple components to solve the junction.

If there are many options for IRRICAD to choose from but you wish a particular item or set of items to be selected change the connection codes to be unique to those items so there is no other choice for the selection. Instead of BSP F T try BSPS F T making sure the item it is connecting to also has been given the unique connection code for this design. You can also make the item cheaper than its competitors.

4.5.2.2 USING RISER RULES

IRRICAD uses internal riser selection rules, but you can override these with creating your own.

The internal rules are: select the riser pipe that is the same size as the top item and the same type as the bottom item. This means that if the submain (100mm PVC MS) is buried at 500mm and the valve (80mm

BSP FT) is at –300mm (above ground) the riser pipe selected will be an 80mm PVC MS pipe.

You can override the internal rule by either specifying your own rule or selecting the pipe you want used in a particular situation. Select *Design|Riser Selection Rules*. Enter the depths to which this rule applies. The first depth entered must be the higher depth. Now either select Rule or User. If you select Rule, you have the options of specifying how the size and type of the riser is determined. If you select User, select the pipe you wish to be used from the drop down list on the far right.

Select *Design|Riser Selection Rules*. The rules you set can only be applied to a particular change in depth. Therefore you can set a riser rule for the riser selection between a submain and the laterals. This will not effect the riser selection between the mainline and valve **providing** the valve is at a different depth than the laterals or the mainline is at a different depth than the submain.

When creating a rule, remember that depth 1 needs to be smaller than depth 2. Remember that 0 is at ground level and a negative number is above ground. If you select User, you can select the pipe you wish to be used as the riser in that particular case. If you select Rule, you can select the size and type of pipe to be used based on the existing items in the design. For example if the valve is 80mm BSP valve and the mainline is 100mm PVC, do you wish the riser to be 80mm PVC, 100mm BSP, 80mm BSP or 100mm PVC? Select Top and Bottom appropriately for size and type.

Using the Tutorial.mdb draw a block of tapes using *Zone|Tape Block* any size you wish. Use *Zone|Cut Pipe* to place a submain through the middle of the block, setting the depth to 20" (500mm). Select a valve and the mainline pipe (at 20" (500mm) depth) to connect to the water supply. Select your own pipe sizes as you place the pipes or use Design to size them for you. Now run *Design|Computer Selection of Fittings*. Using Select Object or Select Window, select one junction where the submain connects to a lateral. Select *Tools|Change*, then click the Show Fittings button. See what IRRICAD selected as the riser. IRRICAD has selected tape as the riser but it cannot find the correct tee to complete the junction.

Go in to *Design|Riser Selection Rules* and set the depths as required (0 for depth 1 and 20" (500mm) for depth 2) and set the rule to be top for size and bottom for type and re-run *Design|Computer Selection of*

Fittings. Using Select Object or Select Window, select one junction where the submain connects to a lateral. Select **Tools|Change**, then click the Show Fittings button. Because IRRICAD is now looking for a ½" (16mm) PVC pipe and there is none available or turned on in the database, it cannot solve the junction.

Now change the rule to User in **Design|Riser Selection Rules**. Select the pipe you wish to use for the riser, such as the ¾" (20mm) Polyethylene hose. Now re-run **Design|Computer Selection of Fittings** and using Select Object or Select Window, select one junction where the submain connects to a lateral. Select **Tools|Change**, then click the Show Fittings button to view the changes.

Note: If there are more than 40 fitting for IRRICAD to choose from, when solving a particular junction, a warning message will be issued just to let you know.

4.5.2.3 USING PIPE FITTING MATCHING SETTINGS

The Pipe Fitting Matching Table in the Design menu allows you to insert new pipe types and designate their connection codes and to what fitting types they can connect.

More than one type of pipe can connect to a fitting type, but each pipe type can only connect to one fitting type, e.g. PVC, PV1, PV2 and PV3 pipe types can all connect to PVC fitting type, but PV1 pipe type can only connect to PVC fitting type.

The Bill of Materials will round up the lengths of pipes, whereas the costing reports will display the exact length. The rounded lengths in the BOM reports can be altered by the extra allowance, the rounding, and the rolls / lengths.

Remember that for an item to connect to another item it must have the same nominal diameter, the same connection type and be the opposite gender.

4.5.2.4 EXPLAINING SUPPLIER CODES AND MULTIPLIERS

Supplier codes can be used to view or print a bill of materials for the different sources of product for a job.

Supplier codes can also be used to increase across the board prices for a particular manufacturer.

Open the *Reports|Supplier Code Multipliers* table. Each supplier code can have a multiplier that can be used to calculate the final prices displayed in the costing reports. These multipliers will increase or decrease the final job cost using a base price, either the retail price or wholesale cost as entered into the database for that item. If the multiplier is a number other than 1 and the above check boxes for B, C, and / or D have been checked, **and** if the default pricing type in *Design|Design Parameters|Economic Parameters* is set to Multiplier, the costing of the job will be calculated accordingly.

If Retail or Wholesale is the default pricing type *Design|Design Parameters|Economic Parameters* then the costing reports will show the relevant prices or costs.

Remember the Bill of Materials will round up the lengths of pipes, whereas the costing reports will display the exact length. The rounded lengths in the BOM reports can be altered by the extra allowance, the rounding, and the rolls / lengths in the Pipe Fitting Matching Table.

4.5.3 CORRECTING FITTINGS ERRORS

After rerunning *Design|Computer Selection of Fittings*, there may be a few junctions that IRRICAD can't solve. This is due to that fact that the items it looks for are not in the database.

The first error may be similar to:

US Units:

Problem selecting suitable Tee

X: 102.20 Y: 263.82

PVC M S 2.00 PVC M S .00 1.50

Metric Units:

Problem selecting suitable Tee

X: 102.20 Y: 263.82

PVC M S 50.00 PVC M S .00 40.00

Use *View|Window* and zoom in on a piece of your design. Select *View|Go To Coords* and type in the X and Y co-ordinates displayed on your report, using the tab key to tab between the two fields. Let go of the mouse and use the Enter key as OK. The cursor will now be at the

co-ordinate you entered, and this co-ordinate will be at the centre of the page. Select *Tools|Change* and click on the item at this co-ordinate. Click the Show Fittings button. Here will you see all the fittings selected to solve this junction.

IRRICAD reports the connection types of the existing items in the design in the fittings errors, not the items it requires. In some instances it is straightforward where we could enter an item in to the database based on the information above, just reversing the gender so the items connect. In more complicated situations, it a good idea to go and look at the junction to see what junction IRRICAD is trying to solve. Reading up on the Fitting Selection Rules will help you understand the items IRRICAD needs to solve the junction.

Run IRRICAD Databases by clicking on the *Start|Programs|Irricad|Irricad Databases* or double-click on the icon if one is present on your desktop. IRRICAD loads the current default database, so click Save Changes to close the currently open database if the database you wish to edit is not the default (note the name and path of the database is displayed in the top blue bar of the database editor). Select *File|Open* and browse for the required database in the *\Irricad\database* folder. Open this database and select the required component tab, entering the item or items required to solve the junction.

Return to IRRICAD and rerun *Design|Computer Selection of Fittings*. If any other fitting errors are still present in the *Reports|Bill of Materials|BOM* report, solve the next junction in the list using the above method to help you.

Use the tape block you drew above. Solve the missing End Cap. Try an example of your own.

4.5.4 CREATING AND MODIFYING ASSEMBLIES

To create an assembly, it is important to note the following rules:

- If creating an assembly based on a particular valve, for example a 2" (50mm) Electric Valve Assembly, you still need to add a 2" (50mm) Electric Valve to the assembly.
- It is not necessary to have all items in the assembly with the correct connections for fitting together as the only connection types used are those entered for the Assembly as the one item.

However, for practical reasons, it is beneficial to have the connections required between the assembly items.

- Outlet assemblies must contain an outlet.

4.5.4.1 USING ASSEMBLIES

You may wish IRRICAD to select different fittings than it has chosen.

You can create an assembly of the items you require, as long as those items are in the database.

For example, if you wish to make an assembly in the Tees group, go to the Tees component group and select the Tee you would like to use in your assembly (this is only so that most of the description is available for you to make changes to). Now click the New Assembly button. Change the usage code to X. Change the description so you know this item is an assembly, and possibly what use it has e.g. 2½" (63mm) tee with expanding coupler to 3½" (90mm). Change the warehouse code. Change the major and minor connection codes to reflect the ends you wish to connect to e.g. 2½" (63mm) MDP FS and 3½" (90mm) MDP FS. Now click the Continue button.

Most importantly, select the tee you wish to use in this assembly e.g. 2½" (63mm) Female Tee and either click on the grey box to the left of the description, or click on the description and click the Select button to the right of the screen. Now select the Reducing Coupling 3½" x 2½" (90 x 63mm). When you have completed adding items into your assembly, click the Finish Assembly button. It is your job to make sure the items you are selecting will connect together.

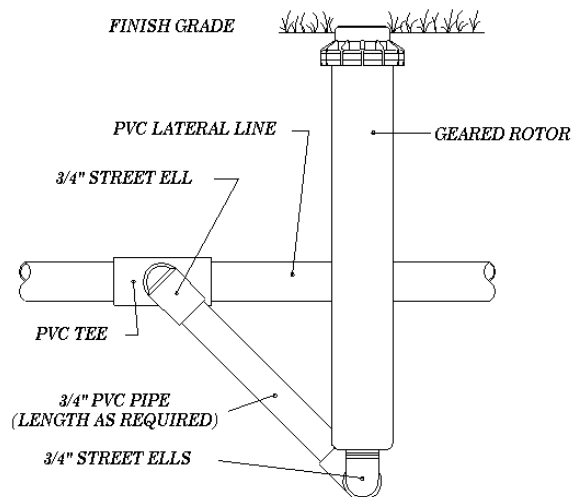
Now run *Design|Computer Selection of Fittings* for your assembly to be selected. View the Bill of Materials reports. You will notice that an X usage code will list the assembly name in the main part of the list, and then afterwards list all the items that make up that assembly.

4.5.4.2 CREATING AN ASSEMBLY

We wish to create a swing joint assembly for use in small turf irrigation.

This assembly will contain:

- Three 90° street elbows
- ¾" PVC pipe



Run the IRRICAD Database Editor (*Start|Programs|Irricad|Irricad Databases*). The database editor opens your default database automatically. If the Tutorial database is not the default database (the name of the database is displayed on the title bar), click the Save Changes button on the open database and using *File|Open* browse for the Tutorial.mdb. This should be in the Irricad\database folder.

Click on the Outlet Connections tab (you may need to scroll along the top to see this tab). Find the Microsprinkler Stake and Tube $\frac{3}{8}$ " (10mm). Click on the gray box to the left of the description to select the item. Click the New Assembly button. Note that the characteristics for the existing riser have been copied. Edit the name for the outlet assembly to be: Pop-Up Swing Joint Assembly. Change the warehouse code to SwingJAssembly and select a supplier code.

The inlet and outlet connections should correspond with the actual items that will be at either end. In this case a $\frac{3}{4}$ " PVC elbow will be at the inlet end with a connection type of BSP MT to connect into the PVC faucet tee IRRICAD selects. The item that will be at the outlet end of the assembly will be a reducing street elbow, found in the Elbows / Bends tab, with a connection type of PVC MT with a minor diameter of $\frac{1}{2}$ " (15mm) to connect directly to the lawn pop-up sprinkler. Check that the inlet and outlet connection types for the assembly are BSP MT and change this if required. The inlet diameter is $\frac{3}{4}$ " (20mm) and the outlet diameter is $\frac{1}{2}$ " (15mm).

The Height Above Ground is 0 (zero) because it is below ground. The Equivalent Length Diameter is $\frac{3}{4}$ " (20mm); this is the diameter to be used in the headloss calculations and represents the average diameter.

The Headloss Equivalent Length is equal to the complete length water will traverse through. We will use 6.6ft (2m) in this case to represent the length of pipe and elbows: 0.66ft (0.2m) of PVC pipe, 2ft (0.6m) x 3 for equivalent lengths of $\frac{3}{4}$ " elbows. The costs will equal those of the included items added together. Click the Continue button.

Using the tabs at the top of the screen, click on the Elbows / Bends tab and select the $\frac{3}{4}$ " (20mm) Female PVC 90 Street Elbow. Type in 2 for the number to be selected. Click OK. Select $\frac{3}{4}$ " x $\frac{1}{2}$ " Male Street Elbow and type in 1 for the number required. Click OK.

Go to the Pipe tab and select the $\frac{3}{4}$ " (20mm) Class 125 PVC Pipe. Type 0.66ft (0.2m) for the length required.

As the Assembly is now complete, click the Finish Assembly button.

4.5.4.3 MODIFYING AN ASSEMBLY

We wish to add to an existing assembly - go to the Outlet Connections component group and select the Pop-Up Swing Joint Assembly. Click the Add to Assembly button.

This assembly currently allows IRRICAD to select the tee required between the pipeline and the swing joint. If you wish to use a particular tee regardless of the pipesize, we can add it to the assembly

Go to the Tees tab and select the 20mm PVC Faucet 90 Tee. Type in 1 for the number to be selected. Click OK. Click the Finish Assembly button.

Select Edit Out Con and change the inlet connection type to PVC FS. Click Save and then the Save Changes button.

Items can be deleted from an assembly by highlighting the item in the Assembly field at the bottom of the dialog and clicking the Remove Item button.

4.6 CREATING AND MODIFYING SYMBOLS

This exercise will cover the process of making a new symbol, modifying an existing symbol and setting up a block of trees.

4.6.1 CREATING NEW SYMBOLS

Firstly we will create a simple grass symbol. The process is to use the drawing options to draw the symbol on screen, then to use Create Symbol to save it for later use. The symbol will consist of a small horizontal line with four curved blades of grass protruding from it.

Select *Draw|Line|Single* and draw a horizontal line about 100ft (30m) long. Place the first point on the screen, and type in the distance on the keyboard and Click the Enter key, or draw out the line until d (on the status bar) is approximately 100ft (30m). Now select *Draw|Curve|Single Bezier*. Select *Right-Click|Snaps|Object* then place the first point near the center of the line. Place the next point where you wish the blade of grass to end, and then move the cursor until the curve is the desired shape. Click once to place the bend at this point, and again to finish. The next curve will draw the other edge of the first blade. Select *Right-Click|Snaps|Object*. Start the curve near the first starting point then select *Right-Click|Snaps|Endpoint* and place the end at the tip of the first curve. Move the cursor as desired and click twice to finish. Repeat the process for the other three blades of grass. Your symbol should look something like Figure CMS 1.



Figure CMS 1

To save the grass symbol for later use, select *Tools|Select|Window*. Drag the window around the symbol. Now the symbol is highlighted. Select *Tools|Create Symbol*. In the dialog, type in a name for the symbol, e.g. Grass. If you wish the grass drawing you have just drawn to become a symbol itself, check the Replace Original with Symbol checkbox. The symbol has now been saved.

Select *Draw|Symbol*. You will notice that the newly created symbol is automatically loaded for use in your current design. The initial width and height in the dialog are the extents of the symbol definition. The Maintain Shape checkbox controls whether an instance of the symbol maintains the ratio of the width and height at which it was created (box checked) or whether it can be stretched or squashed in one dimension / direction (box unchecked). The Dynamically Size checkbox controls whether an instance of the symbol can be sized interactively on the screen by rubberbanding an enclosing rectangle (box checked) or placed at the (fixed) size entered in the dialog (box unchecked).

Experiment with placing grass symbols with and without the boxes checked to see the effects of these options.

4.6.2 MODIFYING AN EXISTING SYMBOL

In this part of the exercise, you will modify the existing CLOTHESLINE symbol.

Select *File|New* to start with a clean screen. Select *Settings|Grid*. Leave the grid size as 33x33ft (10x10m) and check the Display Grid Points checkbox. Now select *Settings|Snap*. Select the Snap to Grid option. We will use the grid to help us align the clothesline wires correctly. Click OK. Select *Draw|Symbol*. You will notice that CLOTHESLINE is not available from the drop down list of symbols. Click the Load button and select CLOTHESLINE from the master list of symbols. Click Open. Uncheck the Dynamically Size checkbox. Type in 198ft (60m) for the width. Click OK. Place the symbol on the screen with a left click. Note that the symbol can only be placed on the grid points.

Before adding to the symbol, you need to explode it into its individual components. Select *Tools|Explode* and click on the symbol. Alternatively, select the symbol prior to invoking the Explode tool. Now select *Draw|Polyline*. Move to the grid point on the top left diagonal nearest the center of the clothesline. Left click and move horizontally to

the equivalent grid point on the top right diagonal and left click again. Repeat for the bottom right then bottom left diagonal then back to the starting point, or select *Right-Click|Close*. Repeat the whole process for a second polyline one-grid point further out from the center. Select *Settings|Snap* and turn off Snap To Grid by selecting Connect. Finally select *Draw|Circle|Center Radius*. Select *Right-Click|Snaps|Midpoint* then place the cursor in the center, left click the mouse button and move the cursor slightly away from the center. Notice the circle follows the cursor. The radius of the circle is given on the status bar (d). Make d about 3ft (1m). Left click to place. The symbol should look like Figure CMS 2.

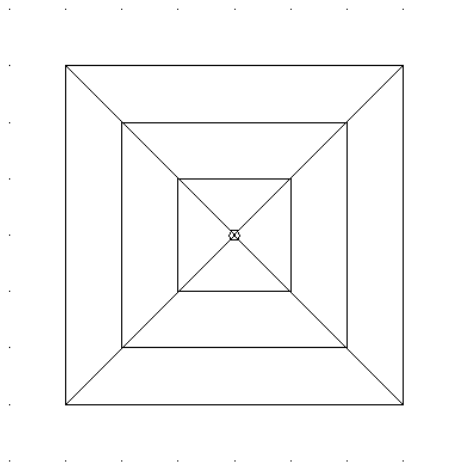


Figure CMS 2

All that remains now is to save the symbol for later use. As before, select the symbol with *Tools|Select Window* and drag the window around the symbol. Save the symbol with *Tools|Create Symbol* and enter a new name e.g. CLOTHESLINE2. Click OK.

If you want to replace the old symbol definition with the new so that you have only one CLOTHESLINE symbol you must first unload the old definition before saving the new. Select *Draw|Symbol*, click the Unload button, select CLOTHESLINE and click OK on the Unload dialog then click Cancel on the Symbol dialog. Now you can use the Create Symbol tool to create the new CLOTHESLINE symbol. These symbols can now be used in subsequent designs.

Note: Symbols are only loaded if they have previously been used in the design. If a new design is started, all required symbols will need to be loaded.

4.6.3 SETTING UP A BLOCK OF SYMBOLS

This exercise will cover the process of making a symbol and then using it to set out a block of trees.

Select *Settings|Grid* and enter X and Y spacing of 20 (6) and check the Display Grid Points checkbox. Now select the Snap tab and select the Snap to Grid option. Click OK. Select *Draw|Line|Single* and draw a vertical line of 160ft (48m) for the trunk. Left click to place the start and drag the line vertically until the status bar d=160 (48) and the line cover 8 grid points then click to place the end. Select *Draw|Arc|Center Start End*. Move to the top of the trunk and one grid point to the left and click. Click on the top of the trunk then move to the grid point vertically below the first (center) arc point and click. Move one grid point to the left of the last end point and click then two grid points to the right (onto the trunk) and click then two grid points vertically below the first (center) arc point and click. Move one grid point to the left of the last end point and click then three grid points to the right (onto the trunk) and click three points vertically below the first (center) arc point and click. Repeat for the three branches on the right hand side of the tree in mirror image. Your symbol should look like Figure CMS 3.



Figure CMS 3

If you wish this symbol to be a green tree, select by using *Tools|Select|All* or *Tools|Select|Window*. Now select *Tools|Change*. In the dialog, select the color you wish to change it to (e.g. dark green) by clicking on the color field and selecting the color you require.

Click OK on the color dialog and click OK on the Drawing Properties dialog. Because there is more than one type of object selected (e.g. line and arc), the Change / Match dialog appears with the color in the Change column checked. Click OK. Now select the object by using *Tools|Select|Window* and invoke the *Tools|Create Symbol* command. Type in Pine Tree for the name and click OK.

Select *Draw|Symbol*. Uncheck the Dynamically Size checkbox. Enter the width as 12ft (3.5m). Click OK.

Place a symbol on a grid point at the top left of the screen. Select *Tools|Copy|Array* and, moving the cursor over the symbol just placed, click the mouse. In the dialog enter 14 as the number of copies, and 14 as the number of rows and click OK. Click on the grid point where the tree is placed as the reference point. Drag the ghosted symbols to the right of the original symbol and left click. Then drag the cursor down at right angles to the previous ghosted row of trees and left click. You now have a block of trees 14 x 15. See Figure CMS 4.

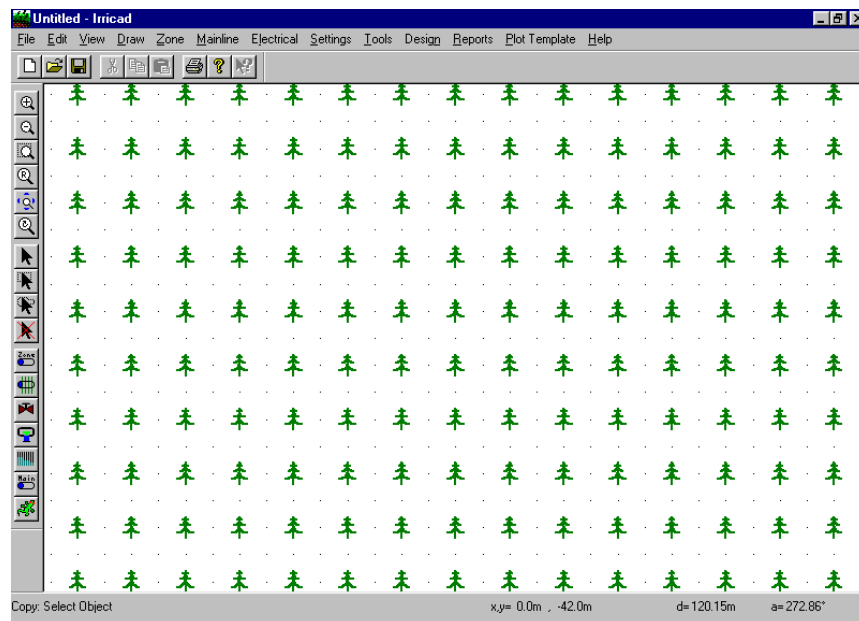


Figure CMS 4

4.7 PRINTING USING PLOT LAYOUTS

This is a simple tutorial to explain how to make your design ready for printing.

For this example we will use the Micro Irrigation Design.

Complete the tutorial if you have not done so already. Open the completed tutorial by using *File|Open* and browsing for a design file.

Select *Settings|Design Details*. Enter the appropriate details in the edit boxes e.g. your Company Name, Site, Date, Designer Name, and Client Name, etc., going to the Client, Company tabs as required. Click OK.

Select *Draw|Plot Layout*. The printer and paper size is set to the defaults. Click the Printer button on the bottom left of the dialog and select the printer you wish to print to from the dropdown list. Click OK.

Select B (A3) as the paper size from the dropdown list if your printer will allow. Otherwise select A (A4) or C (A2) size paper. Select the paper source, e.g. Upper Tray. Select Landscape as the required orientation.

The default margins indicate the smallest margin physically possible for the printer to print on to. Leave the margins as the defaults.

Enter a print scale or click the Calculate button (scale is calculated on the current zoom).

Select a Drawing Template from the dropdown list. Selected the B A3 Key Bottom for the B (A3) paper size. For A (A4) size paper select the A A4 Key Bottom and for C (A2) size paper select the C A2 Key Bottom. In general, you should always select a template to match the selected paper size. Your dialog should look like Figure PP 1.

Click the OK button. The plot layout will be created at the specified scale.

Look at the plan with the layout. You will notice that details such as Company Name, Site, Client Name, Designer Name, Date, Scale and Design No (or Name) are present in the title block of the plot layout.

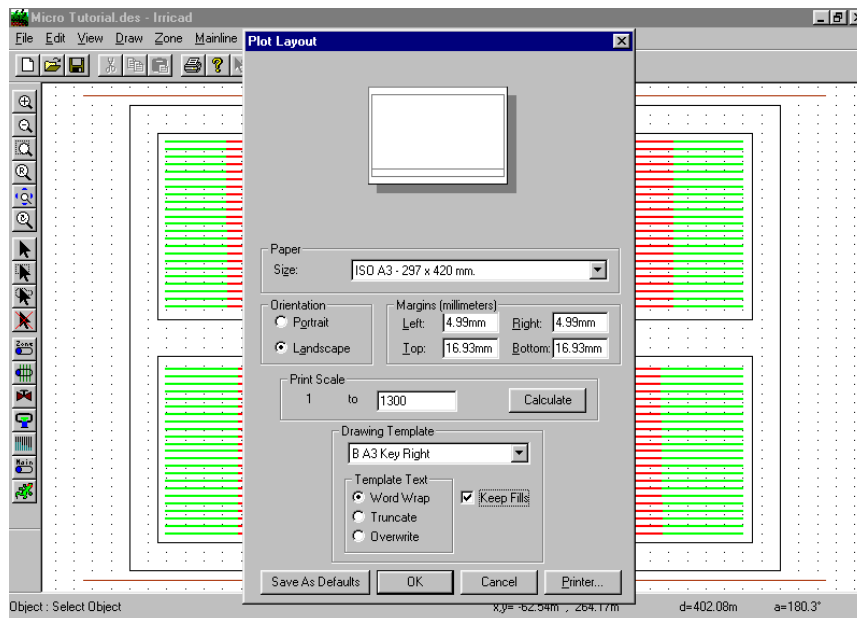


Figure PP 1

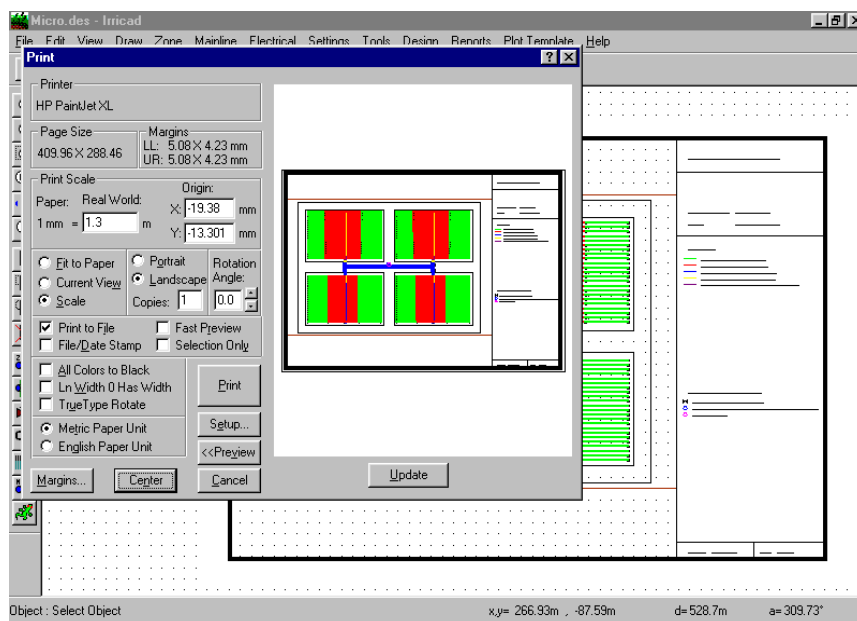


Figure PP 2

If you wish to center the layout on the design, select the border of the layout using *Tools|Select Object* and then select *Tools|Move* and position the layout correctly.

You are now ready to print. Select *File|Print*. The Print dialog will remember the settings from the Plot Layout dialog so you should not have to edit anything.

Check the File / Date Stamp option so this will be printed on the plan. You may need to center the layout on the printable page. You can click the Center button or drag the print preview until positioned properly. Click the Print button.

4.8 DIGITIZING PLANS

A digitizer tablet can be used in conjunction with IRRICAD to enter scale plans on the IRRICAD screen.

There are two ways to do this: entering a scale or entering known reference points on the drawing from which a scale is calculated.

First we need to create a scaled plan from which to digitize – see Figure D1 (metric units) or Figure D2 (US units).

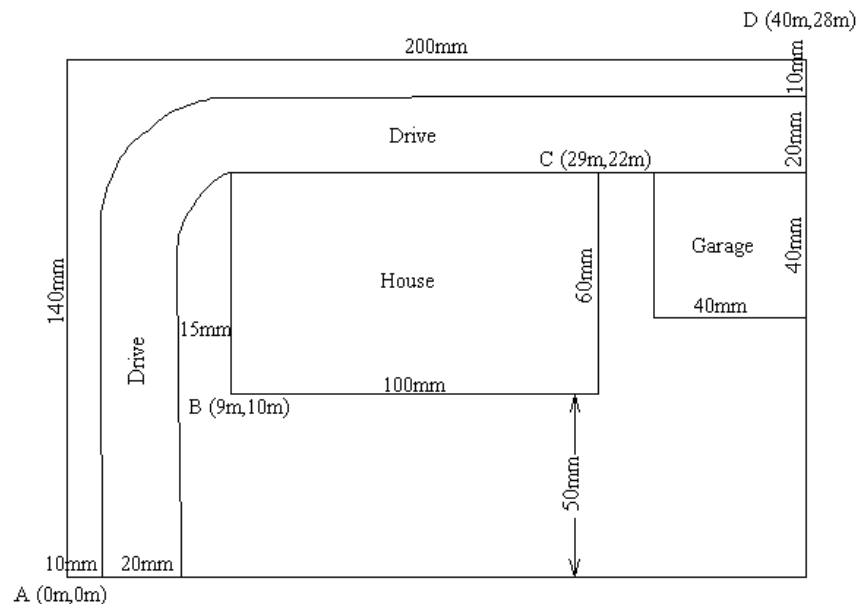


Figure D 1

Draw a rectangle measuring 8" x 6" (200mm x 140mm) on an A (A4) size piece of paper. This represents a property boundary of 120' x 90' (40m x 28m) at a scale of 1" : 15' (1:200). Draw another rectangle 4" x 2.5" (100mm x 60mm) for the house. The bottom left corner of the house should be 2" x 2" (45mm x 50mm) from the bottom left corner of the property. Draw a third rectangle 1.5" x 1.5" (40mm x 40mm) for the garage to the right of the house touching the right property boundary. Draw a curved drive along the left and top of the property. The drive

should be 1" (20mm) wide and positioned 0.5" (10mm) from the left and top boundaries. Label the bottom left corner of the property A (0,0), the bottom left corner of the house B (30',30') or (9m,10m), the top right corner of the house C (90',67.5') or (29m,22m) and the top right corner of the property D (120',90') or (40m,28m). Your drawing should look like Figure D1 (metric units) or Figure D2 (US units) without the measurements.

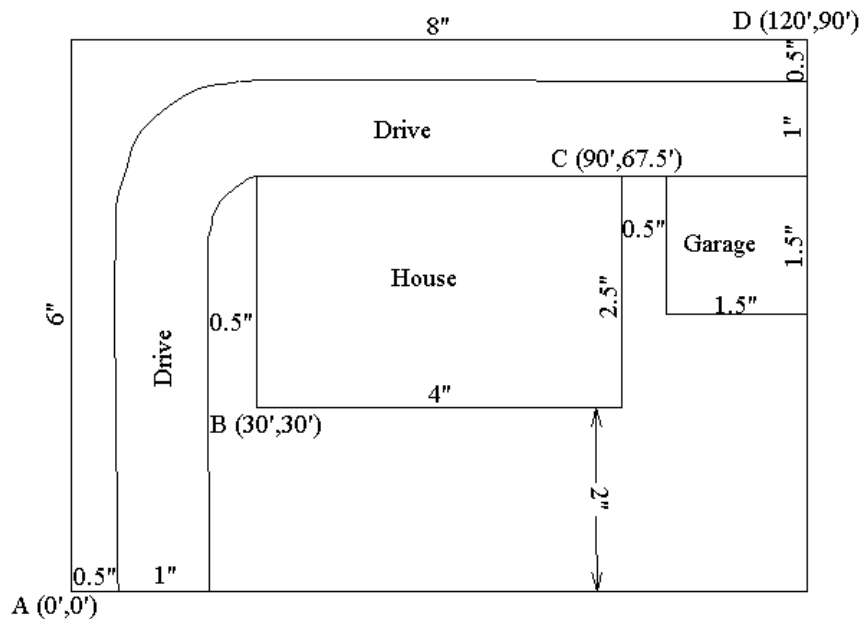


Figure D 2

Attach this scaled plan securely to the tablet so it cannot move during the digitizing process. While digitizing IRRICAD must be in tablet or absolute mode. This mode is turned on automatically when you enter a scale or reference points. You can tell if tablet mode is on or off by looking for a check mark in selecting *Settings|Digitizer|Tablet Mode*. At any time during digitizing you can turn off tablet mode and resume later. You will not need to re-enter a scale or reference points, just turn tablet mode on again. Tablet mode is switched on or off by selecting *Settings|Digitizer|Tablet Mode*. When tablet mode is on, the distance the digitizer puck is moved is relative to the scale. When tablet mode is off, the digitizer puck can be used like a mouse.

When tablet mode is on, the puck cannot be used to select menu items or tools - use the mouse or the keyboard. To use the keyboard, hold

down the Alt key and Click the underlined key (usually a letter) in the menu description (e.g. Alt+D for the Draw menu), then use the arrow and enter keys or the underlined key to select a particular menu item.

The digitizer puck buttons are set up to emulate the mouse buttons. Typically, button 1 is the left mouse button, button 2 the right mouse button, button 3 the middle mouse button (for 3 button mice) and button 4 is Esc. These defaults can be changed in the Windows Control Panel.

Tablet mode may also be toggled using the puck button assigned to the middle mouse button.

4.8.1 USING THE SCALE METHOD

This method can only be used for one-sheet digitizing. The complete area that will be digitized must fit within the tablet's active area. If the drawing is larger than the tablet, and therefore has to be moved around the tablet for the whole plan to be digitized, the reference method must be used.

Select *Settings|Digitizer|Scale*. In the dialog box enter the plan scale 15 (200). Click the OK button. Tablet Mode is automatically turned on.

Select *Draw|Rectangle|2 Point* or Alt+D,R,2. Place the puck on point A and left click. Move to point D and left click again. This will create the property boundary. Move to point B and left click then to point C and left click again. This will create the house. Select *Right-Click|Snaps|Object*. Place the puck on the top right corner of the garage and left click. Move to the bottom left corner of the garage and left click again.

Select *Draw|Curve|Spline* or Click Alt+D then V then S on the keyboard. Select *Right-Click|Snaps|Object* then place the puck on the bottom left of the drive and left click. Move up to where the drive starts to curve around the corner and left click again. Move around the curve left clicking about 6-8 times to create small segments, then move to the top right of the drive. Select *Right-Click|Snaps|Object* then left click on the boundary. Select *Right-Click|Done* or press Esc to finish the curve. Repeat the process for the right hand side of the drive snapping to the bottom boundary, the top left corner of the house and the right boundary.

Turn Tablet Mode off by selecting *Settings|Digitizer|Tablet Mode* (or clicking the middle button). Check the size of the property is 120 x 90ft (40m x 28m). To do this you can select *Draw|Line|Single* and place the first point on the bottom left boundary corner and draw out the rubberband line until the puck is or crosshairs are over the top left property corner. Do not place the second point of the line; note the distance as shown on the status bar (d = ?), Now move the puck to the bottom right boundary corner. Once again, do not place the second point of the line; note the distance as shown on the status bar (d = ?). Select *Right-Click|Restart* or press the Esc key.

4.8.2 THE REFERENCE METHOD

This method is used if at least two points on the plan are known in world co-ordinates. It is also used when the plan to be digitized is larger than the tablet or when the plan will not be completely digitized in one session.

To digitize a large plan it must be divided into sections small enough to fit on the tablet. Sections should have overlapping reference points e.g. if the first section has points A and B then the second section should have points B and C and so on. The first section should be referenced then digitized. When completed, the plan should be placed so that the next section is on the tablet with two other points available for referencing. The plan can be sideways or upside down if necessary. The referencing procedure is now repeated and the new section digitized. This is repeated until the whole plan has been digitized.

Reference points can be measured on the plan prior to starting. The co-ordinates of these points must be calculated in world units. For example, point B is measured as (2",2") or (45mm,50mm) which, when multiplied by the scale 1":15ft (200), gives world co-ordinates of (30ft,30ft) or (9m,10m).

Select *Settings|Digitizer|Reference*. IRRICAD will prompt you to enter the first reference point. Place the puck crosshairs over point A and left click. For the second reference point move to D and left click. Note that we could also use B or C in this example. In the dialog enter 0 for X1, 0 for Y1, 120 (40) for X2, 90 (28) for Y2 and 15 (200) for the scale and click OK.

IRRICAD will calculate a scale from the reference points and compare it to the value entered. If the two scales differ by more than 5% a warning

message with the calculated scale is displayed. If you click Yes to continue IRRICAD will use the entered scale. If you click No to terminate the process, re-select *Settings|Digitizer|Reference* and repeat the process, entering the correct scale. Note that if you do not know the scale of a plan you can use this method to get IRRICAD to calculate the scale for you. Normally round the calculated scale to a sensible value e.g. if the calculated scale is 1:198.86 then enter 1:200.

Tablet mode is automatically turned on at the end of referencing. Digitize the plan and check the size as for the scale method. Also check that the co-ordinates of points A, B, C and D are as shown on the scaled plan.

4.9 PLOT TEMPLATES

4.9.1 EDIT AN EXISTING PLOT TEMPLATE

Often it is easier to customize an existing template rather than to create a completely new template. The steps involved are:

1. Change the background color. In order to see the white fills and black lines, it is best to change the background color so it is neither black nor white. To do this go *Settings|Drawing* and in the lower middle section of the dialog box you will see *Background Color*. Click on the color to bring up the selection palate and select a light shade of a color you prefer. Avoid green as this is the default highlight color. Click OK and when you are back to a clean screen, close IRRICAD and then reopen IRRICAD. The change in background color will not take effect until you have restarted IRRICAD.
2. Select *Plot Template|Edit Template*. By default, IRRICAD lists templates found in the folder specified in the path *\IRRICAD\symbols\template*. If necessary, change the path and drive to locate the template to open.
3. Select a template by double-clicking the file name or by selecting the file name and clicking *Open*. Make sure the template is for the paper size that you want to use. The template will be drawn on the screen.
Edit the template by using any drawing tools such as lines, arcs, rectangles, text and symbols or other IRRICAD tools such as *Change*, *Move* and *Delete* to add and change objects as required.
4. To select objects for editing, use *Tools|Select|Window*, or use the selection filters (*Tools|Selection Filter* setting the type to e.g. text and checking the Filter check box). If *Select Object* is used fills will often be selected when text or lines are targeted.
5. To edit a legend object it must first be exploded (*Tools|Select Object* then *Tools|Explode*). Legends must be (re-)created using *Plot Template|Make Legend* before the template is saved. See the section on *Creating Legends* (Section 4.9.2.1) for a complete explanation.
6. Keywords created as text objects may form part of the template. When IRRICAD generates the plot layout in *Draw|Plot Layout* it recognizes these keywords and replaces them with the required information. Keywords start and end with #.

7. When the template is complete, use *Tools|Select|Window* to select the whole image on the screen. Go to *Plot Template|Save Template* and specify the name for this particular template.

4.9.2 CREATING A NEW PLOT TEMPLATE

The steps involved in creating a new plot template are:

1. Change the background color. In order to see the white fills and black lines, it is best to change the background color so it is neither black nor white. To do this go to *Settings|Drawing Items* and in the lower middle section of the dialog box you will see Background Color. Click on the color to bring up the selection palate and select a light shade of a color you prefer. Avoid green as this is the default highlight color. Click OK and when you are back to a clean screen, close IRRICAD and then reopen IRRICAD. The change in background color will not take effect until you have restarted IRRICAD.
2. Change the distance units to inches (millimeters) by selecting *Settings|Units* and clicking the down arrow on the distance edit field. Decide the paper size that you wish to create a plot template for. e.g., Size B (A3) paper. Determine the maximum printable area on the paper e.g., on 17 x 11" (420mm x 297mm) paper a margin of 0.3" (8mm) will be assumed around the perimeter of the paper. If the lower left corner of the paper is assumed have coordinates of 0, 0 then the printable area is from 0.3, 0.3 to 16.7, 10.7 (8, 8 to 412, 289).
3. Start with a new design. The following process will define the extent of the active area, create two rectangles (one inside the other) and create a white fill in the area between the two rectangles. To work through the example using metric A3 paper, use the numbers in parentheses.

Change the units to in (mm) in *Settings|Units*. Select *Draw|Line|Single*. Type 0.3,0.3 (8,8) and Click Enter. As you type the coordinates they will appear on the status bar at the lower left of the screen. Make sure that the coordinates are typed correctly. The comma between the two numbers is necessary. Type 16.7,10.7 (412,289) and Click Enter.

Select *View|Zoom All* to display the diagonal line representing the extents of the printable area. This will be used later and then deleted.

Select *Draw|Rectangle|2 Point*. Type -0.5,-0.5 (-12,-12) and Click Enter. Type 17.5,11.5 (432,309) and Click Enter. Select *View|Zoom All*

to display the rectangle representing the outer boundary of the fill. This is intentionally outside the paper size.

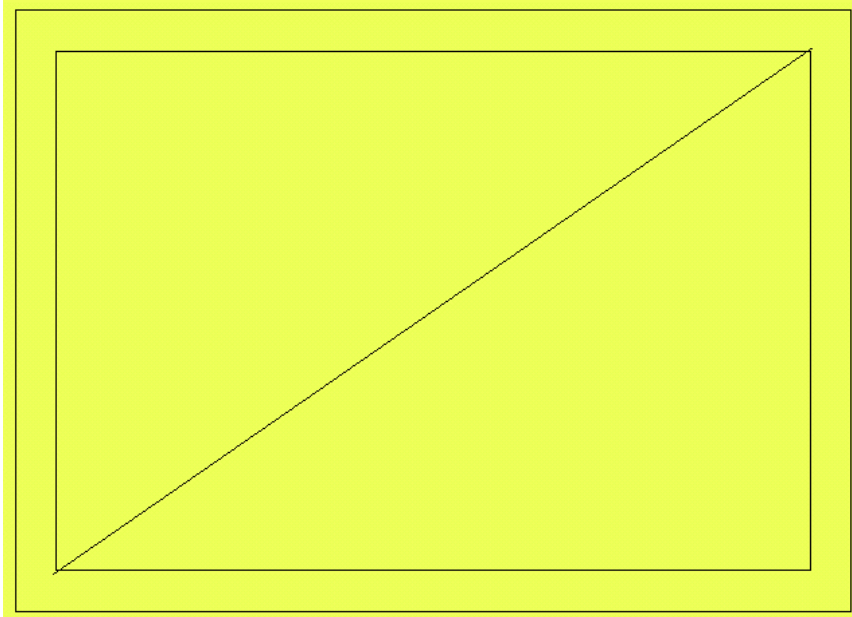


Figure PT 1

Select *Draw|Rectangle|2 Point*. Type 0.4,0.4 (10,10) and Click Enter.

Type 16.6,10.6 (410,287) and Click Enter. Select *View|Redraw* to refresh the image. The smaller rectangle represents the inner boundary of the fill and it will be the border line for the template. See Figure PT 1.

Go to *Settings|Drawing Items* - Current Color. Click on the color box to bring up the color palate and select white. Click OK, OK to return to the main screen.

Select *Draw|Fill|Seed* and click on a space between the two rectangles. The space between the two rectangles will turn white.

Go to *Settings|Drawing Items* - Current Color. Click on the color box to bring up the color palate and select black. Click OK, then OK to return to the main screen. Select *Tools|Select Object*. Place the cursor just at the top of the outer rectangle and click on the edge. Only the outer rectangle should be highlighted. Click the Delete key to delete the rectangle.

While still in Select Object mode, place the cursor just at the inside edge of the inner rectangle and click on the edge. Only the inner rectangle should be highlighted. Select *Tools|Change* and change the line width to 4. While still in Select Object mode, click on the diagonal line. Go to Plot Template and click on Make Active Area. Select *View|Redraw* and a faint dashed rectangle will appear just outside of the border rectangle.

Select *Tools|Clear Selection* and then *Tools|Select Object*, click on the diagonal line and Click the Delete key. See Figure PT 2.

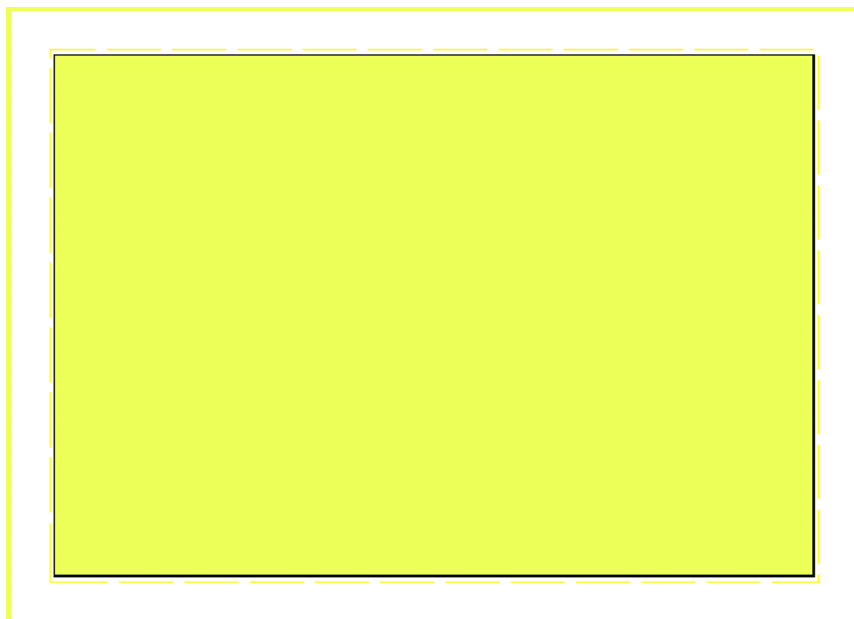


Figure PT 2

It is a good idea to save the work done so far. Select *Tools|Select|Window* and place a window to encompass everything on the screen including the fill. Select *Plot Template|Save Template*. Type in a name of your choice then click OK.

4. The next part of the process is to place dividing lines and text.

Select *Draw|Line|Single*, type 0.4,1.9 (10,48) and Click Enter. Move the mouse across the screen towards the right side of the border. Click the right mouse button, select *Snaps|Perpendicular* and then click on the right border. Select *Tools|Change*, select the line you just placed and change the line width to 4. Don't worry if it appears thicker than the

border rectangle. Go to *Draw|Text* and type in #CONA#. Select a font, set the size to 0.16" (4mm) and click on Left justification. Place the text in right side area of the bottom section. See Figure PT 3. #CONA# is the key word that causes IRRICAD to insert the company name into the design. Many more dividing lines and text can be added to the template.



Figure PT 3

Save the template. Select *Tools|Select|Window*) and place a window to encompass everything on the screen including the fill. Select *Plot Template|Save Template*. Type in the same name that you used before.

4.9.2.1 CREATING LEGENDS

The following steps demonstrate how to create a pipe legend and a valve legend in the plot template being used in this exercise:

1. Select *View|Zoom Window* to zoom in on the lower left corner of the template.
2. Select *Draw|Rectangle|2 Point* and draw a rectangle about 4" (100mm) long and just under 1.8" (45mm) high.
3. Make a copy of this rectangle to the right of the original. Select *Tools|Copy|Linear*, click on the rectangle and then click OK for 1 copy. Click on the top left of the rectangle and while holding the

control key down, move the copy to the right of the original. Click to place the copy. (Holding the control key down while drawing an object activates the Ortho mode). See Figure PT 4.

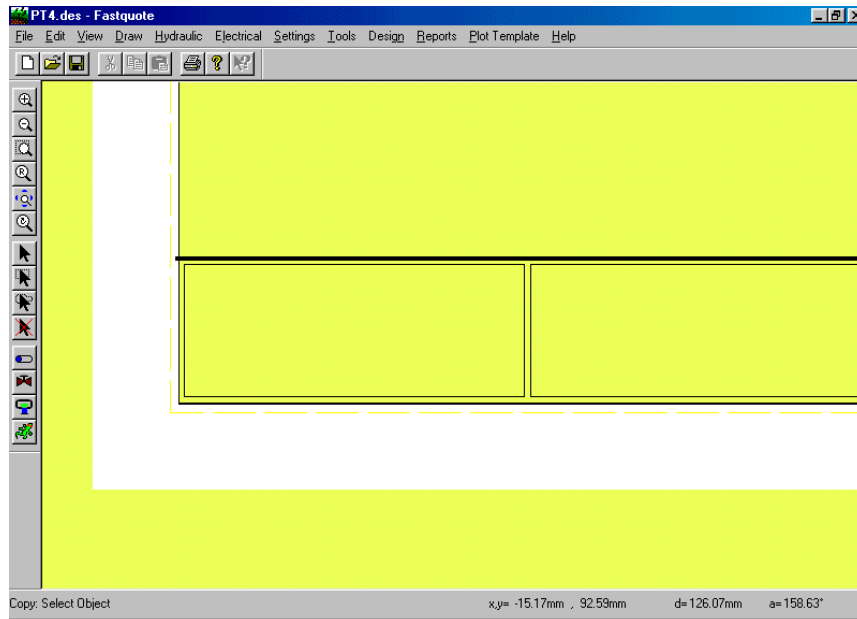


Figure PT 4

4. Go to *Settings|Drawing Items* - Current Color. Click on the color box to bring up the color palate and select white. Click OK, OK to return to the main screen.
5. Select *Tools|Select Object*. Place the cursor on an edge of the left rectangle and click to highlight the rectangle. Select *Draw|Fill|Selection*. A white fill will appear. Repeat this step completely for the right rectangle. For a more detailed explanation of fills in plot templates see Fills, Section 4.9.2.2.
6. Go to *Settings|Drawing Items* - Current Color. Click on the color box to bring up the color palate and select black. Click OK, OK to return to the main screen.
7. Select *Tools|Select Object*. Place the cursor just at the top of the left rectangle and click on the edge. Only the rectangle outline should be highlighted. Click the Delete key to delete the rectangle outline. Repeat for the right rectangle. See Figure PT 5.

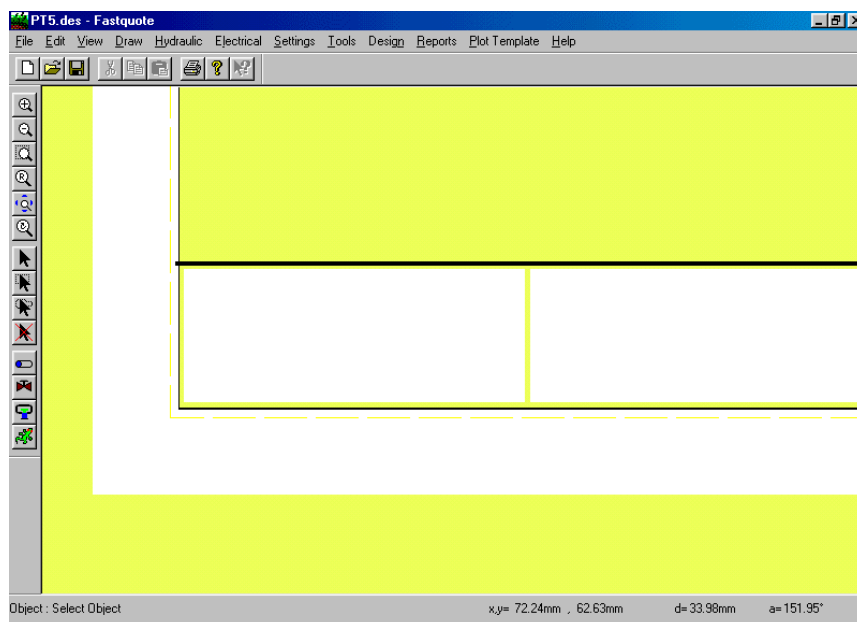


Figure PT 5

8. Select *Draw|Line|Single* and draw a short line in the top left of the small rectangle. Select *Tools|Select Object*, then *Tools|Change* and then click on the line. Change the width to 3.
9. Select *Draw|Text* and type the word Pipe. Set the font to your choice and set the size to 0.12" (3mm). Place the text to the right of the short line.
10. If at any time the line and text disappear behind the fill, select *View|Redraw*. It is easier to use *Tools|Select|Window* to select an item located within a fill.
11. In the second rectangle insert a symbol placeholder. Go to *Draw|Symbol* and click the load button. Go to the \IRRICAD\symbols\database folder. You may need to go up one level to get to this folder. Browse for a symbol called Placeholder.vcs. Highlight this symbol file, click Open, make sure the boxes of Dynamically Size and Maintain Shape are checked and then click OK. This symbol is now be loaded for placement. Move the cursor to the top left of the second rectangle. The symbol needs to be about 1/4" x 1/4" (4mm x 4m) in size so click once to define the bottom left of the symbol, move the mouse up and out and click again to define the top right of the symbol.

12. Select *Draw|Text* and type in the word Symbol. Set the font and size the same as for the pipe legend. Place the text to the right of the symbol. See Figure PT 6.

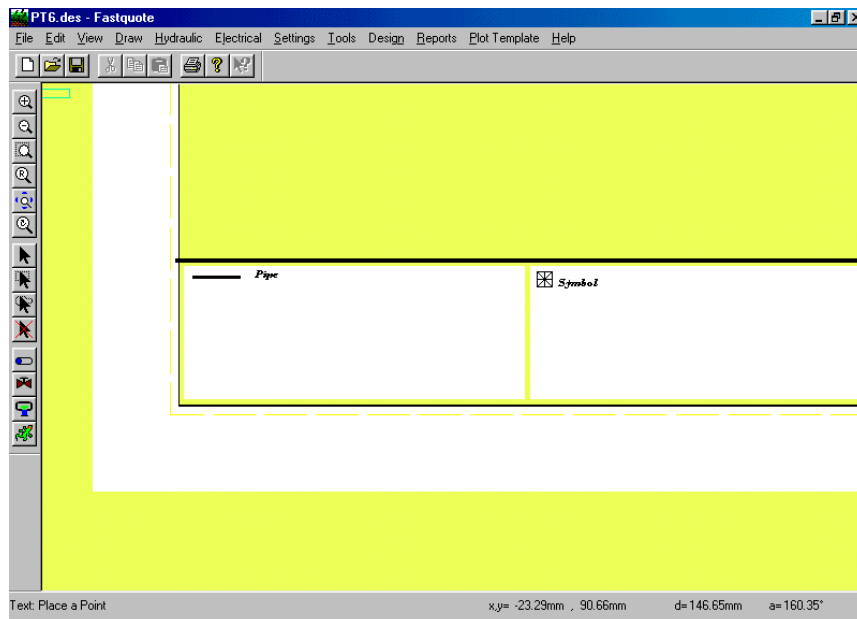


Figure PT 6

13. Now that the components of the legends are in place it is necessary to group them together and save them as legends. Select *Tools|Select|Window* and place a window to completely encompass the pipe legend, including the fill. Select *Plot Template|Make Legend*. Leave the fields as Pipe, 1, and 50%. Click OK.
14. Using *Tools|Select|Window* place a window to completely encompass the symbol legend, including the fill. Select *Plot Template|Make Legend*. Change the legend type to Symbol by clicking on the dropdown arrow and selecting Symbol. Click OK.

4.9.2.2 FILLS

To complete the plot template in this working example it is necessary to place a fill over the bottom section of the template so parts of the design will not be plotted in the area containing the company name, scale, legends etc.

To do this:

1. Select *View|Zoom All*
2. Go to *Settings|Drawing Items - Current Color*. Click on the color box to bring up the color palate and select white. Click OK, OK to return to the main screen.
3. Select *Draw|Fill|Boundary*. Move the cursor to the bottom left of the template.
4. Select *Right-Click|Snaps|Endpoint*. Click on the bottom left corner of the black border line.
5. Select *Right-Click|Snaps|Endpoint*. Click on the end of the left end of the dividing line above the legends.
6. Select *Right-Click|Snaps|Endpoint*. Click on the end of the right end of the dividing line above the legends.
7. Select *Right-Click|Snaps|Endpoint*. Click on the bottom right corner of the black border line.
8. Select *Right-Click|Done*. The whole area under the dividing line should now be white. Any text and lines will have disappeared behind this fill.

4.9.2.3 MOVING FILLS TO BACK



Figure PT 7

In the example it is necessary to bring the text and lines to the forefront. Select *Tools|Select|Window* and place a window that completely encompasses the whole bottom divided section of the template. This should include the legends. See Figure PT 7.

Go to Plot Template and click on Move Fills to Back. The legend symbols, text and #CONA# should now be visible. See Figure PT 8.

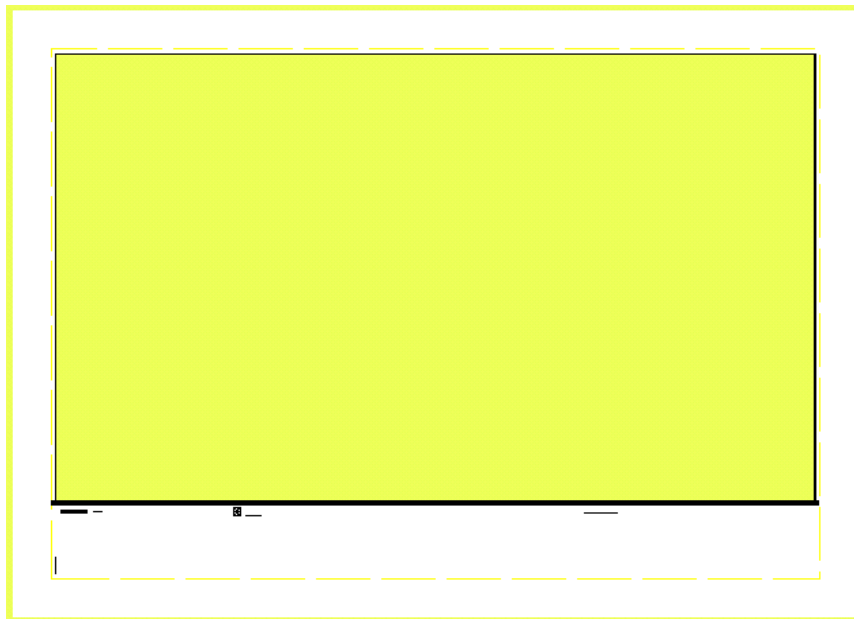


Figure PT 8

Save the template for the last time in this exercise. Select *Tools|Select|Window* and place a window to encompass everything on the screen including the fills. Select *Plot Template|Save Template*. Type in the same name that you used before.

Reset the drawing color to black by going to *Settings|Drawing Items - Current Color*. Click on the color box to bring up the color palate and select black. Click OK, OK to return to the main screen.

The process is complete. Naturally it is possible to customize the plot templates in much more detail. This can be done using the IRRICAD drawing tools.

4.10 TIPS FOR ADVANCED USERS

4.10.1 USING A PUMP IN A DESIGN

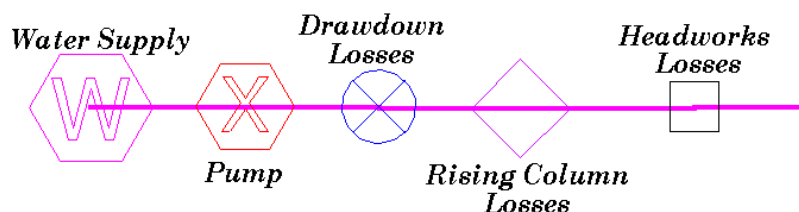
The pump must be placed downstream from the water supply and must not be placed in loops. Remember a water supply can only have one connection and this is the mainline pipe. Enter the water supply details to reflect true conditions of the supply – **the height of water relative to ground level**

If the water supply is a river or open water source and therefore the pressure may be zero, enter a small number for the water supply design and maximum pressures so that IRRICAD will not calculate the pressure required to run the system (e.g. 0.1).

If the water supply is a tank, enter the height of the water level above ground level as the design and maximum pressures e.g. 2ft (m).

If the water supply is a well, enter the pressure as a negative pressure, indicating the level of the water below ground level e.g. -2ft (m) pressure if the water level is 2 feet (meters) below the ground (i.e. the static water level). If the well is artesian i.e. positive static water level, enter a positive number e.g. 2ft (m).

When a pump is used in a system, there are often more items that result in a headloss. These items such as rising column losses (submersible pump only), drawdown losses (well only), headworks losses, etc. can be entered in to the design and therefore analysed as close to field results as possible.



If the water supply is a well with a static water level below ground level, there will be a negative pressure in the pipe between the water supply

and the pump, which will be reported during analysis. It does not matter in which order the above items are placed on the mainline pipe, only that they are placed so that any losses are accounted for. The items above can be entered at the depth they are at, or left at zero for convenience.

4.10.1.1 ENTERING PUMPS IN TO THE DATABASE

Use the manufacturer's data for the pump. From the pump curve supplied read off the pressure and resulting flow for several points along the 6 stage curve. In IRRICAD databases, select the Utilities menu, the Curve Fitting option and the Pumps option. Enter at least three sets of data into the curve fitting utility for pumps (make sure the units above each column match the units you are using from the graph). Click the Fit Curve button. The curve fitting generates three numbers to use in the database (coefficients of a quadratic). This produces numbers A, B and C that IRRICAD uses in the pump formula to calculate the pressure the pump will produce based on the flow. The pressure provided by the pump can be seen in the Mainline Full report – seen as a large head difference – -ve or +ve) or using Hydraulic Object Info.

Enter a new pump into the Tutorial database from a pump curve of your choice.

Run Irricad Databases. Move the open database (check it is Tutorial.mdb) down slightly so you can see the menu bar by dragging the open database down by the top blue bar. Select *Utilities|Curve Fitting|Pumps*. Make sure the units match the units you are reading off the graph. Enter at least 3 sets of points from the curve, particularly around the area you wish to operate the pump in the design. Click the Fit Curve button. Make sure the R^2 is greater than 90%. If it is not, re-enter the points. Leave this dialog open.

Click on the Pump component group tab and click New Pump. Enter the usage (Y), name, warehouse code, connection types (use PUMP F S so it easy to identify in the reports) and diameters. You can copy and paste the numbers from the pump curve fitting into the appropriate fields in the Pump Details dialog or write them down and type them in. Enter the minimum and maximum flows for that pump and select a plotting symbol, symbol size and plotting colour for the new item. Save the new pump.

If a surface pump model is 100 x 65: 100 is the suction diameter, 65 is the diameter of the discharge (outlet). If an extra number is present in

the description – size of the impeller. For a submersible pump, enter the inlet and outlet diameter the same.

4.10.1.2 MISCELLANEOUS HYDRAULIC ITEMS IN YOUR SYSTEM.

These are items that have a pressure loss in the system. These losses can be based on flow or can be a fixed loss.

If fitting selection is not important, it is convenient to enter the connection type for Misc. Hydraulic items to reflect the description e.g. DD for drawdown. This makes it easier to find them in the Mainline Full Report. Also you can change the connection codes after design but prior to fitting selection easily if required.

DRAWDOWN LOSSES

Drawdown losses are based on well tests. Determine the drawdown for the well (pumping level - static water level).

Solve the formula used for Misc. Hydraulic items: $H = K \times Q^n$ where H is in metres and Q is in m^3/hr .

The drawdown is equal to the headloss in m (e.g. if the dd = 9.6m, then the headloss = 9.6m).

Q is the flow at the well, e.g. $49m^3/h$. I is the exponent.

For alluvial aquifers:

If there is only one well test (Q-dd pair) available estimate the index is around 1.5. For a large flow use 1.7 (> 50 l/s). Find the value of the constant e.g. $K = H/Q^n$.

If there are two points supplied (2 well tests) on the same well can calculate the index (exponent). $N = \log (D1/D2)/\log (Q1/Q2)$. $K = D1/Q1^n$.

For wells that are uncased in rock or limestone use an index (n) close to 1.

Enter the constant (K) and index or exponent (n) in to the correct edit fields in the Other Hydraulic component group in the database. The intercept (C) is 0.

Enter a new Drawdown loss item in to your database. The data you have is a flow of 49m³/h and with 9.6m drawdown. Calculate the Constant K and the Index (exponent) n.

Go to the Other Hydraulics component group tab in the Tutorial database. Click on New Item. Select the usage as Y, enter a name, and warehouse code, connection types and diameters. Enter the constant and index as you have calculated in the correct fields. Leave the Fitting Type blank (only used for PRVs). Enter the minimum and maximum flows for the item and select a plotting symbol, symbol size and plotting colour for the new item. Save the new item.

RISING COLUMN (RISING MAIN) LOSSES IN A SUBMERSIBLE PUMP

This item can also be the suction pipe loss in a surface pump.

Use a friction loss chart for the type of rising column used.

Enter at least three sets of numbers read from the chart for the correct flow and rising column size into the curve fitting utility for valves (same as Misc. Hydraulic but no intercept), making sure the units above each column match the units you are using from the chart. Click the Fit Curve button. The curve fitting generates two numbers to use in the database. This produces constants and intercepts that IRRICAD uses in the Misc. Hydraulic formula to calculate the headloss through the rising column. It is easier to calculate for 100m and then adjust for the actual length.

For galvanised rising columns use the following: These have been calculated for a column 328ft (100m) long

Pipe Size	Constant	Index
8"	0.0001479	1.834
6"	0.00049076	1.84
5"	0.001254	1.810
4"	0.003307	1.852
3"	0.01174	1.855
2 ¹ / ₂ "	0.02448	1.874

Alter the constant relative to the length of the rising column (using the metric):

E.g. constant x length (m)
100m

for an 8" rising column which is 85m long $\rightarrow 0.0001479 \times 85 / 100 = 0.000126$

Enter 0.000126 in to the Constant field in the database. Make sure the description specifies the length.

The rising column of the pump we will be using is 6" (150mm) and is 213ft (65m) long. Calculate the constant relative the length (as above).

Go to the Other Hydraulics component group tab in the Tutorial database. Click on New Item. Select the usage as Y, enter a name, and warehouse code, connection types and diameters. Enter the constant and index as you have calculated in the correct fields. Leave the Fitting Type blank (only used for PRVs). Enter the minimum and maximum flows for the item and select a plotting symbol, symbol size and plotting colour for the new item. Save the new item.

HEADWORKS LOSSES

This Misc. Hydraulic item can be used to account for other losses relative to the flow.

$n = 2$

H = for example, if you estimate the pressure loss in the headworks to be 5psi @ 26385gph (3.5m @ 100m³/h) you can assume $n=2$ (in most cases) and solve for K.

Solve for K $H = KQ^n$

There is no intercept so leave the intercept field (C) as 0.

You can calculate the headloss through each of the items in the headworks or expected to be in the headworks at a particular flow and therefore calculate the constant and the index. The headloss will change as the flow increases or decreases. Note that existing systems tend to have high headloss at the headworks.

Enter a new Miscellaneous loss item in to your database – where the pressure loss is 5psi @ 26385gph (3.5m @ 100m³/h).

Go to the Other Hydraulics component group tab in the Tutorial database. Click on New Item. Select the usage as Y, enter a name, and warehouse code, connection types and diameters. Enter the constant and index as you have calculated in the correct fields. Leave the Fitting Type blank (only used for PRVs). Enter the minimum and maximum flows for the item and select a plotting symbol, symbol size and plotting colour for the new item. Save the new item.

MISCELLANEOUS FIXED LOSSES

Misc. losses can be added to account for any other possible losses. These can be added into the Other Hydraulics component group by entering an intercept and leaving the constant and index as zero. Use only if you want to include a fixed loss regardless of flow.

Go to the Other Hydraulics component group tab in the Tutorial database. Click on New Item. Select the usage as Y, enter a name, and warehouse code, connection types and diameters. Enter the intercept as 6.5ft (2m), leaving the constant and index as 0. Leave the Fitting Type blank (only used for PRVs). Enter the minimum and maximum flows for the item and select a plotting symbol, symbol size and plotting colour for the new item. Save the new item.

4.10.1.3 DRAW A DESIGN WITH A PUMP AND ALL COMPONENTS

Now draw a design with the new pump in it, place the drawdown losses, rising column losses, headworks losses and miscellaneous losses you have just entered in the database. Enter the water supply head as required, based on the pump you have entered. Place the Demand Flow outlet (from the Mainline menu) and specify P and Q (based on the pump chosen) on the end of the mainline to represent a hydrant. Design the system and view the reports to see the effect on the system the above items have.

4.10.2 MULTIPLE WATER SUPPLIES

IRRICAD can only design one system, so if you have two or more separate systems on one design, you need to connect them together with a temporary pipe. You can delete this pipe once design has been completed. As long as water supplies are connected in some way via the mainline, IRRICAD can complete the design. It doesn't matter where the mainlines are connected just as long as one mainline is connected to the other mainline. The closest point is usually the most

convenient. If the water supplies are separate, IRRICAD will only design the first system.

If only one water supply exists in a design you can leave the pressure and flow for IRRICAD to calculate based on each system duty. However, if there are 2 or more water supplies present and you are not concerned about pumps, you must enter at least the pressure in to all water supplies. You can increase or decrease the pressure to achieve the flow you require from each.

If a PRV on the water supply is required, in a design containing multiple water supplies, do the following:

Make the water supply the PRV – enter the water supply pressure equal to the PRV pressure setting e.g. if the PRV is to be set at 70psi (50m), enter the water supply pressure as 70psi (50m). Never put PRVs in loops. Manually check the PRV is able to regulate at that set pressure and at that flow.

Remember, if you have more than one water supply or have a looped system you must use Velocity design to size the pipes.

Draw a design with 2 water supplies, one on each end of a mainline pipe, with a demand point in the middle. Make your mainline pipe 8" (150mm) and 164ft (50m) long and set the demand point pressure to be 70psi (50m) and the flow to be 13192gph (50m³/hr). Use *Right-Click|Snaps|Midpoint* to connect the demand point halfway along the pipe. Enter the pressures for the water supplies to be 70psi (50m). After completing Management, Zone analysis and Valve analysis, run *Mainline Design|Analyse*. View the System Duty report.



Now select the demand point and move it closer to the left-hand water supply. Re-analyse the mainline and view the System Duty report.



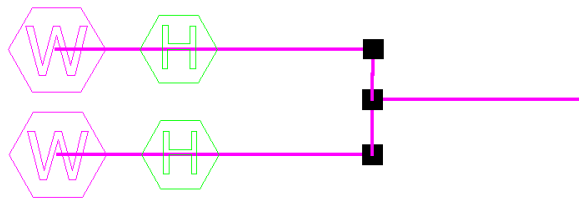
Now select the demand point again and move it closer to the other right-hand water supply. Re-analyse the mainline and look at the System Duty report.

This exercise highlights the effects on the water supplies under changing conditions.

4.10.3 USING PUMPS IN PARALLEL

If two pumps are in parallel – they are effectively in a loop – NEVER put pumps in a loop. If this is the case, draw two water supplies with a pump each and connect the mainline after the pumps:

E.g.:

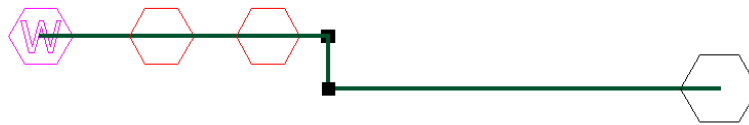


Remember using the same pump in parallel doubles the flow.

Draw a small design like the above picture using the Tutorial.mdb. Enter 0.1m as the Design Head and Max Head for both water supplies. Select an 8" pipe for the mainline pipe. Select the Pump 350gpm @ 70psi (1320lpm @ 50m) as the pump and use the Demand Flow outlet as the Mainline Outlet and enter a pressure of 68psi (48m) and a flow of 39578gph (150m³/hr). Assign all Zones to One System Flow and enter system flow 1 to be supplied by both water supplies. Analyse the zone and run Valve Analysis. Run *Mainline Design|Analyse* and view the Mainline Full report. Click OK on both warning messages about not having pumps in loops. Turn Hydraulic Object Info on in *Settings|Miscellaneous* and click on items in the design to highlight them, select *Right-Click|Object Info* and view the hydraulic results of each component.

4.10.4 PUMPS IN SERIES

Pumps can be placed in series. Once again, no pump should be placed within a loop. Edit the above drawing so that there is only one water supply. Add an extra pump on the same pipeline. Change the demand point to require 128psi (90m) pressure and 19789gph (75m³/hr). Re-run management, zone analysis, valve analysis and mainline analysis. Check the Mainline Full report. Turn Hydraulic Object Info on in *Settings|Miscellaneous* and click on items in the design to highlight them, select *Right-Click|Object Info* and view the hydraulic results of each component.



Remember using the same pump in series doubles the pressure output.

5 Tool & Command Reference

5.1 RIGHT-CLICK MENUS

Right-Click menus are context sensitive, that is, they change according to which tool is currently selected.

HYDRAULIC RIGHT-CLICK MENU:

Done	See Section 5.1.1
Restart	See Section 5.1.2
Snaps	See Section 5.1.8
Zooms	See Section 5.4
Close	See Section 5.1.5
Default Name	See Section 5.1.6
Stop	See Section 5.1.7
Draw	See Section 5.5
Settings	See Section 5.9

DRAWING RIGHT-CLICK MENU:

Done	See Section 5.1.1
Restart	See Section 5.1.2
Snaps	See Section 5.1.8
Zooms	See Section 5.4
Close	See Section 5.1.5
Draw	See Section 5.5
Settings	See Section 5.9

SELECTION RIGHT-CLICK MENU:

Select Object	See Section 5.10.2
Clear Selection	See Section 5.10.3
Invert Selection	See Section 5.10.4
Selection Filter	See Section 5.10.5
Select	See Section 5.10.6
Object Info	See Section 5.1.3
Close	See Section 5.1.5
Restart	See Section 5.1.2
Modify	See Section 5.1.4
Zooms	See Section 5.4

5.1.1 DONE

Found in the Right-Click menu, this option is used to finish an object that has multiple line segments, e.g. polyline, curve, contour, hatch boundary, tape, etc. Done can also be selected for some hydraulic tools, such as *Zone|Area* where the area has not been closed.

5.1.2 RESTART

Found in the Right-Click menu, select to restart an action part way through e.g. move, or to stop a pipe so you can start from another point.

5.1.3 OBJECT INFO

Found in the Right-Click menu, Object Info displays a brief summary of the selected objects. If the Debug Object Info box is checked in *Settings|Miscellaneous*, a full description is displayed. The Change tool can also be used to view information about a selected object.

5.1.4 MODIFY

Found in the Right-Click menu, Modify provides a shortcut to modifying tools such as Delete, Delete Type, Change, Change Type, Move, Copy, Rotate, Explode and Resize. These tools are also found in the Tools menu.

See also:

Tools

Section 5.10

5.1.5 CLOSE

Found in the Right-Click menu, select to close a lasso, contour, curve, polyline, double line and areas when at least three points have been entered.

Note: If you are drawing an area and select the Close option, make sure that the closing line, which will return to the starting point, will not cut any of the other boundary lines for the area.

5.1.6 DEFAULT NAME

Found in the Right-Click menu, this tool allows you to change the default name of zones (*Zone or Mainline|Control Valve, Mainline|Outlet or Mainline Sprayline*), water supplies (*Mainline|Water Supply*) or Irrigation Areas (*Zone|Area*). The effect of the default name change applies to named items placed after this action until another tool is selected.

1. Select the hydraulic item to place, i.e. *Zone|Control Valve*, etc.
2. Before placing the object (or after selecting the tool and clicking OK on the dialog) select *Right-Click|Default Name*.
3. Type the base for the hydraulic items. Leave the automatic numbering signs e.g. ~~~ for automatic numbering to take place. For example typing Block ~~~ as the default zone name will name the zones Block 1, Block 2, etc.
4. Click OK and place / connect the hydraulic items as required.

See also:

Names

Section 5.9.11

5.1.7 STOP

Found in the Right-Click menu, use this tool to stop the block creation process, cut pipe or cut lasso.

5.1.8 SNAPS

Found in the Right-Click menu, snaps give you the ability to place or constrain points in relationship to other objects in your drawing. When you use a Snap command while locating a point, the point snaps into position. The following snaps are available:

Place	Section 5.1.8.1
Midpoint	Section 5.1.8.2
Endpoint	Section 5.1.8.3
Perpendicular	Section 5.1.8.4
Percent	Section 5.1.8.5
Object	Section 5.1.8.6
Intersection	Section 5.1.8.7
Tangent	Section 5.1.8.8
Closest	Section 5.1.8.9

Center	Section 5.1.8.10
Quadrant	Section 5.1.8.11
Parallel	Section 5.1.8.12

You can use a snap whenever you are expected to place a point. For example, when you select *Draw|Line|Single*, you are prompted for the starting point of the line. Before you click the point, you can choose a snaps option from the Right-Click menu, which will affect the placement of the starting point. For example, if you choose the *Right-Click|Snaps|Closest* and click near the end of an object, the starting point of the line will be placed exactly at the endpoint of that object.

The Perpendicular and Tangent snaps can function either as snaps or as drawing constraints. As snaps, these options typically are used to find the ending point of a line or line segment so that the completed line is perpendicular or tangent to a specified object. When used as constraints, these options cause the rubber band preview line to maintain a perpendicular (or tangent) relationship to a specified object as you move the cursor. You can place the endpoint anywhere, and the resulting line will be perpendicular or tangent to the specified object.

The Snaps options can be invoked from a pop-up menu accessed by clicking the right mouse button.

5.1.8.1 PLACE

Use the *Right-Click|Snaps|Place* command to place a hydraulic item instead of connecting it to an existing hydraulic item.

You would use this command when in Connect mode (*Settings|Snap*) when you want to place a single hydraulic item then continue connecting hydraulic items. If you have a large number of items or points to place set Place mode in *Settings|Snap*.

See also:

Snaps

Section 5.1.8

5.1.8.2 MIDPOINT

Use the *Right-Click|Snaps|Midpoint* command in drawing or editing operations to find the midpoint of a line, or along the perimeter of an arc. If you need to find the center of curvature of a circle, arc, or the centroid of a polygon, use the *Right-Click|Snaps|Center* command. The cursor

must be within the snap tolerance (as set in *Settings|Snap*) of the object for the snap to occur.

To find the midpoint of an object:

1. Select *Right-Click|Snaps|Midpoint*.
2. Click anywhere on the target line or arc.

The point is set at the midpoint of the target object.

See also:

Snaps

Section 5.1.8

5.1.8.3 ENDPOINT

Use the *Right-Click|Snaps|Endpoint* command to snap to the end point of a previously placed object. The cursor must be within the snap tolerance (as set in *Settings|Snap*) of the object for the snap to occur.

To use the Endpoint command:

1. Select *Right-Click|Snaps|Endpoint*.
2. Click near one end of the target object. The cursor immediately snaps to the end point of the target.

See also:

Snaps

Section 5.1.8

5.1.8.4 PERPENDICULAR

Use the *Right-Click|Snaps|Perpendicular* command when a single or continuous line must be drawn perpendicular to a target object. You can select to use the Perpendicular command as a snap (which terminates the line on the target object) or as a constraint (which sets the originating point on the target object and constrains the line perpendicular to the object).

Valid target objects include lines, continuous lines, circles, arcs, rectangles, polygons, ellipses, elliptical arcs, spline curves, and bezier curves available from the Draw menu.

To use as a snap:

1. Select a Line command from the Draw menu and place the first point. This initiates rubberbanding as you are prompted to pick the second point.
2. Select *Right-Click|Snaps|Perpendicular*. IRRICAD prompts you to pick an object.
3. Click the target object to set the second point.

IRRICAD terminates the line perpendicular to the target object. If the line cannot be drawn perpendicular to the target object itself, the line is drawn perpendicular to a calculated extension of the object.

To use as a constraint:

1. Start a Line command from the Draw menu.
2. Select *Right-Click|Snaps|Perpendicular*.
3. Click the target object.
4. Now you need to set the starting point of the line. Click to place the starting point.

If you want the starting end of the constrained line to move freely on the target object, click any point without using a snap command. When you do this, a rubberband line connects the target object to the cursor. This line moves and Stretches as you move the cursor, always maintaining a perpendicular relationship between the rubberband line and the target object.

If you want the perpendicular line to originate on a specified point on the target object or elsewhere use another snap command to start the line. The snap determines a fixed starting point of the new line, which is free to Stretch along its axis, but not move laterally.

5. Click a point to terminate the line, or type a required length of the line.

See also:

Snaps

Section 5.1.8

5.1.8.5 PERCENT

Use the *Right-Click|Snaps|Percent* command when a required point is located along an object at a distance from the end equal to a specified

percentage of the length of the target object. Can be used on lines, continuous lines, and arcs available from the Draw menu.

To use the Percent command:

1. When prompted for a point in any command, select *Right-Click|Snaps|Percent*.
2. Click the target object on which the point is to be set. The end nearest the point picked is the 0% end of the target object, and the opposite end is the 100% end.
3. Type the required percent of the length of the target object. Click OK.
4. Click on the target line near the end you wish the percentage to be measured from.

Tips: Do not type the percent symbol (%).

You can enter percentage values less than 0 or greater than 100 to set points on the extension of the target object.

See also:

Snaps

Section 5.1.8

5.1.8.6 OBJECT

Use the *Right-Click|Snaps|Object* command in drawing or editing operations to locate a point on an object when the specific location on the object is not critical.

To snap to an object:

1. Select *Right-Click|Snaps|Object*.
2. Click the target object where you want the point to be set.

The point is set on the target object.

See also:

Snaps

Section 5.1.8

5.1.8.7 INTERSECTION

Use the *Right-Click|Snaps|Intersection* in drawing or editing commands where an exact point of intersection must be found.

To snap to the intersection of two objects:

1. Select *Right-Click|Snaps|Intersection*.
2. Click near the point where the two target objects intersect.

The point is set at the point of intersection of the two target objects. If there are multiple points of intersection (such as a line passing through a circle), IRRICAD finds the point of intersection nearest the mouse click.

See also:

Snaps

Section 5.1.8

5.1.8.8 TANGENT

Use the *Right-Click|Snaps|Tangent* command primarily when a line must be drawn tangent to a target object. You can use the Tangent command as a snap or constraint to determine whether the tangent line terminates on the target object or originates on the target object. Valid target objects include circles, arcs, ellipses, elliptical arcs, interpolating curves, and Bezier curves.

To use as a snap:

1. Start the Line command from the Draw menu and place the first point. IRRICAD prompts you to pick the second point.
2. Instead of immediately picking a terminating point, select *Right-Click|Snaps|Tangent*. IRRICAD prompts you to pick an object.
3. Click the target object.

IRRICAD terminates the line tangent to that object. If the line cannot be drawn tangent to the target object itself, the line is drawn tangent to an imaginary extension of the object.

To use as a constraint:

1. Start a Line command from the Draw menu.
2. Instead of picking the starting point of the line, select *Right-Click|Snaps|Tangent*. IRRICAD prompts you to pick an object.
3. Click the target object.

If you want the starting end of the constrained line to be able to move freely on the target object, click any point without using a snap command. A rubberband line is drawn connecting the target object to

the cursor. This line moves and Stretches as you move the cursor, always maintaining a tangential relationship between the rubberband line and the target object.

If you want the tangent line to originate on a specified point on the target object or elsewhere use a snap command to start the line. The snap determines a fixed starting point of the new line, which is free to Stretch along its axis, but not move laterally.

4. Click a point to terminate the line or type a required length of the line simply by typing the required length. The length you have specified will appear on the status bar. Press the Enter key.

See also:

Snaps

Section 5.1.8

5.1.8.9 CLOSEST

Use the *Right-Click|Snaps|Closest* command to find the nearest construction point.

To snap to the closest point:

1. When prompted to pick or snap to a point, select *Right-Click|Snaps|Closest*.
2. Click near the target definition point.

IRRICAD locates the new point exactly on the existing definition point.

See also:

Snaps

Section 5.1.8

5.1.8.10 CENTER

Use the *Right-Click|Snaps|Center* command to find the center point of a closed object like a circle or polygon. This command differs from the *Right-Click|Snaps|Midpoint* command, which finds the midpoint along the length or perimeter of an object.

To set a point at the center of an object:

1. When prompted for a point, select *Right-Click|Snaps|Center*.
2. Click one of the above objects.

IRRICAD sets the point at the center of the target object.

See also:

*Snap*s

Section 5.1.8

5.1.8.11 QUADRANT

The *Right-Click|Snaps|Quadrant* command is especially useful when an extreme horizontal or vertical point on a circle or arc are needed. For example, you can snap a horizontal or vertical dimension directly to the outer edge of a hole or column. You can also easily measure the diameter of a circle by snapping to opposite quadrant points.

To locate a quadrant point on a circle or arc:

1. When prompted for a point, select *Right-Click|Snaps|Quadrant*.
2. Click the circle or arc near the required quadrant point.

IRRICAD sets a point exactly on the quadrant point.

See also:

*Snap*s

Section 5.1.8

5.1.8.12 PARALLEL

Use the *Right-Click|Snaps|Parallel* command to draw a line parallel to a straight line or segment of a continuous line, polygon or rectangle. The parallel line can be drawn at a specified offset from the target line, or at a distance defined by the starting point of the new line.

To draw a parallel line at a specified offset from an existing line:

1. Select *Right-Click|Snaps|Parallel*.
2. Click anywhere on the target line.
3. A dialog will appear indicating the default offset distance or the last offset distance used. Edit the offset distance as required. When finished, click OK or proceed directly to step 4.
4. Place a point, then drag the cursor to start the new line. IRRICAD will constrain movement of the rubber band line to be parallel to the target line.
5. Place a point to complete the line.

To draw a parallel line starting at an exact, user-placed point:

1. Select the appropriate line drawing command (*Draw|Line|Single*, *Double* or *Continuous*).
2. Place the starting point of the single line, continuous line or double line.
3. Select *Right-Click|Snaps|Parallel*.
4. Click anywhere on the target line. IRRICAD will constrain movement of the rubber band line to be parallel to the target line. The line will start exactly where you placed it in step 2.
5. Place a point to complete the line.

See also:

Snaps

Section 5.1.8

5.2 FILE

The File menu has the following commands:

- New
- Open
- Save
- Save As
- Import
- Import Contours
- Import Bitmap
- Export
- Repair
- Compress
- Convert
- Print
- Direct Plot
- Recent files list
- Exit

5.2.1 NEW

Use *File|New* or click on the clean page icon on the toolbar to start a new design. IRRICAD assigns the name Untitled to the new file.

To start a new design:

1. Select *File|New*.

5.2.2 OPEN...

Use *File|Open...* or click on the Open Folder icon on the toolbar to continue work on a design, or to load an old design file type .dgt from DOS IRRICAD in the new format

To open an existing design file, using the Open command:

1. Select *File|Open...*
2. By default, IRRICAD lists files with the .des extension.
3. To see the list of DOS IRRICAD designs, change the file type from .des to .dgt in the Files of Type list.

4. If necessary, change the path and drive in order to locate the file you wish to open.
5. In the list box, double-click the file name, or select the file name and click Open.

***Note:** It is beneficial to convert the old database (.dbs files) which belong to an old style design prior to converting the design. This is also applicable for any symbols that may be contained in the design. Use the File|Convert menu item to do these conversions.*

5.2.3 SAVE

Use *File|Save* to save your design. Save during and at the end of a session, before exiting IRRICAD. This command saves the design to disk under the current name.

To save the current design:

1. Select *File|Save*.
2. If a Save File dialog box appears, give the design a file name and specify where you would like the file stored.
3. Click Save.

If the file has been previously saved, IRRICAD automatically saves the file under the current name and path. The name of the database used for a design is automatically saved with the design.

5.2.4 SAVE As...

Use *File|Save As...* to save a new design, to save a new version of the current design after making changes or to make a copy of an existing design (which may then be used as the base of a new design).

To save the file in a different file format, so that it can be used with other computer-aided design (CAD) programs, use the Export command.

To save a design under a new name:

1. Select *File|Save As...*
2. A dialog box appears with a list of existing designs displayed in the current path.
3. If necessary, change drives or paths to place the design in the location of your choice.

4. Type a name for the file in the File Name box.
5. Click OK.

The design is saved with the selected name, in the selected folder. The new file name is displayed at the top of the design window. The name of the database used for a design is automatically saved with the design.

5.2.5 IMPORT...

Use the Import command to load files from other programs into an IRRICAD design file. The file formats supported by IRRICAD are:

- .dxf (DXF format)
- .dwg (AutoCAD)
- .gcd (Generic CADD)
- .vcd (Visual CADD)
- .shp (ESRI Maps)
- .mif (Mapinfo Maps)

To open an existing drawing file, using the Import command:

1. Select *File|Import...*
2. By default, IRRICAD lists files with the .dxf extension. You can also select other files types by changing the file type in the Files of Type list.
3. If necessary, change the folder in order to locate the file you wish to open.
4. In the list box, double-click the file name, or select the file name and click Open.

5.2.6 IMPORT CONTOURS

Contours can be imported from other design packages through DXF files.

To import contours:

1. Select *File|Import Contours*.
2. Type in the name of the DXF file you want to import, or search for the file.

3. Click Open or double-click on the highlighted file. IRRICAD will search the file for layers and pop up a list from which contour layers may be selected.
4. Select the layers that are contour layers. Click OK.

IRRICAD will read the DXF file and convert all lines and polylines in the selected layers to contours and all points and symbols to spot heights. These are displayed on the screen as they are converted. All height data is imported; this can be seen if you select *Right-Click|Object Info* or select the contour and choose *Tools|Change*.

Note: *If the contour layers chosen do not have elevation data associated with the drawn item, the elevation will be displayed as 0 or as -10,000.*

IRRICAD requires elevations to be stored with the items as a Z vertex, so they are 3-D items.

5.2.7 IMPORT BITMAP

Bitmap images can be imported from BMP files. If the bitmap was created by scanning an aerial photograph, for example, then this provides an alternative method to digitizing for entering a scaled plan into IRRICAD. You must know the size or area of ground the bitmap represents e.g. 300ft x 400ft and the bitmap must be created at this size.

To import a bitmap:

1. Select *File|Import Bitmap*.
2. Type in the name of the BMP file to import or search for the file.
3. Click Open or double-click on the highlighted file.
4. Left click to place the top left corner.
5. Drag the rectangle to the required size and click again to place the bottom right corner.
6. If required, trace over features in the bitmap using any drawing tools.

Tips: *When prompted for the top left corner, you may type in coordinates e.g. 0,400 (in world units).*

When prompted for the bottom right corner, you may type in coordinates e.g. 300,0, or you may type in a distance (diagonal distance from top left corner) in world units.

You may simply place the top left and bottom right at any scale (make sure Place Images Proportionally is checked in Settings\Bitmap) and resize using Tools\Resize.

Note: *This tool can be used to import any bitmap image into IRRICAD including logos etc. However an image cannot be made part of a symbol (including template symbols).*

5.2.8 EXPORT...

Exporting is used to save a design in a different file format, which can then be read into other CAD programs. The file can be saved as:

- .dxf (DXF format)
- .dwg (AutoCAD)
- .gcd (Generic CADD)
- .vcd (Visual CADD)
- .shp (ESRI Maps)
- .wmf (Windows Metafile)

To export a file:

1. Select *File|Export...*
2. By default, IRRICAD exports .dxf files. To save as a different format select a format from the Save as Type list. If necessary, change the folder you wish to save the file to.
3. Click Save.

5.2.9 REPAIR

This utility attempts to repair the current design. It runs through all objects in the design looking for invalid objects, invalid connections, misplaced objects and so on. Some of the problems which may occur and which may be solved by Repair are:

- IRRICAD objects which have lost their corresponding CAD entity
- Junctions with nothing connected to them remain on the screen
- Hydraulic objects with insufficient or invalid connections
- Looped or zero length pipe
- Mainline objects in a zone or zone objects in a mainline
- Connected objects which have different coordinates
- Pipe or sprayline end points do not match their connections

- Invalid or missing links between associated objects (e.g. outlets and wetted radii)

Repair also cleans up the internal (design) database, removing unused items then updates entities from the database, in case any items have become lost. Repair generates a log of its actions in the file errorlog.txt. This may be viewed by selecting *Reports|View Errors*. Repair's actions cannot be undone but any changes it makes to the design are not saved until you select *File|Save*.

5.2.10 COMPRESS

When hydraulic entities are deleted in a design gaps will be left in IRRICAD's internal structures. These gaps take up space both in memory (i.e. while the program is running) and also on disk when the design is saved. Other situations, such as importing dxf / dwg / vcd files into a design containing hydraulic entities, can also give rise to this situation.

File|Compress reorders the internal ID's of all entities in a design, removing all gaps in the process. Note that management and zone / mainline design (analysis at a minimum) need to be rerun after the compression because of this renumbering.

5.2.11 CONVERT

The Convert options allow you to convert Version 6 files to Version 7 format for use in IRRICAD. Select the type of file you wish to convert.

5.2.11.1 CONVERT DATABASE

This tool will convert old database file types .dbs to the new database file type .mdb.

To convert a database:

1. Select *File|Convert|Database*.
2. Find the correct folder where the old database files are stored, e.g. Irricad5 folder. Click on one .dbs item in the folder.
3. Click Open.
4. Select where to save the converted file (e.g. \Irricad\database).

IRRICAD will convert all the .dbs files present in the first folder to one .mdb file in the second folder. The new .mdb database can be selected to use for the new designs in *Settings\Irrigation – Design Specific*. The original Version 6 files remain unchanged.

5.2.11.2 CONVERT DESIGNS

This tool will convert old design file types .dgt to the new design file type .des. Convert the databases used for the design prior to converting the design itself.

To convert a design:

1. Select *File|Convert|Design*.
2. Find the correct folder where the design file is stored, e.g. Irricad5 folder on C drive. Click on the .dgt design you require.
3. Click Open. IRRICAD will convert the .dgt file and display it as the current design. The original .dgt file remains unchanged.

Tips: Convert the relevant database and any symbols or plot layouts prior to converting the design.

If you old designs exist in Version 5 format, open the design in Version 6 before converting. If you do not have Version 6, ask your technical support.

Note: The converted design is not saved until File|Save is selected.

5.2.11.3 CONVERT SYMBOLS

This tool will convert your old symbol files (.blk) or default symbol library (Symbols.dat) to the new .vcs files.

To convert a symbol file:

1. Select *File|Convert|Symbols*.
2. Find the folder where the file is stored, e.g. Irricad5 folder on C drive.
3. Select the symbol library you want to convert (.blk file or Symbols.dat). Click Open.
4. Select where to save the converted symbols (e.g. \Irricad\symbols\drawing).

Each symbol in the .blk file will be converted to a .vcs file with the same name as the symbol and can be selected using *Draw|Symbol*. The original Version 6 file remains unchanged.

5.2.11.4 CONVERT PLOT LAYOUTS

This tool will convert old plot layout files (.lay) or the standard plot layout file type (pl_def.dat) to the new .vcs files.

Note: If you have symbols associated with a plot layout file (e.g. company logo), convert the appropriate symbol libraries prior to converting plot layouts.

To convert a plot layout:

1. Select *File|Convert|Plot Layout*.
2. Find the folder where the file is stored, e.g. Irricad5 folder on the C drive. Select the .lay or pl_def.dat item in the folder. Click Open.
3. Select where to save the converted layouts (e.g. \Irricad\symbols\template. Click OK.

For each plot layout in the .lay or pl_def.dat file, select the paper size for which the template will be used, e.g. D (A3). If you uncheck the Convert this Layout check box, that particular layout will not be converted and the conversion process will skip to the next layout in the file. To stop the conversion process click Cancel.

If a layout contains symbols (e.g. a company logo) and the symbol is not found in the default symbols folder, you will be prompted to select the folder where the symbol is to be found.

Each plot layout in the .lay or pl_def.dat file will be converted to a .vcs file with the same name as the plot layout and can be selected using *Draw|Plot Layout*.

5.2.12 PRINT...

Select *File|Print...* to print the current design. If you use a Plot Layout (Section 5.5.14) prior to printing, you will not need to change any properties in the print dialog. Simply click Print as IRRICAD will have inserted into the print dialog the required information based on your choices in the *Draw|Plot Layout* dialog.

If printing without a plot layout, set the print dialog fields as required, before clicking Print.

5.2.12.1 PRINT DIALOG

Printer:	The printer currently selected. To change the printer click on the printer description or click Setup... and select another printer.
Page Size:	Shows the dimensions of the currently selected paper. To change the page size, click on the description and select another paper size.
Margins:	Shows the current margin values. To change the margins click on the description or click the Margins... button and enter new margins as required. Click Default to reset the margins to the default values for the selected printer.
Print Scale:	The scale factor for printing. The value is only used when the Scale option is selected e.g. 1 inch = 100ft will give you a scale of 1":100 (1mm = 1.0m will give you a scale of 1:1000).
Origin:	The origin relative to the lower left corner of the margin in paper units (not world coordinates).
Fit to Paper, Current View, Scale:	Defines the type of scaling used when printing. Fit to paper automatically scales the whole design to fit the current paper size. Current View automatically scales the design as seen on the current screen to fit the current paper size. Scale uses the scale entered in the Print Scale field.
Portrait, Landscape:	Select the paper orientation Portrait for vertical or Landscape for horizontal orientation.
Copies:	Enter the number of copies to print.
Rotation Angle:	The angle which a design can be rotated on the page. Click on the arrows to select from 0, 90, 180 and 270 degree angles or enter the angle as required.
Print to File:	Check this option to print to a file. Click Print to print the design. Select the file name and folder and click Save to save as a print file (*.prn).
File / Date Stamp:	Check this option to print the design file name or date stamp on the page. The location is controlled by settings in the Windows registry.

Fast Preview:	Check this option to see only an outline of the entire design in the preview window. Speeds display of complex drawings.
Selection Only:	Check this option to print only selected (highlighted in green) objects.
All Colors to Black:	Check this option to print in black and white printout. Use this option with caution if using a Plot Layout (Section 5.5.14).
Line Width 0 has Width:	By default lines with a width of zero are drawn with the minimum line width possible on the current printer. Checking this option ensures that lines with zero width are easily visible, in practice this normally makes them thicker.
True Type Rotate:	Check this option when printing a design that contains rotated TrueType text. If this option is not checked the text may not be rotated correctly.
Paper Units:	The units for paper size and margins. Select Metric units or English (Imperial) units.
Center:	Click this button to center the design on the page based on the current margin settings.
Print:	Click Print to print the design using the current print settings.
Cancel:	Click Cancel if you do not wish to print.
Setup:	Click Setup... to select the printer to use. Click Options to edit printer properties. These vary between printer drivers and printers.
Preview:	To preview the plan prior to printing, click Preview. The plan will appear on the page as it will be printed. If you make changes to the print dialog while the plan preview is available, click Update to update the preview picture with the changes you have made. The design can be dragged to the required position within the preview window using the mouse.

See also:

Plot Layout

Section 5.5.14

5.2.13 DIRECT PLOT

IRRICAD contains both a Print and Plot command. The print command utilizes the standard Windows drivers for output to the device. The plot command is an internal routine allowing more control over vector output devices by bypassing the Windows drivers. Each of these commands maintains separate default settings for the print output such as scale, orientation and page size.

The Direct Plot option should not be used unless the following situations are evident:

- You do not have a Windows driver for your plotter / printer.
- You have a Windows driver for an HPGL plotter but it does not work very well.

If a Plot Layout is required select *Draw|Plot Layout* before *File|Direct Plot*. Select a Windows printer driver by clicking the Printer... button in the Plot Layout dialog that will support the paper size you wish to print.

The Plot routine is designed to enhance the control over vector output devices (old style pen plotters). By using direct plot, the Windows drivers are bypassed allowing IRRICAD to send information directly to the plotter or to printers not supported through standard Windows drivers.

The Direct Plot dialog can be accessed from the File menu. In order to use direct plot the plotter should be configured to hardware flow control. Direct plot does not support TrueType fonts. Vector fonts will be substituted for TrueType fonts when direct plot is used.

The Direct Plot dialogs contains many of the same settings found in the normal print command along with specific settings for controlling pen mapping and language output. The basic controls allow for standard output features such as orientation and size. In addition to these settings, there are many advanced settings for accessing the plotter pens and the language code for controlling the plotter.

Plotter:	The plotter currently selected. To change the plotter click on the plotter description or click Setup... and select another plotter.
Page Size:	Shows the dimensions of the currently selected paper. To change the page size, click on the description and select another paper size.

Plot Scale:	The scale factor for printing. The value is only used when the Scale option is selected e.g. 1 inch = 100ft will give you a scale of 1":100 (1mm = 1.0m will give you a scale of 1:1000).
Origin:	The origin relative to the lower left corner of the margin in paper units (not world coordinates).
Fit to Paper, Current View, Scale:	Defines the type of scaling used when printing. Fit to paper automatically scales the whole design to fit the current paper size. Current View automatically scales the design as seen on the current screen to fit the current paper size. Scale uses the scale entered in the Plot Scale field.
Plot to File:	Check this option to plot to a file. Click Plot to plot the design. Select the file name and folder and click Save to save as a plot file (*.prn).
File / Date Stamp:	Check this option to plot the design file name or date stamp on the page. The location is controlled by settings in the Windows registry.
Fast Preview:	Check this option to see only an outline of the entire design in the preview window. Speeds display of complex drawings.
Selection Only:	Check this option to plot only selected (highlighted in green) objects.
All Colors to Black:	Check this option to plot in black and white printout. Use this option with caution if using a Plot Layout (Section 5.5.14).
Paper Units:	The units for paper size and margins. Select Metric units or English (Imperial) units.
Center:	Click this button to center the design on the page based on the current margin settings.
Plot:	Click Plot to plot the design using the current plot settings.
Rotation Angle:	Sets the rotation of the drawing relative to the paper.
Preview:	Shows a preview of the drawing as it will plot using the current settings. After changing the Plot Scale of a drawing, the preview window allows the drawing to be dragged into the required position. For example, to plot a detail of a drawing at a specific scale, set the required scale and then drag the image on the preview

	using the mouse until the required detail is shown.
Center:	Centers the drawing on the given page based on the current margin settings.
Setup:	Click Setup... to select the plotter to use. Click Options to edit plotter properties. These vary between plotters. In most cases, IRRICAD provides a common set of driver information for popular plotters. If your plotter is not supported, the settings can be easily manipulated to achieve the required output by trial and error.
Update:	Used to update the plot preview screen after changes have been made to the plot settings.

5.2.13.1 PLOTTER SETTINGS

The plotter tab contains specific settings describing the device including hardware ports and number of carousels. When modifying settings for the communication settings ensure that the hardware itself is configured for hardware flow control.

Port:	Displays the communications port to which the plotter is connected.
Baud Rate, Data Bit, Parity and Stop Bit:	Specifies the communication settings for the current port. Please refer to the hardware documentation for more information.
# Pens:	Sets the number of pens in each carousel.
Total:	Sets the number of pen carousels to be used.
Use Multiple Carousels:	If using more than one carousel this box must be checked for IRRICAD to switch during plotting.
New:	Creates a new plotter definition.
Default:	Sets the current plotter driver as the default for direct plot.
Sort Color:	Activates pen sorting when active. Pen Sorting will improve plot time by reducing pen changes and assuring that each pen is only used once.
Optimize Plotting:	Activates motion optimization when active. Motion optimization will improve plot time by minimizing unnecessary pen movements and drawing from one end of the paper to the other.
Origin at Lower Left:	Places the origin at the lower left corner of the paper when checked, otherwise the origin is placed at the center of the paper.

Page Size:	Selects the size of the plotter media. This size reflects the printed area on the page and not the actual sheet size.
Add:	Adds a new page size to the list by using the values entered in the Length and Width boxes.
Remove:	Deletes the current page size from the list.
DPI:	Specifies the maximum resolution of the plotter in dots per inch.

5.2.13.2 PEN MAP

Pen mapping allows colors in the IRRICAD drawing to represent different pens in the plotter effectively giving precise line width control to the plotter. Pen mapping involves assigning pens from the plotter carousel to colors that exist in the drawing. In addition to simply setting a pen, the map can set the pen width and speed that can improve the output for the plotter. When using pen mapping, it is important to remember that many ink jet plotters use pen numbers to represent different line types. Certain pen numbers or ranges of pens may refer to lines that are not solid or that are created using gray-scale fills. If the All Colors to Black option is checked in the plot dialog, all colors will plot using the pen mapped to color 0, normally black.

New:	Creates a new map. The direct plot routine can store multiple pen mappings for creating different sets of output.
Default:	Sets the current pen map as the default.
IRRICAD Color:	The entity color in the drawing you wish to map.
Pen Number:	Specifies the pen number assigned to the individual color.
Pen Width:	Adjusts the width of the pen. The width setting is used to create solid fills and is measured in millimetres.
Pen Speed:	Sets the speed at which the pen moves across the paper. Speed is measured in millimetres per second. Specifying a high speed may result in damage to the pen tip.

5.2.13.3 LANGUAGE

IRRICAD supports many common plotter languages. However, if the required language is not available, you can create a language directly through the interface. A plotter language consists of a delimiter, initialization string, de-initialization string, pen up, pen move, pen draw,

pen speed and pen change commands. Each of these needs to be specified when creating a language. The required control codes are generally listed in the output device's documentation and set to a specific plotter type.

Delimiter:	Specifies the character that separates commands sent to the plotter. This field can be left blank.
Init. String:	Describes the commands that are sent to the plotter for initialization.
De-Init. String:	Describes the commands that are sent to the plotter after the plot is complete.
Pen Up:	Specifies the characters that raise the pen from the paper.
Pen Down:	Specifies which characters lower the pen to the paper for drawing.
Pen Move:	Specifies the characters that signal the plotter to move the pen from one location to another in the up position.
Pen Draw:	Specifies the characters that signal the plotter to move the pen from one location to another in the down or draw position.
Pen Speed:	Specifies the characters that set the pen speed for the current pen.
Pen Change:	Specifies the characters that signal the plotter to change to a new pen.
New:	Creates a new plotter language setting.
Default:	Restores the plotter language settings to the default values for a HP-GL plotter.
Use HP-GL/2 Commands:	Enables the use of HP-GL/2. This setting can improve the quality of arcs and circles and decrease plot time if the plotter supports HP-GL/2 graphics language. When utilized the Init. String must contain values for the plotter to recognize HP-GL/2 commands.

5.2.14 RECENT FILE LIST

Recently used files are listed under the File menu for ease of recalling them. Simply click on the file name you wish to retrieve. This will bring the design up on the screen.

5.2.15 EXIT

Use the Exit command to exit IRRICAD. If an unsaved design is loaded, IRRICAD prompts you to save the design file before closing IRRICAD.

To exit IRRICAD:

1. Select *File|Exit*.

5.3 EDIT

The Edit menu contains the Undelete command.

5.3.1 UNDELETE

Use the Undelete command to reverse the last delete command.

To reverse the last delete operation performed:

1. Select *Edit|Undelete*.

The last delete is undone and the erased object or objects will reappear.

This is not an Undo command, and only works on undeleting deleted objects.

5.4 VIEW

The View menu has the following commands:

- Redraw
- Zoom All
- Zoom In
- Zoom Out
- Zoom Previous
- Zoom Window
- Zoom Selected
- Pan
- Goto Coords
- Birds Eye View
- Toolbars
- Status Bar
- Wetted Radii
- Sprayline Outlets

5.4.1 REDRAW

Use the Redraw tool to refresh the screen. When you move or erase an object, its old location is re-drawn with the background color. This effect tends to break up or obscure remaining objects that it overlapped or intersected. You can use the Redraw tool to clean up the screen after this happens. This tool is especially useful when editing lines drawn on top of each other or objects that overlap.

The objects are re-drawn in the order they were created or edited

To redraw the display:

1. Select *View|Redraw*.

The screen is immediately re-drawn.



This tool is also available from the hydraulic tool bar on the left-hand side of the screen.

5.4.2 ZOOM ALL

Use the Zoom All tool to see the entire design. This helps you get an overview of what you have drawn, and also helps you find objects far from the main drawing area that may have been created inadvertently. These objects can cause problems when you load a design or try to plot or print using the Fit to Page option (*File|Print*).

Only currently visible layers are displayed and used to calculate the appropriate zoom factor (see Snaps, Section 5.1.8).

To zoom all:

1. Select *View|Zoom All*.

The screen is re-drawn at the highest zoom value that will entirely show all displayed objects.



This tool is also available from the hydraulic tool bar on the left-hand side of the screen.

See also:

<i>Zoom In</i>	<i>Section 5.4.3</i>
<i>Zoom Out</i>	<i>Section 5.4.4</i>
<i>Zoom Previous</i>	<i>Section 5.4.5</i>
<i>Zoom Window</i>	<i>Section 5.4.6</i>
<i>Zoom Selected</i>	<i>Section 5.4.7</i>
<i>Pan</i>	<i>Section 5.4.8</i>
<i>Goto Coords</i>	<i>Section 5.4.9</i>
<i>Birds Eye View</i>	<i>Section 5.4.10</i>

5.4.3 ZOOM IN

Use the Zoom In tool to quickly magnify the current screen image. This tool's zoom is at a set magnification. You can set or edit this magnification in *Settings|Drawing Items*. The center of the screen stays constant during zooming in.

To zoom in:

1. Select *View|Zoom In*.

The drawing is re-drawn at the new magnification.



This tool is also available from the hydraulic tool bar on the left-hand side of the screen.

See also:

<i>Zoom All</i>	<i>Section 5.4.2</i>
<i>Zoom Out</i>	<i>Section 5.4.4</i>
<i>Zoom Previous</i>	<i>Section 5.4.5</i>
<i>Zoom Window</i>	<i>Section 5.4.6</i>
<i>Zoom Selected</i>	<i>Section 5.4.7</i>
<i>Pan</i>	<i>Section 5.4.8</i>
<i>Goto Coords</i>	<i>Section 5.4.9</i>
<i>Birds Eye View</i>	<i>Section 5.4.10</i>

5.4.4 ZOOM OUT

Use the Zoom Out tool to quickly reduce the magnification of the current screen image. You can set or edit this magnification in *Settings|Drawing Items*. The center of the screen stays constant during zooming out.

To zoom out:

1. Select *View|Zoom Out*.

The drawing will be re-drawn at the new magnification.



This tool is also available from the hydraulic tool bar on the left-hand side of the screen.

See also:

<i>Zoom All</i>	<i>Section 5.4.2</i>
<i>Zoom In</i>	<i>Section 5.4.3</i>
<i>Zoom Previous</i>	<i>Section 5.4.5</i>
<i>Zoom Window</i>	<i>Section 5.4.6</i>
<i>Zoom Selected</i>	<i>Section 5.4.7</i>
<i>Pan</i>	<i>Section 5.4.8</i>
<i>Goto Coords</i>	<i>Section 5.4.9</i>
<i>Birds Eye View</i>	<i>Section 5.4.10</i>

5.4.5 ZOOM PREVIOUS

Use the Zoom Previous tool to quickly revert to the previous view. This tool is especially useful during drawing or editing operations where selecting a point or object accurately requires that you zoom in close for detail work. When finished with the detail work, use Zoom Previous to return to the prior view to continue drawing or editing. Select the tool again to toggle back to the same enlarged view for accurate point or object selection.

To return to the previous view:

1. Select *View|Zoom Previous*.

The previous view is displayed.



This tool is also available from the hydraulic tool bar on the left-hand side of the screen.

See also:

<i>Zoom All</i>	<i>Section 5.4.2</i>
<i>Zoom In</i>	<i>Section 5.4.3</i>
<i>Zoom Out</i>	<i>Section 5.4.4</i>
<i>Zoom Window</i>	<i>Section 5.4.6</i>
<i>Zoom Selected</i>	<i>Section 5.4.7</i>
<i>Pan</i>	<i>Section 5.4.8</i>
<i>Goto Coords</i>	<i>Section 5.4.9</i>
<i>Birds Eye View</i>	<i>Section 5.4.10</i>

5.4.6 ZOOM WINDOW

Use the Zoom Window tool to zoom in on only a portion of the screen. IRRICAD will take your selection window and enlarge it uniformly until the width or height meets the limits of the screen. If the zoom window is very small, the magnification will be large. If the zoom window is large, the magnification will be small. In the case of a rectangular window where the width or height is very large relative to the other, the larger dimension will limit the magnification.

To zoom in to a windowed area:

1. Select *View|Zoom Window*.

2. Left click to place a corner point.
3. Move the cursor and left click again to place the opposite corner point.

The area enclosed by the window is enlarged to fill the screen.

***Note:** Do not hold the left mouse button down and drag the cursor, as this will not work.*



This tool is also available from the hydraulic tool bar on the left-hand side of the screen.

See also:

<i>Zoom All</i>	<i>Section 5.4.2</i>
<i>Zoom In</i>	<i>Section 5.4.3</i>
<i>Zoom Out</i>	<i>Section 5.4.4</i>
<i>Zoom Previous</i>	<i>Section 5.4.5</i>
<i>Zoom Selected</i>	<i>Section 5.4.7</i>
<i>Pan</i>	<i>Section 5.4.8</i>
<i>Goto Coords</i>	<i>Section 5.4.9</i>
<i>Birds Eye View</i>	<i>Section 5.4.10</i>

5.4.7 ZOOM SELECTED

Use the Zoom Selected tool to increase the magnification by a factor determined by the selected objects. Only the selected objects are used to determine the appropriate zoom factor and view. Unselected objects may be outside the screen boundaries, even though they are on visible layers. Zoom Selected can also be used to verify what you have selected, since it will fully display all selected objects.

To zoom to view all selected objects:

1. Select the objects you want to zoom in on.
2. Select *View|Zoom Selected*.

The view will change so that the selected objects just fill the screen.

See also:

<i>Zoom All</i>	<i>Section 5.4.2</i>
<i>Zoom In</i>	<i>Section 5.4.3</i>
<i>Zoom Out</i>	<i>Section 5.4.4</i>

<i>Zoom Previous</i>	<i>Section 5.4.5</i>
<i>Zoom Window</i>	<i>Section 5.4.6</i>
<i>Pan</i>	<i>Section 5.4.8</i>
<i>Goto Coords</i>	<i>Section 5.4.9</i>
<i>Birds Eye View</i>	<i>Section 5.4.10</i>

5.4.8 PAN

Use the Pan tool to pan across your design without changing the magnification.

To use the Pan tool:

1. Select *View|Pan*.
2. Place a point where you want the new view to be centered.

The screen view is shifted to center about this point.

See also:

<i>Zoom All</i>	<i>Section 5.4.2</i>
<i>Zoom In</i>	<i>Section 5.4.3</i>
<i>Zoom Out</i>	<i>Section 5.4.4</i>
<i>Zoom Previous</i>	<i>Section 5.4.5</i>
<i>Zoom Window</i>	<i>Section 5.4.6</i>
<i>Zoom Selected</i>	<i>Section 5.4.7</i>
<i>Goto Coords</i>	<i>Section 5.4.9</i>
<i>Birds Eye View</i>	<i>Section 5.4.10</i>

5.4.9 GOTO COORDS

This tool will pan to the x and y coordinates you enter.

To use Goto Coords:

1. Select *View|Goto Coords*.
2. Type in the x and y coordinates for the item / place you wish to go to.
3. Click OK.

The new view will be centered on the x and y coordinates entered.

Tips: You can use the tab key between the X and Y coordinate fields.

Do not use the mouse to click OK, instead use the Enter key, and the crosshairs will then go to the coordinates specified.

See also:

<i>Zoom All</i>	<i>Section 5.4.2</i>
<i>Zoom In</i>	<i>Section 5.4.3</i>
<i>Zoom Out</i>	<i>Section 5.4.4</i>
<i>Zoom Previous</i>	<i>Section 5.4.5</i>
<i>Zoom Window</i>	<i>Section 5.4.6</i>
<i>Zoom Selected</i>	<i>Section 5.4.7</i>
<i>Pan</i>	<i>Section 5.4.8</i>
<i>Birds Eye View</i>	<i>Section 5.4.10</i>

5.4.10 BIRDS EYE VIEW

The Birds Eye View tool opens a small window that displays a thumbnail outline of the whole design. If you are zoomed in, the area currently displayed on the screen is shown as a red display box on the Birds Eye View. You can change the displayed area by manipulating the red box on the Birds Eye View. To resize the red window in the Birds Eye View, click outside the existing red window, and holding the left mouse button down, drag a new window. When you release the left mouse button, the red window will be moved to the position and size you have drawn.

To center the view (at the current zoom state) over any particular point on the design, just click on that point in the Birds Eye View. The display box can also be dragged to any new position by left clicking anywhere inside the box and dragging it to the required position. Right-clicking anywhere in the Birds Eye View brings up a menu that gives access to a set of zoom tools that can also be used to re-size or re-position the view. Using these tools can greatly speed up moving around a large design by eliminating unnecessary re-draws.

The Birds Eye View window can be resized like any other window by dragging an edge or corner using the mouse. To close the Birds Eye View window click on the X or reselect *View|Birds Eye View*.

To use Birds Eye View:

1. Select *View|Birds Eye View*.
2. Click in the Birds Eye View window to center the view on that point or Right-Click for zoom tools.

See also:

<i>Zoom All</i>	<i>Section 5.4.2</i>
<i>Zoom In</i>	<i>Section 5.4.3</i>
<i>Zoom Out</i>	<i>Section 5.4.4</i>
<i>Zoom Previous</i>	<i>Section 5.4.5</i>
<i>Zoom Window</i>	<i>Section 5.4.6</i>
<i>Zoom Selected</i>	<i>Section 5.4.7</i>
<i>Pan</i>	<i>Section 5.4.8</i>
<i>Goto Coords</i>	<i>Section 5.4.9</i>

5.4.11 TOOLBARS

Two tool bars exist in IRRICAD. These can be turned on or off.

5.4.11.1 MAIN

The main toolbar is situated at the top of the screen under the main menu. It can be switched on or off by checking or unchecking the *View|Toolbars|Main* option.



You can use the icons on the Toolbar to quickly select one of the File menu options. The shortcuts available on this toolbar are:

- New
- Open
- Save
- Print.
- About IRRICAD...

To choose a tool, just click the icon. Moving the cursor over the toolbar highlights the name of each tool icon.

5.4.11.2 HYDRAULIC

The Hydraulic Toolbar is situated on the left-hand side of the screen. It can be switched on or off, by checking or unchecking the *View|Toolbars|Hydraulic* option.



The hydraulic toolbar allows you to quickly select a zoom tool such as

Zoom All, a select tool such as Select Window, or a hydraulic tool such as Control Valve.

The shortcuts available on the hydraulic toolbar are:

- Zoom In
- Zoom Out
- Zoom Window
- Redraw
- Zoom All
- Zoom Previous
- Select Object
- Select Window
- Select Lasso
- Clear Selection
- Zone Pipe
- Cut Pipe
- Control Valve
- Zone Outlet
- Block
- Mainline Pipe
- Change
-

To choose a tool, just click the icon. Moving the cursor over the toolbar highlights the name of each tool icon.

5.4.12 STATUS BAR

The status bar is located at the bottom of the drawing screen. It can be switched on or off by checking or unchecking the *View|Status Bar* option.

The status bar serves several functions. It is broken into sections, each of which can give you valuable visual feedback about the entity or tool currently in use. The status bar displays messages during design, flow through connected hydraulic items, prompts for using tools, distances and angles from the last mouse click and the X and Y coordinates of the current mouse position.

Object : Select Object	x,y= 16.63m , 39.19m	d=42.57m	a=67.01°

5.4.13 WETTED RADII

This option can be turned on or off to quickly show or hide the arcs associated with outlets (*View|Wetted Radii*). It shows or hides the default layer that the wetted radius arcs are placed in.

Wetted radii need to be created before this tool will work. Wetted radii can be created with the outlets, or after outlets have been drawn on the screen.

Note: To turn off sprayline wetted radii, you must turn off the *SL_WETTED_RADII* layer in *Settings/Layers*.

See also:

<i>Create Wetted Radii</i>	<i>Section 5.10.21</i>
<i>Settings Create Wetted Radii</i>	<i>Section 5.9.10.2</i>
<i>Irrigation – Design Specific</i>	<i>Section 5.9.10</i>

5.4.14 SPRAYLINE OUTLETS

This is a tool that can be turned on or off to quickly show or hide the outlets associated with connected spraylines (*View|Sprayline Outlets*). It shows or hides the default layer that the sprayline outlets are placed in.

Sprayline outlets need to be created before this tool will work. Sprayline outlets can be created with the drawing of spraylines or created after the sprayline has been drawn on the screen. If creating sprayline outlets, turn the layer on by selecting *View|Sprayline Outlets*.

See also:

<i>Create Sprayline Outlets</i>	<i>Section 5.10.22</i>
<i>Settings Create Sprayline Outlets</i>	<i>Section 5.9.10.3</i>
<i>Irrigation – Design Specific</i>	<i>Section 5.9.10</i>

5.5 DRAW

The Draw menu contains tools that can be used to place geometric objects on the screen. The Draw menu also has options to enhance the appearance of the design.

Tools available from the Draw menu are:

- Point
- Line
- Polyline
- Rectangle
- Polygon
- Circle
- Curve
- Arc
- Hatch
- Fill
- Dimension
- Symbol
- Text
- Plot Layout
- Contour
- Spot Height

5.5.1 POINT

Use the Point tool to place a point for use during the construction of another object or to mark a particular spot.

To place a point:

1. Select *Draw|Point*.
2. Place a point where you want the point marker to be located.
3. Repeat step 2 as required.

Tip: *Type in coordinates to place the points (e.g. 30,40) and then press the Enter key. Note that the coordinates you type are displayed on the status bar in the left-hand corner before you press Enter.*

This tool uses the current values of layer, color, line type and line width to draw the point. These current values are set in *Settings|Drawing Items*. To change the properties of a particular point, select *Tools|Change* and click on the point you wish to change.

See also:

*Snap*s - *Right-Click menu*

Section 5.1.8

5.5.2 LINE

A line can be drawn on the screen by selecting one of the *Draw|Line* options:

- Single
- Double
- Continuous

This tool uses the current values of layer, color, line type and line width to draw the line. These current values are set in *Settings|Drawing Items*. To change the properties of a particular line, select *Tools|Change* and click on the line you wish to change.

Tip: To draw a line a specified length:

- Select the line from the menu, click to place the start point on the screen, and type in the length of the line. This number will appear on the status bar in the left-hand corner. Press Enter on the keyboard and the line will complete the required distance. Note that the angle you move the cursor from the first point, is the angle at which the line will continue at (see α on the status bar).
- An angle can be set by following the required length of the line by a comma, a less than sign (<) and the angle required (e.g. 30,<180 will result in a line 30ft (m) at an angle of 180).
- Alternatively, type in coordinates to place the first and subsequent points (e.g. 30,40) then press the Enter key.

See also:

Single Line

Section 5.5.2.1

Double Line

Section 5.5.2.2

Continuous Line

Section 5.5.2.3

5.5.2.1 SINGLE LINE

Use the Single Line tool to draw a single line segment with a start and end point.

To draw a single line:

1. Select *Draw|Line|Single*.
2. Place the starting point.
3. Place the ending point.
4. Repeat steps 2 and 3 as required.

See also:

Snaps - Right-Click menu
Line Tips

Section 5.1.8
Section 5.5.2

5.5.2.2 DOUBLE LINE

Double lines are useful for drawing walls, roads, and other parallel lines.

To draw a double line:

1. Select *Draw|Line|Double*.
2. A dialog box will appear where the right and left offsets can be entered.
3. You may also check the Solid Fill box to have the space between the lines filled with the current drawing color.
4. Click OK.
5. Place the starting point.
6. Place points to define each new bend in the set of double continuous lines.
7. Finish the line by selecting *Right-Click|Done* from the pop up menu, double-clicking or pressing the Escape key. Selecting *Right-Click|Close* can close the line.
8. Repeat steps 5 to 7 as required.

***Note:** The left and right offset directions are defined relative to the movement of the cursor; the left offset applies to the left of the cursor's forward direction, and the right offset applies to the right. This applies whether the cursor is moving up, down, left or right on the screen. For example, if you are drawing from the bottom of*

the screen to the top, the left offset line is on the left side of the double line as you view your screen. If, however, you are drawing from the top to the bottom, the left offset is actually on the right side of the double line as you view your screen.

Tip: You can select, modify and delete each line of a double line separately.

See also:

Snaps - Right-Click menu
Line Tips

Section 5.1.8
Section 5.5.2

5.5.2.3 CONTINUOUS LINE

Use the Continuous Line tool to create a continuous line consisting of one or more line segments.

To draw a continuous line:

1. Select *Draw|Line|Continuous*.
2. Place the starting point.
3. Place the end point of the first line segment.

This is also the starting point for the second segment.

4. Place additional points to create the line segments of the continuous line.
5. Select *Right-Click|Done*, double-click, or press the Escape key to stop drawing line segments. Alternatively, select *Right-Click|Close* to create a closed boundary.
6. Repeat Steps 2 to 5 as required.

See also:

Snaps - Right-Click menu
Line Tips

Section 5.1.8
Section 5.5.2

5.5.3 POLYLINE

Polyline is another name for Continuous Line and is used in exactly the same way.

See also:

<i>Continuous Line</i>	<i>Section 5.5.2.3</i>
<i>Geometric Properties</i>	<i>Section 5.9.5.1</i>
<i>Snaps - Right-Click menu</i>	<i>Section 5.1.8</i>
<i>Line Tips</i>	<i>Section 5.5.2</i>

5.5.4 RECTANGLE

A rectangle can be drawn on the screen by selecting one of the *Draw|Rectangle* options:

- 2 Point (horizontal or vertical rectangles)
- 3 Point (rectangles at any angle)

This tool uses the current values of layer, color, line type and line width to draw the rectangle. These current values are set in *Settings|Drawing Items*. To change the properties of a particular rectangle, select on the *Tools|Change* and select the rectangle you wish to change.

Tips: *To draw a side of a rectangle a specified length:*

- *Select the rectangle from the menu, click to place the start point on the screen, and type in the length of the side. This number will appear on the status bar in the left-hand corner. Press Enter on the keyboard and the line will complete the required distance. Note that the angle you move the cursor from the first point, is the angle at which the side will continue at (see a= on the status bar).*
- *An angle can be set by following the required length of the side by a comma, a less than sign (<) and the angle required (e.g. 30,<180 will result in a side 30ft (m) at an angle of 180°).*
- *Alternatively, type in coordinates to place the first and subsequent points (e.g. 30,40) then press the Enter key.*

See also:

<i>2 Point Rectangle</i>	<i>Section 5.5.4.1</i>
<i>3 Point Rectangle</i>	<i>Section 5.5.4.2</i>
<i>Geometric Properties</i>	<i>Section 5.9.5.1</i>

5.5.4.1 2 POINT RECTANGLE

A two-point rectangle is a rectangle that has been drawn on the screen by using only two points – the starting point, and the end point. The end point is the corner diagonally opposite the starting point. Use the 2 Point Rectangle tool to create a horizontal or vertical rectangle.

To draw a two-point rectangle:

1. Select *Draw|Rectangle|2 Point*.
2. Place any corner (vertex) of the rectangle.
3. Place the opposite corner.
4. Repeat steps 2 and 3 as required.

Tips: To draw a 2 Point rectangle with a specified diagonal distance:

- *Select the rectangle from the menu and click to place the start point on the screen. Type in the length of the diagonal line. This number will appear on the status bar in the left-hand corner. Press Enter on the keyboard and the line will complete the required distance.*
- *Alternatively, type in coordinates to place the first and second points (e.g. 30,40) then press the Enter key.*

See also:

Snaps - Right-Click menu
Rectangle Tips

Section 5.1.8
Section 5.5.4

5.5.4.2 3 POINT RECTANGLE

A three-point rectangle is one that is drawn using three points. The first two points control the length and direction of one of the sides. The third point is used to size the width or length of the rectangle. Use the 3 Point Rectangle tool to create a rectangle by defining its width and height with three points.

To draw a three-point rectangle:

1. Select *Draw|Rectangle|3 Point*.
2. Place a point at any corner (vertex) of the rectangle.
3. Place the endpoint of the line.
4. Move the cursor perpendicular to the line you just drew.
5. Place a third point to complete the rectangle.

6. Repeat steps 2 to 5 as required.

Note: In most cases, the second and third points can be placed using a snap tool.

Tips: To draw a 3 Point rectangle with specified lengths and widths:

- *Select the rectangle from the menu and click to place the start point on the screen. Type in the length of one side. This number will appear on the status bar in the left-hand corner. Press Enter on the keyboard and the line will complete the required distance. Note that the angle you move the cursor from the first point, is the angle at which the line will continue at (see a= on the status bar). Type in the length of the other dimension and press Enter to complete the rectangle.*
- *An angle can be set by following the required length of the line by a comma, a less than sign (<) and the angle required (e.g. 30,<180 will result in a line 30ft (m) at an angle of 180°).*
- *Alternatively, type in coordinates to place the first, second and third points (e.g. 30,40) then press the Enter key.*

See also:

*Snaps - Right-Click menu
Rectangle Tips*

*Section 5.1.8
Section 5.5.4*

5.5.5 POLYGON

A polygon can be drawn on the screen by selecting one of the *Draw|Polygon* options:

- Center
- Side
- Irregular

This tool uses the current values of layer, color, line type and line width to draw the polygon. These current values are set in *Settings|Drawing Items*. To change the properties of a particular polygon, select *Tools|Change* and click on the polygon you wish to change.

Tips: To draw a polygon with specified lengths:

- *Select the polygon from the menu, click to place the start point on the screen, and type in the length of one side. This number will appear on the status bar in the left-hand corner. Press Enter on the keyboard and the polygon side will measure the required distance. Note that the angle you move the cursor from the first point, is the angle at which the side will continue at (see $a=$ on the status bar).*
- *An angle can be set by following the required length of the side by a comma, a less than sign (<) and the angle required (e.g. 30,<180 will result in a side 30ft (m) at an angle of 180°).*
- *Alternatively, type in coordinates to place the first and second points (e.g. 30,40) then press the Enter key.*

5.5.5.1 POLYGON DIALOG

Number of Sides:	The number of sides required for the polygon.
Circumscribe:	The second point will represent the midpoint of a side of the polygon.
Inscribe:	The second point used to define the polygon will represent a vertex of the polygon.

See also:

<i>Center Polygon</i>	<i>Section 5.5.5.2</i>
<i>Side Polygon</i>	<i>Section 5.5.5.3</i>
<i>Irregular Polygon</i>	<i>Section 5.5.5.4</i>
<i>Geometric Properties</i>	<i>Section 5.9.5.1</i>

5.5.5.2 CENTER POLYGON

A center polygon is one that uses the center of the object as the pivoting point for rotation and sizing. Use the Center Polygon tool to draw a regular polygon.

To draw a regular polygon using center construction:

1. Select *Draw|Polygon|Center*.
2. Enter the number of sides for the polygon and select circumscribe or inscribe in the dialog that pops up. Click OK.
3. Place a point to locate the center of the polygon.
4. Place a point to complete the polygon.
5. Repeat steps 3 and 4 as required.

See also:

Snaps - Right-Click menu
Polygon Tips

Section 5.1.8
Section 5.5.5

5.5.5.3 SIDE POLYGON

Use the Side Polygon tool to draw a regular polygon when you know the length, orientation and location of one side.

To draw a regular polygon using one-side construction:

1. Select *Draw|Polygon|Side*.
2. Select the number of sides for the polygon. Click OK.
3. Place the starting point for one side of the polygon.
4. Place an end point for one side of the polygon.
5. Move the cursor to either side of this line to flip the polygon if required and click the left mouse button to complete the polygon.
6. Repeat steps 3 to 5 as required.

See also:

Snaps - Right-Click menu
Polygon Tips

Section 5.1.8
Section 5.5.5

5.5.5.4 IRREGULAR POLYGON

Use the Irregular Polygon tool to create a polygon of three or more sides, each side being of any length or angle. In effect, this tool creates a closed continuous line.

To draw an irregular polygon:

1. Select *Draw|Polygon|Irregular*.
2. Click to place the first point.
3. Place additional vertex points around the perimeter of the polygon.
4. Select *Right-Click|Done*, or double-click to complete the polygon.
5. Repeat steps 2 to 4 as required.

You do not have to place an end point on top of the starting point; IRRICAD connects the first and last vertices automatically.

See also:

Snaps - Right-Click menu

Section 5.1.8

5.5.6 CIRCLE

A circle can be drawn on the screen by selecting one of the *Draw|Circle* options:

- 3 Point
- Diameter
- Center Radius
- Ellipse

This tool uses the current values of layer, color, line type and line width to draw the circle. These current values are set in *Settings|Drawing Items*. To change the properties of a particular circle, select *Tools|Change* and click on the circle you wish to change.

***Tips:** You can specify the distance between two points by typing in a length and pressing the Enter key to place the second point. This number will appear on the status bar in the left-hand corner. Note that the angle you move the cursor from the first point, is the angle at which the line will continue at (see a= on the status bar).*

An angle can be set by following the required length of the side by a comma, a less than sign (<) and the angle required (e.g. 30,<180 will result in a minimum diameter of 30ft (m) at an angle of 180°).

Alternatively, type in coordinates to place the first, second and third points (e.g. 30,40) then press the Enter key.

Use any if the snap tools to place a point precisely at any location (see Snaps - Right-Click menu, Section 5.1.8).

See also:

<i>3 Point Circle</i>	<i>Section 5.5.6.1</i>
<i>Diameter Circle</i>	<i>Section 5.5.6.2</i>
<i>Center Radius Circle</i>	<i>Section 5.5.6.3</i>
<i>Ellipse Circle</i>	<i>Section 5.5.6.4</i>
<i>Geometric Properties</i>	<i>Section 5.9.5.1</i>

5.5.6.1 3 POINT CIRCLE

A three-point circle is a circle that needs to have three points in order to draw it on the screen. When this tool is chosen, the first two points draw a line, which becomes the smallest possible diameter of the circle. The third point can be anywhere on the circumference of that circle, and determines size and placement. The circle can be placed anywhere about the third point, which acts as a central pivot.

Use the 3 Point Circle tool to create a circle when the center and radius are not known. The circumference must pass through three specific points in your drawing.

To draw a three-point circle:

1. Select *Draw|Circle|3 Point*.
2. Place the first of the three points for the circle to pass through.
3. Place the second point. As you move the cursor, a new rubberband connects the second point to the cursor.
4. Place a third point to complete the circle.
5. Repeats steps 2 to 4 as required.

See also:

Snaps - Right-Click menu
Circle Tips

Section 5.1.8
Section 5.5.6

5.5.6.2 DIAMETER CIRCLE

A diameter circle is a circle that uses the starting point as a pivot for placement and sizing, with the distance of the cursor from the starting point determining the size of the circle. Use the Diameter Circle tool to create a circle whose diameter you specify by placing two points.

To draw a diameter circle:

1. Select *Draw|Circle|Diameter*.
2. Place a point that will be on the circumference of the circle. As you move the cursor, you see a dynamic preview of the circle.
3. Place a second point to define the circle.
4. Repeat steps 2 and 3 as required.

Tips: If you know the diameter, simply type it while you are dragging the preview circle in the required direction and press the Enter key.

See also:

Snaps - Right-Click menu
Circle Tips

Section 5.1.8
Section 5.5.6

5.5.6.3 CENTER RADIUS CIRCLE

A center radius circle is one that uses the center of the circle as a pivoting point for sizing, the distance of the cursor from the center determining the size of the circle.

Use the Center Radius Circle tool to create a circle when you know the location of the center point, and the circle's radius or the location of any point on the circumference of the circle.

To draw a center radius circle:

1. Select *Draw|Circle|Center Radius*.
2. Place the center point of the circle.
3. Place the second point on the circumference of the circle.
4. Repeat steps 2 and 3 as required.

Tips: If you know the radius simply type it as you are dragging the circle and then press the Enter key.

If you know the diameter, type the expression (d)/2 e.g. if the diameter is 10ft type (10)/2.

See also:

Snaps - Right-Click menu
Circle Tips

Section 5.1.8
Section 5.5.6

5.5.6.4 ELLIPSE CIRCLE

Use the Ellipse tool to draw an ellipse defined by the length and width at its principal axes.

To draw an ellipse:

1. Select *Draw|Circle|Ellipse*.
2. Place the starting point of the first axis.
3. Place the endpoint of the first axis. This defines the length and orientation of the ellipse. As you move the cursor perpendicular to the first axis, a preview of the ellipse follows your cursor.

4. Place a third point to complete the ellipse.
5. Repeat steps 2 to 4 as required.

***Tips:** If you know the length of the first axis, simply type it while you are dragging the preview circle in the required direction and press the Enter key.*

See also:

Snaps - Right-Click menu
Circle Tips

Section 5.1.8
Section 5.5.6

5.5.7 CURVE

A curve is a line that is not straight. It can be manipulated to any size or shape. A curve can be drawn on the screen by selecting one of the following *Draw|Curve* options:

- Single Bezier
- Continuous Bezier
- Spline

This tool uses the current values of layer, color, line type and line width to draw the Curve. These current values are set in *Settings|Drawing Items*. To change the properties of a particular curve, select *Tools|Change* and click on the curve you wish to change.

***Tip:** IRRICAD provides extensive support of snap tools and break involving both Bezier and Spline curves. For example, you can trim a continuous Bezier curve to a line, circle, or even another Bezier curve. You can also Right-Click|Snaps|Tangent and Right-Click|Snaps|Perpendicular to each of these entities.*

See also:

Single Bezier Curve
Continuous Bezier Curve
Spline Curve
Geometric Properties

Section 0
Section 5.5.7.2
Section 5.5.7.3
Section 5.9.5.1

5.5.7.1 SINGLE BEZIER CURVE

Use the Single Bezier Curve tool to create a curved line. Two control points determine the shape of the curve. These control points define lines that are tangent to the curve at the end points. IRRICAD constructs a smooth curve connecting the end points and meeting the tangency constraints.

To draw a single Bezier curve:

1. Select *Draw|Curve|Single Bezier*.
2. Place the starting and ending points of the curved line. A preview curve appears, connecting the two end points. Moving the cursor controls the slope and bulge of the curve at the starting end.
3. Place the first control point to fix the slope of the curve at the starting point. The cursor now controls the location of the second control point. Moving the cursor changes the slope and bulge at the end of the curve.
4. When the curve is shaped as required, place the second control point.
5. Repeat steps 2 to 4 as required.

Tip: You can place the points of the curve by typing in the coordinates and pressing the Enter key.

See also:

Snap - Right-Click menu
Curve Tips

Section 5.1.8
Section 5.5.7

5.5.7.2 CONTINUOUS BEZIER CURVE

Use the Continuous Bezier Curve tool to create a continuous curved line, consisting of individual Bezier curves joined at each construction point, but behaving as one entity.

To draw a continuous Bezier curve:

1. Select *Draw|Curve|Continuous Bezier*.
2. Place the starting point of the curve.
3. Place points to define the remaining segments of the curve (the curve will pass through these points). Each segment of the curve is adjusted when you place the second line of the line segment, creating a smooth, continuous curve.

4. Select *Right-Click|Done*, double-click, or press the Escape key to complete the curve.

See also:

Snaps - Right-Click menu
Curve Tips

Section 5.1.8
Section 5.5.7

5.5.7.3 SPLINE CURVE

Use the Spline Curve tool to draw a spline curve. You can move construction points on a spline curve, but you cannot move control points independently.

To draw a spline curve:

1. Select *Draw|Curve|Spline*.
2. Place the starting point of the curve.
3. Place additional construction points to create the required curve.
4. Select *Right-Click|Done*, double-click, or press the Escape key to complete the curve.

See also:

Snaps - Right-Click menu
Curve Tips

Section 5.1.8
Section 5.5.7

5.5.8 ARC

An arc is a part of a circle. An arc can be drawn on the screen by selecting one of the *Draw|Arc* options:

- Start Mid End
- Center Start End
- Elliptical

This tool uses the current values of layer, color, line type and line width to draw the arc. These current values are set in *Settings|Drawing Items*. To change the properties of a particular arc, select *Tools|Change* and click on the arc you wish to change.

Tips: If you know the length of the radius or first axis, simply type it while you are dragging the preview arc in the required direction and press the Enter key.

An angle can be set by following the required length of the side by a comma, a less than sign (<) and the angle required (e.g. 30,<180 will result in a radius 30ft (m) at an angle of 180°). The same rules can apply for the third point.

Alternatively type in coordinates to place the first, second and third points (e.g. 30,40) then press the Enter key.

See also:

<i>Start Mid End Arc</i>	<i>Section 5.5.8.1</i>
<i>Center Start End Arc</i>	<i>Section 5.5.8.2</i>
<i>Elliptical Arc</i>	<i>Section 5.5.8.3</i>
<i>Geometric Properties</i>	<i>Section 5.9.5.1</i>

5.5.8.1 START MID END ARC

Use the Start Mid End Arc tool to create an arc when you know the beginning point, a point on the arc, and the endpoint.

To draw a three-point arc:

1. Select *Draw|Arc|Start Mid End*.
2. Place the starting point for the arc.
3. Place any intermediate point on the arc. A preview of the arc appears, connected on one end to the cursor.
4. Place the endpoint of the arc.
5. Repeat steps 2 to 4 as required.

See also:

<i>Snaps - Right-Click menu</i>	<i>Section 5.1.8</i>
<i>Arc Tips</i>	<i>Section 5.5.8</i>

5.5.8.2 CENTER START END ARC

Two points are placed on the screen that becomes the radius about which an arc can be drawn. Use the Center Start End Arc tool to create an arc when you know its center point, the starting point of the arc, and

any point on the line connecting the center point with the end of the arc (or the extension of that line).

To draw a center start end arc:

1. Select *Draw|Arc|Center Start End*.
2. Place a point at the center of the arc. A rubberband connects the center with the cursor, representing a preview of the radius.
3. Place the first endpoint of the arc. This point determines the radius as well as one endpoint of the arc.
4. When you have opened the arc to the required angle or alignment, place another point.
5. Repeat steps 2 to 4 as required.

See also:

Snaps - Right-Click menu
Arc Tips

Section 5.1.8
Section 5.5.8

5.5.8.3 ELLIPTICAL ARC

Use the Elliptical Start-Span Arc tool to create an elliptical arc based on a parent ellipse. You first create the parent ellipse by defining its major and minor axes. Then, you define the beginning and end of the elliptical arc using an angular span originating at the center of the ellipse.

To draw a elliptical start-span arc:

1. Select *Draw|Arc|Elliptical*.
2. Draw the parent ellipse. Follow the procedure included for the Ellipse Circle tool (Section 5.5.6.4). When the ellipse is completed, a rubberband connects the center to the ellipse to the cursor. The rubberband line represents a cutting line; the intersection of this line and the ellipse will be the start of the elliptical arc.
3. Place the first endpoint of the elliptical arc.
4. Place a point to complete the elliptical arc.
5. Repeat steps 2 to 4 as required.

See also:

Snaps - Right-Click menu
Arc Tips

Section 5.1.8
Section 5.5.8

5.5.9 HATCH

A hatch is a pattern drawn within an area on the screen to represent different materials or textures. A hatch can be drawn on the screen by selecting one of the *Draw|Hatch* options:

- Selection
- Boundary
- Seed

In order for the hatch to be displayed, the Display Hatch check box must be checked in *Settings|Drawing Items*.

This tool uses the current values of layer and color to draw the hatch. These values are set in *Settings|Drawing Items*.

5.5.9.1 HATCH DIALOG

Name:	This is the name of the style of hatch to use. Select from the dropdown list to change the current style.
Scale:	Sets the size of the hatch pattern. If the hatch tool seems to be unsuccessful, increase the scale.
Angle:	Type in an angle from 0° to 360° to rotate the hatch pattern as required.
Show Boundary:	This option has no effect with Hatch Selection or Hatch Seed. Displays hatch boundaries as a line on the screen.

See also:

<i>Hatch Selection</i>	<i>Section 5.5.9.2</i>
<i>Hatch Boundary</i>	<i>Section 5.5.9.3</i>
<i>Hatch Seed</i>	<i>Section 5.5.9.4</i>

5.5.9.2 HATCH SELECTION

Use the Hatch Selection tool to draw a hatch pattern when closed objects such as circles, polygons, connected single lines, etc. define the hatch boundaries. Closed objects located inside other closed objects remain unhatched when all are selected.

To draw a hatch pattern within selected objects:

1. Select the closed objects you wish to hatch.
2. Objects you select must be closed (sharing the same beginning and end point).
3. Select *Draw\Hatch\Selection*.
4. Select a hatch pattern and enter a scale and angle in the dialog. Click OK.

See also:

Hatch Properties

Section 5.5.9

5.5.9.3 HATCH BOUNDARY

You use the Hatch Boundary tool to draw a hatch pattern within an area that you specify by placing points.

To draw a hatch pattern using points to define a boundary:

1. Select *Draw\Hatch\Boundary*.
2. Select a hatch pattern and enter a scale and angle in the dialog. Click OK.
3. Place points to define an imaginary irregular polygon that would enclose the hatch pattern.
4. Rubberbands are displayed connecting the cursor to the last point placed and to the first point placed. These lines provide a preview of the area to be hatched.
5. When finished defining the area to be hatched, select *Right-Click\Done*.
6. Repeat Steps 3 to 5 as required

The defined area will be hatched.

Tips: *To draw a hatch boundary with specified lengths:*

- *Select the hatch boundary from the menu, click to place the start point on the screen, and type in the length of one side. This number will appear on the status bar in the left-hand corner. Press Enter on the keyboard and proceed to enter the length of each side followed by pressing the Enter key. Note that the angle you move the cursor from the first point, is the angle at which the side will continue at (see a= on the status bar).*

- *An angle can be set by following the required length of the side by a comma, a less than sign (<) and the angle required (e.g. 30,<180 will result in a side 30ft (m) at an angle of 180°).*
- *Alternatively type in coordinates to place the first, second and consecutive points (e.g. 30,40) then press the Enter key.*

See also:

Hatch Properties

Section 5.5.9

5.5.9.4 HATCH SEED

Use the Seed Hatch tool to add a hatch to closed objects such as circles, polygons, connected single lines, etc. Closed objects located inside other closed objects remain unhatched.

To draw a hatch pattern within selected objects:

1. Select *Draw|Hatch|Seed*.
2. Select a hatch pattern and enter a scale and angle in the dialog. Click OK.
3. Click inside the area to be hatched.

Remember that the objects must be closed (sharing the same beginning and end point).

4. Repeat Step 3 as required.

The objects will be filled with the current hatch.

Tips: *If there are 100 or more objects on screen when you select Hatch|Seed, IRRICAD will not fill the object.*

If you are not having success with Hatch|Seed, select both objects and use Hatch|Selection.

See also:

Hatch Properties

Section 5.5.9

5.5.10 FILL

Fill is a tool that can be used to add a solid-color fill to objects.

A fill can be drawn on the screen by selecting one of the *Draw|Fill* options:

- Fill Selection
- Fill Boundary
- Fill Seed

In order for the fill to be drawn the Display Fills check box must be checked in *Settings|Drawing Items*.

This tool uses the current values of layer and color to draw the hatch. These values are set in *Settings|Drawing Items*.

See also:

Fill Selection
Fill Boundary
Fill Seed

Section 5.5.10.1
Section 5.5.10.2
Section 5.5.10.3

5.5.10.1 FILL SELECTION

Use the Fill Selection tool to add a solid-color fill to selected closed objects such as circles, polygons, connected single lines, etc. Selected closed objects located inside other closed objects will also be filled.

To draw a solid fill within selected objects:

1. Select the objects you wish to fill. Remember that the objects must be closed (sharing the same beginning and end point).
2. Select *Draw|Fill|Selection*.

The selected objects will be filled with the current drawing color.

See also:

Fill Properties

Section 5.5.10

5.5.10.2 FILL BOUNDARY

Use the Fill Boundary tool to create a solid-color fill within boundaries defined by points that you place. Fills are placed on the current drawing layer and filled with the current drawing color.

To fill an area using points to define the boundary:

1. Select *Draw|Fill|Boundary*.
2. Place points to define an imaginary, irregular polygon that encloses the fill. Rubberbands connect the cursor to the last point placed and to the first point placed. These lines provide a preview of the area to be filled.
3. When finished defining the area to be filled, select *Right-Click|Done*.
4. Repeat Steps 2 and 3 as required.

The defined area will be filled.

Tips: To draw a fill boundary with specified lengths:

- Select the fill boundary from the menu, click to place the start point on the screen, and type in the length of one side. This number will appear on the status bar in the left-hand corner. Press Enter on the keyboard and proceed to enter the length of each side followed by pressing the Enter key. Note that the angle you move the cursor from the first point, is the angle at which the side will continue at (see α on the status bar).
- An angle can be set by following the required length of the side by a comma, a less than sign (<) and the angle required (e.g. 30,<180 will result in a side 30ft (m) at an angle of 180°).
- Alternatively type in coordinates to place the first, second and consecutive points (e.g. 30,40) then press the Enter key.

See also:

Fill Properties

Section 5.5.10

5.5.10.3 FILL SEED

Use the Seed Fill tool to add a solid fill to closed objects such as circles, polygons, connected single lines, etc. Closed objects located inside other closed objects remain unfilled.

To draw a solid fill within selected objects:

1. Select *Draw|Fill|Seed*. Remember that the objects must be closed (sharing the same beginning and end point).
2. Click inside the area to be filled.
3. Repeat Step 2 as required.

The objects will be filled with the current drawing color.

***Tip:** If there are 100 or more objects on screen when you click Seed Fill, IRRICAD will not fill the object.*

If you are not having success with Fill\Seed, select both objects and use Fill\Selection.

See also:

Fill Properties

Section 5.5.10

5.5.11 DIMENSION

Use Dimension tools when you require an exact measurement to be displayed.

Selecting one of the first five Dimension tools will bring up the Dimension Settings dialog.

- Linear Dimension Section 5.5.11.4
- Angular Dimension Section 5.5.11.5
- Radial Dimension Section 5.5.11.6
- Diameter Dimension Section 5.5.11.7
- Ordinate Dimension Section 5.5.11.8

Selecting either Leader or Datum Dimension tools will bring up the Leader / Datum Settings dialog.

- Leader Dimension Section 5.5.11.9
- Datum Dimension Section 5.5.11.10

***Tip:** IRRICAD gives you extensive control over the appearance and other properties of each part of a dimension. You can set and edit these properties when selecting any of the Dimension command tools.*

5.5.11.1 DIMENSION SETTINGS - DIMENSION

DRAWING PROPERTIES

The drawing properties can be altered to your preferences.

Layer: Specifies the layer which the item will be placed. The <DEFAULT> layer for dimension

	items is DRAWING. Select a different layer from the dropdown list if required.
Color:	Specifies the color of the display element. Select a new color from the color chart by clicking on the color edit box, or select the By Layer option to use the default layer color.
Line Type:	Specifies the line type of the display element. Select a different line width from the dropdown list.
Line Width:	Specifies the line width of the display element. Select a different line width from the dropdown list.

MODE

The options in this section determine whether dimensions are to be placed individually or in connected groups, and how grouped dimensions are related.

Single:	Dimensions are placed one at a time, as individual entities. Once a single dimension is placed, the dimension command is completed.
Cumulative:	Places a sequence of dimensions, each originating from the same point, or baseline.
Partitioned:	Places a string or chain of connected dimensions, placed end-to-end. Dimension lines are co-linear for the entire chain.

LINE DIRECTION

The line direction is the orientation used when measuring a distance and drawing dimension lines. This direction is not necessarily aligned with the object being dimensioned. Measured distances on the object are projected onto the dimension direction. For example, the horizontal dimension of a line drawn at a 30° angle represents the horizontal component of the true length of that line.

Horizontal:	Sets the dimension direction to horizontal. Only the horizontal component of the selected object is measured.
Vertical:	Sets the dimension direction to vertical. Only the vertical component of the selected object is measured.

Aligned: Sets the dimension direction to parallel the line selected (or aligned with the points placed). Aligned dimensions always represent the true length of the selected line (or distance between the placed points).

Angle: Sets the degree at which to slant an angled dimension line.

***Note:** A horizontal dimension is equivalent to a 0° dimension, and a vertical dimension is equivalent to a 90° dimension.*

EXTENSION

Extension lines, also called witness lines, visually connect the dimensioned object to the dimension line. They are always drawn perpendicular to (and usually beyond) the dimension line. IRRICAD allows extension lines to be configured as follows:

Offset: Adjusts the space between the drawing object and the end of the extension lines.

Above: Adjusts the distance that the extension line extends past the dimension line and away from the drawing object.

Below: When Stretch is unchecked, adjusts the distance the extension line extends beyond the dimension line and toward the drawing object.

Stretch: When checked, the extension lines stretch to reach the drawing object (minus the Offset distance). When unchecked, the Offset setting is ignored, and the extension lines follow the setting of the Below distance.

Proximity Fixed: Places the dimension line at a fixed distance (Offset plus Below) from the drawing object.

When Proximity Fixed is off, you can place the dimension line at any distance away from the dimensioned object. This means that either the Offset distance or the Below distance must give. If Stretch is checked, the Below section of the extension line will Stretch to fill the gap between the Offset distance and the dimension line. If Stretch is unchecked, the Below distance will remain constant and the Offset distance will give to fill the gap.

ARROW

These options determine the type and angle of arrowheads that will terminate the ends of each dimension line. If you choose to add terminators to your lines, you can end lines with arrowheads, circles, or slashes.

Type:	Lists the types of arrowhead to place at the end of the leader.
Size:	Sets the length of the arrow, slash, or radius of circle in real-world drawing units.
Angle:	Adjusts the shape of the arrowhead or the angle of the slash.
Flip:	Flips the dimension line so that the arrows point inward. Use this option when the extension lines interfere with the dimension text.
Flip Dist Left:	Sets the length of the left dimension line segment when arrowheads are reversed by checking the Flip box (see above). The left and right sides of dimension lines correspond to the view of the dimension if it were to be rotated so that aligned dimension text would be horizontal.
Flip Dist Right:	Sets the length of the right dimension line segment when arrowheads are reversed by checking the Flip box. The left and right sides of dimension lines correspond to the view of the dimension if it were to be rotated so that aligned dimension text would be horizontal.

5.5.11.2 DIMENSION SETTINGS - DIMENSION TEXT

TOLERANCE

Tolerances specify allowable variations in dimensions, and are often used in high-precision work. IRRICAD lets you specify and display tolerances.

Type:	None. Turns off tolerance display.
Stacked:	Tolerance is displayed in stacked-type format, showing measured distance, followed by allowable oversize tolerance stacked on top of allowable undersize tolerance.
Fixed:	The measured distance is shown, followed by the tolerance value. Only a single tolerance

	distance is allowed - the +ve and -ve tolerances are identical.
Min / Max:	Shows the maximum allowable distance stacked on top of the minimum allowable distance. Measured distance is not shown.
Lower:	Sets the maximum distance permitted for a dimension to be under the specified value measured by IRRICAD.
Upper:	Sets the maximum distance permitted for a dimension to be over the specified value measured by IRRICAD.

VECTOR SETTINGS

Char Space:	Specifies the spacing between characters of a text line as a percentage of the character size. The default is 20%. This option only applies to vector text.
Slant Angle:	Specifies the angle at which vector text is slanted to emulate italics. The angle must be between -45° and 45°. This option only applies to vector text.
Mono Space:	When checked, all characters are the same width. When unchecked, wide characters (M and W) take up more space than narrow characters (I and L).
Fill Text:	When checked, characters are solid filled. When unchecked, characters are displayed in outline, making both redrawing and printing faster.

PREFIX, SUFFIX AND OVERWRITE

Normally, the text in a dimension is calculated automatically by IRRICAD. The Prefix / Suffix options let you add a custom prefix and / or suffix to the angle or distance that IRRICAD calculates, without losing the associative property of the dimension. The box also includes an Overwrite control that lets you completely replace the text that IRRICAD calculates for the dimension.

Prefix:	When checked, the text in the adjacent text box is displayed before the distance or angle text calculated by IRRICAD. Be sure to add a space or other appropriate characters after the prefix

	text to separate the prefix and the calculated text.
Suffix:	When checked, the text in the adjacent text box is displayed after the distance or angle text calculated by IRRICAD but before the tolerance. Be sure to add a space or other appropriate characters before the suffix text to separate the calculated text and the suffix.
Overwrite:	Checking this box replaces the calculated dimension text with text that you type in the adjacent text box.

SCALE

Sets the real-world size of dimension text in current drawing units.

CENTERED

When checked, dimension text is placed at the midpoint of the dimension line, regardless of the orientation or mode chosen above. When unchecked, you position the dimension text by moving the cursor as you position the line. Thus, for the first dimension in a chain, you will simultaneously position both the dimension line and the dimension text.

LOCATION

In Line:	Dimension text is inserted and centered in a break in the dimension line. The gap from the dimension line to the dimension text is the Offset distance defined above. Can be used whether Horizontal or Aligned dimension text option is chosen.
Above:	Specifies that dimension text is placed parallel to and offset from the dimension line. Automatically sets dimension text to Aligned mode.

ORIENTATION

Horizontal:	Specifies that dimension text is horizontal regardless of orientation of the dimension line. Applies only if dimension text placement is set to the In Line Dist option (see description below).

Aligned: Specifies that dimension text will always be oriented parallel to the dimension line. This option is set automatically if the dimension text relationship to the dimension line is set to the Above option (see description below).

DIMENSION TEXT

These options let you set the font and size of dimension text, and its orientation with respect to the dimension line. The dimension text is set in the Dimension Font box in the Dimension Text tab.

Font:	Sets the font used for dimension text.
Height:	Specifies the size (height) of text characters in the current drawing unit. The height of the text is measured in real-world scale.
Aspect Ratio:	Adjusts the height-to-width ratio of characters in text blocks created using a vector font. For example, with a text height of 1 and an aspect of 2, the text character will be twice as wide as it is tall.
Bold:	Specifies bold type when checked. This option applies only to TrueType text.
Italic:	Specifies italic type when checked. This option applies only to TrueType text.
Underline:	Specifies underlined type when checked. This option applies only to TrueType text.
Line Spacing %:	Sets the spacing (as a percentage of one line height) between lines of text for stacked tolerance display.

5.5.11.3 LEADER / DATUM SETTINGS

This dialog appears when the Leader or Datum Dimension options are selected (*Draw[Dimension]...*).

DRAWING PROPERTIES

The drawing properties can be altered to your preferences.

Layer:	Specifies the layer which the item will be placed. The <DEFAULT> layer for dimension items is DRAWING. Select a different layer from the dropdown list if required.

Color:	Specifies the color of the display element. Select a new color from the color chart by clicking on the color edit box, or select the By Layer option to use the default layer color.
Line Width:	Specifies the line width of the display element. Select a different line width from the dropdown list.
Line Type:	Specifies the line type of the display element. Select a different line width from the dropdown list.

VECTOR TEXT SETTINGS

Char Space:	Specifies the spacing between characters of a text line as a percentage of the character size. The default is 20%. This option only applies to vector text.
Slant Angle:	Specifies the angle at which vector text is slanted to emulate italics. The angle must be between -45° and 45°. This option only applies to vector text.
Mono Space:	When checked, all characters are the same width. When unchecked, wide characters (M and W) take up more space than narrow characters (I and L).
Fill Text:	When checked, characters are solid filled. When unchecked, characters are displayed in outline, making both redrawing and printing faster.

TEXT EDIT BOX

Enter the text you wish to be placed with the Leader or Datum dimension as applicable.

DATUM DIMENSION

Datum Dimension options sets the datum dimension style to display X values, Y values, or both.

OFFSET

Sets the distance between the tail end of the leader shoulder, and the leader text.

SHOULDER

Adjusts the size of the leader tail's horizontal segment that is nearest the text.

ARROW SETTINGS

These options determine the type and angle of arrowheads that will terminate the ends of each dimension line. If you choose to add terminators to your lines, you can end lines with arrowheads, circles, or slashes.

Type:	Lists the types of arrowhead to place at the end of the leader.
Size:	Sets the length of the arrow, slash, or radius of circle in real-world drawing units.
Angle:	Adjusts the shape of the arrowhead or the angle of the slash.

LEADER TEXT

These options let you set the font and size of dimension text, and its orientation with respect to the dimension line. The dimension text is set in the Dimension Font box in the Dimension Text tab.

Font:	Sets the font used for dimension text.
Height:	Specifies the size (height) of text characters in the current drawing unit. The height of the text is measured in real-world scale.
Aspect Ratio:	Adjusts the height-to-width ratio of characters in text blocks created using a vector font. For example, with a text height of 1 and an aspect of 2, the text character will be twice as wide as it is tall.
Bold:	Specifies bold type when checked. This option applies only to TrueType text.
Italic:	Specifies italic type when checked. This option applies only to TrueType text.
Underline:	Specifies underlined type when checked. This option applies only to TrueType text.
Line Spacing %:	Sets the spacing (as a percentage of one line height) between lines of text for stacked tolerance display.

5.5.11.4 LINEAR DIMENSION

Use the Linear Dimension tool to display a length. Typically, linear dimensions are used to show the length of an object, but they can also show the distance between objects, or any other distance. Once placed, a linear dimension is associative - if the dimensioned items are moved, Stretched or re-scaled, the associated dimension is updated automatically.

To place a linear dimension:

1. Select *Draw|Dimension|Linear*. Edit the dialog as required (see Dimension Settings - Dimension, Section 5.5.11.1). Click OK.
2. Place the starting point for the dimension. IRRICAD will locate each endpoint, and start the linear dimension. The first point should be placed precisely, since it will be the basis for the first distance measurement. The first point can be positioned via Snaps, especially if for Partitioned or Cumulative modes
3. Place the ending point for the first dimension. As you move the cursor, a dynamic preview of the dimension now appears, constrained to move perpendicular to the dimension direction. You can place the dimension on either side of the line you are measuring. Depending on the settings for Proximity Fixed and Extension Stretch, you may or may not be able to freely drag the dimension preview (within its constraints). The extension lines may Stretch as required to maintain the specified extension offset, or they may remain constant in length, allowing the offset distance to vary.
4. Move the dimension line to the required location away from the dimensioned object, and place a point to set the dimension line. For single dimensions, this step completes the tool. For Partitioned dimensions, this point sets the first dimension line and establishes the starting point and offset for the next dimension line (so you will not need to place the dimension line for subsequent dimensions). For Cumulative and Partitioned dimensions, place subsequent points to create each new dimension.
5. Select *Right-Click|Done* or double-click to complete the tool.

See also:

<i>Dimension Settings - Dimension</i>	<i>Section 5.5.11.1</i>
<i>Dimension Settings - Dimension Text</i>	<i>Section 5.5.11.2</i>
<i>Snaps - Right-Click menu</i>	<i>Section 5.1.8</i>

5.5.11.5 ANGULAR DIMENSION

Use the Angular Dimension tool to measure any angle in your drawing by first identifying a vertex and then a point on each ray. For every angle, you have a choice of dimensioning either the inside or the outside measurement. Once placed, angular dimensions are associative. This means that if the dimensioned angle changes, the associated angular dimension will be updated automatically.

To place an angular dimension:

1. Select *Draw|Dimension|Angular*. Edit the dialog as required (see Dimension Settings - Dimension, Section 5.5.11.1). Click OK.
2. Place a vertex for the angle, snapping to a point on the object you are dimensioning.
3. If you are dimensioning the angle spanned by an arc, click the arc. IRRICAD will find the end-points and determine the angle (if this is the case, you can skip to step 5).
4. Place a second point to identify the first ray of the angle.
5. Place a third point to identify the second ray of the angle.
6. Drag the mouse to choose the smaller or larger angle.
7. A dynamic preview of the angle dimension will now appear.
8. Drag the preview dimension to the required location and place a point to position the dimension.

Tip: The text is always placed horizontally in angular dimensions.

See also:

<i>Dimension Settings - Dimension</i>	<i>Section 5.5.11.1</i>
<i>Dimension Settings - Dimension Text</i>	<i>Section 5.5.11.2</i>
<i>Snaps - Right-Click menu</i>	<i>Section 5.1.8</i>

5.5.11.6 RADIAL DIMENSION

Use the Radial Dimension tool to measure the radius of a circle or arc. Once placed, a radial dimension is associative: if the dimensioned items are Stretched or re-scaled, the associated dimension will be updated automatically.

To place a radial dimension:

1. Select *Draw|Dimension|Radial*. Edit the dialog as required (see Dimension Settings - Dimension, Section 5.5.11.1). Click OK.

2. Click the circle or arc you are dimensioning.
3. A preview of your dimension appears along a path, which passes through the object's center point and your cursor. The dimension line rotates as necessary to stay aligned with the cursor and the dimension arrow points outward toward the circle perimeter when the cursor is inside the circle and inward toward the circle when the cursor is outside the circle.
4. Drag the dimension to the required position then click to set the radial dimension.

See also:

<i>Dimension Settings - Dimension</i>	<i>Section 5.5.11.1</i>
<i>Dimension Settings - Dimension Text</i>	<i>Section 5.5.11.2</i>
<i>Snaps - Right-Click menu</i>	<i>Section 5.1.8</i>

5.5.11.7 DIAMETER DIMENSION

You use the Diameter Dimension tool to measure the diameter of a circle or arc. Once placed, a diameter dimension is associative; if the dimensioned items are Stretched or re-scaled, the associated dimension will be updated automatically.

To place a diameter dimension:

1. Select *Draw|Dimension|Diameter*. Edit the dialog as required (see *Dimension Settings - Dimension*, Section 5.5.11.1). Click OK.
2. Click the circle or arc you are measuring.
3. A preview of your dimension appears along a path, which passes through the object's center point and your cursor. The dimension line rotates as necessary to stay aligned with the cursor, and the dimension arrows point outward toward the circle perimeter when the cursor is inside the circle, and inward toward the circle when the cursor is outside the circle.
4. Drag the dimension to the required position, and then click to set the diameter dimension.

See also:

<i>Dimension Settings - Dimension</i>	<i>Section 5.5.11.1</i>
<i>Dimension Settings - Dimension Text</i>	<i>Section 5.5.11.2</i>
<i>Snaps - Right-Click menu</i>	<i>Section 5.1.8</i>

5.5.11.8 ORDINATE DIMENSION

Ordinate dimensions allow you to place a series of dimensions based on a point you specify on the drawing.

1. Select *Draw|Dimension|Ordinate*. Edit the dialog as required (see Dimension Settings - Dimension, Section 5.5.11.1). Click OK.
2. Click a base point from which to measure the dimensions.
3. Click a point that describes the positive axis of your measurements.
4. Click where you want to locate the dimension lines.
5. Click the points that you want to dimension. When done, select *Right-Click|Done*.

See also:

<i>Dimension Settings - Dimension</i>	<i>Section 5.5.11.1</i>
<i>Dimension Settings - Dimension Text</i>	<i>Section 5.5.11.2</i>
<i>Snaps - Right-Click menu</i>	<i>Section 5.1.8</i>

5.5.11.9 LEADER DIMENSION

Leaders (or call-outs) are notes that identify or call attention to objects or areas in the drawing. A multi-segmented, arrowhead-tipped line connects the object to a block of text.

To place a leader:

1. Select *Draw|Dimension|Leader*. Edit the dialog as required (see Leader / Datum Settings, Section 5.5.11.3). Type the leader text in the empty box in the dialog box screen. Click OK.
2. Click to set the tip of the arrowhead. An arrowhead-tipped rubberband will appear between the first point and the cursor location.
3. Place additional points to set segments of the leader line. By placing multiple segments, you can make the leader line bend around objects in the drawing. Remember that the final segment or shoulder will be drawn automatically to connect the leader lines to the text block.
4. When finished drawing the leader line segments, select *Right-Click|Done*. Do not press Esc, as this will cancel the tool.
5. Click at a point to show which side of the leader line you want the text to appear, as prompted on the Status bar. A bounding box appears next to the leader shoulder in the drawing. This box indicates the position of the leader text, although you will later be

able to shift it to either side of the leader shoulder. The leader text will appear next to the leader shoulder. As you move the cursor to the left or right, the leader text will flip to the opposite side of the shoulder.

6. Click to place the leader text.

See also:

Leader / Datum Settings
Snaps - Right-Click menu

Section 5.5.11.3
Section 5.1.8

5.5.11.10 DATUM DIMENSION

Use Datum dimensioning to place a leader containing the absolute X, Y or XY value of a chosen point.

1. Select *Draw|Dimension|Datum*.
2. Edit the dialog as required (see *Leader / Datum Settings*, Section 5.5.11.3). Click OK.
3. Click the point to dimension.
4. Click additional points to draw the leader. Select *Right-Click|Done* to complete the leader line.
5. Click to position the datum text.

See also:

Leader / Datum Settings
Snaps - Right-Click menu

Section 5.5.11.3
Section 5.1.8

5.5.12 SYMBOL

Symbols are collections of objects that are grouped together, named, saved, and treated as a single object. You can insert them repeatedly in the same drawing, or save them on disk for use in future designs. This saves you the time that would be necessary to draw the same objects over and over.

To place symbols accurately in a design, you should be familiar with IRRICAD's coordinate entry and point placement tools. In general, you work with symbols in IRRICAD as described in the following list. For more information, see the descriptions of the specific tools.

To place a symbol in your design:

1. Select *Draw|Symbol*.
2. Edit the dialog as required. Click OK.
3. Place the symbol in your design.
4. Repeat Step 3 as required.

5.5.12.1 SYMBOL DIALOG

Layer:	The layer the symbol will be stored in. The <DEFAULT> layer is DRAWING_SYMBOLS.
Use Placement Color:	Check to draw the symbol in the current drawing color. Leave unchecked to draw the symbol in its definition color i.e. the color it was when created.
Name:	The name of the currently selected symbol. Symbols available in the dropdown list have been previously loaded (see Load Symbol, Section 5.5.12.2).
Width:	The width of the symbol in the defined units.
Height:	The height of the symbol in the defined units.
Orientation:	The orientation (rotation) of the symbol.
Dynamically Size:	Check to drag the symbol to any size using a rubberband rectangle. Uncheck to enter a size.
Maintain Shape:	Check to maintain a ratio of the width and height at which the symbol was created. Uncheck to Stretch or squash the symbol in one direction.

Tips: You can replace all instances of one symbol in your drawing with another by lassoing the items and choosing *Tools|Change Type*.

*You can create a symbol in your drawing by highlighting (selecting) the existing entities to be included in the symbol and then selecting *Tools|Create Symbol*. This also saves the named symbol to a file for use in other designs.*

*You can divide a symbol you have placed into its individual component entities by first selecting it, and then selecting *Tools|Explode*.*

5.5.12.2 LOAD SYMBOL

Before a symbol can be used in a design its definition must first be loaded. The names of the loaded symbols appear in the dropdown list of Names in the symbol dialog.

To load symbols:

1. Click Load.
2. In the Open dialog box, select one or more symbol files to be loaded into your design. You can browse for .vcs symbol files in other directories such as symbols\database, to load database symbols.
3. Click Open.

The selected symbols will be loaded ready for use.

Tips: You may need to check the Placement Color check box in the dialog if the symbol has been created in white.

You can load more than one symbol at a time by holding down the Ctrl key on the keyboard.

5.5.12.3 UNLOAD SYMBOL

Symbols which are unused i.e. which are loaded but not placed in the design, may be unloaded. This useful when there are a large number of symbols in the dropdown list of names to select from.

To unload symbols:

1. Click Unload.
2. Select the symbols to unload.
3. Click OK.

Note: If you try to unload a symbol that is used in the design, IRRICAD will display a message and the symbol will not be unloaded.

5.5.13 TEXT

This tool allows you to place text on the screen.

To place text on the screen:

1. Select *Draw|Text*.

2. Type in the required text or label.
3. Edit the dialog as required. Click OK.
4. Place the text where required on the design. The box displayed is approximately the size of the text entered.
5. Repeat Step 4 as required.

True type text is shown by the presence of a star to the right of the font name.

5.5.13.1 TEXT DIALOG

Layer:	Specifies the layer in which the item will be placed. The <DEFAULT> layer for text items is TEXT. Select a different layer from the dropdown list if required.
Color:	Specifies the color of the text. Select a new color from the color chart by clicking on the color edit box, or select the By Layer option to use the default layer color.
Line Width:	Specifies the line width of the display element. Select a different line width from the dropdown list.
Line Type:	Specifies the line type of the text. Select a different line type from the dropdown list.
Char Space:	Specifies the spacing between characters of a text line as a percentage of the character size. The default is 20%. This option only applies to vector text.
Slant Angle:	Specifies the angle at which vector text is slanted to emulate italics. The angle must be between -45° and 45°. This option only applies to vector text.
Mono Space:	When checked, all characters are the same width. When unchecked, wide characters (M and W) take up more space than narrow characters (I and L).
Fill Text:	When checked, characters are solid filled. When unchecked, characters are displayed in outline, making both redrawing and printing faster.
Font:	Sets the font used for attributes. Special font formatting, such as bold, italics and underline type styles, are not available for attributes. IRRICAD can use either Windows TrueType

	fonts or vector fonts. TrueType text tends to be more aesthetically pleasing and to redraw faster than vector fonts. TrueType fonts, however, are not as accurate as vector fonts and can present problems for some vector output devices such as HP-GL plotters.
Height:	Specifies the size (height) of text characters in the current drawing unit. The height of the text is measured in real-world scale.
Orientation:	Specifies the orientation of text from 0° to 360°. Orientation is counter-clockwise. This field is non-editable when placing text. The orientation of the text can be altered when the text is selected and using <i>Tools Change</i> , typing in the required text orientation.
Aspect Ratio:	Adjusts the height-to-width ratio of characters in text blocks created using a vector font. For example, with a text height of 1 and an aspect of 2, the text character will be twice as wide as it is tall.
Justify:	Determines text justification. Text can be justified left, justified right, or centered horizontally relative to the placement point.
Bold:	Specifies bold type when checked. This option applies only to TrueType text.
Italic:	Specifies italic type when checked. This option applies only to TrueType text.
Underline:	Specifies underlined type when checked. This option applies only to TrueType text.
Line Spacing:	Specifies the spacing between lines as a percentage of the font size. This is measured from the reference point of the first line to the reference point of the second line. For example, using a font height of 2 and line spacing of 200%, the distance between the lines would be 4.
Load ASCII:	Loads text from a file into a text box.
Paste:	Pastes text previously copied to the clipboard into the text box.

5.5.14 PLOT LAYOUT

A plot layout is usually placed on the completed design just prior to printing. The layout will place a border around the design, supply details such as designer, client, date, company logo etc., and supply a legend for the pipes and other hydraulic items present in the design.

To place a plot layout on the screen:

1. Zoom in or out as required so that the part of the design (or whole design) to be printed is visible on the screen.
2. Select *Draw|Plot Layout*.
3. Edit the dialog as required. Use the Calculate button to determine an appropriate scale if unknown (the scale is calculated on the current zoom). Click OK.
4. The plot layout will be created at the specified scale and the zoom state will be altered so the complete plot layout and required part of the design can be seen on the screen..
5. Use *Tools|Move* to move the layout if required.
6. Now select *File|Print*.
7. Do not change anything in the print dialog, as IRRICAD has set the print page based on your options in the *Draw|Plot Layout* dialog. Simply click Print.

***Tips:** Scale Calculate: Clicking the Calculate button will automatically select a scale suitable for the current zoom state, this scale can be overridden by simply typing in a different scale.*

Keep Fills: Check this option if you want the generated plot layout to retain any fills in the template. You will need to do this if you are printing only a portion of the plan where the plot layout overlaps the design so that the parts of the design underneath the plot layout are not visible. Do NOT check this option if you have selected the All Colors to Black option or will use File|Direct Plot to plot the plan since the fills will be printed in black or whatever plotter pen color has been assigned to the color white. In the standard plotting templates for this version, fills have been added around the edges of the border and under title blocks.

5.5.14.1 PLOT LAYOUT DIALOG

Paper Size: Shows the dimensions of the currently selected paper. To change the page size, click the down

	arrow and select another paper size supported by the selected printer.
Orientation:	Select the paper orientation Portrait for vertical or Landscape for horizontal orientation.
Margins:	Shows the current margin values. Type 0 to get the minimum default margins for the printer selected.
Print Scale:	The required scale to print the drawing to.
Calculate:	IRRICAD will calculate a scale based on the current zoom.
Drawing Template:	The template file used to create the plot layout.
Template Text:	Specifies the option selected for the title block text. Word wrap will create subsequent lines if the text is longer than the title block. Truncate will cut off additional text once the border is reached. Overwrite will print the text beyond the border of the plot layout.
Keep Fills:	Creates the plot layout with white fills around the border and under the title block area. Used if printing a section of the design
Save As Defaults:	Saves the currently selected printer, set margins and template as the default. The default will be loaded each time <i>Draw Plot Layout</i> is selected.
Printer:	Select the printer and printer properties required.

See also:

Convert Plot Layouts
Print

Section 5.2.11.4
Section 5.2.12

5.5.15 CONTOUR

Contours are used to enter topographic information.

To draw contours:

1. Select *Draw|Contour*.
2. Place the starting point.
3. Place the end point of the first segment. This is also the starting point for the second segment.
4. Place additional points to create the line segments at the contour line.

5. To finish select *Right-Click|Done* .
6. Edit the dialog as required. Click OK.
7. Repeat Steps 2 to 6 as required.

5.5.15.1 CONTOUR DIALOG

Layer:	Specifies the layer contours will be stored in. The <DEFAULT> layer for the contour is the ELEVATIONS layer. Select a different layer if required.
Color:	Specifies the default color of contour lines. Click on the color to change. Contours can also be specified as By Layer color – will display the color as specified in <i>Settings Layers</i> for the layer the contours are in.
Line Type:	Specifies the default line type for contours. To change click the down arrow and select a new line type.
Line Width:	Specifies the default line width for contours. To change click the down arrow and select a new line width.
Height:	Specifies the elevation of the contour. Type in the value. IRRICAD remembers the last elevation used.

The default settings can be edited in *Settings|Irrigation Items*.

Note: *Contours may be closed in a similar manner to polylines. Contours may be connected to other contours. The height of the new contour is automatically set to the height of the contour to which it is connected.*

See also:

<i>Spot Height</i>	<i>Section 5.5.16</i>
<i>Convert to Elevations</i>	<i>Section 5.10.24</i>
<i>Import Contours</i>	<i>Section 5.2.6</i>

5.5.16 SPOT HEIGHT

Spot heights are used to enter topographic information.

To put in spot heights:

1. Select *Draw|Spot Height*.

2. Place the points where required. Upon left clicking the mouse on the screen to place a spot height, a dialog box will appear.
3. Enter the height and edit the drawing properties as required.
4. Click OK.

5.5.16.1 SPOT HEIGHTS DIALOG

Layer:	Specifies the layer spot heights will be stored in. The <DEFAULT> layer for the spot height is the ELEVATIONS layer. Select a different layer if required.
Color:	Specifies the default color of spot height lines. Click on the color to change. Spot heights can also be specified as By Layer color – will display the color as specified in <i>Settings Layers</i> for the layer the spot heights are in.
Height:	Specifies the elevation of the spot height. Type in the value. IRRICAD remembers the last elevation used.

The default settings can be edited in *Settings|Irrigation Items*.

See also:

<i>Contour</i>	<i>Section 5.5.15</i>
<i>Convert to Elevations</i>	<i>Section 5.10.24</i>
<i>Import Contours</i>	<i>Section 5.2.6</i>

5.6 ZONE

The Zone menu has the following commands:

- Autohead
- Outlet
- Control Valve
- Misc. Hydraulic
- Pipe
- Cut Pipe
- Sprayline
- Tape
- Block
- Tape Block
- Area
- Junction

The Zone menu allows you to place and connect zone items in the design. A Zone is defined as connected hydraulic items downstream from a control valve.

5.6.1 AUTOHEAD

The Autohead tool automatically places sprinklers in a given area.

To use Autohead:

1. Place an Irrigation Area (*Zone|Area*) if the arcs of part circle sprinklers need to be oriented (see Area, Section 5.6.11).
2. Select *Zone|Autohead*.
3. Select a representative sprinkler body and nozzle and edit other dialog fields as required. Click OK.
4. Place the starting point of the boundary.
5. Place additional points to create the boundary of the area to be filled.
6. To finish select *Right-Click|Close*.
7. Repeat Steps 4 to 6 as required.

See also:

<i>Automatically Placing Sprinklers for Small Park or Residential Design</i>	<i>Section 2.5.1</i>
<i>Outlet Dialog</i>	<i>Section 5.6.2.1</i>
<i>Tape</i>	<i>Section 5.6.8</i>
<i>Set Arc Orientation using Area</i>	<i>Section 2.5.3.1</i>

5.6.2 OUTLET

Outlets are devices that discharge water from an irrigation system.

To place outlets on the design:

1. Select *Zone|Outlet*. Select a sprinkler, nozzle and riser from the dropdown lists in the dialog.

***Note:** If you know the first letter of a database entry, N for a Nelson product for example, pressing N on the keyboard will take you to the first N entry in the database.*

2. Edit the dialog as required. Click OK.

***Note:** Changing one of the pressure, flow and radius fields for the nozzle will cause a change in one or both of the other two. Press the Enter key to update the fields.*

3. Click to connect this outlet where required.
4. Repeat Step 3 as required.
5. To change to another sprinkler, simply follow steps 1 to 5 again.

IRRICAD will automatically connect the outlet to a pipe if you have selected the Default Snap Mode as Connect (see *Settings|Snap*, Section 5.9.1) and the cursor is close to the pipe.

***Tip:** The Outlet tool is also available from the left-hand Toolbar.*

5.6.2.1 OUTLET DIALOG

DRAWING PROPERTIES

Layer: The <DEFAULT> layer for outlets is the OUTLETS layer. Colors and symbols for outlets can only be edited in the Database Editor (see

Outlets, Section 3.5.11). Wetted radii default settings can be changed in *Settings\Irrigation Items*.

SPRINKLER

Sprinkler: The outlet body currently selected. Sprinklers available in the dropdown list have been entered and enabled in the Database Editor.

NOZZLE PROPERTIES

Nozzle: The sprinkler nozzle currently selected. Nozzles available in the dropdown list have been entered and enabled in the Database Editor.

Pressure: Operating pressure for the sprinkler; the default value is user-defined in the database.

Flow: Flow rate for the sprinkler at the pressure shown.

Arc: The plan angle over which the sprinkler operates (in degrees).

Radius: The wetted radius for the selected nozzle at the defined pressure.

Intensity: Flow rate divided by area of application for a single sprinkler; used as a simple measure of precipitation rate.

RISER

Riser: The riser currently selected. The risers (outlet connectors) available in the dropdown list have been entered and enabled in the Database Editor.

ORIENTATION

Orientation: The orientation in degrees for the nozzle symbol.

DEMAND POINT PROPERTIES

If the outlet selected is a demand point, then instead of nozzle properties, demand point properties will appear.

Pressure:	The required pressure for the demand point; the default value is user-defined in the database.
Flow:	Flow rate for the demand point.
Symbol:	A single character that will be drawn inside the demand point symbol so you can identify it.

5.6.3 CONTROL VALVE

Control Valves are used to control flow to zones (groups of outlets).

To place a Control Valve:

1. Select *Zone|Control Valve*.
2. Edit the dialog as required. Click OK.
3. Place the Control valve at the required location or connect it to a pipe. A dialog will then appear allowing you to enter a zone name (or accept the default name). Click OK.
4. Repeat Step 3 as required.

***Note:** If you know the first letter of a database entry, N for a Nelson product for example, pressing N on the keyboard will take you to the first N entry in the database.*

The default zone names can be changed in *Settings|Names*, or can be temporarily changed by selecting *Right-Click|Default Name* before placing / connecting the control valves on the screen. The temporary name change will remain in effect until another tool is selected.

IRRICAD will automatically connect the control valve to a pipe if you have selected the Default Snap Mode as Connect (see *Settings|Snap*, Section 5.9.1) and the cursor is close to the pipe.

***Tip:** The Control Valve tool is also available from the Toolbar.*

5.6.3.1 CONTROL VALVE DIALOG

DRAWING PROPERTIES

Layer:	The <DEFAULT> layer is the CONTROL_VALVES layer. Color and symbol are edited in the Database Editor only (see Control Valves, Section 3.5.3).

ITEM

Item: The control valve currently selected. Control valves in the selection list have been entered and enabled in the Database Editor.

ORIENTATION

Orientation: The Orientation in degrees for the control valve symbol.

PIPE TYPE

Pipe Type: Not used in this version of IRRICAD.

DEPTH

Depth: The depth of the hydraulic item below ground level. If the hydraulic item is above ground level enter this height as a negative number.

See also:

Names

Section 5.9.11

5.6.4 MISC. HYDRAULIC

Misc. Hydraulic items are items such as pressure reducing valves, isolating valves, etc.

To place Miscellaneous Hydraulic items:

1. Select *Zone|Misc.Hydraulic*.
2. Edit the dialog as required Click OK.
3. Place the item at the required position or connect it to a pipe.
4. Repeat Step 3 as required.

IRRICAD will automatically connect the Misc. Hydraulic item to a pipe if you have selected the Default Snap Mode as Connect (*Settings|Snap*) and the cursor is close to the pipe.

5.6.4.1 MISC. HYDRAULIC DIALOG

DRAWING PROPERTIES

Layer: The <DEFAULT> layer will place Misc. Hydraulic items on the MISC_HYDRAULIC layer. Color and symbol are edited in the Database Editor only (see Other Hydraulics, Section 3.5.4).

ITEM

Item: The Misc. Hydraulic item currently selected. The miscellaneous hydraulic items available in the dropdown list have been entered and enabled in the Database Editor.

ORIENTATION

Orientation: The Orientation in degrees for the misc. hydraulic item symbol.

DEPTH

Depth: The depth of the hydraulic item below ground level. If the hydraulic item is above ground level enter this height as a negative number.

PRESSURE

Pressure: If the miscellaneous hydraulic item is a pressure-reducing valve (PRV), enter a pressure. This field cannot be edited if the item is not a PRV.

5.6.5 PIPE

Pipes are hydraulic items connecting outlets and valves to water supplies.

To place a pipe:

1. Select *Zone|Pipe*.
2. Edit the dialog as required. Click OK.
3. Place the starting point.

4. Place the end point. This is also the starting point of the next pipe.
Place additional points to create connected pipes.
5. To finish, select *Right-Click|Restart*.

IRRICAD will automatically connect the pipe to another hydraulic item if you have selected the Default Snap Mode as Connect (*Settings|Snap*, Section 5.9.1) and the cursor is close to the pipe

Tip: The Pipe tool is also available from the Toolbar.

5.6.5.1 PIPE DIALOG

DRAWING PROPERTIES

Layer:	The <DEFAULT> layer is ZONE_PIPES or MAINLINE_PIPES respectively.
Line Width:	The line width can be changed and saved as default in <i>Settings Irrigation - Design Specific</i> . Color and symbol are edited in the Database Editor only (see Pipes, Section 3.5.1).

ITEM

Item:	The currently selected pipe. Pipes available in the dropdown list have been entered into and enabled in the pipe database.
Computer Sized:	Check to get IRRICAD to select a suitable pipe size during Design. Uncheck if manually selecting a pipe or to keep the pipe size previously selected by IRRICAD during Design.
Permanent Junctions:	Check to create permanent junctions at the start and end of pipe segments. Non-permanent junctions are removed during design if the pipe segments are considered to be close to a straight line.

DEPTH

Depth:	The depth of the hydraulic item below ground level. If the hydraulic item is above ground level enter this height as a negative number.

Tip: The Pipe tool is also available from the Toolbar.

See also:

Snaps - Right-Click menu

Section 5.1.8

5.6.6 CUT PIPE

Cut Pipe is a tool to connect a zone pipe to many existing zone pipes or laterals.

To use Cut Pipe:

1. Select *Zone|Cut Pipe*.
2. Choose a pipe, or leave as Computer Selected; edit drawing properties if required. Click OK.
3. Place the pipe where required, crossing other pipes as needed.
4. Select *Right-Click|Restart*. The new pipe will now join to all pipes it has crossed, or is placed close to the ends of.

5.6.6.1 CUT PIPE DIALOG

DRAWING PROPERTIES

Layer: The <DEFAULT> layer is ZONE_PIPES.
Line Width: The line width can be changed and saved as default in *Settings|Irrigation - Design Specific*. Color and symbol are edited in the Database Editor only (see Pipes, Section 3.5.1).

ITEM

Item: The currently selected pipe. Pipes available in the dropdown list have been entered into and enabled in the pipe database.
Computer Sized: Check to get IRRICAD to select a suitable pipe size during Design. Uncheck if manually selecting a pipe or to keep the pipe size previously selected by IRRICAD during Design.

DEPTH

Depth: The depth of the hydraulic item below ground level. If the hydraulic item is above ground level enter this height as a negative number.

Tip: The Cut Pipe tool is also available from the Toolbar.



5.6.7 SPRAYLINE

A method of spacing outlets uniformly along a pipe.

To draw a Sprayline:

1. Select *Zone|Sprayline*.
2. Edit the dialog as required. Click OK.
3. Place the starting point.
4. Place the end point of the first sprayline segment. This is also the starting point of the second segment. Place additional points to create the sprayline segments.
5. To finish select *Right-Click|Restart*.

IRRICAD will automatically connect the sprayline to a pipe if you have selected the Default Snap Mode as Connect (see *Settings|Snap*, Section 5.9.1) and the cursor is close to the pipe

5.6.7.1 SPRAYLINE DIALOG

PIPE PROPERTIES

Pipe:	The currently selected pipe. The pipes available in the dropdown list have been entered into and enabled in the pipe database.
Computer Sized:	Check to get IRRICAD to select a suitable pipe size during Design. Uncheck if manually selecting a pipe or to keep the pipe size previously selected by IRRICAD during Design.
Permanent Junctions:	Check to create permanent junctions at the start and end of pipe segments. Non-permanent junctions are removed during design if the pipe segments are considered to be close to a straight line.

DEPTH

Depth:	The depth of the hydraulic item below ground level. If the hydraulic item is above ground level enter this height as a negative number.

SPRINKLER

Sprinkler: The currently selected outlet body. The outlets available in the dropdown list have been entered and enabled in the Database Editor.

NOZZLE PROPERTIES

Nozzle: The currently selected nozzle. The sprinkler nozzle currently selected. Nozzles available in the dropdown list have been entered and enabled in the Database Editor.

Pressure: Operating pressure for the sprinkler; the default value is user-defined in the database.

Flow: Flow rate for the sprinkler at the pressure shown.

Arc: The plan angle over which the sprinkler operates (in degrees).

Radius: The wetted radius for the selected nozzle at the selected pressure.

Intensity: Flow rate divided by area of application for a single sprinkler; used as a simple measure of precipitation rate.

RISER

Riser: The currently selected riser. The risers available in the dropdown list have been entered and enabled in the Database Editor.

SPRAYLINE PROPERTIES

Outlet Spacing: The spacing between the outlets on the sprayline.

Offset: The distance of the first sprinkler from the start of the sprayline.

Options: Click this button to edit other properties of spraylines

Connected: If checked, IRRICAD is to treat the sprayline with outlets as one item. If unchecked, sprayline is Unconnected. Once placed the spraylines becomes individual entities of pipes and sprinklers.

OPTIONS – DRAWING PROPERTIES

- Layer: The <DEFAULT> layers are SPRAYLINES for the sprayline pipe, SPRAYLINE_OUTLETS for the outlet you have selected, and SL_WETTED_RADII for the sprayline outlets wetted radii. These can be turned on or off in *Settings|Layers*. If a sprayline is unconnected, the default layers are ZONE_PIPES, OUTLETS and OUTLET_WETTED_RADII respectively. Wetted radii default settings can be changed in *Settings|Irrigation Items*.
- Line Width: Select a line width from the dropdown list. Outlet color and symbol, pipe color and symbol are edited in the Database Editor only (see Pipes, Section 3.5.1).

OPTIONS – OUTLET PROPERTIES

- Orientation: The orientation in degrees for the outlet symbol.

OPTIONS – FIXED SPACING

- Fixed Spacing: Indicates whether the outlet spacing is fixed or adjusted to fit between two points.

5.6.8 TAPE

Tapes are laterals with built in emitters.

To draw a Tape:

1. Select *Zone|Tape*.
2. In the dialog, select the tape item that is required in the design.
3. Type in the required depth, if any, and edit the Inlet Pressure if required.
4. If the design requires a regulated submain pressure, check the Regulated box, and type in a minimum submain pressure in the box below.

The nominal SDR is shown at the bottom of this dialog. This value has been entered in the tape database.

5. Click OK.

6. Place the start of the tape by clicking the left mouse button. End the tape by a left click. Bent tapes can be drawn in much the same way as polylines. Select *Right-Click|Done* to finish.
7. Repeat step 6 as required.

5.6.8.1 TAPE DIALOG

DRAWING PROPERTIES

Layer: The <DEFAULT> layer is SPRAYLINES.
 Line Width: The line width can be changed and saved as default in *Settings|Irrigation - Design Specific*. Color and symbol are edited in the Database Editor only (see Tapes, Section 3.5.2).

ITEM

Item: The currently selected tape. Tapes available in the dropdown list have been entered into and enabled in the database.

DEPTH

Depth: The depth of the hydraulic item below ground level. If the hydraulic item is above ground level enter this height as a negative number.

INLET PRESSURE

Inlet Pressure: The pressure is required at the start of each tape.

REGULATED

Pressure Regulation: Indicates whether or not pressure regulation (e.g. PRVs, spaghetti tube) will be used to control the pressure at the tape inlet. During analysis it is assumed that the regulation device burns up the difference between the sub-main pressure and the nominal inlet pressure at the start of the tape.

SUBMAIN MIN PRESSURE

Submain Min Pressure: The minimum pressure required in the submain.

Required for pressure regulated tapes. The difference between the submain pressure and tape inlet pressure provides a differential pressure in which the pressure regulators must operate. If the Regulated option is unchecked, the submain minimum pressure is not used.

NOMINAL SDR

Nominal SDR: The nominal Specific Discharge Rate specified in the database and used for Show Flow and Management reports only. This can be changed in the Database Editor.

IRRICAD will automatically connect the tape to a pipe if you have selected the Default Snap Mode as Connect (*Settings|Snap*) and the cursor is close to the pipe. You cannot connect a control valve directly to a tape.

5.6.9 BLOCK

Block is used to place spraylines at fixed intervals.

To use Block:

1. Select *Zone|Block*. A dialog will appear which will require you to enter information about pipe properties, sprinkler selection, nozzle properties, riser selection, and block properties. Check the Connected check box if you require connected spraylines.
2. In clicking Options you can enter information about the lateral, including lateral direction if User-Defined, the outlets, including a reference outlet if User-Defined, and layer / line width properties.
3. Now Click OK on both dialogs.

The dialog will disappear and the block boundaries can be drawn using the cursor. Upon closing the boundaries, the laterals are placed automatically.

4. If the User Defined direction box has been checked, then another line must be drawn to show the direction and placement of a reference lateral. Also, if the Reference Outlet User Defined box has been checked, a point must be entered to show the required position.

5.6.9.1 BLOCK DIALOG

PIPE PROPERTIES

Pipe: The currently selected pipe. The pipes available in the dropdown list have been entered into and enabled in the pipe database.

Computer Sized: Check to get IRRICAD to select a suitable pipe size during Design. Uncheck if manually selecting a pipe or to keep the pipe size previously selected by IRRICAD during Design.

DEPTH

Depth: The depth of the hydraulic item below ground level. If the hydraulic item is above ground level enter this height as a negative number.

SPRINKLER

Sprinkler: The currently selected outlet body. The outlets available in the dropdown list have been entered and enabled in the Database Editor.

NOZZLE PROPERTIES

Nozzle: The currently selected nozzle. The sprinkler nozzle currently selected. Nozzles available in the dropdown list have been entered and enabled in the Database Editor.

Pressure: Operating pressure for the sprinkler; the default value is user-defined in the database.

Flow: Flow rate for the sprinkler at the pressure shown.

Arc: The plan angle over which the sprinkler operates (in degrees).

Radius: The wetted radius for the selected nozzle at the selected pressure.

Intensity: Flow rate divided by area of application for a single sprinkler; used as a simple measure of precipitation rate.

RISER

Riser: The currently selected riser. The risers available in the dropdown list have been entered and enabled in the Database Editor.

BLOCK PROPERTIES

Lateral Spacing: The spacing between laterals within the block.

Outlet Spacing: The spacing between the emitters along the sprayline.

Offset: The distance of the first sprinkler from the start of the sprayline.

Connected IRRICAD is to treat the sprayline with outlets as one item.

Options - Laterals

Number of Laterals: The number of laterals to be inserted in the block. This is used when you want a specific number entered. Otherwise IRRICAD will fill the area defined by the block boundaries.

Lateral Direction: The direction the laterals are required to run. This can be user defined, or determined automatically by IRRICAD upon the first block boundary that is drawn.

Extra Outlets on Ends: Check this box if you require an extra outlet on the sprayline ends.

OPTIONS – OUTLET PROPERTIES

Orientation: The orientation in degrees for the outlet symbol.

Reference Outlet: An indicate where the first outlet is placed on the sprayline. This can be user defined where you can specify where the first outlet is to be placed, or determined automatically where the first outlet is placed at the start of the first sprayline.

OPTIONS – DRAWING PROPERTIES

- Layer: The <DEFAULT> layers are SPRAYLINES for the sprayline pipe, SPRAYLINE_OUTLETS for the outlet you have selected, and SL_WETTED_RADII for the sprayline outlets wetted radii. These can be turned on or off in *Settings|Layers*. If a sprayline is unconnected, the default layers are ZONE_PIPES, OUTLETS and OUTLET_WETTED_RADII respectively. Wetted radii default settings can be changed in *Settings|Irrigation Items*.
- Line Width: Select a line width from the dropdown list. Outlet color and symbol, pipe color and symbol are edited in the Database Editor only (see Pipes, Section 3.5.1).

Tip: The Block / Sprayline tool is also available from the left-hand Toolbar.

See also:

Sprayline

Section 5.6.7

5.6.10 TAPE BLOCK

Tape Block is used to place tapes at fixed intervals.

To use Tape Block:

1. Select *Zone|Tape Block*.
2. In the dialog, select the tape item that is required in the design.
3. Type in the required depth, if any, and edit the inlet pressure if required.
4. If the design requires a regulated submain pressure, check / tick the Regulated box, and type in a minimum submain pressure in the box below.

The nominal SDR is shown at the bottom of this dialog.

5. Type in the block properties, i.e. the lateral spacing and number of laterals.
6. Select either the Determine Automatically option or the User Defined option.

7. Click OK.

The dialog will disappear and the block boundaries can be drawn using the cursor. Upon closing the boundaries, the tapes are placed automatically.

8. If the User Defined direction box has been checked, then another line must be drawn to show the direction and placement of a reference tape.

5.6.10.1 TAPE BLOCK DIALOG

DRAWING PROPERTIES

Layer:	The <DEFAULT> layer is SPRAYLINES. These can be turned on or off in <i>Settings Layers</i> .
Line Width:	Select a line width from the dropdown list. Outlet color and symbol, pipe color and symbol are edited in the Database Editor only (see Tapes, Section 3.5.2).

ITEM

Item:	The currently selected tape. Tapes available in the dropdown list have been entered into and enabled in the database.

DEPTH

Depth:	The depth of the hydraulic item <u>below</u> ground level. If the hydraulic item is <u>above</u> ground level enter this height as a <u>negative</u> number.

INLET PRESSURE

Inlet Pressure:	The pressure is required at the start of each tape.

REGULATED

Pressure Regulation:	Indicates whether or not pressure regulation (e.g. PRVs, spaghetti tube) will be used to control the pressure at the tape inlet. During analysis it is assumed that the regulation device burns up the difference between the sub-main

pressure and the nominal inlet pressure at the start of the tape.

SUBMAIN MIN PRESSURE

Submain Min Pressure: The minimum pressure required in the submain. Required for pressure regulated tapes. The difference between the submain pressure and tape inlet pressure provides a differential pressure in which the pressure regulators must operate. If the Regulated option is unchecked, the submain minimum pressure is not used.

NOMINAL SDR

Nominal SDR: The nominal Specific Discharge Rate specified in the database and used for Show Flow and Management reports only. This can be changed in the Database Editor.

Laterals

Spacing: The spacing between laterals within the block.

Number of Laterals: The number of laterals to be inserted in the block. This is used when you want a specific number entered. Otherwise IRRICAD will fill the area defined by the block boundaries.

Lateral Direction: The direction the laterals are required to run. This can be user defined, or determined automatically by IRRICAD upon the first block boundary that is drawn. If user defined is selected you have the option to draw bent tapes by checking the Polyline check box.

5.6.11 AREA

An Area is a parcel of land that has the same water requirements.

To define an Area:

1. Select *Zone|Area*.
2. Place the starting point.
3. Place the end point of the first segment of the boundary.

4. Continue placing points to create the area boundary.
5. To finish select *Right-Click|Close*.

Where an area cannot be completed in one sequence e.g. while digitizing, select Done instead of Close.

6. Edit the dialog as required. Click OK.
7. Repeat Steps 2 to 6 as required.

Note: An Area boundary may be completed later using the Area tool by connecting a new boundary segment to one end of the existing boundary and continuing to place points.

5.6.11.1 AREA DIALOG

DRAWING PROPERTIES

Layer:	The <DEFAULT> layer is IRRIGATION_ AREAS.
Color:	Change the color of the Area line by selecting a different color from the color chart when clicking on the current color edit field. You can change the default color of the layer in <i>Settings Layers</i> .
Line Type:	The line type can be selected from a dropdown list. The default line type for the layer may be changed in <i>Settings Layers</i> for IRRIGATION_ AREAS if required.
Line Width:	The line width can also be selected from the dropdown list in the dialog. The default line width for the layer may be changed in <i>Settings Layers</i> for IRRIGATION_ AREAS if required.

The default settings can be edited in *Settings|Irrigation Items*.

NAME

Name: The name of the area.

SET ARC ORIENTATION USING AREA

Set Arc Orientation Using Area: Check this box if you wish all sprinklers that will be encompassed by the area to have their arcs rotated to water within the area only.

Sprinklers added after the area has been drawn will automatically have their arcs orientated to water within the area regardless of this setting.

IRRIGATION PARAMETERS

Max. Intensity: The maximum allowable mean precipitation rate for the area. Actual precipitation rates are checked against this value. Can be left as 0 if the area is used only to orientate sprinkler arcs.

Required Quantity of Water: The amount of water to be applied to the Irrigation Area on a daily basis expressed as a depth or as a volume. Can be left as 0 if the area is used only to orientate sprinkler arcs.

Note: *Areas work in the opposite way to most other hydraulic tools, i.e. most tools: Select tool, dialog to set properties, draw or place. Areas: Select tool, draw area, dialog to set properties.*

See also:

<i>Names</i>	<i>Section 5.9.11</i>
<i>Set Arc Orientation</i>	<i>Section 2.5.1</i>
<i>System Flow Report</i>	<i>Section 5.12.3.3</i>
<i>Water Requirement Report</i>	<i>Section 5.12.3.5</i>

5.6.12 JUNCTION (HYDRAULIC)

A junction denotes where two or more pipes are connected if no other hydraulic item (e.g. outlet, valve or water supply) is present.

To place a junction:

1. Select *Zone|Junction*.
2. Edit the dialog as required. Click OK.
3. Click to connect the junction where required.
4. Repeat Step 3 as required.

IRRICAD will automatically connect the junction to a pipe if you have selected the Default Snap Mode as Connect (see *Settings|Snap*, Section 5.9.1) and the cursor is close to the pipe

5.6.12.1 JUNCTION DIALOG

DRAWING PROPERTIES

Layer:	The <DEFAULT> layer for junctions is ZONE_JUNCTIONS.
Color:	The color for junctions can be edited by selecting a color from the color chart by clicking on the color edit field, or by changing the default layer color in <i>Settings Layers</i> and selecting the By Layer option in the junction dialog.
Symbol Name:	The default symbol for junctions is the Junction symbol. Select from the dropdown list in the dialog if you wish to use another symbol for this junction. Be aware that some symbols may have their default color as white not black, and will not be seen unless another color is selected for the new symbol.
Symbol Size:	The symbol size ranges from 0 to 9 and is relative to the size of the design. For more details on symbol sizes, see <i>Settings Miscellaneous – Design Size</i> , Section 5.9.9.3.

The default settings can be edited in *Settings|Irrigation Items*.

OBJECT PROPERTIES

Permanent:	Check if the junction is required to be permanent – i.e. will not be deleted during design if it is on a straight piece of pipe.
Orientation:	The orientation in degrees of the junction symbol. The orientation of the symbol is purely visual, e.g. an orientated square is a diamond shape.

5.7 MAINLINE

The Mainline menu allows you to place and connect mainline items in the design.

5.7.1 OUTLET

Outlets are devices that discharge water from an irrigation system. Mainline outlets connect to mainline pipes and do not require a control valve.

To place on outlets on the design:

1. Select *Mainline|Outlet*. Select a sprinkler, nozzle and riser from the dropdown lists in the dialog.

Note: If you know the first letter of a database entry, N for a Nelson product for example, pressing N on the keyboard will take you to the first N entry in the database.

2. Edit the dialog as required. Click OK.

Note: Changing one of the pressure, flow and radius fields for the nozzle will cause a change in one or both of the other two. Press the Enter key to update the fields.

3. Click to connect this outlet where required.
4. Repeat Step 3 as required.
5. To change to another sprinkler, simply follow steps 1 to 5 again.

IRRICAD will automatically connect the outlet to a pipe if you have selected the Default Snap Mode as Connect (see *Settings|Snap*, Section 5.9.1) and the cursor is close to the pipe.

Because mainline outlets are valve-in-head sprinklers, they require a Zone name. You can edit the default zone name by typing in a new name in the edit dialog when the outlet is first placed. You are also able to change the default name for the outlets prior to placing them on the screen by selecting the *Right-Click|Default Name* option. Type in a new name in the edit box. Zone names can be changed individually after the

outlets have been placed, by using *Tools|Select Object* and *Tools|Change*.

5.7.1.1 OUTLET DIALOG

DRAWING PROPERTIES

Layer: The <DEFAULT> layer for outlets is the OUTLETS layer. Colors and symbols for outlets can only be edited in the Database Editor (See Outlets, Section 3.5.11). Wetted radii default settings can be changed in *Settings|Irrigation Items*.

SPRINKLER

Sprinkler: The outlet body currently selected. Sprinklers available in the dropdown list have been entered and enabled in the Database Editor.

NOZZLE PROPERTIES

Nozzle: The sprinkler nozzle currently selected. Nozzles available in the dropdown list have been entered and enabled in the Database Editor.

Pressure: Operating pressure for the sprinkler; the default value is user-defined in the database.

Flow: Flow rate for the sprinkler at the pressure shown.

Arc: The plan angle over which the sprinkler operates (in degrees).

Radius: The wetted radius for the selected nozzle at the defined pressure.

Intensity: Flow rate divided by area of application for a single sprinkler; used as a simple measure of precipitation rate.

RISER

Riser: The riser currently selected. The risers (outlet connectors) available in the dropdown list have been entered and enabled in the Database Editor.

ORIENTATION

Orientation: The orientation in degrees for the nozzle symbol.

DEMAND POINT PROPERTIES

If the outlet selected is a demand point, then instead of nozzle properties, demand point properties will appear.

Pressure: The required pressure for the demand point; the default value is user-defined in the database.

Flow: Flow rate for the demand point.

Symbol: A single character that will be drawn inside the demand point symbol so you can identify it.

See also:

<i>Names</i>	<i>Section 5.9.11</i>
<i>Outlet component database</i>	<i>Section 3.5.11</i>
<i>Zone Outlet</i>	<i>Section 5.6.2</i>

5.7.2 CONTROL VALVE

Refer to *Zone|Control Valve* (see Section 5.6.3). You can select a Control Valve from the Zone or Mainline menu.

5.7.3 MISC. HYDRAULIC

Refer to *Zone|Misc. Hydraulic* (see Section 5.6.4). For placing Misc. Hydraulic items on a mainline, select from the Mainline menu. No zone items can be connected to mainline items.

5.7.4 PIPE

Refer to *Zone|Pipe* (see Section 5.6.5).

The default layer for mainline pipes is MAINLINE_PIPES. No zone items can be connected to mainline items.

5.7.5 SPRAYLINE

A mainline sprayline is a tool for placing equally spaced Valve-In-Head outlets connected by mainline pipes.

Refer to *Zone|Sprayline* (see Section 5.6.7). No zone items can be connected to mainline items. All mainline spraylines are unconnected. Therefore the *Mainline|Sprayline* tool is a means for placing outlets at a fixed spacing along a pipe in one action; once placed the pipe and outlets are separate entities.

Because mainline sprayline outlets are valve-in-head sprinklers each outlet is a zone. When entering mainline outlets you will be asked to name the sprayline and individual outlets, or to accept the default name. The default name can be edited in *Settings|Names*, or prior to placing the sprayline in *Right-Click|Default Names*. The default name can also be edited when the first point of the sprayline has been placed, and after the second point has been placed you are still able to edit the outlet names, though the sprayline name is now fixed.

The default layers for mainline spraylines are MAINLINE_PIPES for the sprayline pipe, OUTLETS for the outlet you have selected, and OUTLET_WETTED_RADII for the outlets wetted radii. These can be turned on or off in *Settings|Layers*. Wetted radii default settings can be changed in *Settings|Irrigation Items*.

See also:

Default Name
Names

Section 5.1.6
Section 5.9.11

5.7.6 JUNCTION

Refer to *Zone|Junction (Hydraulic)* (see Section 5.6.12). No zone items can be connected to mainline items

5.7.7 WATER SUPPLY

A water supply is a point of supply for the irrigation system.

To place Water Supplies on the screen:

1. Select *Mainline|Water Supply* and click on the screen at the required location.
2. Edit the dialog as required. Click OK.

If the Design Head and Flow values are left equal to zero, then IRRICAD will assume that it has to calculate what these values will be. If you have multiple water supplies, enter the Head and Flow data in the edit boxes provided.

5.7.7.1 WATER SUPPLY DIALOG

DRAWING PROPERTIES

Layer:	The <DEFAULT> layer for the water supply is MISC_HYDRAULIC.
Color:	You can change the color of the water supply symbol by clicking on the color edit field and selecting a color from the chart, or by changing the default layer color in <i>Settings Layers</i> , and selecting the By Layer option in the dialog.
Symbol Name:	The default symbol is the Water Supply symbol. Select from the dropdown list in the dialog if you wish to change the symbol used. Be aware that some symbols may have a default color of white, not black. Change the color as required.
Symbol Size:	Select a symbol size for the water supply. The symbol size ranges from 0-9. This symbol size, along with the design size will dictate the size of the symbol on the design. For more information on symbol size, see <i>Settings Miscellaneous – Design Size</i> , Section 5.9.9.3.

The default settings can be edited in *Settings|Irrigation Items*.

OBJECT PROPERTIES

Water Supply Name:	Specifies the name of the water supply. The default can be changed in <i>Settings Names</i> , or from <i>Right-Click Default Names</i> .
Design Flow:	The flow available from the water supply that ideally should not be exceeded for the design. If your valve operating sequence results in a

	water supply that exceeds this value, you will be warned but allowed to proceed. If the Design Flow is left as zero, IRRICAD will calculate the Design Flow requirement for the system.
Maximum Flow:	The maximum flow available from the water supply that cannot be exceeded under any circumstances. IRRICAD will prevent you from continuing if you enter a control valve operating sequence that results in a water supply flow demand greater than this value.
Design Head:	The pressure available from the water supply that ideally should not be exceeded for the design. This pressure, if specified, is used in the calculation of mainline pressures. If a pressure is not specified, IRRICAD will calculate the Design Pressure requirement for the system.
Maximum Head:	The maximum pressure available from the water supply that cannot be exceeded under any circumstances.

See also:

*Design Size
Names*

*Section 5.9.9.3
Section 5.9.11*

5.7.8 PUMP

A pump is a device that supplies water with a known pressure discharge relationship.

To place a pump on your design:

1. Select *Mainline|Pump*.
2. Edit the dialog as required. Click OK.
3. Click to connect the pump. If the pump is a main supply pump connect it slightly downstream of the water supply. If it is a booster pump connect it within a pipeline not at a tee junction.
4. Repeat Step 3 as required.

IRRICAD will automatically connect the pump to a pipe if you have selected the Default Snap Mode as Connect (see *Settings|Snap*, Section 5.9.1) and the cursor is close to the pipe.

5.7.8.1 PUMP DIALOG

DRAWING PROPERTIES

Layer: The <DEFAULT> layer for pumps is MISC_HYDRAULIC. The symbol and color properties can only be edited in the Database Editor (see Pumps, Section 3.5.10).

ITEM

Item: The pump currently selected. All pumps available in the dropdown list have been entered and enabled in the Database Editor.

ORIENTATION

Orientation: The orientation in degrees for the pump symbol.

DEPTH

Depth: The depth of the hydraulic item below ground level. If the hydraulic item is above ground level enter this height as a negative number.

5.8 ELECTRICAL

The Electrical menu has the following commands:

- Controller
- Wire
- Light
- Misc. Electrical
- Junction

The Electrical menu allows you to place electrical items in the design for costing purposes only.

5.8.1 CONTROLLER

A controller is an electrical device which is able to turn valves on and off as required.

To place a Controller:

1. Select *Electrical|Controller*.
2. Edit the dialog as required. Click OK.
3. Click to place the item where required.
4. Repeat Step 3 as required.

IRRICAD will automatically connect the controller to a wire if you have selected the Default Snap Mode as Connect (see *Settings|Snap*, Section 5.9.1) and the cursor is close to the wire.

5.8.1.1 CONTROLLER DIALOG

DRAWING PROPERTIES

Layer: The <DEFAULT> layer for the controller is ELECTRICAL. Edit the layer if necessary. Color and symbol are edited in the Database Editor only (see Controllers, Section 3.5.15).

ITEM

Item: The controller currently selected. All items in the dropdown list have previously been entered and enabled in the Database editor.

ORIENTATION

Orientation: The orientation in degrees for the controller symbol.

5.8.2 WIRE

Used to place electrical wiring and to connect other electrical items in this design.

To place a wire:

1. Select *Electrical|Wire*.
2. Edit the dialog as required. Click OK.
3. Place the starting point.
4. Place the end point of the first wire segment. This is also the starting point of the next segment.
5. Continue placing points to create wire segments.
6. To finish select *Right-Click|Restart*.
7. Repeat Steps 3 to 6 as required.

IRRICAD will automatically connect the wire to another wire if you have selected the Default Snap Mode as Connect (see *Settings|Snap*, Section 5.9.1) and the cursor is close to the wire.

5.8.2.1 WIRE DIALOG

DRAWING PROPERTIES

Layer: The <DEFAULT> layer for Wire is ELECTRICAL.

Line Width: The line widths range from 1 to 15. Color and line types are edited in the Database Editor only (see Wires, Section 3.5.14).

ITEM

Item: The wire currently selected. All wires in the dropdown list have been entered and enabled in the Database Editor.

5.8.3 LIGHT

Used to place electrical lighting in your design.

To place a light in the design:

1. Select *Electrical|Light*.
2. Edit the dialog as required. Click OK.
3. Click the place the light where required.
4. Repeat Step 3 as required.

IRRICAD will automatically connect the light to a wire if you have selected the Default Snap Mode as Connect (see *Settings|Snap*, Section 5.9.1) and the cursor is close to the wire.

5.8.3.1 LIGHT DIALOG

DRAWING PROPERTIES

Layer: The <DEFAULT> layer for lights is ELECTRICAL. Color and symbol are edited in the Database Editor only (see Lights, Section 3.5.16).

ITEM

Item: The light currently selected. The lights in the dropdown list have been entered and enabled in the Database Editor.

ORIENTATION

Orientation: The orientation in degrees for the light symbol.

5.8.4 MISC. ELECTRICAL

Miscellaneous Electrical items are any electrical items that are not Controllers, Wires or Lights.

To place Misc. Electrical items:

1. Select *Electrical|Misc. Electrical*.
2. Edit the dialog as required. Click OK.
3. Click to place the item where required.
4. Repeat Step 3 as required.

IRRICAD will automatically connect the Misc. Electrical item to a wire if you have selected the Default Snap Mode as Connect (see *Settings|Snap*, Section 5.9.1) and the cursor is close to the wire.

5.8.4.1 MISC. ELECTRICAL DIALOG

DRAWING PROPERTIES

Layer: The <DEFAULT> layer for Misc. Electrical items is ELECTRICAL. Color and symbol are edited in the Database Editor only (see Other Electrics, Section 3.5.17).

ITEM

Item: The misc. electrical item currently selected. The misc. electrical items in the dropdown list have been entered and enabled in the Database Editor.

ORIENTATION

Orientation: The orientation in degrees of the misc. electrical item symbol.

5.8.5 JUNCTION

A junction is the joining of two to four electrical items, e.g. wires, lights, controllers etc.

To place a Junction:

1. Select *Electrical|Junction*.
2. Edit the dialog as required. Click OK.
3. Click to place the junction where required.
4. Repeat Step 3 as required.

5.8.5.1 JUNCTION DIALOG

DRAWING PROPERTIES

Layer: The <DEFAULT> layer for the electrical junction is ELECTRICAL.

Color: The color for junctions can be edited by selecting a color from the color chart by clicking

	on the color edit field, or by changing the default layer color in <i>Settings Layers</i> and selecting the By Layer option in the junction dialog.
Symbol name:	The default symbol for junctions is the Junction symbol. Select from the dropdown list if you wish to use another symbol for this junction. Be aware that some symbols may have their default color as white not black, and will not be seen unless another color is selected for the new symbol.
Symbol Size:	The symbol size ranges from 0 to 9 and is relative to the size of the design. For more details on symbol sizes, <i>Settings Miscellaneous – Design Size</i> , Section 5.9.9.3.

The default settings can be edited in *Settings|Irrigation Items*.

OBJECT PROPERTIES

Permanent:	Has no effect for Electrical Junctions.
Orientation:	The orientation in degrees of the junction symbol. The orientation of the symbol is purely visual, e.g. an orientated square is a diamond shape.

5.9 SETTINGS

The Settings menu has the following commands:

- Snap
- Layers
- Grid
- Irrigation Items
- Drawing Items
- Units
- Cursor
- Design Details
- Miscellaneous
- Irrigation - Design Specific
- Names
- Company
- Client
- Bitmap
- Moving Grid
- Digitizer

Settings are the default values, modes or limits IRRICAD will use.

System settings are those settings which, once set, will remain in force from design to design until you change them. They will not be reset when you start a new design. Examples of system settings are the cursor color and IRRICAD units.

Design settings are those settings which you set for each design and which will be reset to defaults when you start a new design. Examples of design settings are the selected database and lateral line width. Design settings are stored with the design and are therefore restored when you open an existing design.

Save As Defaults: Applies to design settings only. Saves the current values to the registry so they will be used as the defaults for a new design.

Restore Defaults: For design settings, restores the default values from the registry. For system settings, restores the hardwired default values.

The items in the Settings menu are displayed as tabs on a dialog.

5.9.1 SNAP

The following snaps are available from the Right-Click menus:

- Endpoint
- Midpoint
- Place
- Center
- Closest
- Intersection
- Object
- Parallel
- Percent
- Perpendicular
- Quadrant
- Tangent

To change the Default Snap Mode:

1. Select *Settings|Snap*.
2. Select the mode you require: Connect, Place or Snap to Grid.
3. Edit the tolerances if required. Click OK.

5.9.1.1 DEFAULT SNAP MODE

Connect will ensure that all hydraulic items are physically connected if the cursor is placed close enough for IRRICAD to recognize the proximity of another hydraulic item, irrespective of which layer these items may have been designated. Connect will also mean that drawing objects are connected under the same circumstances.

Place will allow you to place items near, on or over existing items without connecting to them.

Snap to Grid is a tool used for accurate drawing. With or without the grid displayed, the cursor will only allow you to move between grid points. Note that the circular cursor is automatically turned off when snap to grid is turned on.

Edit the tolerances as required. Tolerances indicate the limits to which IRRICAD will recognize that an item may want to be snapped.

5.9.1.2 TOLERANCES

Snap Tolerance:	The distance to which an item will be connected to a like item (Drawing or Hydraulic) in inches or mm on the screen.
Min Tolerance:	Indicates the minimum distance in world terms (ft or m) that an item will need to be placed on the screen in order to be connected to another hydraulic item.
Max Tolerance:	Indicates the maximum distance in world terms (ft or m) that an item will need to be placed on the screen in order to be connected to another hydraulic item.
Cut Pipe Tolerance:	The distance to which cut pipe will connect to the pipes it crosses or to the end of pipes / laterals in mm or inches on the screen. In this case, if your cut pipe tolerance is 0.2 inches, but in your design you have laterals 0.1 inches apart, then only every second lateral will be connected to the submain.
Cut Pipe Length Factor:	This factor is used along with the Cut Pipe Tolerance to determine if the cut pipe is close enough to the ends of laterals to be connected to them. This factor is used as a proportion of the total length of the cut pipe and is not related to the zoom state. The greater of the Cut Pipe Length Factor multiplied by the total length of the cut pipe or the world value of the Cut Pipe Tolerance is used to determine if the ends of laterals are close enough to snap to.

See also:

Settings
Snaps - Right-Click menu

Section 5.9
Section 5.1.8

5.9.2 LAYERS

Everything you draw in IRRICAD is placed on a layer of your drawing.

5.9.2.1 CURRENT LAYERS

There is one current default layer for each group of items - drawing, zone, mainline, electrical, and elevation. You can change the current layer for any one group.

To select the current layer for a group:

1. Select *Settings|Layers*.
2. Select a layer from the dropdown list. The value <DEFAULT> means an object will be placed on the default layer for that type of object as specified above, e.g. control valves will be placed on the CONTROL_VALVES layer. If you select CONTROL_VALVES to be your current layer for Zone items, all Zone items will now be placed on the CONTROL_VALVES layer.

Tip: For hydraulic objects, the current layer acts as a default layer. You can change the current layer for a particular type of object when you select that tool from the Zone or Mainline or Electrical menu.

5.9.2.2 LAYER MANAGER

In IRRICAD there are a number of hardwired layers on which objects will be placed by default. The names of these layers cannot be changed nor can the layers be deleted but you can edit the other layer properties. The <DEFAULT> layers are as follows:

IRRICAD:	All other objects
TEMPORARY:	(Unused at present)
TEXT:	Text
DRAWING_SYMBOLS:	Symbols
DRAWING:	Points, lines, polylines, rectangles, polygons, circles, curves, arcs, hatches, fills, dimensions, bitmaps
ELEVATIONS:	Contours, spot heights
OUTLETS:	Outlets
CONTROL_VALVES:	Control valves
ZONE_PIPES:	Zone pipes
MAINLINE_PIPES:	Mainline pipes
SPRAYLINES:	Spraylines (connected), tapes

ZONE_JUNCTIONS:	Zone junctions
MAINLINE_JUNCTIONS:	Mainline junctions
IRRIGATION_AREAS:	Areas
MISC_HYDRAULIC:	Water supplies, miscellaneous hydraulic items, pumps
ELECTRICAL:	Electrical junctions, lights, controllers, miscellaneous electrical items, wires
SPRAYLINE_OUTLETS:	Spraylines outlets
OUTLET_WETTED_RADII:	Outlet wetted radii
SL_WETTED_RADII:	Sprayline outlet wetted radii
PLOT_TEMPLATE:	Plot layout

If you do not wish to view a layer, select *Settings|Layers*, and uncheck the Show column in the Layer Manager corresponding to the layer you wish to turn off. SPRAYLINE_OUTLETS and OUTLET_WETTED_RADII can also be turned off and on by checking / unchecking these two items in the View menu.

Add new layers by clicking on the New button. Remove layers (except hardwired ones) by selecting a layer and clicking on the Remove button.

LAYER PROPERTIES:

Name:	The name of the layer.
Show:	Checked means all objects drawn on the layer are visible, unchecked means they are hidden.
Color:	The color that objects on this layer are drawn in if their color property is BYLAYER.
Line Type:	The line type that objects on this layer are drawn with if their line type property is BYLAYER.
Line Width:	The line width that objects on this layer are drawn with if their line width property is BYLAYER.

5.9.3 GRID

Grid is a tool that places a grid of points on the screen to aid in drawing.

To set grid properties:

1. Select *Settings|Grid*.
2. Edit the grid properties as required.
3. Click OK.

5.9.3.1 GRID PROPERTIES:

SPACING

Spacing: Sets the spacing of grid points to any convenient spacing in the X and Y directions.

ORIGIN

Origin: Moves the grid so that a specified point of the drawing falls exactly on a grid point.

VISIBILITY

Display Grid Points: toggles on or off the display of the grid.

Tip: Turning the grid display on or off does not affect the status of Snap to Grid. This can still be on (constraining cursor movement to grid points only) even if the grid points themselves are not visible.

5.9.4 IRRIGATION ITEMS

These settings are system settings for hydraulic items and tools. Once set they remain in force until you change them, i.e. they do not get reset when you start a new design.

To change the default settings for Irrigation Items:

1. Select *Settings|Irrigation Items*.
2. Change any settings as required.
3. Click OK.

5.9.4.1 AUTOHEAD SPACING LIMITS (%)

The overlap ranges that Autohead uses to space sprinklers can be restricted to the limits specified.

Autohead, where possible, will space sprinklers so that the overlap lies between the minimum and maximum values. The default values are 40% minimum to 60% maximum. (A 50% value corresponds to head-to-head spacing). Reduce these values for closer spacing (e.g. in windy areas), or increase them for wider spacing.

5.9.4.2 FLOW CHECK

Where limits are placed on the flow available for a system or a particular zone flow is not to be exceeded, this setting aids in keeping a tally of connected zone flows during design input. If the water supply has a limitation, this would be entered as the maximum flow allowed in *Settings/Irrigation Items* (see Section 5.9.4).

Check the enabled box and enter the maximum flow required for a zone into the max field.

As you connect pipes to outlets or to groups of connected outlets, the flow required for the group is displayed (f=) on the status line. The maximum flow (m=) for a zone is also displayed. When you connect other outlets to the group, the connected flow is automatically updated. If the currently connected flow exceeds maximum flow, a warning is displayed which allows you to continue or to terminate the last connection.

5.9.4.3 DATABASE SYMBOLS PATH

The default path (folder) where IRRICAD looks for database symbols, i.e. the symbols used for hydraulic items such as sprinklers, valves, etc.

5.9.4.4 UPDATE ENTITIES FROM DATABASE

When you place hydraulic items in a design IRRICAD copies the hydraulic information from the current database to a local database it keeps with the design. When you open a design file IRRICAD runs through all the local database items and updates them from the current database. If this setting is checked IRRICAD will also run through all the hydraulic objects in the design and update them using the updated local database. If you have changed any drawing properties in the database such as pipe colors or symbol names then check this setting so that the hydraulic objects in the design will be updated with the new colors etc. when you re-load the design.

5.9.4.5 LINES

Item:	The name of the hydraulic item type to which the drawing properties apply
Color:	Either select a specific color by clicking on the color or select By Layer to use the color property of the current layer for this type of item. Note that wetted radii have a third alternative By Nozzle that uses the same color as the sprinkler nozzle to which the wetted radius belongs.
Line Type:	Select a specific line type from the dropdown list or <BYLAYER> to use the line type property of the current layer for this type of item.
Line Width:	Select a specific line width from the dropdown list or <BYLAYER> to use the line width property of the current layer for this type of item.

5.9.4.6 SYMBOLS

Item:	The name of the hydraulic item type to which the drawing properties apply
Color:	Either select a specific color by clicking on the color or select By Layer to use the color property of the current layer for this type of item.
Symbol Name:	The name of the database symbol for this type of item.
Symbol Size:	The size of the database symbol for this type of item. Select from the dropdown list or enter a specific value. Normally you would use a value between 1 and 10. The base size is 5 with other values proportional to this, e.g. a symbol with size 3 would be $\frac{3}{5}$ the base size.

See also:

Design Size

Section 5.9.9.3

5.9.5 DRAWING ITEMS

These settings are system settings for geometric items and drawing tools. Once set they remain in force until you change them, i.e. they do not reset when you start a new design.

To change the default settings for Drawing Items:

1. Select *Settings|Drawing Items*.
2. Change any settings as required.
3. Click OK.

5.9.5.1 GEOMETRIC PROPERTIES

Geometric items are all items from the Draw menu excluding contours and spot heights.

Current Color:	Either select a specific color by clicking on the color or select By Layer to use the color property of the current layer for geometric items.
Current Line Type:	Select a specific line type from the dropdown list or <BYLAYER> to use the line type property of the current layer for geometric items.
Current Line Width:	Select a specific line width from the dropdown list or <BYLAYER> to use the line width property of the current layer for geometric items.

5.9.5.2 CURSOR SETTINGS

See Cursor, (Section 5.9.6).

5.9.5.3 MISCELLANEOUS SETTINGS

Rubberband color:	The color used for the rubberband line (a temporary line that provides a dynamic preview of where the next point would be placed in the current drawing or editing operation, in relation to the last point entered and the current cursor position).
Selection color:	The color used for highlighting selected objects.
Background color:	The background color of the design. Choosing a background color changes only how the drawing appears on the screen. Because IRRICAD does not print or plot the background, the output is unaffected.
Zoom factor:	Sets the multiplier used to change the drawing magnification when the Zoom In command is used. The factor for the Zoom Out command is the reciprocal of this number.

Drawing Symbols Path:	The default path (folder) where IRRICAD looks for drawing symbols, i.e. symbols such as trees etc. used in the <i>Draw Symbol</i> tool.
Plot Layout Path:	The default path (folder) where IRRICAD looks for plot templates, i.e. templates containing pipe legends etc. used in <i>Draw Plot Layout</i> .
Designs Path:	Specifies the default folder for designs for <i>File Open</i> and <i>File Save</i> .

5.9.5.4 DISPLAY SETTINGS

Hatches, Fills, Line Types, and Line Widths can be turned off in this dialog. Unchecking will hide hatches and fills, and draw line types as solid, and line widths as 1 regardless of the actual values. This can speed up redraws or hide these properties for printing.

5.9.5.5 ORTHO SETTINGS

Ortho Mode aligns each new point horizontally or vertically with the previous point placed. The angle of alignment can be changed from horizontal and vertical to any specified angle with the Ortho Angle setting.

Angle:	Specifies the Ortho Angle.
Ortho Mode:	Specifies if Ortho Mode is on or off.

***Note:** Holding the Ctrl key down when on Ortho Mode will disengage Ortho Mode. Holding the Ctrl key down when not in Ortho Mode will engage Ortho Mode and the angle set in this dialog field.*

5.9.6 CURSOR

The cursor settings control the appearance of the cursor.

To change the Cursor:

1. Select *Settings|Cursor*. This option will take you to the Drawing tab.
2. Change settings as required.
3. Click OK.

CURSOR SETTINGS:

Small cross:	The cursor is drawn as a small cross.
Cross hairs:	The cursor is drawn as crosshairs.

Color: Select the color of the cursor by clicking on the color.

5.9.6.1 CIRCULAR CURSOR

When Display Circle is checked a circle of the given Radius centered around the main cursor is displayed. Circular cursor may be used to place sprinklers at a given spacing (the radius of the circle) or draw spraylines parallel to curved boundaries.

Note: Circular cursor is automatically turned off if snap to grid is turned on.

5.9.7 UNITS

These settings control the units displayed and entered for each type of quantity.

To change units:

1. Select *Settings|Units*.
2. Edit each measurement as required.
3. Click OK.

Note: The units that are present when IRRICAD is exited, become the default units. The default units are used in the Database Editor.

5.9.7.1 NUMBER DECIMAL PLACES

Sets the number of digits that IRRICAD displays to the right of the decimal point on the status bar.

5.9.7.2 RESET TO DEFAULTS

You can choose the units for each quantity, or you can simply click the US button if you require the default set of US units, or click the Metric button if you require the default set of metric units.

5.9.8 DESIGN DETAILS

These settings allow you to enter specifics for the project. The details will be printed on reports and on your plotted design.

To enter design headings:

1. Select *Settings|Design Details*.
2. Enter all necessary data.
3. Click OK.

5.9.8.1 HEADINGS

Site:	The site of the design or a title for it to be used for printing and reports.
Date:	The date the design is started.
Description:	A brief description of the design to be used in document output.
Notes / Comments:	Any comments you wish to make about the design such as which databases you used, any other designs you wish to refer to etc.

Note: Use this field to enter additional notes, especially if re-doing the design in a different way. These will be printed at the start of each report.

5.9.8.2 MISCELLANEOUS

Rep Name:	Name of local branch representative or salesman.
Rep Code:	Code for local branch rep (if company uses them).
Job Address:	Full address of site for the design.
Quote Number:	Unique reference for use in documents.
Acceptance Date:	Date quote is accepted.
Commencement Date:	Date installation is commenced.
Completion Date:	Date installation is completed.
Labor:	Total number of hours labor for installation.
Mileage:	Total distance traveled (miles or km) for the job.
Installation Cost:	Total cost of installation excluding tax.

5.9.9 MISCELLANEOUS

These settings are those which do not fit into any other category.

To edit Miscellaneous settings:

1. Select *Settings|Miscellaneous*.
2. Edit the settings as required.

3. Click Save as Defaults if you wish to retain these settings between designs. Click OK.

5.9.9.1 MISC. COMPANY

Signatory:	Name of person signing documents.
Signatory Title:	Official title of above person.
Labor Charge:	Hourly cost of labor.
Mileage Charge:	Travel charge per mile or km.
Tax Rate:	% GST, VAT etc. to be added to prices (e.g. total price, materials price) in documents.

5.9.9.2 DESIGNER

Designer: Name of person completing the designs.

5.9.9.3 DESIGN SIZE

Rough guidelines for selecting a design size calculated are:

- Small: up to 330 x 330ft (100 x 100m).
- Medium: up to 1640 x 1640ft (500 x 500m).
- Large: larger than 1640ft (>500m).

Selecting a design size will alter the suggested base database symbol size. You can type in a base database symbol size instead of selecting a design size.

Base Database Symbol Size: The world size of a hydraulic item on the screen corresponding to symbol size 5 in the database. Other sizes are proportional to this.

Update Database Symbols: Check this box if you have changed the Base Database Symbols Size so that all the database symbols already present in the design will be updated to reflect the new size. If this box is unchecked, then all existing symbols in your design will remain unchanged, but all new symbols inserted into the design will be in the new world size.

5.9.9.4 MISCELLANEOUS

- Cad Error Checking: If this box is checked, error messages from the CAD engine will be displayed. Under normal circumstances leave this option unchecked.
- Debug Object Info: When this check box is checked, the *Right-Click|Object Info* option will include much more information to help your IRRICAD technician find the source of a problem. Under normal circumstances leave this option unchecked.
- Hydraulic Object Info: Check this box if you wish to view hydraulic information when viewing *Right-Click|Object Info* on a selected hydraulic object. Depending on the type of object selected, hydraulic information displayed can be pressure, flow, headloss and / or velocity.
- Automatic Save: Check the check box if you wish AutoSave to save your design. Type in a time interval in the edit field below. To recover an autosaved file select *File|Open* and load the ~Irricad~Backup.des file found in the operating systems Temp directory (usually C:\Windows\Temp under Windows 95/98, or C:\Documents and settings\User\Local Settings\Temp in Windows 2000/XP). While this file is loaded IRRICAD cannot use AutoSave. Use *File|Save As...* to rename the file before continuing. To check the Temp directory for your operating system type SET in MS-DOS prompt.

5.9.10 IRRIGATION – DESIGN SPECIFIC

These settings are design settings for hydraulic items and tools.

To change the default settings for Irrigation - Design Specific:

1. Select *Settings|Irrigation – Design Specific*.
2. Change any settings as required.
3. Click OK.

5.9.10.1 COMPONENT DATABASE

The database where all hydraulic information is stored and from which hydraulic items in the design are selected. Either type in the path and name of the database or click Browse to select it.

5.9.10.2 CREATE WETTED RADII

If checked, a wetted radius arc will be created for each outlet drawn. If Create Sprayline Outlets is also checked then a wetted radius arc will also be created for each sprayline outlet drawn. If this option is left unchecked, when you place outlets, wetted radii will not be created.

See also:

Tools|Create Wetted Radii

Section 5.10.21

5.9.10.3 CREATE SPRAYLINE OUTLETS

If checked, sprinkler symbols will be created for each connected sprayline drawn. If this option is left unchecked, when you place spraylines, sprayline outlet symbols will not be created.

Note: *Wetted radii and sprayline outlets may be created later using Tools|Create Wetted Radii and Tools|Create Sprayline Outlets.*

It is a good idea not to create sprayline outlets as their tend to be many sprayline outlets in a sprayline deisgn. The presence of these sprayline outlets can slow down redrawing and other tools markedly.

See also:

View|Sprayline Outlets

Section 5.4.14

Tools|Create Sprayline Outlets

Section 5.10.22

5.9.10.4 ROTATE WETTED RADII INDEPENDENTLY

If checked then a wetted radius arc may be selected and rotated independently of its sprinkler symbol. Usually a sprinkler symbol and its wetted radius arc are rotated together as a single unit.

5.9.10.5 LINES

Item:	The name of the hydraulic item type (pipes or wires) to which the drawing property applies.
Line Width:	Select a specific line width from the dropdown list or <BY LAYER> to use the line width property of the current layer for this type of item.

5.9.11 NAMES

Sets the default names for Zones, Mainline Spraylines (valve-in-head sprinklers), Water Supplies and Areas including automatic numbering if required. The defaults start at number one and name the items consecutively, e.g. Water Supply No 1, Water Supply No 2, etc.

To change default names:

1. Select *Settings|Names*.
2. Change the name in the name box as required for any of the four items: Zones, Mainline Spraylines, Water Supplies or Areas.
3. Change the numbering if required – the default starts at 1.
4. Click OK.

Note: If you have deleted some items, the numbering does not acknowledge the deletion and will carry on the numbering as if those items still remained. Simply change the numbering to that you wish to start from e.g. 3 and then continue placing the items.

5.9.11.1 AUTOMATIC NUMBERING

If the default name contains one or more tilde (~) characters when you place an item of that type in the design the tildes will be replaced by the next consecutive number. For example, if the default zone name is Green ~~~ and the Number From field is 5, then zone valves will be named Green 5, Green 6, etc. For mainline spraylines, since each outlet is a valve-in-head outlet, each outlet will be numbered and therefore the default name will also contain one or more carat (^) characters. When you place a mainline sprayline in the design the carats will be replaced by the number of the outlet on the sprayline. For example, if the default name is Sprayline ~~~ - ^^ then the outlets on the first mainline sprayline will be named Sprayline 1 - 1, Sprayline 1 - 2, etc. The outlets on the second sprayline will be named Sprayline 2 - 1, Sprayline 2 - 2, etc. and so on.

***Tip:** If you select Right-Click\Default Name after selecting the Control Valve, Water Supply, Mainline Outlet, Mainline Sprayline or Area tools then you can change the default name temporarily just while using that tool without changing the default setting above.*

See also:

Area	Section 5.6.11
Control Valve	Section 5.6.3
Water Supply	Section 5.7.7
Mainline Outlet	Section 5.7.1
Mainline Sprayline	Section 5.7.5

5.9.12 COMPANY

These settings contain information about your company that can be printed on reports and designs.

To enter company information:

1. Select *Settings\Company*.
2. Enter the required information.
3. Click OK.

5.9.12.1 COMPANY

Short Company Name:	Abbreviated or popular company name, e.g. Acme for use as an adjective in letters etc., e.g. The Acme sprinklers ...
Formal Company Name:	Normal form of name, e.g. Acme Irrigation, this may appear on a plot.
Legal Company Name:	Full legal company name to be used in documents such as contracts, e.g. Acme Irrigation Services Pty. Ltd.
Company Address:	Address of company head office (in full).
Company Phone:	Phone number of company head office.
Company Fax:	Fax number of company head office.

5.9.12.2 BRANCH

Branch Name:	Name of local branch of company.
Branch Code:	Code of local branch (if company has codes for branches).
Branch City:	City local branch is located in.

Branch Phone:	Phone number of local branch.
Branch AH Phone:	After hours phone number of local branch (if applicable).
Branch Fax:	Fax number of local branch.
Branch Contact:	Name of person for clients to contact.

5.9.13 CLIENT

Client Name:	Full name of client.
Short Name:	First name or diminutive form for use in letters etc.
Client Address:	Full address of client.
Client Home Phone:	Home phone number of client.
Client Work Phone:	Work phone number of client.
Client Fax:	Fax number of client (if applicable).
Client Code:	A three-character code for the client.

5.9.14 BITMAP

These settings control how a bitmap image is imported and displayed.

Default image path:	The folder that is current when the File Open dialog is displayed in Import Bitmap.
Remember last path:	Check to get IRRICAD to remember the folder last selected in the File Open dialog in Import Bitmap.
Redraw on edits:	Unused at present.
Redraw on placement:	Unused at present.
Place images proportionally:	Check to maintain a bitmaps shape when importing. Uncheck to Stretch or squash a bitmap.
Print images:	Check if you want bitmaps printed.
Display images:	Check to display or uncheck to hide bitmaps.
Flip images:	Check to flip all imported bitmaps about the x-axis.

5.9.15 MOVING GRID

Not available in this version.

5.9.16 DIGITIZER

A digitizer is used for tracing scaled drawings attached to the digitizer tablet.

A WinTab driver must be installed for using a digitizer in IRRICAD Version 7.

A WinTab driver can be obtained from:

- Disks which accompanied your digitizer / tablet
- Your hardware supplier
- The Internet
- The tablet's manufacturer

Before digitizing the drawing IRRICAD requires you to either specify a scale or to enter known reference points on the drawing.

5.9.16.1 TABLET MODE

In normal drawing mode, you can use the digitizer much like a mouse to draw and select commands. In Tablet Mode, you can digitize paper drawings attached to the digitizer tablet by tracing over them. Tablet Mode will automatically be turned off when switching to another Windows application, and turned back on when you return to IRRICAD.

To digitize paper drawings using Tablet Mode:

1. Select the Scale or Reference option (*Settings|Digitizer*). These options will automatically switch Tablet Mode on.
2. Trace points with the digitizer puck to transfer the drawing to IRRICAD. Note that when Tablet Mode is on, the digitizer puck cannot select menus. Use the mouse or keys (e.g. Alt S for Settings menu) to select menus and menu options.
3. Select *Settings|Digitizer|Tablet Mode* (with the middle puck button, mouse or keys) to turn Tablet Mode off.

When Tablet Mode is on, a box appears around the cursor. When Tablet Mode is off, the box around the cursor disappears. When Tablet Mode is on, the puck can not select from the main menus, hence Tablet Mode may be turned off temporarily, or the Right-Click menu can be used. As well as selecting this command from the Settings menu to turn Tablet Mode on or off, this mode may also be toggled using the digitizer puck button assigned to the middle click button. Buttons can be

assigned in the control panel for the digitizer. Tablet Mode is automatically turned off when the Right-Click is invoked and automatically turned on again when the selection is made and the cursor is returned to the input screen.

If Tablet Mode is turned off temporarily, scaling or referencing does not need to be re-done to continue digitizing. As well as selecting this command from the Settings menu to turn Tablet Mode on or off, this mode may also be toggled using the digitizer puck button assigned to the middle click button.

The zoom state does not effect the digitizer referencing. Select the View menu options with the mouse or keys to zoom in or out as required. When in Tablet Mode the Zoom, Draw and Settings menus are also available in all Right-Click menus to make it easier to change tools and settings while digitizing.

Tip: You can only use Tablet Mode with WinTab compliant hardware and drivers.

5.9.16.2 SCALE

Select this option to specify the scale of the drawing to digitize into IRRICAD. Use this option with one-sheet digitizing.

This option can be used when you know the scale of the drawing. If you know a known world distance of a line, you can use the Reference option or use it as a check for the scale you have used.

The initial zoom state automatically spans the whole-proposed drawing on the screen. The zoom state does not effect the digitizing of the drawing. Use View menu options or the Right-Click menu to zoom in and out as required.

5.9.16.3 REFERENCE

Use the Reference option to align the reference frames and to determine the scale factor between the screen and paper drawing. Reference is used to prepare to digitize a paper drawing, when at least one world distance or set of coordinates on the paper drawing is known. The coordinates need to be in a world distance. Reference not only calculates the scale factor of the paper drawing, but will also give a warning if the scale entered is more than 5% different to the calculated scale.

To align and digitize a paper drawing:

1. Securely attach the paper drawing to the digitizer tablet using tape or other means. Horizontal or vertical alignment is not critical.
2. Select Reference (*Settings|Digitizer|Reference*). If it was not already on, Tablet Mode will automatically be turned on.
3. Place a point at the bottom left corner of the drawing. Place a second point at the top right corner of the drawing. A dialog will appear requiring the coordinates of the bottom left corner (X1 & Y1, e.g. 0,0) and the top right corner coordinates (X2 & Y2, e.g. 137,99).
4. Type in the scale of the drawing. Click OK.
5. The ratio between the two distances will be calculated automatically as the digitizer scale factor.
6. If the calculated scale is more than 5% difference from the scale you entered, a warning will be displayed, giving the calculated scale. Click Yes to continue to use the scale you entered. Click No to discontinue. Go back and enter the reference points again, making sure the cross hairs are exactly over the points on the drawing. Enter the scale again, or enter the scale as calculated by IRRICAD.
7. Proceed to digitize in the drawing. Use the Right-Click menu, mouse or keys to select menu items, e.g. *Draw|Line|Continuous*.
8. Move the paper plan to place another area in active area of the tablet. Repeat Steps 3 to 7 as required.

Tips: The digitizer scale is only used when in Tablet Mode. When in drawing mode, the digitizer scale has no effect.

*If the scale is unknown, type a scale number larger than 0. IRRICAD will calculate the scale according to the reference points entered, and display the calculated scale. Re-enter the *Settings|Digitizer|Reference* option as described above.*

The initial zoom state spans the reference coordinates.

5.10 TOOLS

The Tools menu has three groups of tools:

Tools involved in selecting items:

- Select Object
- Clear Selection
- Invert Selection
- Selection Filter
- Select

Tools involved in modifying items:

- Delete
- Delete Type
- Change
- Change Type
- Move
- Move Point
- Copy
- Rotate
- Explode
- Resize
- Break

Tools involved in providing special operations specifically related to generating the design:

- Cut Lasso
- Trim
- Move Sizes
- Create Wetted Radii
- Create Sprayline Outlets
- Create Symbol
- Convert to Elevations
- Sprayline to Tapes
- Tapes to Spraylines

5.10.1 TOOL TIPS

5.10.1.1 DISTANCE COUNTER – F9

To use a distance counter for any object on the screen, place the cursor over point 1 and press the F9 key to zero the distance counter. Move the cursor to the end of the distance you wish to measure and read the status bar. The distance and angle moved since pressing F9 will be displayed.

Note: This tool does not work in all modes. Will function when in Select Object mode, or when in a Drawing tool mode.

5.10.1.2 SHORTCUT TO CHANGE

Double-clicking on an item when in Select Object mode brings up the change dialog.

5.10.2 SELECT OBJECT

Use this tool to select a single object. Selected items become highlighted in the color specified in the Drawing Settings (green by default).

To select one or more objects:

1. Select *Tools|Select Object*
2. Click on an object to select it.
3. Repeat Step 2 as required.

This option is available on the left-hand tool bar.

To de-select an object, click on it again or use the *Tools|Clear Selection* option which will de-select all selected objects.

See also:

Selection Filter
Select

Section 5.10.5
Section 5.10.6

5.10.3 CLEAR SELECTION

Globally de-selects all currently selected objects. This tool is performed immediately.

To clear a selection:

1. Select *Tools|Clear Selection*

5.10.4 INVERT SELECTION

Selects all objects that have not been selected and de-selects all objects that have been selected.

To invert a selection:

1. Select *Tools|Invert Selection*.

5.10.5 SELECTION FILTER

Use the Selection Filter tool to define a set of selection criteria based on entity type and / or properties. When the filter is on, selection operations capture only those objects meeting all of the filter criteria.

Each setting further defines the properties of the objects to be selected. Only those objects meeting all of the criteria are selected. If you do not want to restrict the selection based on a particular object or property, click <ALL> in that dropdown list.

To use the selection filter:

1. Select *Tools|Selection Filter*
2. Change the object group type, layer, color, line type and line width text boxes to define the selection criteria you want to use
3. Check the Filter box to activate the filter. If this box is unchecked, the filter is inactive and any selections performed are not filtered.
4. Click OK.

The Filter will apply until you uncheck the Filter check box.

5.10.6 SELECT

Use a Select tool to specify which objects a subsequent editing tool acts upon.

The selection operation can be performed as a separate command, prior to choosing an editing tool, or is initiated automatically if you choose an editing tool with no objects pre-selected. However, in the latter case, only one object at a time can be selected to apply the editing command to.

Selected items become highlighted in the color specified in the Drawings Settings (green by default).

5.10.6.1 SELECT LASSO

Selects all objects inside an irregularly shaped boundary.

To select objects inside a lasso:

1. Select *Tools|Select|Lasso*.
2. Place the starting point.
3. Place additional points to create the boundary.
4. Select *Right-Click|Close*, or cross the last line segment over the first corner to stop drawing the boundary.

All objects totally inside the boundary will be selected. This tool is also available from the left-hand tool bar.

See also:

Select

Section 5.10.6

5.10.6.2 SELECT WINDOW

Selects all objects fully enclosed by a user-drawn rectangular selection window.

Note: do not confuse this window with the document or application window as used in Windows products documentation.

To select objects inside a window:

1. Select *Tools|Select|Window*.
2. Click on the screen to place any corner of the window.

3. Drag the cursor and click again to place the opposite corner.
4. All objects totally inside the Window will be selected. This tool is also available from the left-hand tool bar
5. Repeat steps 2 and 3 as required.

See also:

Select

Section 5.10.6

5.10.6.3 SELECT CROSSING

Selects all objects enclosed or intersecting a user-drawn selection window (do not confuse this window with the document or application window as used in Windows products documentation).

To select objects crossing a window:

1. Select *Tools|Select|Crossing*.
2. Click on the screen to place any corner of the window.
3. Drag the cursor and click again to place the opposite corner.
4. All objects partly or totally inside the window will be selected.
5. Repeat steps 2 and 3 as required.

See also:

Select

Section 5.10.6

5.10.6.4 SELECT ALL

This tool allows you to select everything in the design.

To select all objects in a design:

1. Select *Tools|Select|All*.

See also:

Select

Section 5.10.6

5.10.6.5 SELECT ADJOINING

Selects a series of objects that share end points. Used to select continuous lines or polygons that have been exploded (see *Tools|Explode*, Section 5.10.15), or any other chain of objects that have end points in common. To select the connected objects, IRRICAD starts

at the object you click, and checks in both directions for adjoining objects.

To select adjoining objects:

1. Select *Tools|Select|Adjoining*.
2. Click on an object joining another object or objects.

See also:

Select

Section 5.10.6

5.10.6.6 SELECT SCREEN

This option allows you to select all objects totally or partially visible on the screen.

To select all objects on the screen:

1. Select *Tools|Select|Screen*.

See also:

Select

Section 5.10.6

5.10.6.7 SELECT LAST

Reselects the objects that were selected before the last editing operation, or before the last selection set was cleared with the Clear Selection tool.

To reselect the last selection:

1. Select *Tools|Select|Last*.

See also:

Select

Section 5.10.6

5.10.7 DELETE

Use the Delete tool to delete unwanted objects.

To delete objects:

1. Select *Tools|Delete*.
2. Click on an object to delete it.
3. Repeat step 2 as required.

Tip: *Delete is reversible. To restore the last item or selection that has been erased, select Edit|Undo.*

5.10.8 DELETE TYPE

This tool is used to delete selected objects of the same type and with the same properties. You determine the criteria for which objects are deleted. For example, you can delete all ¾" PVC pipes or all red lines or all outlets with a wetted radius of 30ft (m) in the Zone 1 layer.

To delete objects by type:

1. Select the objects (see Select ,Section 5.10.6).
2. Select *Tools|Delete Type*.
3. Click on an object which is representative of those to be deleted.
4. A dialog will appear listing properties for that type of object. Check those properties of the object you want matched for deletion.

Only selected objects of the same type as the representative object and matching the representative object on the checked properties will be deleted.

See also:

Match / Change Dialog

Section 2.4.3.5

5.10.9 CHANGE

This tool is used to change the properties of an object.

To change objects:

1. Select *Tools|Change*.
2. Select the object to change.
3. Change the properties in the dialog as required. Click OK.
4. Repeat steps 2 and 3 as required.

5.10.9.1 SHOW FITTINGS

When this button is clicked, another dialog will show the fittings selected for the items connecting at this junction, after running Computer Selection of Fittings. The dialog will also show where problems have occurred in selecting items to solve the junction.

- The Hide Fittings button will close the dialog and return to the Junctions dialog.
- The Delete button will delete any item on the fittings list which has been highlighted.
- The Add button will add any item from the database that you require at the junction. To select an item, highlight it and click the Select button. The item will be added to the list of selected items (alternatively, click on the gray box to the left of the item description as this automatically selects the item). Select all the items required by clicking on the component groups and selecting items. Click Close when finished.
- The Replace button will replace any highlighted fittings item with one that is selected from the pop-up database. To replace an item highlight it and click the Select button. The item will be added to the list of selected items (alternatively, click on the gray box to the left of the item description as this automatically selects the item). Click Close when finished.

To change the quantity of fittings items, click in the Quantity column and type in the required number. Unwanted items or items mistakenly added from Add or Replace can be deleted by highlighting and clicking the Delete button.

See also:

Manually Adjusting Fittings

Section 2.6.5.2

5.10.10 CHANGE TYPE

This tool is used to change selected objects of the same type and with the same properties. You determine the criteria for which objects are changed and how they are changed. For example, you can change all $\frac{3}{4}$ " PVC pipes to $\frac{1}{2}$ " PVC pipes or all red lines to blue.

To change objects by type:

1. Select the objects (see Select, Section 5.10.6).

2. Select *Tools|Change Type*.
3. Click on an object which is representative of those to be changed.
4. The same dialog as for changing an individual object of that type will appear. Change the properties in the dialog box as required. Fittings can also be changed as required (see Show Fittings, Section 5.10.9.1). Click OK.
5. A dialog will appear listing properties for that type of object. Check those properties of the object you want matched and those you want changed.
6. Only selected objects of the same type as the representative object and matching the representative object on the checked properties will be changed. Also only the checked properties of the matched object will be changed to new values.
7. Repeat steps 3 to 5 as required.

See also:

Match / Change Dialog

Section 2.4.3.5

5.10.11 MOVE

Use the Move tool to change the location of selected objects without changing the orientation or size.

To move an object:

1. Select *Tools|Move*.
2. Select the object to move.
3. Place a reference point that will define where the object will be moved from.
4. Place a point to define where the object will be moved to.
5. Repeat steps 2 to 4 as required.

If a single point hydraulic object (e.g. outlet or junction) is selected then step 3 is omitted; the reference point is automatically taken to be the center of the symbol.

If a single point hydraulic object is connected to another non-selected line hydraulic object (e.g. a junction on the end of a pipe), the line hydraulic object will Stretch to maintain the connection when the point hydraulic object is moved. If a line hydraulic object is selected then all point hydraulic connections are automatically selected and moved also.

Some objects like Continuous Line are treated as a single object and a segment cannot be moved on its own, unless the object is first exploded. To move a group of objects reverse Steps 1 and 2 above i.e. select the objects first, then the move tool.

5.10.12 MOVE POINT

Use the Move Point tool to reshape or resize objects by moving definition points.

To move a point of an object:

1. Select *Tools|Move Point*.
2. Select the object to apply the tool to.
3. Place a reference point that will define where the selection will be moved from.

After the reference point is placed, the selected object with a definition point at the location defined in step 3 will drag with the cursor to provide a dynamic preview of the object after modification.

4. Click to set the point in the new location.

The point you selected is moved to the new location, and the form or size of the selected object is updated.

5. Repeat steps 2 to 4 as required.

Steps 1 and 2 may be reversed but the tool can then only be applied once.

5.10.13 COPY

Use the Copy tools to duplicate objects already in the design. Only the Multiple Copy tool can be used to duplicate connected hydraulic objects.

See also:

<i>Linear Copy</i>	<i>Section 5.10.13.1</i>
<i>Radial Copy</i>	<i>Section 5.10.13.2</i>
<i>Array Copy</i>	<i>Section 5.10.13.3</i>
<i>Multiple Copy</i>	<i>Section 5.10.13.4</i>

5.10.13.1 LINEAR COPY

Use the Linear Copy tool to duplicate objects already in the design. You can make multiple copies arranged in a line; each item in the series is placed at the same user-defined offset from the previous item.

Note: This tool cannot be used for connected hydraulic objects.

To make linear copies of an objects:

1. Select *Tools|Copy|Linear*.
2. Select the object to copy.
3. Enter the number of copies required and click OK.
4. Place a point to define the starting point for the relative offset of each copy.

The distance and angle from this point to the next point will be used as the offset distance and direction for each new copy relative to the previous. Neither point has to actually be on, or even near the objects being copied. After this point is placed, a rubber band will display between the first point and the cursor location. This line previews the offset vector. In addition, a bounding box will appear for each copy that you specified, each placed at the relative offset defined by the rubber band line. The location and spacing of these bounding boxes provides a dynamic preview of where the copies will be placed.

5. Place a point to define the ending point for the relative offset.
6. Repeat Steps 2 to 5 as required.

To copy a group of objects reverse Steps 1 and 2 above i.e. select the objects first then the linear copy tool.

See also:

Copy

Section 5.10.13

5.10.13.2 RADIAL COPY

Use the Radial Copy tool to create copies in a radial pattern, such as spokes around the hub of a wheel. This type of tool is sometimes called a radial or circular array.

Note: This tool cannot be used for connected hydraulic objects.

To make radial copies of an object:

1. Select *Tools|Copy|Radial*.
2. Select the object to copy.
3. Enter the number of copies required and the span angle (the angle spanned by the array of copies) then click OK.

A dynamic preview will appear, showing the copies in the correct relationship to the originally selected object(s) and the cursor. The copies are shown as bounding boxes radiating around the cursor, which represents the center of the array.

4. Place a point to set the center of the array.

The copies will be placed around the center point, with the copies spanning the specified angle. Each copy will be the same distance away from the center point, with the original selection at the beginning of the angular span, and the last copy at the end of the angular span.

5. Repeat Steps 2 to 4 as required.

Tip: In addition, a span of 360° is treated as a special case. Normally, the last copy is placed at the end of the specified span angle; however, in the case of 360°, this would cause the last copy to be placed directly on top of the original selection. Normally, when you specify a span of 360°, you want the original and all copies to be uniformly spaced around a full circle. IRRICAD does this by not placing the last copy when the span angle is exactly 360°.

To copy a group of objects reverse Steps 1 and 2 above i.e. select the objects first then the radial copy tool.

See also:

Copy

Section 5.10.13

5.10.13.3 ARRAY COPY

With the Array Copy tool, you create a grid of copies of an object. For example, you could easily draw rows of trees or shrubs in a landscaping plan, a column grid in a structural drawing, or a block of seats in a theatre, etc. The grid need not be rectangular; it can be oriented in any direction and shaped like any parallelogram.

Note: This tool cannot be used for connected hydraulic objects.

To make an array of copies of an object:

1. Select *Tools|Copy|Array*.
2. Select the object to copy.
3. Enter the number of copies (number of grid columns excluding the original selection) and the number of grid rows then click OK.
4. Place a point to define the starting point for the first relative offset vector.

The distance and angle from this point to the next point will be used as the offset distance and direction from copy to copy in the first row. Neither point has to actually be on or even near the objects being copied.

5. Place a point to define the ending point for the first relative offset vector.

The first row of copies will be placed at the first relative offset. A second rubber band line will appear, tethered to the starting point of the first vector. A bounding box will appear for each copy that you specified for the array, with the spacing between rows determined by the relative offset defined by the second rubber band line.

6. Place a point to set the endpoint for the vector that determines the spacing between the row of copies.

The specified number of rows of copies will be placed, with the row-to-row spacing determined by the second offset vector.

7. Repeat Steps 2 to 6 as required.

To copy a group of objects reverse Steps 1 and 2 above i.e. select the objects first then the array copy tool.

See also:

Copy

Section 5.10.13

5.10.13.4 MULTIPLE COPY

Use this tool to make multiple copies of objects at user defined points within the design.

To make multiple copies of an object:

1. Select *Tools|Copy|Multiple*.
2. Select the object to copy.
3. Click to define a reference point on the object.

An image of the object now follows your cursor around the drawing area.

4. Click to place a duplicate object.
5. Repeat Step 4 as required.
6. Press the Escape key to end the tool or select *Right-Click|Restart*.
7. Repeat Steps 2 to 6 as required.

To copy a group of objects reverse Steps 1 and 2 above i.e. select the objects first then the multiple copy tool.

Note: You can use this copy tool on hydraulic items.

See also:

Copy

Section 5.10.13

5.10.14 ROTATE

Use the Rotate tool to rotate a selection around an axis.

To rotate a selection:

1. Select *Tools|Rotate*.
2. Select the object to be rotated.
3. Place a point to serve as the center of rotation.

The selection will rotate as the cursor moves around the axis point.

4. Place a point when the object is rotated to the correct orientation.
5. Repeat steps 2 to 4 as required.

If a single point hydraulic item (e.g. an outlet) is selected then step 3 is omitted; the reference point is automatically taken to be the center of the symbol.

Some objects like continuous line are treated as a single object and a segment cannot be rotated on its own unless the object is first exploded.

To rotate a group of objects reverse Steps 1 and 2 above i.e. select the objects first then the rotate tool.

5.10.15 EXPLODE

The Explode tool is normally used when you want to individually edit an object contained within a compound object. For example, to change the color of a single segment within a continuous line, you must first explode the continuous line.

To explode an object:

1. Select *Tools|Explode*.
2. Select the object to be exploded.
3. Repeat Step as required.

Compound objects within the selection will be exploded to the next lower level.

Tip: Continuous lines, rectangles, regular and irregular polygons, continuous Bezier curves, symbols, dimensions, fills, and hatch patterns can be exploded. Single lines, arcs, circles, ellipses, elliptical arcs, single Bezier curves, spline curves and text are basic objects which cannot be reduced further.

The results of the explode tool depend on the object being exploded. An object may contain other objects requiring more than one exploding operation to reduce it to its elemental parts. The following list demonstrates the results when the object is exploded:

- Continuous lines, rectangles and regular and irregular polygons become single lines.
- Continuous Bezier curves become single Bezier curves.
- Symbols become the collection of objects that were used to create them, including other symbols when appropriate.
- Dimensions become lines, fills and text blocks.
- Hatch patterns become individual lines.

5.10.16 RESIZE

Use the Resize tool to rescale or change the size of an object.

To resize an object:

1. Select *Tools|Resize*.
2. Enter the scale. Numbers between 0 and 1 will make the object smaller. Numbers greater than 1 will make the object larger. Select the reference point required. This is the point about which an object is scaled. If Specify Coordinates is selected then enter the required coordinates. Click OK.
3. Select the object to be resized.
4. Repeat Step 3 and 4 as required.

To resize a group of objects select the objects first then the resize tool. Note that in this case, the scale and reference point refer to the extents of the selected objects.

5.10.17 BREAK

Use the Break command when you want to create a gap in an object. For example, you may want to create an opening in a wall or trim where two objects intersect. The break tool can only be used on geometric objects not on hydraulic objects.

To create a break in an object:

1. Select *Tools|Break*.
2. Select the object to break.
3. Place a point at or near where you want the break to begin.

This point need not be exactly on the object; the break will start at the point closest to the point you place. A dynamic preview of the break appears, shadowing the cursor movement.

4. Place a point at or near where you want the break to end.
5. Repeat Steps 2 to 4 as required.

Tip: To trim a line place the first point on the line where you want to trim from and the second point beyond the line end. To break an object without creating a gap click twice in the same place.

Note: You cannot use the break tool on a group of objects.

5.10.18 CUT LASSO

Cut lasso is used to make changes to sprayline or zone pipe size and / or type, when you require the change to apply to only parts of the existing pipes, rather than complete pipes. It also can be used to delete all pipes, including parts of pipes, within the boundaries of the lasso. It differs from the ordinary change and delete tools, which will only change or delete a pipe if it is entirely within the boundary.

To use Cut Lasso:

1. Select *Tools|Cut Lasso*.
2. Draw the lasso, selecting *Right-Click|Close* after placing at least three points, or crossing the last point over the first, making sure the lasso boundary cuts the pipe in the required place.
3. Change the junction properties of the new junctions if required and select the type of cut lasso. Click OK.

5.10.18.1 ACTION:

Cut Only:	Cuts pipe at the intersection of the pipe and the lasso, inserting a junction at this spot.
Cut and Change:	Cuts pipe then invokes the Change Type tool on pipes inside the lasso. (Click on one of the pipes to be changed to bring up the Change Type dialog).
Cut and Delete:	Cuts pipes then invokes the Delete Tool on pipes inside the lasso.

4. Repeat steps 1 and 2 as required.

5.10.19 TRIM

This tool is used to trim connected spraylines back to the last emitter on the sprayline. It does not work on unconnected spraylines.

When the Trim lasso is closed, all connected sprayline ends inside the lasso will be trimmed to the nearest emitter provided the end of the sprayline is not connected to other objects such as submain pipes, other spraylines or extra outlets.

To trim one end of a sprayline, lasso that end. If both ends are to be trimmed in one operation, then the entire sprayline must be inside the

lasso. Note that if the starting end of a sprayline is trimmed, the offset is set to zero.

To trim spraylines:

1. Select *Tools|Trim*.
2. Lasso the sprayline ends to be trimmed.
3. Repeat step 2 as required.

5.10.20 MOVE SIZES

In most situations, the points at which laterals change size in blocks with telescoping laterals can greatly vary in a block, making installation difficult. It is sometimes desirable to square things up so that the position of lateral size changes is more uniform. The Move Sizes tool is provided for this purpose.

To move sizes:

1. Select *Tools|Move Sizes*.
2. Draw a line through the telescoping laterals at a point where you wish the change of size to be. This line can be continued to consist of a number of segments.
3. Finish the line by selecting *Right-Click|Done*.
4. Check the Nearest Outlet box if you want the size change to take place at the outlet closest to the line. Leave it unchecked if you want the size change to be at the point the line crosses the laterals.
5. Select the lateral size to be moved to the new change size position.

Close:	The junction closest to the line will be moved to the line.
Small:	The smaller pipe will be moved to the line.
Large:	The larger pipe size will be moved to the line.

6. Click OK.
7. Repeat steps 2 to 6 as required.

5.10.21 CREATE WETTED RADII

Use this tool to create wetted radius arcs on outlets that do not already have them.

When an outlet is placed in the design, whether or not a wetted radius arc is created for it is controlled by the Create Wetted Radii check box in

the *Irrigation – Design Specific* option (*Settings|Irrigation – Design Specific*).

To create wetted radii:

1. Select *Tools|Create Wetted Radii*.
2. Click on an outlet to select it. A wetted radius arc will be created for that outlet.
3. Repeat Step 2 as required.

Tip: To quickly show or hide all wetted radii in the default layer, use *View|Wetted Radii*. To create wetted radii on a sprayline, you do not need to create sprayline outlets first. However, to view the wetted radii on the sprayline you must turn on the *SL_WETTED_RADII* layer in *Settings|Layers*.

5.10.22 CREATE SPRAYLINE OUTLETS

Use this tool to create outlet symbols on connected spraylines that do not already have them.

When a connected sprayline is placed in the design, whether or not outlet symbols are created for the connected sprayline is controlled by the *Create Sprayline Outlets* check box in the *Irrigation – Design Specific* option (*Settings|Irrigation – Design Specific*).

To create sprayline outlets:

1. Select *Tools|Create Sprayline Outlets*.
2. Click on a sprayline to select it. Outlet symbols will be created for that sprayline.
3. Repeat step 2 as required.

To quickly show or hide all sprayline outlets in the default layer use *View|Sprayline Outlets*.

5.10.23 CREATE SYMBOL

Use the *Create Symbol* tool to create a symbol made up of existing objects, which may then be placed repeatedly in the design (rotated and re-scaled as required) or saved to disk for future use.

To create a symbol:

1. Select the objects that make up the symbol.
2. Select *Tools|Create Symbol*.
3. Type the name of the symbol in the text box – do not exceed 32 characters.
4. Select Drawing or Database
5. Browse for the folder you wish to save the symbol in if it is different than the default database folder currently showing. Click OK.

The default folders for drawing or database symbols are specified in *Settings|Drawing Items* - Drawing Symbols Path, and *Settings|Irrigation Items* – Database Symbols Path respectively. These symbols may be accessed through *Draw|Symbol*. If you wish to use a database symbol as a drawing symbol browse for the folder where the database symbols are stored.

Replace Original with Symbol: Check this box to replace the objects on the screen that make up the symbol with the created symbol. Note that if the symbol contains hydraulic items these items will lose all hydraulic significance and become one geometric item (the symbol).

5.10.24 CONVERT TO ELEVATIONS

Use this tool to convert lines, polylines and curves to contours, and points and symbols to spot heights.

To convert to elevations:

1. Select *Tools|Convert to Elevations*.
2. Select the object to be converted.
3. Change the drawing properties if required and enter the height. Click OK.
4. Repeat Steps 2 and 3 as required.

Note: *If a symbol is converted to an elevation, it is replaced by the spot height symbol (+).*

If you select a line segment the IRRICAD will find all connected line segments and create a single contour.

To convert a group of objects to elevations with the same height reverse Steps 1 and 2 above i.e. select the objects first then the convert to elevations tool.

5.10.25 SPRAYLINES TO TAPES

This tool is used to change a group or block of spraylines to tapes. You can use it to change spraylines back to tapes after flushing analysis or when you want to try another option for designing a block.

To change spraylines to tapes:

1. Select the spraylines to be changed.
2. Select *Tools|Spraylines To Tapes*.
3. In the tape dialog, select the required tape and enter any other values required. Click OK.

See also:

Tapes to Spraylines
Tape

Section 5.10.26
Section 5.6.8

5.10.26 TAPES TO SPRAYLINES

This tool is used to change a group or block of tapes to spraylines. You can use it when you want to analyze the tapes under flushing which requires you to simulate the tapes using spraylines. You can also use it when you want to try another option for designing a block.

To change tapes to spraylines:

1. Select the tapes to be changed.
2. Select *Tools|Tapes To Spraylines*.
3. In the sprayline dialog, select the required lateral pipe, sprinkler, nozzle and riser and enter any other values required. Click OK.

Note: *Only connected spraylines are allowed and the offset must be no larger than the spacing.*

See also:

Spraylines to Tapes
Sprayline

Section 5.10.25
Section 5.6.7

5.11 DESIGN

The Design menu includes settings and commands involved in the hydraulic design process.

The Design menu contains the following commands:

- Design Parameters
- Check Outlet Connectivity
- Zone Operating Times
- Water Supply Times
- Assign System Flows to Zones
- Assign All Zones to One System Flow
- Assign Each Zone to a Unique System Flow
- Re-interpolate Elevations
- Zone Design
- Valve Analysis
- Mainline Design
- Zone Design Configuration
- Computer Selection of Fittings
- Riser Selection Rules
- Pipe Fitting Matching Table

5.11.1 DESIGN PARAMETERS

These parameters influence the design process. The design parameters are in three sections accessible from tabs in the Dialog

Hydraulic Parameters: Hydraulic constraints.

Economic Parameters: Values used in the capital versus running costs trade-off.

Analysis Parameters: Internal mathematical tolerances used in the design engine.

To set design parameters:

1. Select *Design|Design Parameters*.
2. Make any changes required.
3. The Save as Defaults button saves the new values as default values for all subsequent designs. The Restore Defaults button sets all the parameters to the currently saved default values.
4. Click OK.

5.11.1.1 HYDRAULIC PARAMETERS

MAXIMUM ZONE PIPE VELOCITY

The maximum fluid velocity used in the computer selection of zone pipe diameters by the Velocity method. Zone pipes are pipes downstream from a control valve. The LP Design method checks actual velocities against this value and warns if it is exceeded but it does not form an absolute constraint.

MAXIMUM MAINLINE PIPE VELOCITY

The maximum fluid velocity used in the computer selection of mainline pipe diameters by the Velocity method. Mainline pipes are pipes upstream from a control valve. The LP Design method checks actual velocities against this value and warns if it is exceeded but it does not form an absolute constraint.

MINIMUM LATERAL LENGTH

If laterals shorter than the specified length arise during the placement of laterals they will be discarded. This helps to avoid possible problem occurring during Zone Design and helps to avoid placing unrealistic lateral lengths accidentally.

5.11.1.2 ECONOMIC PARAMETERS:

DEFAULT PUMP EFFICIENCY, POWER COST, OPERATING HOURS PER YEAR

These are used to determine the annual operating cost of zones and mainline so that pumping costs can be taken into account.

DEFAULT INTEREST RATE, ECONOMIC TERM

These are used to determine the annual capital cost of pipe by calculating and applying a capital recovery factor.

CYCLE TIME

The maximum time in days that the irrigation system is likely to require to complete an irrigation cycle. Its main purpose is to check that any operating times entered in the management dialogs fall within the cycle. The allowable range is 1-21 days.

DEFAULT PRICING TYPE

The method for calculating the prices of components used for Bill of Materials Reports.

Wholesale:	Prices for materials and components will be based on wholesale cost as listed in the database.
Retail:	Prices for materials and components will be based on retail prices as listed in the database.
Multiplier:	Prices for materials and components will be calculated from a base price (either the wholesale or retail price in the database) multiplied by up to a maximum of four factors or multipliers.

See also:

Supplier Code Multipliers

Section 5.12.9

MARGIN OR DISCOUNT

A modifier that can be applied to the prices of components calculated using the default pricing type. If the default pricing type is Wholesale then the percentage entered will be added as a margin to the wholesale price otherwise it will be subtracted as a discount from the component price.

5.11.1.3 ANALYSIS PARAMETERS

These parameters should not be changed under normal circumstances.

TOLERANCES

Tape Calculation:	Pressure tolerance used to check convergence, i.e. to decide when the iterations have finished when doing tape calculations.
LP Convergence:	A tolerance used to determine when LP has a close enough solution.
Detailed Analysis Flow Close Fraction:	Determines how accurate the final emitter flows are – the smaller the value, the more accurate the flows. A value of 0.001 gives flows to 0.1%.

ITERATIONS

Maximum for Detailed Analysis: The maximum number of iterations allowed to achieve a solution during Detailed Analysis. You can increase this number, if required; however, this will not guarantee that the solution will converge.

Maximum for Velocity & LP: The maximum number of iterations allowed to achieve a solution during computer pipe sizing.

CONVERGENCE RATIOS

Detailed Analysis Factor: The default value is 0.75 and in normal circumstances this should not be changed. Valid values are however between 0.0 (fastest) and 0.99 (slowest), using a smaller factor may mean some systems will not converge at all.

Mainline Analysis Factor: Do not change this under any circumstances unless specifically told to by your technical support person. The default is 0.001.

MISCELLANEOUS

Maximum Contours for Interpolation: The maximum number of contour segments near a point used when evaluating its height. This number should be between 10 and 500. The default is 50.

Number of Virtual Emitters for Tape Calculations: The maximum number of virtual emitters used in the new tape calculations. The smaller the number, the faster but less accurate the calculations. A value of 200 barely affects the flows and headlosses and is reasonably quick. IRRICAD uses the physical number of emitters on the tape if there are less than this number.

Delay Time for information warnings: Information warnings, which appear during design, will stay on the screen for the length of time set here. If you do not wish to get such messages, set the Delay Time.. option to zero. Note the units are in milliseconds, i.e. 2500 equals 2.5 seconds.

5.11.2 CHECK OUTLET CONNECTIVITY

A check is made to ensure that all outlets are connected through the pipe system to a zone control valve and that all zone control valves are connected to a water supply. If an outlet or a zone control valve is not connected, a warning giving the coordinates of the outlet or valve is displayed on the screen.

Note: This check is optional but it is recommended that you use it immediately after entering the irrigation system on the screen and after making any significant changes to the layout.

To check your design for unconnected items:

1. Select *Design|Check Outlet Connectivity*.

IRRICAD will check that all hydraulic items in the design are connected.

If there are any unconnected items, a warning message will tell you the coordinates of the item(s).

5.11.3 ZONE OPERATING TIMES

To specify operating times:

1. Select *Design|Zone Operating Times*.
2. Enter up to 3 On and Off times for each zone valve. The times for any zone may overlap or be the same as times for other zones.
3. Click OK.

Use the scroll bar or the arrow keys to move up and down the screen.

5.11.4 WATER SUPPLY TIMES

This table will allow you to enter and designate On times and Off times for the water supply.

The water supply can be specified as being available at specific times during the irrigation cycle time.

Examples of where this may occur are:

- Where the water supply may be turned off for weekends, or
- Where irrigation cannot take place during certain hours of the day.

Up to 10 start and stop times for each water supply can be specified.

Where the Assign System Flow... options are used, multiple water supplies can be designated to operate on certain system flows or groups of zones. If Zone Operating Times are used, Water Supply Times must be entered if more than one water supply is present. This ensures that the resulting system flows from overlapping operating times will have the information required to know which water supply they are running on.

5.11.5 ASSIGN SYSTEM FLOWS TO ZONES

This method of entering zone management information allows the designer to choose the number of system flows (stations) and their operating times, and then to select which of these system flows each zone will operate on. It is the preferred option for larger systems where valve grouping rather than actual valve start and stop times are important.

Allocate times to the system flows and designate which zones will operate on which system flows.

Times allocated to system flows must not overlap otherwise a warning will be issued requesting the data to be corrected. Likewise, the times must not violate the irrigation cycle time (as set in *Design|Design Parameters|Economic Parameters*) and the water supply availability (if used).

For systems with two or more water supplies, each supply can be assigned to any or all of the system flows. This means you can control which water supply will supply each valve. If there is only one water supply, the supply is not mentioned as all system flows operate on the one water supply.

To assign system flows to zones:

1. Select *Design|Assign System Flows To Zones*.

2. Enter the number of system flows and the on / off times for each system flow. Allocate the system flows to the water supplies and zones. More than one zone can operate on a system flow.
3. Click OK.

Tip: This method can also be used for partial management.

If you increase or decrease the number of system flows, you may need to click on the screen, for this change to take place.

The default On / Off times are set for one hour, one hour apart. You can change the On / Off times if the actual starting and stopping times are important.

If more than one water supply is present, it is still necessary to allocate which system flow will operate on which water supply.

See also:

<i>Assign All Zones to One System Flow</i>	<i>Section 5.11.6</i>
<i>Assign Each Zone to a Unique System Flow</i>	<i>Section 5.11.7</i>
<i>Partial Management</i>	<i>Section 2.6.2</i>

5.11.6 ASSIGN ALL ZONES TO ONE SYSTEM FLOW

This method of entering zone management information saves time by automatically assigning all zones in the design to one system flow, operating all zones at one time.

To assign all zones to one system flow:

1. Select *Design|Assign All Zones To One System Flow*.
2. Make any changes required in the dialog.
3. Click OK.

The default On / Off times are set for one hour, one hour apart. You can change the On / Off times if the actual starting and stopping times are important.

See also:

<i>Assign System Flows to Zones</i>	<i>Section 5.11.5</i>
<i>Assign Each Zone to a Unique System Flow</i>	<i>Section 5.11.7</i>
<i>Partial Management</i>	<i>Section 2.6.2</i>

5.11.7 ASSIGN EACH ZONE TO A UNIQUE SYSTEM FLOW

This method of entering zone management information saves time by automatically assigning each zone in the design to a unique system flow, operating the zones sequentially.

To assign each zone to a unique system flow:

1. Select *Design\Assign Each Zone to a Unique System Flow*.
2. Make any changes required in the dialog.
3. Click OK

The default On / Off times are set for one hour, one hour apart. You can change the On / Off times if the actual starting and stopping times are important.

If more than one water supply is present, it is still necessary to allocate which system flow will operate on which water supply.

Note: *If the number of zones exceeds 23, and the cycle time is 1 day, a warning message will occur. To fix this, you can either allocate less than 1 hour to each system flow, or increase the cycle time in Design\DesignParameters\Economic Parameters.*

See also:

<i>Assign System Flows to Zones</i>	<i>Section 5.11.5</i>
<i>Assign All Zones to One System Flow</i>	<i>Section 5.11.6</i>
<i>Partial Management</i>	<i>Section 2.6.2</i>

5.11.8 RE-INTERPOLATE ELEVATIONS

This option is used to tell IRRICAD to completely re-interpolate elevations for all irrigation components in the design, regardless of whether elevations had been previously interpolated.

This tool should only be used if changes to contours or spot heights have been made during the course of the design causing the elevation of objects already included in the design to change.

It is not necessary to select this option for a new design, as elevation will be automatically calculated for all objects. For subsequent runs of design, elevations for new objects that have been added will also be automatically calculated. Elevations for objects, which previously had

elevations calculated, would not have elevations recalculated unless Re-interpolate Elevations is first selected.

The elevation interpolation is automatically performed when Zone Design is selected, or when Mainline Design is selected if it had not previously been completed in Zone Design.

To Re-interpolate Elevations:

1. Select *Design|Re-interpolate Elevations*.
2. Wait until the process has finished.

5.11.9 ZONE AND MAINLINE DESIGN

To design your system, you have four options:

Analyze Existing Sizes – Calculate flows and pressures when the designer has manually specified zone or mainline pipe sizes or IRRICAD has previously sized Computer Sized pipes.

LP Design – A method that attempts to select pipe diameters so that the required pressures of the zone outlets or control valves are met.

Velocity Design – A method that attempts to select pipe diameters based on the flow and velocity in the pipes.

Detailed Analysis – An iterative process to exactly match the flow of an outlet or control valve to the pressure at that point. Used after all the pipes have been sized and a valve pressure has been specified in Zone Design Configuration (*Design|Zone Design Configuration*), or after a water supply pressure has been specified in the water supply dialog.

Prior to designing the zones, complete a connectivity check and specify in the zone configuration table which and how zones are designed.

See also:

<i>Analyze (Existing Sizes)</i>	<i>Section 5.11.9.1</i>
<i>LP Design</i>	<i>Section 5.11.9.2</i>
<i>Velocity Design</i>	<i>Section 5.11.9.3</i>
<i>Detailed Analysis</i>	<i>Section 5.11.9.4</i>

5.11.9.1 ANALYZE (EXISTING SIZES)

This option can be used where the designer has manually specified pipe sizes, or has previously sized Computer Sized Pipes by running LP Design or Velocity Design.

To analyze existing sizes:

1. Select *Design|Zone Design|Analyse* or *Design|Mainline Design|Analyse*.
2. IRRICAD will analyze your design.

See also:

Zone and Mainline Design
Valve Analysis

Section 5.11.9
Section 5.11.10

5.11.9.2 LP DESIGN

LP (Linear Programming) is a method that attempts to select pipe diameters so that the required pressures of the zone outlets are met.

To size pipes using LP Design:

1. Select *Design|Zone Design|LP Design* or *Design|Mainline Design|LP Design*.
2. IRRICAD will attempt to size any Computer Sized pipes in your design.

Note: *LP sizing can not be used for looped systems or for mainline design in systems with multiple water supplies.*

See also:

Zone and Mainline Design
Valve Analysis

Section 5.11.9
Section 5.11.10

5.11.9.3 VELOCITY DESIGN

This method of computer sizing is based on the velocity of flow in pipes. For a given flow in a pipe the smallest diameter is selected so that the maximum velocity for pipes (specified in Design Parameters) is not exceeded.

To size pipes using Velocity Design:

1. Select *Design|Zone Design|Velocity Design* or *Design|Mainline Design|Velocity Design*.
2. IRRICAD will size any Computer Sized pipes in the design.

If sizing pipes in a ringmain system, Velocity Design must be used.

See also:

Zone and Mainline Design
Valve Analysis

Section 5.11.9
Section 5.11.10

5.11.9.4 DETAILED ANALYSIS

Detailed analysis uses an iterative process to exactly match the flow of an emitter or sprayline or control valve to the pressure at that point and therefore allows a designer to more accurately gauge how a system would perform in practice. Use detailed analysis if you have manually sized the pipes, or after sizing the pipes using LP Design or Velocity Design.

To design using Detailed Analysis:

1. Specify a valve pressure for each zone in *Design|Zone Design Configuration*, or for Mainline analysis, specify a pressure at the water supply.
2. Select *Design|Zone Design|Detailed Analysis* or *Design|Mainline Design|Detailed Analysis*.
3. IRRICAD will analyze your system.

See also:

Zone and Mainline Design
Valve Analysis

Section 5.11.9
Section 5.11.10

5.11.10 VALVE ANALYSIS

IRRICAD calculates the pressure loss through the valves based on the pressure / flow relationship defined in the valve component group of the database.

To analyze the control valves:

1. Select *Design|Valve Analysis*. IRRICAD will analyze control valves.

To see the results of the analysis, display *Reports|Design Reports|Zone Summary* report – pressure loss through the valve and downstream pressure.

Valve Analysis must be run before designing the Mainline.

5.11.11 ZONE DESIGN CONFIGURATION

This table allows the user to select zones to be sized or analyzed and to specify the number of lateral and submain sizes to be used in computer sizing. Selection of zones to be sized or analyzed is particularly useful where the majority of zones in a design are successfully completed and one or two zones only need to be modified and reanalyzed as reanalysis of all the zones is not required. It also allows progressive or staged design where the basic design parameters of some blocks (e.g. lateral pipe types) may be different.

To specify the Zone Design Configuration:

1. Select *Design|Zone Design Configuration*.
2. Change the settings for any zone as required.
3. Click OK.

Process:	Check this box if the named zone is to be processed (analyzed or have pipes computer selected).
Allow for Minor Losses:	Check this box if minor losses should be included when processing the zone. Note that for tape blocks, minor losses are not included.
Change Diameter at Outlet:	Check this box if you want pipe size changes in spraylines with telescoping diameters to take place at sprinkler locations. Leave unchecked for the size change to take place at the position calculated by IRRICAD.
Number of Lateral Sizes:	The maximum number of pipe sizes that can be used during computer selection of pipe sizes for each lateral. The options are 1, 2 or 3.

Number of Submain Sizes: The maximum number of pipe sizes that can be used during computer selection of pipe diameters for submain pipes (non-laterals). The options are 1-9, with 0 (the default) being used to indicate no restriction.

Valve Pressure: Pressure on the downstream of the control valve. If LP Design is used, IRRICAD treats this pressure as a maximum allowable pressure and may calculate a lower value if it is necessary or more economical to do so. If Velocity Design, Detailed Analysis or Analyse is used, IRRICAD fixes the downstream control valve pressure at the specified value.

If you want IRRICAD to calculate the required valve pressure, leave this at the default value of zero.

5.11.12 COMPUTER SELECTION OF FITTINGS

When this option is selected, IRRICAD refers to the databases and chooses the fittings required to connect the pipes and components, which have been previously selected. Before any fitting selection takes place, junctions that should not require any fittings (such as when two straight pipes are joined together) are removed.

To computer select fittings:

1. Select *Design|Computer Selection of Fittings*.
2. IRRICAD will automatically select the required fittings at each junction.
3. Refer to the Bill of Materials reports for any fitting selection errors.

See also

IRRICAD Selecting Fittings for the Design *Section 2.6.5*

5.11.13 RISER SELECTION RULES

When entering hydraulic components into a design, depths can be specified for spraylines, zone and mainline pipes, control valves and miscellaneous hydraulic items.

To over ride the default riser selection rules, select the selection rules for the specified depths or select a riser pipe to be used.

To edit the Riser Rules:

1. Select *Design|Riser Selection Rules*
2. Edit the dialog as required.
3. Click OK.

Depth 1:	The higher of the two depths.
Depth 2:	The lower of the two depths.
Riser:	Select Rule or User. If Rule is selected, specify the Rule in the Size and Type fields. If User is selected specify the pipe to be used in the Riser Description field.
Size:	Specifies if the size of the riser is to match the top pipe or the bottom pipe size
Type:	Specifies if the pipe type of the riser is to match the top pipe or the bottom pipe type.
Riser Description:	Selects a pipe from the database to be used as the riser.

See also:

Entering Items at Different Levels

Section 2.4.2.3

5.11.14 PIPE FITTING MATCHING TABLE

This table is very important in that it sets out which fittings can be used with which pipes. This information then governs the selection of fittings for all junctions and hence the cost.

To edit the Pipe Fitting Matching Table:

1. Select *Design|Pipe Fitting Matching Table*.
2. Make any changes required. Use the Insert and Remove buttons to add rows to and remove rows from the table.
3. Click OK.

Pipe Type:	A code that defines the material and construction of the pipe. The codes from this table provide the dropdown list used when entering pipe data in the database editor. If you wish to add a new pipe type to the database,

	you must first enter it into this table. This code can not contain more than 4 characters.
Connection Gender:	The gender of the pipe connection. Note that all pipes are assumed to have only one connection gender and pipes that actually have both (i.e. socketed one end) are always assumed to have the same gender as specified in this table. This means that in practice the socketed end would be cut off or removed if it was required to connect to a fitting. This convention applies in practice to virtually all types of fitting.
Connection Type:	A single character code that signifies whether the pipe connection is threaded, press-fit, flanged, etc. The code used must be consistent with that used in the database.
Fitting Type:	A connector matching code that defines the particular fittings that this pipe type can be connected to. The matching codes used must be consistent with the system of matching codes used when entering data in the database editor. This code must not contain more than four characters.
Maximum Angle:	The maximum angle that the pipe system can safely be deflected through without the use of a specific fitting. For rigid pipes, such as asbestos cement, it will be the maximum angle of the pipe-to-pipe connection system used. For semi-rigid pipes, such as smaller diameter PVC, it will be the allowable joint deflection plus an allowance for bending the pipe itself. For flexible pipe, such as polyethylene it will be the maximum angle the pipe can be safely bent through. Typical data for these values should be available from the various pipe manufacturer's handbooks.
Extra Allowance:	After determining the total length of each pipe required for a design, IRRICAD adds an additional length which is calculated by applying the extra allowable percentage to the total length to give a final reported length. The new lengths apply to all Bill of Materials reports. This does not effect the quantities reported in any Costing reports.

Rounding:	After the extra allowance has been added to the original pipe lengths determined by IRRICAD, the new total is rounded up to the nearest figure defined by the rounding figure. This rounding applies to all Bill of Materials reports except the Zone / Mainline BOM. This does not effect the quantities reported in any Costing reports.
Roll / Len:	The length of a roll or length of pipe. IRRICAD will use this value to determine how many rolls or lengths of pipe are required for a design and this number will be reported in the Bill of Materials reports. A value of zero tells IRRICAD to report the total length of pipe required. This does not effect the quantities reported in any Costing reports.

5.12 REPORTS

The Reports menu contains the following commands:

- Report Settings
- Show Flow
- Management Reports
- Design Reports
- Costing Reports
- Bill of Materials Reports
- View Errors
- Miscellaneous Costs
- Supplier Code Multipliers
- Costing Reports Options
- Zone Design Reports Configuration
- Mainline Design Reports Configuration

All reports are viewed in a notepad-like format. Upon selecting a report, a reporting window allows you to view, edit and print the report.

To produce a report:

1. Select the required report from the Reports menu. A window will appear containing the report.
2. View the report as required.
3. Print the report if required (*File|Print* or click the print icon).

All reports have a header showing the client, job address, quote number, date and description as entered in *Settings|Design Details* and *Settings|Client*.

A font can be selected in the report screen by selecting *Edit|Set Font*. Only fixed width fonts are displayed as proportional fonts change the length of each line and distort the borders (if used).

5.12.1 REPORTS SETTINGS

This dialog allows you to change settings that affect the reports.

Printer Page Length:	The maximum number of lines that will fit on one printed page. Used for automatic pagination of reports.
Report Border Type:	Controls the appearance of the border around each report. Note not all fonts can display an IBM type border.

5.12.2 SHOW FLOW

This tool makes the process of zoning or grouping sprinklers easier by giving the flow required to service a particular area in the design.

The following information is displayed on the screen:

Area:	The plan area enclosed by the lasso.
Outlets:	The number of outlets in the enclosed area.
Flow:	The total flow of all outlets in the enclosed area.
Precipitation rate:	The average intensity of application within the enclosed area.

To show the flow for an area:

1. Select *Reports|Show Flow*.
2. Draw a lasso on the screen around the area you wish to view. Close the lasso by clicking on the starting point or by selecting *Right-Click|Close*.
3. Upon closing the lasso, a dialog appears which displays the area, outlets, flow and precipitation rate. Click Close to exit, or highlight the required text and click the Copy button to copy selected information to the clipboard.

***Note:** Keep in mind that in calculating the precipitation rate, IRRICAD assumes that all the water from the enclosed sprinklers falls in the area lassoed.*

5.12.3 MANAGEMENT REPORTS

These reports are produced from the management strategy entered.

The Management Report options are:

- Water Supply
- Zone Flows

- System Flows
- System Management
- Water Requirements

5.12.3.1 WATER SUPPLY REPORT

This is a reprint of the water supply data entered and includes:

- Supply No
- Irrigation cycle
- Design flow
- Maximum flow
- Design head
- Maximum head
- Operating times

See also:

Management Reports

Section 5.12.3

5.12.3.2 ZONE FLOWS REPORT

This report provides a summary of zone flows, required operating times and precipitation rates for all zones.

This report includes:

Zone Name:	A name to identify the zone.
# Outlets:	The total number of outlets in the zone.
Flow:	The total flow into the zone regardless of whether any outlets fall outside Irrigation Areas.

If an Irrigation Area has been specified:

Operating Time:	The time in days, hours and minutes within the irrigation cycle that the zone needs to operate to apply the amount of water specified in Irrigated Areas dialogs.
Precip. Rate:	The mean precipitation rate for the zone and the water supplies operational at the time.
Maximum Precip. Rate:	The maximum allowable mean precipitation rate for the Irrigation Area.

Note: For a design which contains tapes, the zone flows reported in this and other management reports will be based on the nominal specific discharge rate of the tape as specified in the Tape component group in the database.

In determining zone operating times,,, only those zone outlets that are placed within an Irrigation Area are assumed to contribute to the area. The operating time for the area (and therefore the zone operating times) is determined by dividing the total volume requirement of the Irrigation Area by the total flow into the area. For this reason, all zones that contribute to the same area will have the same operating times and precipitation rates regardless of how the outlets are physically placed within the area.

Operating time, precipitation rate and maximum precipitation rate are only calculated if Irrigation Areas have been previously defined.

If in reality zones within a common Irrigation Area are known to have different precipitation rates and should therefore have different operating times then create separate Irrigation Areas for each of these zones.

See also:

Management Reports

Section 5.12.3

5.12.3.3 SYSTEM FLOWS REPORT

This report gives a summary of total flows in the irrigation system resulting from the management strategy entered.

It is divided into sections or time intervals according to the irrigation system flows. A new system flow time interval is created when there is a change in the flow required by the system due to valves being turned on or off in particular time intervals or due to changes in water supply operation. In this way, each system flow is unique in that it has a discrete time interval and flow.

Within each system flow section listed in the report the following information is presented:

System flow No:	Generated internally by IRRICAD.
Flow:	Flow required at the Water Supply.

Design flow:	From Water Supply dialog.
Maximum flow:	From Water Supply dialog.
On time:	Beginning of time interval.
Off time:	End of time interval.
Zones operating:	In the above time interval.
Water supplies:	Operating at the time.

See also:

Management Reports

Section 5.12.3

5.12.3.4 SYSTEM MANAGEMENT REPORT

The report summarizes the management strategy entered.

Duty No:	This is essentially a station number, set number or satellite number applied to a group of valves (System Flow Number).
Time on:	The start time of the group (Days, Hours, Minutes).
Time off:	The finish time of the group (Days, Hours, Minutes).
Run Time:	The length of time the valves are operating (Days, Hours, Minutes).
Zones / WS:	The zone valves operating on the above time interval and the water supplies operational at the time.

See also:

Management Reports

Section 5.12.3

5.12.3.5 WATER REQUIREMENTS REPORT

This report only applies if Irrigation Areas have been previously defined.

So that a check can be made to ensure that the required amount of water is applied to each Irrigation Area, this report summarizes the calculated and required applications made to each area on a zone-by-zone basis.

Name:	The name of the zone contributing to the area.

Flow:	The flow that the zone is contributing to the Area. Outlets outside of the Irrigation Area are not included.
Contrib. Area:	The area within the Irrigation Area that the zone is assumed to be applying water.
Depth App.:	The depth of water the zone is calculated to be applying to the contributing area, based on the operating times specified for the zone by the designer.
Depth Req.:	The required depth of water for the area.
Volume App.:	The calculated volume of water the zone is applying to the contributing area based on the specified operating times.
Volume Req.:	The required volume of water for the contributing area.

The above information for each zone is summarized for the Irrigation Area, where:

Name:	Name of the Irrigation Area.
Flow:	The total flow into the Area.
Contrib. Area:	The total area of the Irrigation Area.
Depth App:	The mean depth of water applied to the Irrigation Area.
Depth Req.:	The mean depth of water required for the Irrigation Area.
Volume App.:	The total volume of water applied to the area.
Volume Req.:	The total volume of water required for the area.

***Note:** The amount of water applied is based on the current operating time specified for the zone. This may be the default run time of 1 hour. Reset the operating times to that specified in the Zone Flows report for the Depth Applied and the Volume Applied to be that of the recommended run time.*

See also:

Management Reports

Section 5.12.3

5.12.4 DESIGN REPORTS

These reports are produced from the design analysis process and tell you what is happening hydraulically in each area of interest.

The Design Report options are:

- Zone Full
- Zone Summary
- Control Valve Summary
- Zone Outlet
- Zone Pipe
- Mainline Full
- System Duty
- Mainline Summary
- Mainline Pipe

5.12.4.1 ZONE FULL

Detailed pressure and flow information is presented for each zone in the design.

Zone:	The name of the zone.
Flow:	Total zone flow.
Valve:	Description of control valve.
Valve pres. upstream:	The pressure on the upstream side of the control valve.
Valve pres. downstream:	The pressure downstream of the control valve.

***Note:** The flow reported in this and other design reports for zones that contain tapes is based on the calculated flow into each tape, not based on the nominal specific discharge rate for the tapes. The calculated flow takes into account the length, slope and nominal inlet pressure of the tape.*

A + or - sign following the zone flow indicates the maximum or minimum flow limits for the control valve have been exceeded.

For each pipe in the zone:

From:	The x, y coordinates at the start of the pipe.
To:	The x, y coordinates at the end of the pipe.
Pipe Size:	The diameter of the pipe.
Pipe Code:	The pipe type code from the pipe database.
Flow (start):	The flow at the start of the pipe.
Flow (end):	The flow at the end of the pipe.

Vel:	The velocity at the end of the pipe with the highest flow.
Length:	The length of the pipe.
H Diff:	The pressure loss from the start to the end of the pipe including elevation change.

Note:

- *A negative flow indicates that the flow direction in the pipe is from the end coordinate of the pipe to the start coordinate.*
- *A negative pressure loss indicates a gain in pressure from the start to the end of the pipe.*
- *If the allowable velocity has been exceeded, a * will be printed beside that value.*

For each pipe in the zone the flow is reported at the start of the pipe and at the end. For ordinary zone pipes these two values will be the same, but for connected spraylines or tapes the end flow will be less than the start by an amount equal to the total outlet flow which has occurred between the two points.

For each outflow or inflow in the zone:

Location (x,y,z):	The x, y coordinates of the outlet and its elevation (ground level).
Out loss:	The pressure loss in the outlet connector, if any.
Flow:	The flow from the outlet.
Pres.:	The actual pressure at the outlet.
Min Pres.:	The minimum allowable pressure at the outlet.
Max Pres.:	The maximum allowable pressure at the outlet.

Note: *Outlets operating above or below the allowable pressure range will have a + or - beside them.*

Junctions with negative flows indicate a net inflow into the junction (normally the inflow at the valve).

Max Pres. and Min Pres. are the maximum and minimum allowable pressures which result from the flow tolerance specified in the emitter database when applied to the nominal flow of the emitter.

VALVE-IN-HEAD OUTLETS

For a valve-in-head sprinkler the zone pressure loss is zero because there are no pipes in the zone - the sprinkler is a zone in itself.

If an outlet connector such as a swing joint is used to connect the outlet to the mainline pipe the pressure loss for the connector is shown as a control valve pressure loss in the Zone Full Design report.

If an outlet connector is not used, no pressure loss will be shown.

The pressure required for the zone is the pressure required at the valve inlet of the VIH sprinkler.

VALVE-UNDER-HEAD OUTLETS

Where an outlet is connected directly to a control valve (i.e. a valve and outlet are connected at the same position), the pressure loss through the valve is shown in the Zone Full Design report as the difference between upstream and downstream pressure loss at the control valve.

Where an outlet connector is used, the pressure loss through the connector is added to the pressure on both the upstream sides and downstream side of the valve.

The required pressure for the outlet excludes the connector pressure loss.

The required pressure at the valve includes the connector pressure loss.

CONNECTED SPRAYLINES (LATERALS) AND TAPES

Each section of a lateral with a given diameter is reported as a separate length of pipe in the Sprayline part of the report (and also in the Pipe part of the report mentioned above). For each pipe in the sprayline the report includes:

From:	The x, y coordinates at the start of the sprayline section.
To:	The x, y coordinates at the end of the section. Start Pressure - The pressure at the outlet closest to the start of the sprayline section.
End Pressure:	The pressure at the outlet closest to end of the sprayline section.
Min Pres.:	The minimum allowable outlet pressure.

Max Pres.: The maximum allowable outlet pressure.
Flow: The flow from a single outlet used in this sprayline section or, if a tape, the inlet flow for the tape.
O/Loss: The pressure loss in the outlet connector, if any.

Note: Outlets on a sprayline section which are operating above or below the allowable pressure range will have a + or - respectively in the most right hand column of the report. A single symbol (+ or -) indicates the pressure at one end of the sprayline is out of range while a double symbol (++ or --) indicates the outlets at both ends of the sprayline section are out of range.

See also:

Design Reports

Section 5.12.4

5.12.4.2 ZONE SUMMARY

This report gives a summary of the hydraulic performance of each zone.

Zone: The name of the zone.
Total zone flow: The total flow for the zone.
Min allowable outlet pressure: The minimum allowable outlet pressure based on the flow tolerance given in the Outlet Database.
Max allowable outlet pressure: The maximum allowable outlet pressure based on flow tolerance given in the Outlet Database.
Allowable outlet pressure variation: The difference between the minimum and maximum allowable outlet pressures expressed as a % of the nominal outlet pressure.
Actual outlet pressure variation: The difference between the actual minimum and maximum outlet pressures expressed as a % of the nominal outlet pressure.
Present pressure downstream of valve: The actual pressure downstream of the zone control valve.
Pressure loss through valve: The actual pressure loss through the zone control valve.
Present min outlet pressure: The actual minimum outlet pressure in this zone.

Present max outlet pressure: The actual maximum outlet pressure in this zone.

All reports have a header showing the Client, Site, Designer and Date information as entered in *Settings|Design Details*.

See also:

Design Reports

Section 5.12.4

5.12.4.3 CV SUMMARY

A report which lists the control valves used for each zone.

Zone:	The name of the zone.
Valve:	Description of control valve.

See also:

Design Reports

Section 5.12.4

5.12.4.4 ZONE OUTLET

A full description of each outlet in every zone is given.

Zone:	The name of the zone.
Flow:	The total flow of the zone.
Outlet Description:	The description of the emitter or outlet.
Nozzle Description:	The nozzle selected for the above outlet.
Arc:	The arc setting for the outlet.
Radius:	The wetted radius for the outlet.
Pressure:	The actual pressure at the outlet.
Flow:	The nominal flow of the outlet.
Location (x, y):	The x, y coordinates for the outlet.

Note: In large designs with high numbers of zones and outlets per zone, this report can be very large and, as it is normally in condensed print mode, can take considerable time to print on a dot matrix printer.

For each section of a sprayline of a given diameter, the details for the outlets closest to the start and end of the section are reported.

If the only outlets in the zone are tapes, outlet data for the zone will not be given.

See also:

Design Reports

Section 5.12.4

5.12.4.5 ZONE PIPE

Detailed pressure and flow information is listed for each zone in the system.

For each pipe in the zone (listed zone by zone):

From (x,y,z):	The x, y, z coordinates at the start of the pipe. Z is the elevation of the start of the pipe.
To (x,y,z):	The x, y, z coordinates at the end of the pipe. Z is the elevation of the end of the pipe.
Depth:	The depth of the pipe below ground level.
Pressure (Start):	The pressure at the beginning of the pipe.
Pressure (End):	The pressure at the end of the pipe.
Pressure (Allow):	The pipe pressure rating (from the pipe database).
Flow (Start):	The flow at the start of the pipe.
Flow (End):	The flow at the end of the pipe.
Size:	The nominal diameter of the pipe.
Code:	The pipe type code from the database.

Note: *If actual pipe pressure exceeds the pressure rating for the pipe, a
+ will be printed at the end of the entry (after the type code) for the
pipe.*

See also:

Design Reports

Section 5.12.4

5.12.4.6 MAINLINE FULL

Detailed pressure and flow information is presented for each system flow in the mainline.

System flow Name:	As defined in Management.
Flow:	The flow required at the first water supply.

Pressure:	The pressure required or specified at the first water supply.
Main Supply:	The name of the water supply supplying the system flow.

The information printed for each pipe in the mainline system is the same as for zone pipes in the Zone Full Design Report.

For each inflow, outflow or junction in the mainline system:

Location (x,y,z):	The x, y coordinates and elevation of the junction, valve or water supply.
Out Loss:	The pressure loss in the outlet connector, if any.
Flow:	The flow from the valves operating during the time of the system flow operation (the negative flow represents the inflow from the water supplies).
Pres:	The actual pressure at each junction, valve or water supply.
Min Pres:	The minimum allowable pressure at the zone valves that are operating at that time.
Max Pres:	The maximum allowable pressure at the zone valves that are operating at that time.

*Note: An * alongside the valve entry in this report indicates that the flow rate through the valve is outside of specification.*

See also:

Design Reports

Section 5.12.4

5.12.4.7 SYSTEM DUTY

This report is a summary of the duty required at each water supply for each system flow.

Water Supply:	The name of the water supply referred to.
Duty N°:	The system flow number.
Time On:	Beginning of time interval for which the duty applies.
Time Off:	End of time interval.
Pressure:	Pressure required at water supply during the above time interval.

Flow: Flow required at the water supply during the above time interval.

See also:

Design Reports

Section 5.12.4

5.12.4.8 MAINLINE SUMMARY

A summary of pressures at each of the water supplies and zone control valves is given for each grouping of valves.

Zone Name:	The name given to the zone control valve.
x,y:	The x and y coordinates of the zone valve.
Valve Pres:	The pressure on the upstream side of the valve resulting from the specified or calculated water supply pressure.
Reqd Valve Pres:	The pressure required on the upstream side of the zone control valve.
Water Supply:	The name of the water supply.
x,y:	The x and y coordinates of the water supply.
Pressure:	The pressure at the water supply for the valve grouping.
Flow:	The flow at the water supply for the valve grouping.

The above information is repeated for the different flow conditions (System Duties) arising from the management for the system.

See also:

Design Reports

Section 5.12.4

5.12.4.9 MAINLINE PIPE

Detailed pressure and flow information is listed for each system duty.

For each mainline pipe:

From:	The x, y, z coordinates at the start of the pipe. Z is the elevation of the start of the pipe.
To:	The x, y, z coordinates at the end of the pipe. Z is the elevation of the start of the pipe.
Depth:	The depth of the pipe below ground level.

Pressure (Start):	The pressure at the beginning of the pipe.
Pressure (End):	The pressure at the end of the pipe.
Pressure (Allow):	The pipe pressure rating (from the pipe database).
Flow (Start):	The flow at the start of the pipe.
Flow (End):	The flow at the end of the pipe.
Size:	The nominal diameter of the pipe.
Code:	The pipe type code from the database.

Note: *If actual pipe pressure exceeds the pressure rating for the pipe, a + will be printed at the end of the entry (after the type code) for the pipe.*

See also:

Design Reports

Section 5.12.4

5.12.5 COSTING REPORTS

These reports are primarily intended for the designer to view. They contain detailed technical and costing information that is not usually provided to clients. They also contain options for transferring basic information into inventory systems.

The component costs are calculated using the default pricing type in conjunction with the costs entered in the database. If Multiplier is used (*Design|Design Parameters|Economic Parameters*) and the multipliers are set in *Reports|Supplier Code Multipliers* the multiplier used is reported at the start of each Costing report. Multipliers do not effect the BOM with Costs report.

All reports have a header showing the client, job address, quote number, date and description as entered in *Settings|Design Details* and *Settings|Client*.

ASSEMBLIES

The reporting of assemblies is controlled by the usage codes given to the assemblies in the databases.

Where the usage code Y is used, any assemblies used in a design will be broken down into their individual components and these components will be listed in the report.

Where the usage code A is used, the assemblies will be listed in the reports as an assembly description and not be broken down into individual components.

Where the usage code X is used, the assemblies will be listed in the reports as in A above but will also be listed at the end of each report with a list of their components.

The Costing Report Options are:

- Zone / Mainline Costing Summary Report
- Detailed Zone / Mainline Costing Report
- Design Summary Report
- Detailed Costs Report

5.12.5.1 ZONE / MAINLINE SUMMARY

A summary of the costs for each zone and the mainline is given.

The individual zone summaries include:

Zone:	The name of the zone.
Length / No:	Length of pipe or wire or number of items. Note that no rounding allowance is included in these lengths.
Description:	Description of item.
Unit Price:	The price used for the costing.
Item Price:	The total price of the individual item.
Total Price:	The total price for the zone.

The mainline costing summary is exactly the same as for zones except that the section is headed Mainline and the items and costs refer to the full mainline.

Any fitting selection errors arising from Computer Selection of Fittings are also presented.

Note: Unit prices (and therefore total prices) can also be adjusted according to the settings for Default Pricing Type in Design\Design Parameters\Economic Parameters, and therefore may not necessarily be the same as those listed in the databases.

See also:

Costing Reports

Section 5.12.5

5.12.5.2 ZONE / MAINLINE DETAILED

Costs and full details of connection types are given. This makes this report useful for identifying problems in the database that may have caused fitting selection errors.

Zone name (or Mainline)

Length / No:	Length of pipe or wire or number of items. Note that no rounding allowance is included in these lengths.
Description:	Full description of item.
Unit Price:	The price of the item used for the costing.
Item Price:	The total cost for the number of items.
Warehouse code:	The item's warehouse code.
Fitting:	The fitting type code for the pipe or major diameter of the item.
Size:	The nominal diameter of pipe or major diameter of item.
Fitting:	The fitting type code for the minor diameter of the fitting.
Size:	The nominal diameter of the minor connection.
Total Price:	The total price for each zone on the mainline.

Following each zone or mainline report, fitting selection error messages are given.

Finally, a summary of all items used in the design is given in the same format as the data presented above.

A total final cost is also given.

***Note:** Unit prices (and therefore total prices) can also be adjusted according to the settings for Default Pricing Type in Design\Design Parameters\Economic Parameters, and therefore may not necessarily be the same as those listed in the databases.*

See also:

Costing Reports

Section 5.12.5

5.12.5.3 DESIGN SUMMARY

A summary of all items used in the design is given in this report. The items are grouped in the following order:

- Pipes
- Zone control valves
- Couplers
- Bends
- Tees
- Emitters
- Connectors
- Miscellaneous

Length / No:	Length of pipe or wire or number of items. Note that no rounding allowance is included in these lengths.
Description:	Full description of item.
Unit Price:	The price used for the costing.
Item Price:	The total price of the individual items.
Total Price:	The total price for the design.

This information is followed by a summarized list of fitting selection errors.

Note: Unit prices (and therefore total prices) can also be adjusted according to the settings for Default Pricing Type in Design|Design Parameters|Economic Parameters, and therefore may not necessarily be the same as those listed in the databases.

See also:

Costing Reports

Section 5.12.5

5.12.5.4 DETAILED COSTS

A full costing of all components in the design is given.

Length / No:	Length of pipe or wire or number of items. Note that no rounding allowance is included in these lengths.
Description:	A full description of the item.

Unit Wholesale:	The wholesale cost of the item listed in the database or the buying price calculated from the base price and multiplier A.
Unit Retail:	The retail price of the item listed in the database or the selling price calculated from the base price and all the enabled multipliers.
Total Wholesale:	The total wholesale or buying price of the items.
Total Retail:	The total retail or selling price of the items.
Margin:	The difference between the total retail (or selling) price and wholesale (or buying) price for the item.

***Note:** Unit prices (and therefore total prices) can also be adjusted according to the settings for Default Pricing Type in Design\Design Parameters\Economic Parameters, and therefore may not necessarily be the same as those listed in the databases.*

See also:

Costing Reports

Section 5.12.5

5.12.6 BILL OF MATERIALS REPORTS

These reports are primarily intended for the client.

The Bill of Materials Reports are:

- Zone / Mainline Bill of Materials Report
- Bill of Materials with Costs Report
- Bill of Materials (BOM)
- Bill of Materials by Supplier Report
- Inventory by Warehouse Code Report
- Inventory by Description Report
- Inventory Report

The component costs are calculated using the default pricing type (Retail or Wholesale only as set in *Design\Design Parameters\Economic Parameters*) from the costs entered in the database .

Pipe lengths include the extra allowance and are rounded according to the settings in the Pipe Fitting Matching Table. If Roll / Length is used in the Pipe Fitting Matching Table, then the number of rolls is reported instead of the total length.

All reports have a header showing the client, job address, quote number, date and description as entered in *Settings|Design Details* and *Settings|Client*.

ASSEMBLIES

The reporting of assemblies is controlled by the usage codes given to the assemblies in the databases.

Where the usage code Y is used, any assemblies used in a design will be broken down into their individual components and these components will be listed in the report.

Where the usage code A is used, the assemblies will be listed in the reports as an assembly description and not be broken down into individual components.

Where the usage code X is used, the assemblies will be listed in the reports as in A above but will also be listed at the end of each report with a list of their components.

5.12.6.1 ZONE / MAINLINE BOM

A bill of materials on an individual zone and mainline basis is provided in this report.

Length / No:	Length of pipe or wire or number of items. Includes any extra allowance, rounding and / or number of rolls / lengths.
Description:	Full description of item.
Warehouse Code:	The warehouse code of the item.

Pipe lengths include the extra allowance but do not include the rounding. The length is rounded so as not to have any decimal places to the nearest number (down if less than 0.5, up if greater than 0.5). The extra allowance is also rounded up or down to the nearest whole number, instead of rounding up as in all other BOM reports. If Roll / Length is used in the Pipe Fitting Matching Table, then the number of rolls is reported instead of the total length.

Fittings errors are also listed.

See also:

Bill of Materials Reports

Section 5.12.6

5.12.6.2 BOM WITH COSTS

A summarized list of all items used in the design is given.

Length / No:	Length of pipe or wire or number of items. Includes any extra allowance, rounding and / or number of rolls / lengths.
Description:	Full description of item.
Warehouse Code:	The warehouse code of the item.
Item Price:	Total price of each item.
Total Price:	The total price for the design.

Pipe lengths include the extra allowance and are rounded according to the settings in the Pipe Fitting Matching Table. If Roll / Length is used in the Pipe Fitting Matching Table, then the number of rolls is reported instead of the total length.

Any fittings errors are also listed.

Note: Unit prices (and therefore total prices) can also be adjusted according to the settings for Default Pricing Type in Design\Design Parameters\Economic Parameters, and therefore may not necessarily be the same as those listed in the databases.

See also:

Bill of Materials Reports

Section 5.12.6

5.12.6.3 BOM

This report is a listing of the number and description of all items used in the design. No prices are given.

Length / No:	Length of pipe or wire or number of items. Includes any extra allowance, rounding and / or number of rolls / lengths.
Description:	A full description of the item.
Warehouse Code:	The warehouse code of the item.

Pipe lengths include the extra allowance and are rounded according to the settings in the Pipe Fitting Matching Table. If Roll / Length is used in the Pipe Fitting Matching Table, then the number of rolls is reported instead of the total length.

Any fittings errors are also listed.

See also:

Bill of Materials Reports

Section 5.12.6

5.12.6.4 BOM BY SUPPLIER

This report provides a list of all items used in the design summarized on a supplier code basis. All items with the same supplier code are grouped together with each supplier code list beginning a new page to make distribution of these lists easier.

Length / No:	Length of pipe or wire or number of items. Includes any extra allowance, rounding and / or number of rolls / lengths.
Description:	A full description of the item.
Warehouse Code:	The warehouse code of the item.

Pipe lengths include the extra allowance and are rounded according to the settings in the Pipe Fitting Matching Table. If Roll / Length is used in the Pipe Fitting Matching Table, then the number of rolls is reported instead of the total length.

Any fittings errors are also listed.

See also:

Bill of Materials Reports

Section 5.12.6

5.12.6.5 INVENTORY BY W / H CODE

So that a summary of materials required for a design can be easily transferred into inventory packages, a simplified list containing the number of items required and the warehouse code for those items is given. All titles, borders and paging have been removed.

This report can be saved as an ASCII file (using *File|Print*) and has the following format:

Number of items:	Columns 1 to 7
Comma:	Column 8
Warehouse code:	Columns 9 to 20

Pipe lengths include the extra allowance and are rounded according to the settings in the Pipe Fitting Matching Table. If Roll / Length is used in

the Pipe Fitting Matching Table, then the number of rolls is reported instead of the total length.

See also:

Bill of Materials Reports

Section 5.12.6

5.12.6.6 INVENTORY BY DESCRIPTION

So that a summary of materials required for a design can be easily transferred into inventory packages, a simplified list containing the number of items required and the description for those items is given. All title, borders and paging have been removed.

This report can be saved as an ASCII file (using *File|Print*) and has the following format:

Number of items:	Columns 1 to 7
Comma:	Column 8
Item Description:	Columns 9 to 48

Pipe lengths include the extra allowance and are rounded according to the settings in the Pipe Fitting Matching Table. If Roll / Length is used in the Pipe Fitting Matching Table, then the number of rolls is reported instead of the total length.

See also:

Bill of Materials Reports

Section 5.12.6

5.12.6.7 INVENTORY

So that a summary of materials required for a design can be easily transferred into inventory packages, a simplified list containing the number of items required and the description and warehouse code for those items is given. All title, borders and paging have been removed.

This report can be saved as an ASCII file (using *File|Print*) and has the following format:

Number of items:	Columns 1 to 7
Comma:	Column 8
Item Description:	Columns 9 to 48
Comma:	Column 49
Warehouse code:	Columns 50 to 61

Pipe lengths include the extra allowance and are rounded according to the settings in the Pipe Fitting Matching Table. If Roll / Length is used in the Pipe Fitting Matching Table, then the number of rolls is reported instead of the total length.

See also:

Bill of Materials Reports

Section 5.12.6

5.12.7 VIEW ERRORS

This option will let you view a list of the errors that have occurred during the last IRRICAD session, e.g. Zone Design. The report will show all the error messages that were displayed during the design process. If you have set design to run and had to leave the computer, the error messages can be viewed here. Alternatively, if the Delay Time for information warnings is zero (hence, does not display error messages during design) then the errors can be viewed in this report.

5.12.8 MISCELLANEOUS COSTS

Not available in this version.

5.12.9 SUPPLIER CODE MULTIPLIERS

This table has three major functions:

- To define the four character Supplier Codes that the designer wishes to use to identify suppliers and / or product groups for the various components in the databases
- To associate with each code a base price and up to four multipliers which are then used to calculate the cost of each database item for the costing reports
- To allow the user to select which of the four multipliers should be used in any given design.

To edit the Supplier Code Multipliers:

1. Select *Reports|Supplier Code Multipliers*.
2. Make any changes required. Use the Insert and Remove buttons to add rows to and remove rows from the table.

3. Click OK.

***Note:** For multipliers to be used in Costing reports, you must first enable Multiplier as the Default Pricing Type in Design|Design Parameters|Economic Parameters.*

Multipliers Enabled:	Indicates which of the multipliers will be used to calculate prices. Multiplier A must always be checked as it is used to calculate the buying price from the base price but there are no restrictions on the use of the other three multipliers.
Description:	A purely informative description that can be used to identify the particular supplier or product group represented by the Supplier Code.
Supplier Code:	A four-character code the designer wishes to use to identify suppliers or product groups for the components in the database. The code has two functions: firstly, to link database items with the costing multipliers used to calculate prices for the Costing and Bill of Materials reports and, secondly, it is used for making global changes to the prices recorded in the databases. When entering database items, the list of supplier codes is taken from this table so new supplier codes must be added to the table before they can be used in the database. Up to 260 different supplier codes can be entered.
Base Price:	Indicates whether the database wholesale or retail price is to be used as the base price for the costing calculations.
Multiplier A,B,C,D:	Any value between 0.0001 and 9.9999 can be entered for each multiplier.

5.12.10 COSTING REPORTS OPTIONS

Sometimes it is desirable to provide Costing or Bill of Material reports that contain a restricted group of components. For example, a list of pipes or fittings only, or sprinklers and nozzles only is required. This dialog allows you to select which groups of items are to be included in any Costing or Bill of Materials report.

The groups are:

- Pipes
- Sprinklers
- Nozzles
- Control Valves, Misc. Hydraulic
- Outlet Connectors
- Fittings
- Electrical Items
- Miscellaneous Items
- Fittings Selection Errors
- Exploded Assemblies

The last group is used to include or exclude the listing of assembly components at the end of a report for assemblies with usage code X.

To generate a report for a selection of hydraulic items:

1. Select *Reports|Costing Report Options*.
2. Check those items to be included and uncheck those to be excluded.
3. Click OK.
4. Select one of the BOM reports. Only the selected hydraulic items will be reported.

5.12.11 ZONE DESIGN REPORTS CONFIGURATION

Design reports can be generated on a single or multiple zone basis. This removes the necessity to generate a report that includes all zones, when you only require details of a few zones.

The default setting is that all zones are included in the reports.

To generate a report for a selection of zones:

1. Select *Reports|Zone Design Reports Configuration*.
2. Check those zones to be included and uncheck those to be excluded.
3. Click OK.
4. Select one of the zone design reports. Only the selected zones will be reported.

5.12.12 MAINLINE DESIGN REPORTS CONFIGURATION

Design reports can be generated on a single or multiple system flow basis. This removes the necessity to generate a report that includes all system flows, when you only require details of a few system flows.

The default setting is that all system flows are included in the reports.

To generate a report for a selection of system flows:

1. Select *Reports|Mainline Design Reports Configuration*.
2. Check those system flows to be included and uncheck those to be excluded.
3. Click OK.
4. Select one of the mainline design reports. Only the selected system flows will be reported.

5.13 PLOT TEMPLATE

The Plot Template menu allows you to customize the templates used to generate the plot layout in *Draw|Plot Layout*. A plot layout contains text, logos, symbols, legends, title blocks etc. that will be printed on your final plan. You can edit an existing template (recommended) or create a new template.

Note: Start a new design in order to have a clean screen when editing templates.

5.13.1 EDIT TEMPLATE

Use this option to select an existing template to edit.

To edit a template:

1. Select *Plot Template|Edit Template*
2. By default, IRRICAD lists templates found in the folder specified in *Settings|Drawing Items - Plot Layout Path*. If necessary, change the path and drive to locate the template to open.
3. Select a template by double-clicking the file name or by selecting the file name and clicking Open.

The template will be drawn on the screen.

See also:

<i>Using Plot Templates to Create Plot Layouts</i>	<i>Section 2.8.2</i>
<i>Editing Plot Templates</i>	<i>Section 2.8.2.8</i>

5.13.1.1 KEYWORDS

Keywords created as text objects may form part of the template. When IRRICAD generates the plot layout in *Draw|Plot Layout* it recognizes these keywords and replaces them with the required information. Keywords start and end with #.

See also:

<i>Keywords Used in Plot Templates</i>	<i>Section 6.9.1</i>

5.13.2 MAKE ACTIVE AREA

The active area of a plot layout defines the area of the layout that will fit on the paper minus the margins. It is drawn as a dashed yellow rectangle. Every plot template must have an active area.

To make an active area:

1. Select the entity or entities whose extents will define the active area.
2. Select *Plot Template|Make Active Area*.

See also:

<i>Using Plot Templates to Create Plot Layouts</i>	<i>Section 2.8.2</i>
<i>Creating a New Template</i>	<i>Section 2.8.2.2</i>

5.13.3 MAKE LEGEND

Use this option to create a legend object as part of a template.

To make a legend object:

1. Select the objects making up the legend.

Tip: Use a selection window or lasso for this as clicking on a fill will only select the fill not the objects behind it.

2. Select *Plot Template|Make Legend*.
3. Fill in the Legend dialog. Click OK.

See also:

<i>Using Plot Templates to Create Plot Layouts</i>	<i>Section 2.8.2</i>
<i>Creating a New Template</i>	<i>Section 2.8.2.2</i>
<i>Creating Legends</i>	<i>Section 2.8.2.3</i>

5.13.3.1 LEGEND DIALOG

TYPE

Type: The type of legend to create. Pipe lists the pipes and wires used in the design. Symbol lists the outlets, valves, pumps, electrical and misc. hydraulic items used in the design.

Combined combines both pipe and symbol legends.

Order: The order in which legends are filled when there is more than one of the same type in the template. The lowest number is filled first.

Between Line Spacing: The space between items in the legend as a percentage of the text height.

5.13.4 MOVE FILLS TO BACK

Use this option to move any fills that are obscuring text or other items occupying the same space to behind those items.

1. Select the fill(s) and objects being obscured.

Tip: Use a selection window or lasso for this as clicking on a fill will only select the fill not the objects behind it.

2. Select *Plot Template|Move Fills To Back*.

Note: *Move Fills to Back* can be used for normal drawing items and fills. However, Fills cannot be moved behind hydraulic items.

See also:

<i>Using Plot Templates to Create Plot Layouts</i>	<i>Section 2.8.2</i>
<i>Creating a New Template</i>	<i>Section 2.8.2.2</i>
<i>Creating Legends</i>	<i>Section 2.8.2.3</i>
<i>Fills</i>	<i>Section 2.8.2.4</i>
<i>Moving Fills to Back</i>	<i>Section 2.8.2.5</i>

5.13.5 SAVE TEMPLATE

Use this option to save a template.

1. Select the objects that will be part of the template (usually all objects).
2. Select *Plot Template|Save Template*.
3. Type a template name in the dialog. Click OK.

Note: *The template is saved in the folder specified in Settings|Drawing Items - Plot Layout Path. If the name is the same as an existing template it will be overwritten.*

If the template does not contain an active area object then a default one is created whose area is defined by the extents of all the selected objects.

See also:

<i>Using Plot Templates to Create Plot Layouts</i>	<i>Section 2.8.2</i>
<i>Editing Plot Templates</i>	<i>Section 2.8.2.8</i>

5.14 HELP

This menu allows you to access the on-line Help and information about this version of IRRICAD

5.14.1 RELEASE NOTES

This option allows you to access a help file that will contain help information on any functions added to IRRICAD since the manual was printed.

The Release Notes follow the same layout as the Help Topics. (See Help Topics, Section 5.14.2).

5.14.2 HELP TOPICS

Help|Help Topics opens the manual on-line help. It is the same manual as the hard copy and is laid out in the same way. You will notice 6 main sections:

- Overview
- User Manual
- Database Editor Manual
- Tutorials
- Tool & Command Reference
- Technical Reference

The help file can be loaded as WinHelp or HTML Help. If you do not have Internet Explorer 3.04 or later, you can choose to install Internet Explorer 4.0. The installation files for Internet Explorer 4.0 are available on the IRRICAD CD (CD Drive:\Install\IE4\iesetup.exe).

5.14.2.1 HTML HELP

This window can be resized as required. Click the maximize button (middle button at the top right of the dialog window) or move the cursor to any edge until the cursor becomes a two-headed arrow and drag the dialog to the required size. The right hand side of the dialog adjusts the text to fit the right hand window.

At the top of the help dialog are icons: Hide, Back, Print, Options.

HIDE / SHOW

If the left hand side of the help dialog, containing the contents, index and search option is visible, clicking Hide will hide the left hand side. If the left hand side is hidden, clicking Show will show the left hand side of the dialog.

Contents

If this tab is selected, the manual's content page is displayed. Each heading with a "+" sign can be opened to reveal its sub-headings. The sub-headings can be hidden by clicking on the "-" sign.

Clicking any heading will take you directly to that section of the manual. The text is displayed on the right hand side of the help window.

Index

Use the Index tab to select an indexed keyword. These words have been selected to aid you in finding topics. Select a topic and click the Display button.

Search

Use Search to find a topic. Search lists all the places the word is found in the on-line help.

To use Search:

1. Type in the word you wish to find. Make the word as specific as possible e.g. type X to find the meaning of this usage code for assemblies.
2. Click List Topics.
3. Select a topic from those listed.
4. Click Display. The selected topic will be displayed on the right hand side.

BACK

Back takes you back to the last topic accessed, whether you have selected the topic by using Contents, Index or Search or used the yellow arrows at the end of each topic to navigate.

Click Back as many times as required - this function will move back through all your previous selections.

PRINT

Select *Print* to print any part of the on-line help. A print dialog will appear. Fill in the print dialog accordingly.

OPTIONS

Options include:

- Hide Tabs / Show Tabs (See above)
- Back (See above)
- Forward
- Home
- Stop
- Refresh
- Internet Options
- Print (See above)
- Search Highlight On / Off

Forward

Select *Options|Forward* if you have used *Options|Back* and wish to return to the previous document.

Home

Select *Options|Home* if you wish to connect to our website www.IRRICAD.com.

Stop

Select *Options|Stop* to stop searching for topics or loading a page.

Refresh

Select *Refresh* to reload the current HTML help page

Internet Options

Select *Options|Internet Options* to change your internet options.

Search Highlight On / Off

Toggle the search highlight on or off to highlight the keyword found in the text.

5.14.2.2 WINHELP

CONTENTS

If this tab is selected, the contents of the manual are displayed. Each heading containing a sub-heading can be opened by double-clicking on the book icon to the left of the heading name. Double-clicking on the book icon can hide the sub-headings.

Clicking on any heading will take you directly to the appropriate section of the manual. The text is displayed on the right hand side of the help window.

INDEX

Use the Index tab to select an indexed keyword. These words have been selected to aid in finding topics. Select a topic and click Display.

FIND

Use Find to search for a topic. Find lists all the places the word is found in the on-line help.

5.14.3 ABOUT IRRICAD

To find the version of IRRICAD:

1. Select *Help|About IRRICAD*
2. The dialog tells you version of IRRICAD and the year copyright was registered.

6 Technical Reference

6.1 TECHNICAL SUPPORT, SALES AND TRAINING SERVICES

This chapter outlines the contact details for your distributor and technical support.

6.1.1 CONTACT DETAILS

6.1.1.1 USA, CANADA, CENTRAL & SOUTH AMERICA:

Nelson Irrigation Corporation

Steve McCoon or Graham Hutchinson
Route 4, Box 169
Airport Road
Walla Walla
WA 99362-6426
USA

Telephone: +1 509 525 7660
Facsimile: +1 509 525 7907
Email: support@nelsonirr.com

6.1.1.2 SOUTH AFRICA

Turf-Ag Products Pty Ltd

Mark Bailey
P.O Box 37226
Chempet 7442
South Africa

Telephone: +27 (021) 551 0790
Facsimile: +27 (021) 551 0769
E-Mail: mark@turf-ag.co.za

6.1.1.3 AUSTRALIA:

Urban Irrigation Consultants

Tony Addis
PO Box 2840 Southport
QLD 4215
Australia

Telephone: +61 7 5532 2244
Facsimile: +61 7 5532 3304
Email: tonyaddis@ozemail.com.au

Nelson Irrigation Corporation Australia Pty Ltd.

Jason McLean
P O Box 530 Sumner
QLD 4074
Australia

Telephone: +61 7 3715 8555
Facsimile: +61 7 3715 8666
Email: jason.mclean@nelsonirrigation.com.au

6.1.1.4 NEW ZEALAND & THE REST OF THE WORLD:

AEI Software

Phil Dewar
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Lincoln
Christchurch 8152
Canterbury
New Zealand

Telephone: +64 3 325 3723
Facsimile: +64 3 325 3725
Email: IRRICAD@Lincoln.ac.nz

6.2 APPENDIX A: IRRICAD LIMITS

Limits in IRRICAD are:

Number of connections at a junction	4
Number of contour line segments / point spot heights	15000
Number of database items which can be loaded to solve an IRRICAD internal connection	40
Number of different fittings that can be selected at a junction	40
Number of flagged pipe sizes available for mainlines	40
Number of flagged pipe sizes available for zones	40
Number of irrigation areas	50
Number of irrigation areas within another	20
Number of junctions in a mainline	12500
Number of junctions in a zone	12500
Number of on / off times per supply	10
Number of on / off times per zone	3
Number of pipes in a mainline	5000
Number of pipes in a zone	5000
Number of system duties	1890
Number of system flows per zone	10
Number of system flows in total	300
Number of unique database items for costing	2000
Number of water supplies	10
Number of zones (fitting selection, reporting, plotting)	2000

6.3 APPENDIX B: DESIGN FILES

Files generated by IRRICAD during the course of a design, their file extension and where they are created:

File Extension	IRRICAD Files	Where Created
.mdb	internal database file	<i>File New / File Save</i>
.des	design file	<i>File New / File Save</i>
.vcd	visual cadd file	<i>File New / File Save</i>
.stn	system flow file	<i>Design Assign System Flows to Zones... / Design Zone Operating Times</i>
.wsp	water supply file	<i>Design Assign System Flows to Zones... / Design Zone Operatibg Times</i>
.zne	zone file	<i>Design Assign System Flows to Zones... / Design Zone Operatibg Times</i>
.ztn	zone time file	<i>Design Assign System Flows to Zones... / Design Zone Operatibg Times</i>
.dzf	zone design configuration file	<i>Design Zone Design Configuration</i>
.dzn	zone design file	<i>Design Zone Design</i>
.dml	mainline design file	<i>Design Mainline Design</i>
.cer	costing error file	<i>Design Computer Selection of Fittings</i>

6.4 APPENDIX C: HAZEN-WILLIAMS C VALUES

The Hazen-Williams C values listed below apply to hydraulically smooth pipes with flow velocities of 3.3ft/s (1m/s). Do *not* use these values for tapes or driplines with built-in emitters. Contact technical support for these values.

PIPE DIAMETER

Inches	MM	C Value
½	13	137.2
-	16	137.8
¾	19	138.8
1	25	140.0
1¼	32	141.2
1½	40	143.0
2	50	144.4
2½	65	146.0
3	80	147.2
4	100	148.0
5	125	148.6
6	155	149.0
8	190	149.3
9	225	149.5
12	300	150.0

6.5 APPENDIX D: DEFAULT DATABASE ORDER

The databases have an in-built ordering system that determines the order items are displayed in the Database editor and drop down list in IRRICAD. This is set out below to help you understand the ordering of items in each component group. Items in each component group are ordered alphabetically or numerically in ascending order based upon each of the fields below in turn. For example, Controllers are ordered numerically by the [Order] field then alphabetically by [Description] and so on.

Note that the [order] field is an internal one that is not available in the IRRICAD Database Editor. It can, however, be accessed via Microsoft Access. By default, the order field for all items is the same and therefore has no effect. If you wish to give the order field another number to change the ordering, you can do so in the column labeled Order Number.

Controllers	[Order], [Description], [Number of Stations]
Couplers	[Order], [Major Connection Type], [Minor Connection Type], [Major Diameter], [Minor Diameter], [Description]
Crosses	[Order], [Major Connection Type], [Minor Connection Type], [Major Diameter], [Minor Diameter], [Description]

Elbows / Bends	[Order], [Major Connection Type], [Minor Connection Type], [Major Diameter], [Bend Angle], [Minor Diameter], [Description]
LTOs	[Order], [Major Pipe Type], [Minor Connection Type], [Minimum Submain Diameter], [Lateral Diameter], [Description]
Lights	[Order], [Description], [Rating]
Misc. Items	[Order], [Description], [Size / Diameter 1], [Size / Diameter 2]
Nozzles	[Order], [Description], [Arc], [Constant]
Other Elec.	[Order], [Description], [Rating]
Other Hyd.	[Order], [Inlet Connection Type],

	[Outlet Connection Type], [Inlet Diameter], [Outlet Diameter], [Description]
Outlet Conn.	[Order], [Inlet Connection Type], [Outlet Connection Type], [Inlet Diameter], [Outlet Diameter], [Description]
Outlets	[Order], [Description], [Inlet Connection Type], [Inlet Diameter]
Pipes	[Order], [Pipe Type], [Nominal Diameter], [Allowable Pressure], [Description]
Pumps	[Order], [Inlet Connection Type], [Outlet Connection Type], [Inlet Diameter], [Outlet Diameter], [Description]
Tapes	[Order], [Description], [Nominal Diameter]

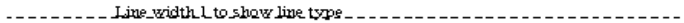
Tees	[Order], [Major Connection Type], [Minor Connection Type], [Major Diameter], [Minor Diameter], [Description]
Valves	[Order], [Inlet Connection Type], [Outlet Connection Type], [Inlet Diameter], [Outlet Diameter], [Description]
Wires	[Order], [Description], [Nominal Diameter]

6.6 APPENDIX E: AVAILABLE LINE TYPES

This chapter lists the available line types. These line types are available for geometric items, such as lines, rectangles, etc. and hydraulic items, such as pipes, tapes and wires.

BORDER	
BORDR_X1	
BORDR_X2	
BORDR_X3	
CENTER	
CL__X1	
CL__X2	
CL__X3	
COLD__W	
DASHDOT	
DASHED	
DASHED48	 Line width 1 to show line type
DIRT_RD	
DITS_X1	 Line width 1 to show line type
DITS_X2	

DITS__X3	-----
DIVIDE	-----
DOTS	-----
DOTS__X1	----- Line width 1 to show line type
DOTS__X2	-----
DOTS__X3	-----
FL__X1	-----
FL__X2	-----
FL__X3	-----
GAS__X1	-----
GAS__X2	-----
GAS__X3	-----
GRAVELRD	-----
HIDDEN	-----
HOT__W	-----
PAVED_RD	-----
PHANTOM	-----
PL__X1	-----
PL__X2	-----
PL__X3	-----
RETURN_W	-----
SAN__X1	-----
SAN__X2	-----
SAN__X3	-----

SOLID					
TIE_LINE					
TYPE__1					
TYPE__2					
TYPE__3					
TYPE__4					
TYPE__6					
TYPE__8					
VENT__					
WATER_X1					
WATER_X2					
WATER_X3					

6.7 APPENDIX F: DESIGN TECHNICAL INFORMATION

This chapter outlines the design technical information relevant to the design process and pipe selection process.

6.7.1 USE OF ELEVATIONS IN DESIGN

Where elevations have been entered as either contour lines or spot heights, IRRICAD interpolates between these to calculate elevations at all points in the design (excluding physical items such as landmarks and text).

The general method used is direct linear interpolation between contour lines with some triangulation / linear interpolation where spot heights are used. Where objects such as sprinklers or pipe junctions fall on contour lines, the height of these objects is set to the height of the contour. Where objects fall between contour lines or spot heights, linear interpolation is used to find the height of the object.

Where objects fall outside the contour lines, but are close to a contour line, the height of the object is set equal to the height of the closest contour line or spot height. If objects are placed outside the contour lines but not close to them, again the object height is set equal to the closest contour height and the user is warned by a message displayed on the screen that this has happened.

If a small number of spot heights or contours are used to define elevations, then provided objects are placed within these heights or contours, elevations will usually be calculated for the objects. A warning message will be displayed if there are insufficient contours or spot heights and elevations for some points may be set to zero.

It is the user's responsibility to ensure that sufficient contour lines or spot heights have been entered to allow an accurate interpolation to be made.

Note: Elevations for pipes are only calculated and reported at pipe junctions.

If long straight pipelines are being designed, particularly if they are undulating, the designer *must* ensure that sufficient permanent junctions are incorporated to characterize the changes in elevation. This can be achieved by connecting a suitable fitting into the pipeline at the appropriate points. Elevations and pressures will then be calculated for these points.

It is suggested that a pressure point fitting be added to the Other Hydraulics component group in the database for this purpose. Give the fitting a distinctive symbol, zero cost and some non-standard connection type. After the design is finalized this component can be deleted before the final plans and reports are prepared (delete the item from your design and re-run *Design|Computer Selection of Fittings* but do not repeat Design).

The counter visible on the status bar during interpolation of elevations gives an indication of the number of objects that have had elevations interpolated in the design.

6.7.2 ZERO FLOW PIPES

A number of situations can arise during pipe diameter selection that results in pipes with zero flow in them.

Typical examples are:

- In zones where a pipe or pipes have no outlets on their downstream end, i.e. dead end pipes or pipes with miscellaneous hydraulic items on their ends.
- In looped systems, some pipes, because of the symmetry of the system, may effectively be redundant and have zero flow or very small flow.
- Where a small group of valves are selected to represent a worst case situation, it is likely that some mainline pipes will not have flow in them during mainline design, particularly in systems that contain a number of side branches

Because of the methods used to calculate pipe size, IRRICAD cannot size zero-flow pipes. IRRICAD checks for these situations and identifies these pipes on the screen as yellow pipes. The message NO PIPE SELECTED also appears on the plan. This pipe has a diameter of 0.04" (1mm) and is so described in the reports.

Note: IRRICAD is only able to detect situations where there is zero flow in the pipe. In all other situations pipe sizing or analysis is based solely on the schedule the designer has entered in Management (Zone Operating Times or Assign System Flows...).

Diameters can be given to these pipes by manually sizing the pipes, or by entering an operating schedule in Management, which will result in flow in the pipes.

6.7.3 VALVE PRESSURE CALCULATION

The method used to calculate the pressure on the downstream side of zone control valves varies according to the type of outlets in the zone.

For zones containing outlets or spraylines, the valve pressure is set so that the sum of the squares of the pressure difference between the average actual outlet pressures and the average specified nominal pressures for the outlets is minimized. This ensures that the outlet pressures are as close as possible to the required nominal pressures.

For zones containing pressure regulated tapes, the valve pressure is calculated so as to provide at least the user specified minimum required submain pressure at all points on the submain.

For zones containing unregulated tape inlet pressures, a nominal tape pressure is calculated as the average of the minimum and maximum allowable inlet pressures according to the tolerance specified in the database for the tape. This nominal tape pressure is then used in the same way as for a zone not containing tapes.

If the zone contains both regulated and unregulated tapes, the highest value resulting from the calculation of the regulated and unregulated cases is used.

6.7.4 PIPE DIAMETER SELECTION

If the designer has selected Computer Sizing when positioning pipes or laterals, IRRICAD will calculate the diameters for these pipes.

With computer sizing, any pipes which have their Computer Sized check box checked will have their diameters calculated or recalculated regardless of whether or not they have been previously sized.

If a particular size is required for a pipe, then that pipe must be manually specified or having been previously computer sized have the automatic Computer Sized check box unchecked. This is achieved via the Change tool (See Making Changes to Your Design or Drawing, Section 2.4.3).

If Analyse or Detailed Analysis is selected and pipes exist that have not been previously sized either manually or by IRRICAD, an error message will appear indicating this.

For diameter selection of spraylines, each connected sprayline is converted within IRRICAD into two pipes (with diameters specified as computer selected rather than of fixed diameter) and a single outlet. This is done in such a way that the hydraulics of the two pipes and single outlet represent the hydraulics of the original lateral.

Using these simulated pipes and outlets, all pipes are sized according to the sizing method selected (LP or Velocity). The system is analyzed to provide the start and end pressures for the laterals. The laterals are then sized using one, two or three diameters (as specified in *Design|Zone Design Configuration*) using specially developed lateral sizing techniques. Each of these new laterals is converted to pipes and outlets for final analysis and reporting.

If a zone or block has a central submain and has laterals in three sizes each size of the submain, internally within IRRICAD there will be six pipes and three outlets each side of the submain. In terms of the limits on the number of pipes used for analysis, each of these pipes is treated as an individual pipe. This means, for example, that a block with 50 laterals, three sizes each side of the submain, will be treated as a zone with 650 pipes and 300 outlets. Similarly, a block with 50 laterals in one diameter fed from one end will be treated as a zone with 150 pipes and 50 outlets.

Driplines or tapes are treated differently so that a 50 lateral tape block with a central submain will be treated as a zone with 150 pipes and 100 outlets.

6.7.5 HIGHLY LOOPED MAIN LINES

Due to memory constraints, there is a limit to the size of network analysis that can be analyzed using IRRICAD. For a branched system (no loops) with a single water supply, the limit for the number of pipes in the network will be described in IRRICAD Limits in **Error! Reference**

source not found., (Section **Error! Reference source not found.**). If loops or multiple water supplies are present, the number of pipes that can be handles within the limits of analysis is reduced. The more loops the fewer pipes that can be accepted. For this reason, highly looped systems may not be able to be analyzed even though the total number of pipes in the system does not exceed the stated limits.

If highly looped networks, which exceed the design limits, are to be analyzed, it is necessary to reduce, firstly, the number of loops and, secondly, the number of pipes in the system until analysis can be run. Taking out non-critical connecting pipes in loops and replacing secondary branched sections with demand points are possible ways to do this.

6.7.6 MULTIPLE WATER SUPPLY DESIGNS

In some circumstances particularly in highly looped situations the mainline analysis of designs with a number of water supplies *operating at the same time* results in outflows or inflows being wrongly assigned to a small number of pipe junctions, or pressure losses through some pipes which are incorrect.

Sometimes these inconsistencies are so small that they have virtually no effect on the final results. At other times this is not so. Some potential problems are trapped and screen messages are displayed. However, there may be occasions where this does not occur and so users should always check the Mainline Full design report before proceeding. If a problem exists please contact AEI Software. Solutions are available.

6.8 APPENDIX G: FITTING SELECTION DETAILS

This chapter explains the how and why of computer selection of fittings. Understanding these rules means you can make IRRICAD select the types of fittings you use in specific types of designs.

The number, the diameter and the type of pipes in any junction, and the angle at which those pipes enter the junction determine which fittings are required to make up that junction.

6.8.1 TWO PIPE JUNCTIONS

Two-pipe junctions can be broadly divided into two groups:

- Straight connections
- Connections with a change in angle

6.8.1.1 STRAIGHT CONNECTIONS

IRRICAD looks at the matching codes and diameters of the components that are required to be straight connected and searches the current database for one fitting which will make the connection so that the matching codes of the component and each end of the coupling are compatible. The pipe code must be the same, the gender must change, and the connection type must be the same. The diameters for each component in the joint must also be equal.

For example, consider the following:

Two pipes are to be joined, one 3" (80mm), one 4" (100mm). Both are PVC with a slip fit (glued).

Codes for the pipe are: PVC M S (4" / 100mm)
PVC M S (3" / 80mm)

The Pipe Fitting Matching table (*Design|Pipe Fitting Matching Table*) lists PVC fittings as being able to be connected to PVC pipe.

A suitable fitting (reducing socket) to join the above pipes could be:

Major diameter: 4" code PVC F S
Minor diameter: 3" code PVC F S

as a 4" PVC M S pipe fits into a 4" PVC F S end of fitting and a 3" PVC M S pipe fits into a 3" PVC F S end of fitting.

If a fitting cannot be found which directly solves the connection, IRRICAD tries two or three fittings to make the connection.

Where more than one solution to the junction can be found, IRRICAD chooses the arrangement that is cheapest.

6.8.1.2 BENT CONNECTIONS

Bends can change diameter within a junction.

To join two pipes (or a pipe and component) meeting at an angle, IRRICAD first tries to fit a bend to the angle with a major and minor diameter equal to each of the pipe diameters in turn. If two bends can be found, the cheapest is chosen.

If a bend has been selected, the connection between the bend and each pipe (or other component) is treated as straight coupling.

If a single bend of either diameter cannot be found, IRRICAD tries two or three bends to make up the junction. The cheapest option is chosen. As with a single bend, the connection between any two components within the junction is treated as a straight connection.

Note: With any straight connection, a maximum of three fittings can be used.

With any bent connection, a maximum of three elbows can be used.

This means for a bent two-pipe junction, up to 15 separate elements can be used to make up the junction.

During the selection of bends, gender is not taken in to account when making up the angles.

Having selected the bends required to satisfy an angle, the straight connection routines account for any gender changes or diameter changes within the junction.

6.8.2 THREE-PIPE JUNCTIONS

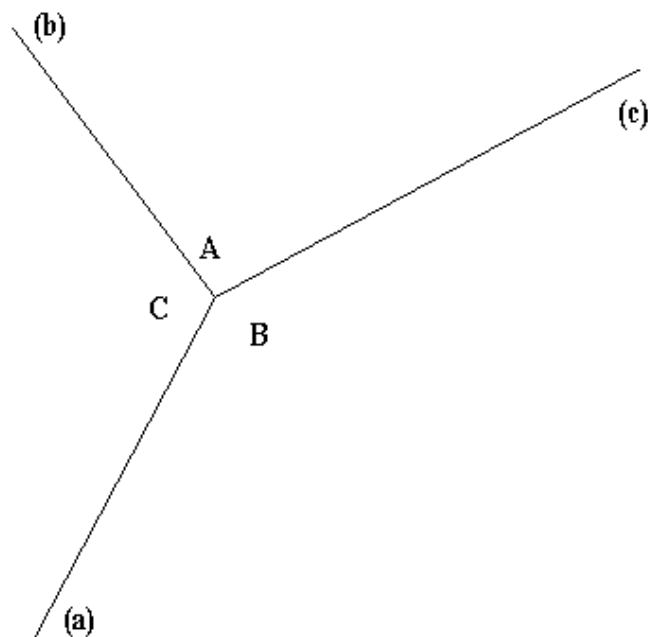
All three-pipe junctions use a tee (or saddle) and associated fittings to resolve the junction.

The method for selecting tees is:

- a) Orient the tee in the most suitable position
- b) Select the diameter of the tee
- c) Add any bends if required
- d) Resolve the straight connections within the junction

6.8.2.1 TEE ORIENTATION

Before any tee selections can be carried out, the orientation of the tee with respect to pipes in the junction is determined.



Major Axis

The major axis of the junction and hence the tee orientation is determined as follows:

IRRICAD determines the angles between the pipes entering the junction (Angles A, B, C above).

The largest angle determines the two pipes that could form the major axis. The remaining pipe forms the minor axis.

E.g.:

- Angle B is the largest, so the major axis will be aligned with either pipe (a) or pipe (c).
- If Angle A equals 90° , the major axis is aligned with pipe (c).
- If Angle C equals 90° , the major axis is aligned with pipe (a).
- If neither Angle A nor Angle C is 90° , the major axis is aligned with the shorter of pipes (a) and (c).

The reason for this is that it is more difficult to bend short pipes to accommodate angle changes than to bend long pipes.

6.8.2.2 DIAMETER SELECTION

Diameter selection is as follows:

- All diameters equal
A plain tee of equivalent diameter is selected.
- Major axis diameters equal, minor axis diameters different
Either a reducing tee, increasing tee or, if these are not available, a plain tee with diameter equal to the major axis diameters will be selected.
- One major diameter and one minor diameter equal
A plain tee of major diameter is selected.
- All pipe diameters different
The largest diameter in the junction sets the major axis diameter of the tee. If a reducing tee can be found to suit the reduction in minor axis diameter, it will be selected in preference to a plain tee of largest diameter.

If a tee diameter cannot be found to satisfy the above conditions, the costing reports will state that a solution to the junction cannot be found.

6.8.2.3 ADDITIONAL BENDS

The routines used for solving bends in two pipe junctions are now used to fit any bends.

At least one of the three branches of the tee will already be aligned with one pipe. If necessary, up to three bends can be used to resolve angles on either of the two remaining branches of the junction.

6.8.2.4 STRAIGHT CONNECTIONS

Any straight connections (couplings) remaining after the tee has been chosen and bends added are now resolved to complete the junction.

Gender and connection types are matched and diameter reductions made if necessary.

6.8.3 *FOUR-PIPE JUNCTIONS*

The solution of fittings for four-pipe junctions depends on the entry angles of the pipes into the junction.

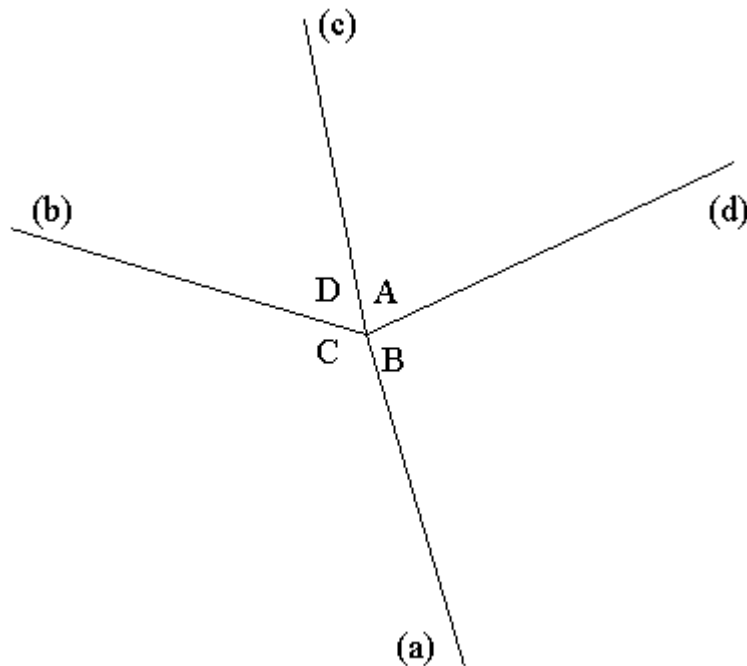
IRRICAD counts up the occurrences of near 90° angles in the junction to enable a decision to be made whether to use crosses or two tees.

If the number of near 90° entry angles is greater than two, then the remaining angle is also near 90°. A cross can be selected for this situation.

If there are any adjacent 90° entry angles, a cross can also be selected.

If either of the above two conditions does not hold, then two tees will be selected.

6.8.3.1 CROSSES



In the above example, two adjacent angles (A and B) are approximately 90° . A cross can be selected for this junction.

To determine the diameter of the cross, IRRICAD first finds the maximum diameter of pipes (a) and (c), and of (b) and (d).

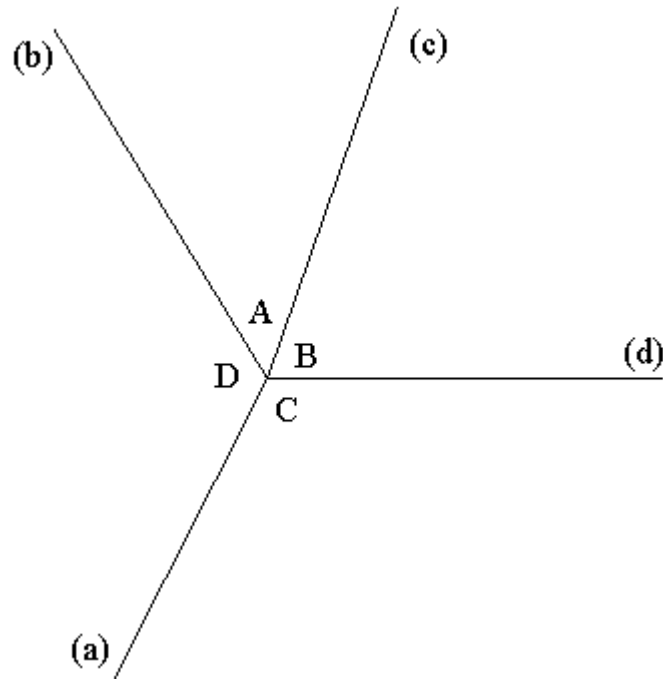
A reducing cross of diameter equal to the maximum diameters of each axis can be selected. If a reducing cross is not available, a plain cross is selected with diameter equal to the maximum of the four-pipe diameters.

If a cross cannot be found, then two tees will be used in the junction.

Having selected a suitable cross, any remaining bends and diameter changes are resolved with the two-pipe junction routines.

6.8.3.2 TWO TEES

When using two tees to solve a four-pipe junction, the following procedure is used.



The junction is categorized into one of three possible groups, according to the following conditions:

- One of the angles is approximately 180°
- Two of the angles opposite each other are approximately 90°
- The junction does not fall into the above two groups

Group 1

If an angle is near 180° (for example, Angle D above), the major axis of the two tees is aligned with the average direction of the two pipes forming the near 180° bend (pipes (a) and (b) above).

Having positioned the major axis of the two tees, the three-pipe junction routines are used to resolve what are effectively two three-pipe

junctions. The connection between the two tees is resolved with the straight coupler routines.

Group 2

If any two opposite angles are approximately 90° (i.e. in the above example if Angle C and Angle A were approximately 90°), one tee is aligned so that its major axis is in the same direction as pipe (b) with minor axis pipe (c). The other tee is aligned with pipe (d) with minor axis pipe (a).

Having fixed the major and minor axis for the two tees, the three-pipe junction routines are used to resolve two three-pipe junctions:

- Junction 1 major axis along pipe (b)
 minor axis of pipe (c) in general direction
- Junction 2 major axis along pipe (d)
 minor axis in general direction of pipe (a)

Two-pipe junction routines select the necessary bends and finally solve the diameter reductions, gender and connecting types.

The connection between the two tees is resolved as follows:

- The connecting side of one of the tees is assumed to be of male gender rather than female. This implies that a short section of pipe is fitted into the tee.
- Bends are then chosen to satisfy the angle between two tees.
- Finally, the straight coupler routines connect the bends to the two tees.

It is possible to get extra fittings in the junction when gender changes in the bend.

Group 3

If the junction does not fall into the above two categories, then angles A and B, and angles B and C are summed.

The total that is closest to 180° defines the two pipes that form the major axes of the two tees.

The major axes of the two tees are aligned with these two pipes.

The process to solve the junction is then the same as that used in Group 2.

6.8.4 FIVE-PIPE JUNCTION

Because a check during the drawing / input stage of a design prevents users from creating junctions that contain more than four pipes, there is no requirement for IRRICAD to resolve junctions containing five or more pipes.

6.8.5 ANGLE TOLERANCE

A tolerance is placed on angles to allow bends whose angle is close to the angle required for a junction to be used.

The angle tolerance is entered in *Design|Pipe Fitting Matching Table*. This tolerance can be set for each pipe type.

A bend can be selected for a junction if the required angle lies within the bend plus or minus the angle tolerance.

If pipe type differs in a two-pipe junction, IRRICAD uses the average of the tolerance set for each pipe as the allowable tolerance.

Angle tolerance can have quite an effect on the number of bends selected in a junction. Care therefore must be taken to ensure realistic tolerance values are entered in the Pipe Fitting Matching Table.

6.8.6 FITTINGS FOR VALVE-UNDER-HEAD SYSTEMS

Care must be taken in those special cases where a separate control valve and outlet are positioned together to form a valve-under-head system.

When the fitting selection routines encounter a control valve they assume the valve is part of a normal zone configuration and choose the fittings accordingly. For a valve-under-head system this results in the correct selection as long as the outlet is placed within a straight section of pipe. For outlets at the end of a pipe or located at the change of direction the appropriate bend to place the valve and outlet in the vertical position will not be selected.

Two solutions are possible. The first is to create an assembly using the appropriate control valve plus the necessary bend and fittings. This assembly is then selected for use at the appropriate locations in the

design. Alternatively the required additional fittings can be added after fitting selection by using the Show Fittings button on a hydraulic dialog.

6.9 APPENDIX H: FORM OF THE EQUATIONS

This appendix lists the formula used in pressure / flow calculations.

The actual forms of the equations for the four types of components are described below. The units shown are those output by the curve fitting utilities (see Section 3.8.1) and used internally by IRRICAD in its calculations.

Pumps: $H = AQ^2 + BQ + C$

H – pump pressure (metres)

Q – pump flow (litres/sec)

A, B, C – constants

Outlet Flow: $Q = K H^n$

Q – outlet flow rate (litres/hour)

H – outlet pressure (metres)

K – constant

n – index or exponent

Outlet Radius: $R = K H^n$

R – wetted radius of outlet (metres)

H – outlet pressure (metres)

K – constant

n – index or exponent

Valves: $H = K Q^n + C$

H – pressure loss through valve (metres)

Q – valve flow (cubic metres/hour)

K – headloss equation constant

n – headloss equation index

C – intercept or start up head

6.10 APPENDIX I: KEYWORDS FOR USE IN PLOT TEMPLATES

Keywords:

#FLAG#	}	Company name - as in <i>Settings Company</i> -
#CONA#	}	Company Formal Name
#NUMB#		Design name (.des file name)
#SCLE#		Plan scale (number only)
#SCAL#		Full US / Metric scale
#XDTE#	}	Design date - as in <i>Settings Design Details</i> -
#DATE#	}	Headings Date.
		Date is created when design is started
#CDAT#		Current date
#DESG#	}	Designer - as in <i>Settings Miscellaneous</i> -
#DESR#	}	Designer
#TITL#		Design title / site - as in <i>Settings Design Details</i> -
		Headings Site
#CLNT#	}	Client name - as in <i>Settings Client</i> - Client Name
#CLNA#	}	
#NOTE#		Design notes - as in <i>Settings Design Details</i> -
		Headings Notes / Comments
#BRCI#		Branch city - as in <i>Settings Company</i> - Branch City
#COAD#		Company address - as in <i>Settings Company</i> -
		Company Address
#COPH#		Company phone - as in <i>Settings Company</i> -
		Company Phone
#COFA#		Company fax - <i>Settings Company</i> - Company Fax
#JOAD#		Job address - as in <i>Settings Design Details</i> –
		Miscellaneous Job Address
#QNUM#		Quote number - as in <i>Settings Design Details</i> –
		Miscellaneous Quote Number

Redundant Keywords:

#COA1#	}	Company address
#COA2#	}	
#COA3#	}	
#NOT1#	}	Design notes
#NOT2#	}	
#NOT3#	}	
#NOT4#	}	
#NOT5#	}	
#DNUM#		Drawing number
#JOA1#	}	Job address
#JOA2#	}	
#JOA3#	}	

6.11 APPENDIX J: SCREEN MESSAGES

This chapter looks at common reasons for problems, and explains the error and warning messages you get on the screen.

6.11.1 INTRODUCTION

During the operation of IRRICAD it is possible that mistakes will be made or problems arise that cause warning messages to be displayed on the screen. Because of space limitations it is often not practical to display a detailed description of the problem, nor of the best course of action to remedy the situation. This section has been prepared to answer both of these questions.

Messages are displayed in a window that appears in the center of the screen. Figure AG1 shows a typical example.

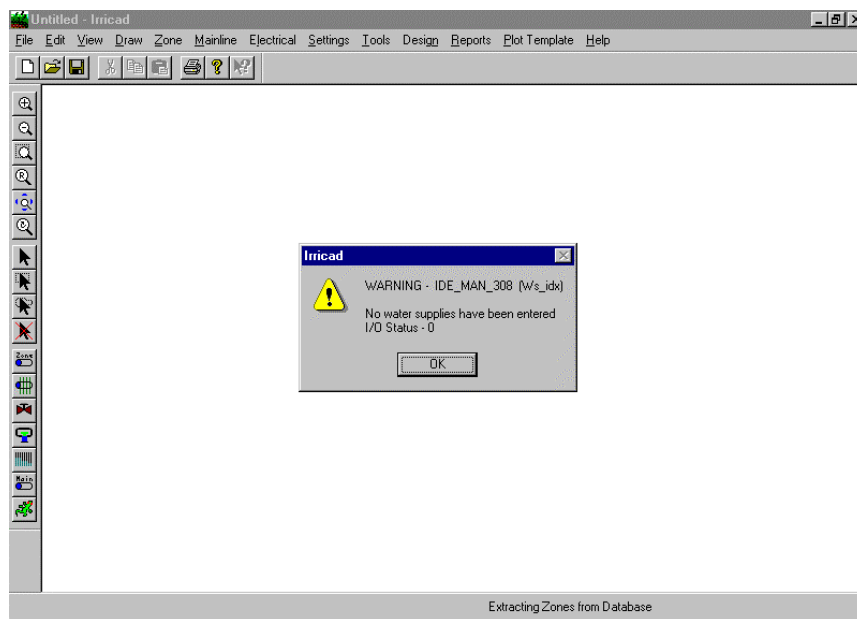


Figure AG 1

For example the message in Figure AG1, IDE_MAN_308: IDE applies to all screen messages and is therefore ignored, MAN indicates that the

message has occurred in the management section; 308 is the message number. To seek help with the message look up MAN 308 in Screen Messages, Section 6.11.3 in alphabetical order and then numerical order. The word in the top right corner is an internal name indicating the program module where the error occurred (this is no interest to the user but it is useful to the technical support person if you need to seek help. The actual message is in the center of the window. A button or two buttons informs the user as to the options available for continuing. These are usually Yes and No, or OK.

In some cases an additional error number might be displayed for example 6414 File not found in the body of the message. This is a program language error statement, rather than an IRRICAD message, and is of value to the support programmer only. The IRRICAD message number is still displayed at the top of the message.

Note: If you encounter a problem which you cannot resolve and contact your support for help, please quote the message number and the program language error number if both occur.

Problems can occur for many reasons but can roughly be classified into two groups:

- Those relating to opening, reading or writing to the various files that are used by IRRICAD.
- Those that are caused by performing tasks out of sequence or exceeding the limitations or capacity of the program itself.

Because difficulties with file operations are numerous in number and have very similar causes and solutions a special section is included to deal with these. This is followed by the main list of messages, their probable cause and suggested solution. For ease of use all the files handling messages are included in the main numerical list but the reader is referred to the appropriate part of the file handling section where this is appropriate.

6.11.2 IRRICAD FILE HANDLING MESSAGES

IRRICAD uses and generates a large number of files during the normal course of its operation. These files can be grouped into four categories:

- IRRICAD Program Files - The actual program files.

- IRRICAD Design Files - Files generated during the course of a particular design.
- IRRICAD Database Files - These contain details of all fittings, sprinklers etc. that IRRICAD can use.
- IRRICAD System Files - A small group of files used by the program to store definitions, menu text, graphic items etc.

The IRRICAD program resides in a number of files, all of which must be present for the program to run successfully. If you are having trouble running IRRICAD, take note of any error messages that occur and contact your technical support or AEI Software.

The files generated by IRRICAD during the course of a design, their file extension, and the location in IRRICAD where they are created are:

Costing Error File	.CER	Fittings Selection
IRRICAD file	.DES	Running IRRICAD
Mainline Design File	.DML	<i>Design Mainline</i>
Zone Design File	.DZN	<i>Design Zone</i>
Internal Database File	.MDB	Running IRRICAD
System Flow File	.STN	Management / Water Supply
Visual CADD Objects File	.VCD	Running IRRICAD
Water Supply File	.WSP	<i>Mainline Water Supply</i>
Zone File	.ZNE	Placing Zone items
Zone Time File	.ZTM	Management / Water Supply

The message associated with these files include:

6.11.2.1 DIFFICULTY OPENING...FILE

Error numbers: 300, 320, 330, 335, 341, 418, 447, 500, 1112, 1124

The most likely causes of this message are:

- An attempt has been made to run a section of IRRICAD that requires the use of a file that has not yet been created. Return to the section of IRRICAD where the file is created and re-run the appropriate part of the program.
- The file is not present in the Irricad\Designs directory. If the file has been copied to another directory copy it back to the Irricad\Designs directory; if it has been accidentally deleted it will

be necessary to re-run that section of IRRICAD where the file is generated.

- A sharing violation may be occurring where another process has got the file. Shut down all programs and restart the computer.
- If the file is present in the Irricad\Designs directory but the Difficulty Opening File message still occurs there is the possibility that the file has become corrupted in some way. Delete the offending file and re-run the appropriate and subsequent sections of IRRICAD to generate a completely new version of the file.
- The files are Read Only or the temporary files created in the \Temp folder are Read Only. Change the properties of all files so they are no longer Read Only.
- There is not enough virtual memory available to allow the file to be used. If insufficient memory is available close all other programs, or increase the amount of Virtual memory available for use.

If none of the above options solve your problem take careful note of the warning error message, save the design files and contact your service agent or AEI Software.

6.11.2.2 DIFFICULTY READING...FILE

Message numbers: 301, 321, 331, 336, 342, 419, 448, 501, 1111, 1125

File reading problems can be caused by:

- The file is not present in the Irricad\Designs directory. If the file has been copied to another directory copy it back to the Irricad\Designs directory; if it has been accidentally deleted it will be necessary to re-run that section of IRRICAD where the file is generated.
- An attempt has been made to run a section of IRRICAD that requires the use of a file that has not yet been created. Return to the section of IRRICAD where the file is created and re-run the appropriate part of the program.
- If the file is present in the Irricad\Designs directory but the Difficulty Reading File message still occurs there is the possibility that the file has become corrupted in some way. Delete the offending file and re-run the appropriate and subsequent sections of IRRICAD to generate a completely new version of the file.

- There is a hardware fault. This is very unlikely and should be considered only after all other possibilities have been exhausted. Contact your service agent or AEI Software.

6.11.2.3 DIFFICULTY WRITING TO...FILE

Message numbers: 302, 322, 332, 337, 343, 420, 449, 502, 1117, 1126

The likely cause of this problem include:

- The hard disk is full; that is, there is no more room to continue writing information to the hard disk. Delete unwanted files or transfer files to floppy disk.
- There is a hardware fault i.e. a faulty disk drive or a device not properly connected.
- The file has been made Read Only. Find the file in the Irricad\Designs directory and check the properties of the file by right clicking on it and selecting Properties. Make sure the Read Only check box is not checked.
- If the file is on a network drive and the network connection has been broken.

6.11.3 SCREEN MESSAGES

CAD 2 : Cad error

Appears if a CAD error occurs with CAD error checking enabled (*Settings\Miscellaneous*).

CAD error checking is normally only enabled to help locate a problem in IRRICAD. Contact your technical support.

CAD 3 : Cad initialization failed

The CAD engine in IRRICAD failed to initialize. Exit IRRICAD and restart. If the problem persists contact your technical support.

CONVERT 2 : Cannot find assembly item

While converting an assembly from DOS IRRICAD databases, IRRICAD has failed to find one of its components. IRRICAD will attempt to make a new component in the Miscellaneous component group of the new database but check the item using the database editor.

CONVERT 3 : Old IRRICAD 5 format file must be converted to IRRICAD 6 format before Windows IRRICAD can convert it

Conversion can only handle IRRICAD Version 6 designs and symbol files. Convert Version 5 files to Version 6 before converting to Version 7.

CST 1100 : Nothing connected to object

An object is not connected to any other object. Either delete the object if it is not required or connect something to it.

CST 1101 : An item is not connected to the pipe system

A warning that a pipe or object has nothing connected to it at that particular location so fittings cannot be selected at that point.

CST 1102 : Number of items required to connect this object exceeds maximum limit

IRRICAD has a limit for the items, which can be selected to join objects at a junction (See Appendix A: IRRICAD Limits, Section 6.2). If this limit is exceeded it suggests that the user has attempted to connect several very dissimilar components and / or the database does not contain an appropriate selection of fittings for the type of components being used in the design. Check also that the connection types and diameters for the components concerned are correctly entered in the database.

CST 1103 : Fitting type for item does not exist

IRRICAD is trying to find a connection type to connect a junction to a junction. Normally these connections are removed as redundant junctions. If not, the error may occur. Check the output to see if the object is a valid one. If not, ignore the message.

CST 1104 : Unable to find required item in databases

Since an item was selected for use in the design, information pertaining to that item has been changed or deleted. Use *Tools|Change* to reselect the item.

CST 1105 : Non zone or mainline item connected to system

This error should only occur if for some reason IRRICAD has lost track of the correct connectivity among the components. Run Repair (*File|Repair*).

CST 1106 : More than two items connected to inline object

This error should only occur if for some reason IRRICAD has lost track of the correct connectivity among the components. Run Repair (*File|Repair*).

CST 1107 : More than the maximum number of fittings could be chosen

More than the number of possible fittings (see Appendix A: IRRICAD Limits, Section 6.2) to be used on a particular two pipe or two component connection within a band between the component diameters could be selected from the Coupler component group of the database. The first x items (where x is the limit) will be used. If likely items are further down the database, take the usage flag from some of the earlier items.

CST 1108 : No of database items exceeds limit, design too big to cost

The costing section of IRRICAD can deal with a maximum number of unique database items up to the limit set in Appendix A: IRRICAD Limits, Section 6.2 for any one design. If this limit is reached the design is too large to be costed. It may be possible to reduce the complexity of the design or break it into smaller sections for costing purposes.

CST 1109 : The maximum number of water supplies has been exceeded

A maximum number of water supplies are specified for any one design. Reduce the number used to the limit or less (Appendix A: IRRICAD Limits, Section 6.2).

CST 1110 : The maximum number of control valves has been exceeded

A maximum number of control valves, or zones, can be used in any one design (see Appendix A: IRRICAD Limits, Section 6.2).

CST 1111-1112 : Refer to IRRICAD File Handling Messages (Section 6.11.2)

CST 1117 : Refer to IRRICAD File Handling Messages (Section 6.11.2)

CST 1121 : Not all fittings loaded into memory, costing may be slowed

At the beginning of costing IRRICAD attempts to load the fittings data into memory to speed up this part of the program. If there is insufficient room to do this the costing process may take longer than normal.

CST 1122 : Two point objects connected. Unable to solve junction

This message indicates that more than one point object, e.g. misc. hydraulic item, outlet, etc has been placed at the same position. This usually results from an error when connecting items in the design. Because the two items are at the same location it is impossible to detect visually. Run Repair (*File|Repair*). If this fails to fix the problem you should be able to determine which zone the problem occurs in by watching the zone number displayed on the status bar while design is taking place. It is then a matter of examining each point object in turn until a location is found where two objects exist. Use *Tools|Select|Window* and *Right-Click|Object Info*. Delete one and re-run design.

CST 1123 : Pipe to be computer sized has not been sized

Computer Selection of Fittings has been selected before Design has been completed and one or more computer sized pipes has been entered in the design. Fittings cannot be selected for junctions that involve pipes that have not been sized.

CST 1124-1126 : Refer to IRRICAD File Handling Messages (Section 6.11.2)

CST 219 : Second depth must be larger than first - please re-enter

Where editing the Riser Selection Rules (Design menu) Depth 1 must always be the smaller of the two depths and Depth 2 the larger.

DBS 1 : Internal database item not found in external database

Since an item was selected for use in the design, information pertaining to that item has been changed or deleted in the IRRICAD database. Click OK and select the changed item or an item to replace it from the list.

DBS 2 : Internal database item key changed

You should never get this message! Somehow the internal database has become corrupted. Contact your technical support.

DBS 3 : Invalid database name

The file selected for conversion is not a valid DOS IRRICAD database. Repeat the command (*File|Convert|Database*) and select a DOS IRRICAD or IRRICAD database.

DBS 4 : Database could not be created

An IRRICAD database or design file could not be created. Take careful note of the reason given which should give some indication what action to take. Common reasons are disk full and sharing violation. If the disk is full make some space available by deleting some files. Exit IRRICAD and restart.

DBS 5 : Database exception error

Some problem has occurred with the IRRICAD database. Take careful note of the reason given and contact your technical support if you are unable to fix the problem.

DBS 6 : No items, or none enabled, in database

The database does not contain any items of the type you wish to use, or no items in the component group have been enabled. Run IRRICAD databases and change the usage flag to Y (or L, Z, M in the case of pipes or tapes).

DBS 187 : Cannot find item in database

A pipe, outlet, valve or outlet connector has been used in the design and then subsequently modified or deleted from the database. IRRICAD can no longer find the object later in the design process. Be very careful when modifying any of the databases to avoid deleting items which may later be wanted.

DBS 188 : Too many pipes enabled for use - only the first 40 loaded

The number of pipes with L, Z or M flags, i.e., pipes available for use is greater than that allowed.

IRRICAD will continue to run but the pipes listed in the database beyond the limit for the appropriate pipe type will not be used. To be sure that all valid pipes are considered in the design, reduce the number of pipes with L, Z or M codes to the limit allowed. See **Error! Reference source not found.**, Section **Error! Reference source not found.** for limits.

DEMO 1 : File Saved As: demo.des

The Demonstration Version of IRRICAD limits you to saving each design as demo.des.

DEMO 2 : **This program is a demonstration version of IRRICAD 3.
The following design restrictions apply: 1 water supply 3
zones 20 (approx.) mainline pipes Up to 120 zone pipes
(less for spraylines)**

The Demonstration Version of IRRICAD has the above limits in the design section.

DES 230 : **Unable to rename file**

If this message appears exit the program and check for a file called nnn.dzt in the \Irricad\Designs folder (where nnn is the name of the design you are currently working on). If this exists delete it and return to the program. If the problem is still present exit the program and delete the nnn.dzn file as well as the nnn.dzt file. Return to the program and repeat the design step. Note that all zones will need to be designed as all previous design information has now been deleted.

DES 300-302 : **Refer to IRRICAD File Handling Messages (Section 6.11.2)**

DES 320-322 : **Refer to IRRICAD File Handling Messages (Section 6.11.2)**

DES 324 : **Data not entered for all irrigation areas**

Water requirements or maximum precipitation rate data has not been entered for one or more irrigation areas.

DES 333 : **More than max. number outlets on a branch within a zone**

The pipe network for the zone cannot be interpreted due to its complexity.

The solution to this problem is to rearrange the pipe network layout for the zone so that the limit in any one branch within the zone is not exceeded. See Appendix A: IRRICAD Limits, Section 6.2.

DES 334 : **Too many unique junctions and outlets in a zone**

The number of different sprinklers / nozzle types used in a zone is such that the maximum number of unique junctions and outlets is exceeded.

Change the layout of the zone to reduce this number. See Appendix A: IRRICAD Limits, Section 6.2.

DES 403 : Two outlets or outlet and valve connected at same position

An outlet has been directly connected to another outlet without a pipe connecting them. Although this is possible to do when drawing the design, it is regarded as an error in Design.

An outlet has been directly connected to a valve that is already connected to a zone pipe. Again this is possible to do when drawing the design; it is treated as an error in Design.

Delete the outlet. If the outlet is required at a position close to another outlet or valve, make sure that a small length of pipe is placed between the two items.

An outlet may be directly connected to a valve (as in a valve-in-head sprinkler, or a valve-under-head sprinkler) but objects other than mainline pipes cannot be connected to the valve.

DES 404 : The maximum number of pipe connections has been exceeded

There are more than four objects connected at a single junction.

Delete or move some of the objects to reduce the number to four or less.

If more than four objects are to be connected at a junction, divide the objects into two groups, joined by a short length of pipe, i.e. create two junctions.

DES 405 : Two pipes connected without junction

This should not normally occur. Run Repair (*File|Repair*).

DES 406 : Two spraylines connected without junction

This should not normally occur. Run Repair (*File|Repair*).

DES 407 : Two control valves connected at the same position

A control valve has been directly connected to another control valve without an intermediate-connecting pipe.

Delete one of the valves, reposition it away from the remaining valve, and if required place a connecting mainline pipe between the two valves.

DES 408 : Invalid item detected in mainline

The mainline program has found an item that cannot be included in the analysis.

Run Repair (*File|Repair*).

If this does not solve the problem, the only solution is to delete and re-insert sections of the mainline until the error is removed. If the error persists save the design and contact your service agent or AEI Software.

DES 409 : Attempt to find location of non-point object

IRRICAD has tried to find the position of an object that does not have a point location.

Run Repair (*File|Repair*).

If this does not solve the problem, the only solution is to delete and re-insert sections of the design until the error is removed. If the error persists save the design and contact your service agent or AEI Software.

DES 410 : The maximum number of junctions has been exceeded

The number of junctions in the mainline exceeds the limit (see Appendix A: IRRICAD Limits, Section 6.2). Re-arrange the system so there are fewer junctions. If this restriction is a frequent limitation in your normal design work please contact your servicing agent or AEI Software.

DES 411 : Water supply pressure not specified in water supply data

The mainline analysis program cannot find a water supply pressure to use as a reference.

Select *Tools|Change* and highlight each water supply separately, checking to see supply has a pressure entered.

DES 412 : No water supply specified

A main water supply has not been entered. Enter at least one water supply. Mainline design cannot be completed without first defining a water supply.

DES 413 : Two water supplies directly connected in series

Two water supplies have been entered in series with a pipe connecting them directly together.

It is necessary to modify the situation so that an item other than a direct pipe linkage are present between the supplies, i.e. connect the second water supply via a tee on the mainline.

DES 414 : Zone Management has not been completed

Either zone design is being attempted before zone management has been completed, or, zones have not been entered in the design. Ensure that at least one zone has been entered (Mainline Outlets or Control Valves), complete zone management data entry (Assign System Flows... or Zone Operating Times) and proceed to Zone Design.

DES 415 : Water supply data has changed - re-run Management / Design

This problem is most likely to occur if a design has been completed (or partially completed) and then some feature of the water supply (position, name, data etc) has been changed. It is necessary to re-run management (Assign System Flows... or Zone Operating Times) before continuing with the design in this case.

If the problem persists, delete the .stn and .wsp files associated with the design in the .Irricad\Designs folder. Re-run management as described above.

DES 416 : Zone or control valve design not completed

Mainline design is being attempted before zone design and control valve analysis has been successfully completed.

Make sure that both zone design and control valve analysis has been successfully completed before attempting mainline design.

DES 417 : No water supplies entered in Design Input

A water supply has not been entered. Enter at least one water supply (*Mainline|Water Supply*).

DES 418-420 : Refer to IRRICAD File Handling Messages (Section 6.11.2)

DES 421 : Nozzle pressure outside specified operating range

The pressure at one or more outlets within a zone is outside the allowable pressure range for the outlet as defined in the database.

View *Reports|Design Reports|Zone Full* to identify the location of outlets outside the range and the actual operating pressures of the outlets. If

the pressure at these outlets is unacceptable, return to the IRRICAD screen to rectify the problem.

DES 422 : Zone design or analysis has not been completed

Zone design or zone analysis has not been completed because a problem has arisen during the pipe sizing process or analysis sections. Where pipe sizing is based on maximum allowable velocity, this error sometimes occurs because the maximum allowable velocity criteria cannot be achieved with the pipes enabled in the database.

The solution is to:

- Add larger pipes to the database
- Increase the allowable maximum velocity in *Design|Design - Parameters|Hydraulic Parameters*
- Rearrange or reduce the size of the zone on the screen

DES 423 : Zone operating times not entered

Some zones have not had operating times entered for them in management. Return to *Design|Zone Operating Times* and enter the required information.

DES 424 : Insufficient pressure available for control valves

The pressure specified at the water supply is insufficient to provide the required pressure at the zone control valves with the current mainline pipe sizes.

Suggested solutions are:

- Reduce the required pressure at critical control valves
- Increase mainline pipe sizes to reduce the pressure loss to the valves
- Increase the water supply pressure

DES 425 : Water supply pressures / operating times not entered

When two or more water supplies are being used operating times and pressures for all water supplies must be entered. Return to *Design|Water Supply Times* and enter operating times for all water supplies, or use Change on each water supply symbol to enter pressures for all water supplies.

DES 426 : Mainline analysis cannot be completed

The network analysis routines have not converged to a specific accuracy during zone analysis or mainline analysis.

Check the design reports to ensure that the resulting flows are acceptable (if strange flows are reported this indicates the analysis was not converging).

If the flows are reasonable but further accuracy is required, try increasing the maximum number of iterations in *Design|Design Parameters|Analysis Parameters*. If the system is not converging towards a solution, change the configuration of the pipe network slightly and re-run. If problems are still experienced contact your service agent or AEI Software.

DES 427 : No pipe size specified for analysis

Either zone analysis or mainline analysis has been selected while one or more pipes have not been sized, either by computer select or manually specified.

Select computer sizing, or manually specify unsized pipes using the change tool.

DES 428 : Max velocity criteria exceeded with available pipe sizes

The pipe sizes available from the database cannot meet the maximum velocity criteria specified for the design. The solution is to:

- Add larger pipes to the database
- Increase the allowable maximum velocity in *Design|Design Parameters|Hydraulic Parameters*
- Rearrange or reduce the size of the zone on the screen

DES 432 : Control valve flow is outside valve specification

The flow through a control valve is outside the range specified by the minimum and maximum flow rate limits set in the database.

DES 433 : No outlets entered for a zone

A control valve has been entered but there are no outlets connected to it. Because this zone has no flow it cannot be designed. Add the missing outlets or delete the control valve.

DES 434 : Warnings issued during design process

During the actual design processes (zone and mainline design, etc) warning messages may occur if, for example, a valve or pipe pressure is outside its specified range etc. These messages only appear briefly and if the user is not watching the screen for the entire time they may be missed. This message will appear at the end of the relevant designs etc if any warnings have been issued. The user is advised to check the View Errors report and then the appropriate design reports to determine the exact nature of the problem.

DES 435 : Pipe pressure greater than maximum allowable pressure

Additional information listing the number of pipes and the zone number where the over pressure occurred will follow this message.

The cause of this problem is that the pressure calculated for a particular size pipe exceeds the maximum allowable pressure specified for that pipe in the database. It will be necessary to either select or enable pipe types of a higher pressure rating or modify the design to reduce the actual pipe pressures.

During sizing or analysis of very complex looped systems that contain more than one water supply point, three of these messages in particular may occur.

DES 436 : More than 2 pipes connected to Misc. hydraulic item

A Miscellaneous Hydraulic item is considered to have only two connection points, an inlet and an outlet. It cannot be used at a three-pipe junction. If a junction is required, shift the connection point a short distance from the hydraulic item.

DES 437 : Duplicate pipe detected in network

Two separate pipes have been used to connect the same pair of junctions. Run Repair (*File|Repair*). If the problem is still present it will be necessary to use *Tools|Select|Adjoining* and *Right-Click|Object Info* to examine each pipe in turn until one is found that displays two pipes. Delete one of the pipes.

DES 438 : Suitable pipes unavailable to size sprayline(s)

The range of pipe sizes enabled (or entered) as spraylines (Usage code L) is insufficient to allow one or more spraylines to be sized. Add more sprayline pipes to the database or enable more if they have already been entered.

DES 440 : Pipe velocity greater than maximum allowable velocity

One or more pipe sizes determined by the LP method or manually selected have resulted in flow velocities exceeding the limits specified in *Design|Design Parameters|Hydraulic Parameters*. The pipes in which this occurs and the actual velocities can be obtained from either the Zone or Mainline Full reports in the *Reports|Design Reports*. If the high velocities are of concern it may be necessary for the designer to fix some of the critical pipe sizes in the design and then re-run pipe sizing to obtain the remaining sizes, or increase the pipe diameter when manually selected. Note that this action is likely to lead to some of the pressure limits not being met or failure of the LP method to find a solution.

DES 441 : LP pipe sizing failed - unbounded objective function

DES 442 : LP pipe sizing failed because of the constraints given

In general terms these messages indicate that the designer has set some constraints on the design in terms of flows and / or pressures which are impossible to meet. It is impossible to cover all the possibilities but likely problems include:

- specifying some pipe diameters which are too small or too big
- incorporating some high headloss Miscellaneous Hydraulic items
- not having a sufficient range of pipe sizes enabled in the database
- velocities too low, etc.

DES 443 : Upstream pressure is less than required downstream pressure

During the selection of candidate diameters used to set up the LP problem, a reverse hydraulic gradient was detected. This is most likely due to the designer specifying some hydraulic conditions (in terms of pressures and / or flows) which are impossible to meet. Things to look for include setting the maximum water supply pressure (or valve pressure) which is lower than the required outlet pressure (accounting for the variable flow variation), or placing outlets with widely different pressure requirements on the same lateral pipe, etc.

DES 444 : **Difficulty opening temporary zone design file**

DES 445 : **Difficulty reading temporary zone design file**

DES 446 : **Difficulty renaming design file to temporary design file**

Should any of these messages occur exit from IRRICAD and delete the design file in the \Irricad\Designs folder (nnn.dzn) and temporary zone file (nnn.tzf), return to IRRICAD and re-run the whole of zone design again (where nnn = the current design name).

DES 447-449 : **Refer to IRRICAD File Handling Messages (Section 6.11.2)**

DES 450-469 :

This group of messages relates to the program used to analyze zone and mainline pipe systems. Trouble shooting in this area is very difficult but in the unlikely event of problems arising the following steps are suggested:

- Check there is nothing unusual about the water supplies, especially for messages 451 and 452. Delete and re-enter the water supplies and re-enter the water supply data in *Design|Water Supply Times* if more than one is present. Re-run Management (Zone Operating Times or Assign System Flows...).
- Check for impossible design situations. These include:
 - The water supply is not connected to the mainline
 - One or more zone control valves are not connected to the mainline
 - The zone control valves are not all directly connected to the water supply through the mainline system, i.e. two distinct sections of mainline exist.

DES 451 : **Root node out of range**

This is usually caused by an error in specifying water supply pressures, particularly with multiple supplies. As a first step, check the water supply data has been entered correctly by using Change on each water supply symbol. Re-run Management (Zone Operating Times or Assign System Flows...) and then Design. If the problem persists delete one or more of the water supplies. Successively re-position them, give them a different name to prevent possible confusion with previous supplies, and re-run Management (Zone Operating Times or Assign System Flows...) and Design after the addition of each water supply.

DES 457 : Too many elements for Rb

This means that the pipe system cannot be analyzed because the limits set within IRRICAD have been exceeded. The number of loops rather than the number of pipes in the network primarily determine whether the limits will be exceeded. The maximum number of loops that can be present in each zone or within the mainline is in order of 15 to 25. The actual number varies with the configuration of the system.

If the above message occurs, change the configuration of the system by removing pipes to reduce the number of loops until the system can be analyzed. Also consider reducing the number of water supply points in the system to a single supply. Successively add water supplies or loops until the limit is again reached. Trial and error will be required to determine which loops or water supplies can be included.

DES 459 : No elements in row of F

Zone control valves not connected to a water supply usually causes this message. To check run *Design|Check Outlet Connectivity*. This will identify any problems of this nature. If all valves are connected to at least one water supply, try changing the configuration of the system, or manually specifying some pipe sizes.

If any of the above messages occur and the reason for the problem cannot be found, save the design and contact your service agent or AEI Software.

DES 470 : Couldn't find pipe in design file

If this message appears it is likely that the design files have become corrupted. Exit from IRRICAD and delete the mainline or zone design file in the \Irricad\Designs folder (nnn.dml or nnn.dzn), return to IRRICAD and re-run design again (where nnn = the current design name).

DES 471 : Storage available for MAXY exceeded - refer to Manual

The size of MAXY depends on the complexity of the design configuration, that is the number of pipes in the design and the number of closed loops. Unfortunately there is not simple rule which can be used to determine this value beforehand as it is virtually design specific. Reduce the number of pipes or loops in the design and try again.

If you are analyzing a flushing main (see Section 2.9.2), combine multiple spraylines into one to reduce the number of loops (see Section 2.9.3).

DES 472 : Network imbalance in pressure or flow - refer to Manual

The system is too complex for IRRICAD to handle. Try reducing the number of loops, the number of water supplies and / or the number of pipes in the network.

In some instances the network imbalance is minimal and can be ignored. Check the Full report.

DES 473 : Valve / WS pressure not specified for detailed analysis

In order to use the Detailed Analysis options a Valve pressure must be specified for each zone control valve for zone design (*Design|Zone Design Configuration*) and a water supply pressure must be specified for each water supply for mainline design (use change on the water supply symbol).

DES 475 : Pipe has zero diameter or HW constant - please check

A pipe has been entered or edited in the database so that the pipe actual diameter or the Hazen-Williams Pipe Roughness C factor has been entered as 0. Run the Database Editor and rectify for the pipe used in the design.

DES 476 : Maximum number of iterations exceeded, detailed analysis

Detailed analysis uses an iteration method to determine actual flows and pressures. This message indicates one of two things:

The calculations were not completed to the accuracy required. Try increasing the number of maximum iterations or increasing the Detailed Analysis Flow Close Fraction in *Design|Design Parameters|Analysis Parameters*.

The network analysis routines have not converged to a specific accuracy. If strange flows are reported in the Design reports this indicates the analysis was not converging towards a solution. Change the configuration of the pipe network slightly and re-run. If problems are still experienced contact your service agent or AEI Software.

DES 479 : Two contours coincide. Using average elevation

Two contour lines or spot heights cross or are at the same position. The average of the two heights will be used.

DES 480 : No elevation for point, setting to 0.0 - refer to manual

An elevation for a point in the design could not be determined. Check that contour lines and spot heights have been entered correctly and span the entire design. You may have to enter more contours.

Re-interpolate elevations (In the Design menu) to try to solve the problem.

DES 481 : Insufficient contour or height info to calculate elevation

A warning to say that an item is either outside of all the contour lines and spot heights or that it is too far away from the contours line or point, its elevation may be set to zero. If this occurs, add more contour lines, estimated if necessary, until no elevations are set to zero.

DES 482 : Re-interpolate elevations if pipe slope lengths required

The design is using elevations but a particular pipe has been found with no associated elevation data. This could arise if extra pipes and / or height data have been added to a design and the re-interpolate option has not been used. Run *Design|Re-interpolate Elevations*.

DES 483 : Water supply flow exceeded. Rezone or increase WS flow

The flow required by the system as designed exceeds that available from the water supply. Either increase the water supply flow (if possible) or re-arrange the zone layout to reduce the system flow.

DES 484 : Too many contour line segments. Some contours ignored

A maximum of 4000 line segments may be used to define contour lines. If more than this number is entered there will be some loss of elevation information over part of the design area.

DES 485 : System flow (zone valve or outlet) not connected to Mainline

Either a zone valve or a VIH outlet is not connected to the mainline system but is listed in the Management option (Zone Operating Times or Assign System Flows...). Either make the necessary connection in the system or go into Management (Zone Operating Times or Assign System Flows...) and reduce the number of system flows accordingly.

DES 486 : Tape inlet pressure outside required range

The minimum submain pressure specified for a pressure-regulated tape or dripline has not been met.

Check pipe reports to determine the extent of the variation. If LP has been used for the design, the differences should only be small (due to the selection of the smaller of the two possible diameters for a given pipe segment. If the velocity method has been used and the error is large it will be necessary to adjust the zone pipe velocity in *Design|Design Parameters|Hydraulic Parameters*.

DES 487 : Branches or bends in tapes or driplines are not allowed

Tape designs can only be done on single, straight tapes that do not have any other pipes or outlets attached to them.

Make the necessary changes to the tape identified (note that only one end of the tape will be listed, the problem however may be anywhere along this tape).

DES 488 : Tape pressure outside the specified operating range

The pressure in one or more tapes is outside the allowable pressure range specified in the database. (This message refers to the tape operating pressure not the absolute pressure limit of the tape).

DES 489 : Tape pressure range cannot be met for conditions given

The combination of tape length and elevation changes is such that the allowable pressure range specified for the tape in the database is exceeded. Check that the input data is correct and that the specified tape pressure range is realistic. If you want to see how far out of range the pressures are likely to be, use the Velocity option to design the zone.

DES 490 : Valve pressure set < = specified minimum submain pressure

A pressure compensated tape has been used in a zone and the minimum submain pressure set. The zone valve pressure has then been set at a value less than this minimum pressure. The zone valve pressure must be greater than the minimum submain pressure.

DES 491 : Two different minimum submain pressures have been specified

Two tapes with pressure controlled inlets have been used in a given zone and minimum submain pressure for each is different. The minimum submain pressure for PC tapes must be the same throughout a zone.

DES 492 : Pump flow rate outside specification limits

The flow through one or more of the pumps in the design is outside the range for the pump as specified in the database. Check the validity of the pump selection for the actual flows in the design.

DES 493 : Pump head near zero, check pump choice & water supply head

During the network analysis, the flow through a pump is such that the required pump head is close to zero. The network analysis may fail under these conditions. Check the pump selected has the right characteristics for the expected duty, and that the water supply pressure is correctly specified.

DES 494 : Only five pumps are permitted in any looped system

A maximum of 5 pumps is allowed in a looped system. If more than this are encountered, the above message is given, and Design terminated.

DES 495 : Available heads across PRV not enough for proper regulation

There is insufficient head across one or more PRVs to ensure their proper operation, i.e. the required downstream pressure cannot be achieved. Check pressure settings for any upstream PRVs and the valve or water supply pressure (if set).

DES 496 : DO NOT use PRVs in loops or with multiple water supplies

Make sure PRVs are not placed in the looped section of a design. If used in loops, the design will either fail or the results will be incorrect. PRVs may be used in designs containing loops, but only in branching sections.

DES 498 : Negative pressure in pipes detected - PLEASE CHECK REPORTS

One or more node pressures have been found which are below zero. The pipes with negative pressures are indicated with a '-' in the RHS column of the zone or mainline pipe report. Increase the zone valve pressure (*Design|Zone Design Configuration*) or water supply pressure by an amount equal to the most negative pressure and re-analyze to ensure all node pressures are positive.

Note: that pressures may be negative on the suction side of pumps. This is acceptable provided the negative pressure does not exceed 19-23ft (6-7m).

DES 499 : Tapes must not be connected directly to control valves

Tapes must not be connected directly to control valves. Make sure that there is a piece of zone pipe between any control valve and a tape or dripline.

DES 550 : Maximum number of pipes exceeded for Demo version

The Demo version has a limitation in the number of pipes that can be used in a design. Delete pipes or decrease the number of spraylines in the design and try Design again.

DES 551 : Constraint counts don't match in input data to LP solver

DES 552 : Negative values appear in LHS of array passed to LP solver

Both these messages indicate that the data passed to the Linear Program solver has been corrupted in some way. Re-running Design may overcome the problem, but if it still occurs please save your design and contact your service agent or AEI Software. You should be able to complete the design using the Velocity option.

DES 553 : Maximum number of iterations for LP exceeded

For the particular design configuration the Linear Program solver is not converging towards a solution. It will be necessary to either use the Velocity option or to change the design layout in some way. If this problem does occur please save the design details and contact your service agent or AEI Software.

DES 554 : Only use LP with single water supplies and branched systems

At present the LP pipe-sizing method in use can only handle branched (i.e. no loops in the pipe network) systems with single water supplies.

For multiple water supplies or looped systems use the Velocity option.

DES 555 : Your system is too big to use LP pipe sizing

Available memory limits the size of the design problem that can be solved using the LP method. It is difficult to give guidance on the size of the system that can be handled because it is dependent on a number of

factors relating to the configuration, number of pipe sizes enabled, etc. Note that spraylines contribute far less to the size of the problem compared to a similar number of discrete pipes and outlets. Another option is to increase the amount of Virtual Memory available on your machine.

DES 556 : Large enough pipe not enabled - LP may not achieve solution

Prior to performing the LP analysis, IRRICAD selects a range of candidate diameters. During this process the program wanted to choose a diameter larger than the largest pipe enabled in the database. If you continue it is likely that the program will find a solution. There is a possibility, however, that the LP solver will fail. If this occurs, enable (or add) a larger pipe size in the database and re-run design.

DES 557 : Iterations exceeded - tape probably too long - flow set to 0

This message can mean that the tape runs are too long. Decrease the length of the tapes and re-run design.

DES 558 : Headloss too high:- fixed pipe sizes or PRV etc, too small

A fixed diameter pipe (either user specified, or fixed due to pipes flagged in the database if computer selected), or a Miscellaneous Hydraulic item (e.g. PRV) has a pressure loss which is too high to allow the required maximum or minimum heads at the outlets to be met. If manually fixed, increase the diameter of the pipe at the indicated location. If computer sized, make larger pipes available in the database.

DES 559 : User selected pipe diameter too large - headloss too low

A fixed diameter pipe (either user specified, or fixed due to pipes flagged in the database if computer selected), or a Miscellaneous Hydraulic item (e.g. PRV) has a pressure loss which is too low to allow the required maximum or minimum heads at the outlets to be met. If manually fixed, reduce the diameter of the pipe at the location given or change the pipe to computer selected.

DES 560 : Zero pipe diameter detected during velocity check

This message should rarely occur as it indicates that one of the design files has become corrupt. Please save the design to floppy disk and call your service agent or AEI Software.

DES 561 : No pipe sizes have been enabled for:-

During Design, IRRICAD is trying to size pipes of the indicated type (zone, sprayline or mainline) but no pipes of this type have been enabled in the database. Run the Database Editor and in the Pipe tab, make sure pipes of the appropriate type are flagged for use.

DES 562 : Solution not found - fixed pipe sizes too big in path:-

This message indicates the LP analysis was unable to find a design solution that meets both the pressure requirements at the outlets and the pipe velocity limits set in *Design|Design Parameters|Hydraulic Parameters*, using the pipe sizes available. The analysis indicates that a likely reason is that some of the pipes in the path indicated by the coordinates given have been fixed in diameter and are too large. This could be because small enough pipes (of the correct usage) have not been enabled in the database, or you have selected a pipe in your design that is too big, or because the pipe size has been limited by the velocity specified in *Design|Design Parameters|Hydraulic Parameters*. Check for any manually specified pipe sizes first. If there are none or they are suitable, check the Database and make sure an appropriate range of sizes have been flagged as available with the correct usage flag.

If the design still fails with this message try increasing (temporarily) the velocity limit in *Design|Design Parameters|Hydraulic Parameters* until the zone or mainline section will design. Check the Zone Full report to see what actual velocities resulted and if necessary return to the IRRICAD screen and fix the diameters of the offending pipes manually and then run Analyze to determine the effects of these changes on the pressure distribution.

DES 563 : Solution not found - fixed pipe sizes too small in path:-

This message indicates the LP analysis was unable to find a design solution that meets both the pressure requirements at the outlets and the pipe velocity limits set in *Design|Design Parameters|Hydraulic Parameters*, using the pipe sizes available. The analysis indicates that a likely reason is that some of the pipes in the path indicated by the coordinates given have been fixed in diameter and are too small. This could be because large enough pipes (of the correct usage) have not been enabled in the database, or you have selected a pipe in your design that is too small. Check the Database and enable some larger pipes with the appropriate usage flag.

DES 564 : Invalid outlet data, Pmax less than Pmin, re-select outlet

IRRICAD has detected inconsistent data for the minimum and maximum allowable pressures for a nozzle. This could be an error in the database or some other problem. Check the pressures of the nozzle for the outlet, and if OK, go back to the IRRICAD screen and re-select the outlet.

DES 565 : Not enough memory for LP sizing

Close all other programs that are currently running and / or increase Virtual memory.

DES 600 : Make sure Pumps are NOT placed within loops - PLEASE CHECK

A warning to say that the presence of both pumps and loops in the system have been detected. If pumps are included within a looped system, the analysis will fail or the results will be in error. Make sure pumps are placed only in the branched sections of a design.

DES 601 : Design incomplete. Please fix problems before proceeding

The IRRICAD design module has failed to complete design. Note the reasons given and fix the problems. If the problem persists contact your technical support.

DES 602 : Pressure too low to operate PRV. No adjustments made

The water supply pressure is not high enough to maintain at least one PRV in the zone at a pressure sufficient to operate correctly. Increase the water supply pressure or change or adjust the PRV. When this problem occurs, the pressures throughout the zone are not adjusted.

DIG 1 : Tablet X and Y scales are not the same, tablet not enabled

Use Control panel Tablet settings to set the x and y scales the same or contact your technical support.

DIG 2 : Unable to open default tablet context, tablet not enabled

Turn off your computer and restart. Check the digitizer is working.

Contact your technical support.

DIG 3 : Unable to open tablet context, tablet not enabled

Turn off your computer and restart. Check the digitizer is working.

Contact your technical support.

DIG 4 : No tablet scale entered, use Scale or Reference first

Tablet mode has been selected before a scale has been entered.
Select *Settings|Digitizer|Scale* or *Settings|Digitizer|Reference*.

DIG 5 : Entered scale different from calculated scale

When referencing a plan using the digitizer IRRICAD calculates a scale from the reference point coordinates. This message will appear if this calculated scale is more than 5% different from the plan scale already entered. Carefully check the plan scale is correctly entered, that the coordinates of the reference points have been correctly calculated and entered, and that the appropriate reference points have been correctly digitized.

DIG 6 : Tablet points identical, tablet not enabled

The two coordinates entered in the reference dialog box are the same. IRRICAD requires the two points to be different to calculate a scale. Enter two different points.

DIG 7 : Unable to retrieve tablet device information, tablet not enabled

Turn off your computer and restart. Check the digitizer is working.

Contact your technical support.

FILE 1 : File could not be opened

FILE 2 : File could not be closed

FILE 3 : File could not be read

FILE 4 : File could not be written

FILE 5 : File record could not be found: Seek failed

See the notes on IRRICAD File Handling Messages (Section 6.11.2).

FILE 35 : File is not a IRRICAD design

The selected file is not an IRRICAD design file. Repeat the command (*File|Open*) and select an IRRICAD design file.

**FILE 38 : Please note: AutoSaving unavailable for backup design
please use *File|Save As***

AutoSave uses the reserved file name ~IRRICAD~Backup.des. The current design name is this so AutoSave cannot run. Manually save the design using *File|Save As* and save the design under a new name.

FILE 39 : AutoSave Error

AutoSave has failed to save the design. Manually save the design using *File|Save*.

FILE 40 : Cannot find IRRICAD component database

IRRICAD cannot find the component database. This can happen if the database has been shifted to another folder or computer. Click OK and select the required database or another one to replace it.

**FILE 41 : Please check all settings and objects as IRRICAD had
difficulty reading the design file**

IRRICAD has had problems reading the design file. Some objects may be missing or invalid. Some settings may have changed. Check settings using the Settings menu and *Design|Design Parameters*. If you have problems with objects in the design, try running repair.

FILE OPEN ERR : Failed to open file

IRRICAD was unable to open the error log file errorlog.txt.

FIT 1119 : Can only edit fittings (non-hydraulic items)

When you are in Show Fittings section of a hydraulic dialog you cannot edit any component (such as a sprinkler for example) which would affect the hydraulic performance of the design (i.e. affect pressure or flow)

**HTML HELP : Unable to create HTML style help, reverting to Windows
help**

Either IRRICAD cannot find the IRRICAD Html file or it cannot find the HTML help viewer (Internet Explorer 3.01 or later). IRRICAD Help will be displayed using the standard Windows help.

**IDS FAILED LOAD PRINT : Failed to load print values into the print
dialog**

This is unlikely to occur. If it does, exit IRRICAD and restart. If it persists contact your technical support.

IDS INVALID INPUT : Invalid input

The value entered in the dialog is invalid. Take note of the reason given and click OK to return to the dialog and correct the problem.

IDS IRRICAD RUNNING : IRRICAD is already running

You are trying to start IRRICAD when it is already running. Only one instance at a time can be running.

IDS NO OBJECT PLACED : No object placed

IRRICAD was unable to connect or place the hydraulic object. Probably you were trying to connect two objects of the same type or to place one object directly on top of another.

IDS NO SPLASH SCREEN : Failed to create splash screen

IRRICAD has a problem displaying its splash screen.

INP 215 : Unable to calculate flow for sprayline / tape, try again

The lasso defining a Show Flow area must not cut a sprayline into more than one section unless it includes a sprayline end. Redefine the boundary and try again.

INP 1032 : Can't continue pipe as 4 items already connected

After connecting a pipe to a junction which already has three objects connected to it, this last pipe cannot be continued as a further pipe leaving the junction would create five objects at that junction.

As the maximum number of objects connected at a junction is four, the pipe being connected to the junction is discontinued at the junction.

INP 1033 : Delete mainline or zone pipe before deleting valve

A valve within a pipeline has, on its upstream side a mainline pipe, and on its downstream side, a zone pipe.

If the valve were deleted, a mainline pipe would be connected directly to a zone pipe that is an invalid connection in IRRICAD.

IRRICAD, because of this, requires the user to delete either the upstream mainline pipe or the downstream zone pipe before the valve can be deleted. Error 1033 warns the user that this must be done.

INP 1701 : Can't position lateral boundaries

Under normal circumstances you should not encounter this message. If you do please save the design and contact your service agent or AEI Software.

INP 1702 : Too many boundary lines crossed

This message may occur when automatically laying out laterals in block which have re-entrant boundaries. In this case some laterals will have to stop and then re-start on the other side of the re-entrant part of the boundary. The maximum number of such crossings is limited to four. (This would occur for example in a block shaped like a capital E with laterals running vertical).

INP 1703 : Odd number of lateral boundaries crossed

In some circumstances a lateral may just contact a boundary line at one point, i.e. it appears to cross only one boundary. In this case the lateral concerned will not be drawn and the above message displayed. Either place the missing lateral manually or make a small adjustment to the position of the boundary.

INP 1704 : Couldn't position specified number of laterals

For the given spacing the specified number of laterals would not fit within the block boundaries. Check for incorrectly entered (or calculated) spacing and lateral numbers.

INP 1900 : Cannot correctly space selected sprinkler along area edge

The selected sprinkler cannot be spaced along an area edge using the constraints that the spacing must lie between the specified minimum and maximum percentages of the wetted diameter. The edge concerned appears immediately following this message. If the spacing used is of concern you will have to select another sprinkler type or change the nozzle / pressure combination.

INP 1901 : Required nozzle arc not found for selected sprinkler

The shape of the irrigated area is such that nozzle arcs are required that are not listed in the database for the particular sprinkler selected.

INP 1903 : Too many edges in area to split

INP 1904 : Fill stack full

Both these messages indicate that the irrigation area you have designated is too complex in shape for automatic head placement to work. The solution is to subdivide the area into smaller sections; two will usually be sufficient.

INP 1951 : No water supply found - Flow check not done

If no water supply has been entered the check made when connecting outlets together cannot be made. This message warns this is the case.

INP 1979 : Only one water supply allowed

Only one water supply can be used for any given design. Remove the extra water supplies.

INPT 1 : This value is below the recommended minimum

A value entered in a dialog is below the recommended minimum. Click OK to accept the value and continue or cancel to return to the dialog and correct the value.

INPT 2 : This value is above the recommended maximum

A value entered in a dialog is below the recommended maximum. Click OK to accept the value and continue or cancel to return to the dialog and correct the value.

INPT 3 : Nozzle pressure out of range

You have tried to select a nozzle pressure that is outside the minimum and maximum limits set for that nozzle in the database. Either change your selected pressure, or change the pressure limits for the nozzle in the database.

INPT 4 : Select row(s) to remove

In a dialog with a table select the rows to delete before clicking the Delete or Remove button or pressing the Delete key.

INPT 5 : Select file containing symbol definition

IRRICAD is trying to load a drawing, database or template symbol but cannot find the symbol file in the default path (folder) specified in Settings. Click OK then select the required file from the appropriate folder.

INPT 7 : Intensity changed. Selected nozzle may no longer be appropriate

Due the editing the wetted radius arc of a variable nozzle the angle has changed by more than 150°. This means the intensity has changed and the nozzle associated with this arc may no longer be appropriate.

INPT 8 : Arc change is inconsistent with nozzle-arc combination selected

Since the nozzle type is Fixed the arc change is cosmetic i.e. the arc is drawn at the new angle on the screen but the underlying hydraulic characteristics have not changed.

To change to another fixed nozzle-arc combination select the outlet with the Change tool and edit the nozzle in the outlet dialog.

INPT 9 : Cannot use this copy tool on connected hydraulic objects

Linear, Radial and Array copy can only be used on geometric and unconnected hydraulic objects. Use the multiple copy tool for connected hydraulic objects.

INPT 10 : Too many items selected

Too many symbols or DXF contour layers have been selected at one time. A maximum of 256 symbols will be unloaded or contour layers imported. Repeat the procedure for the rest of the items.

INPT 11 : Cannot unload symbol definition because the design contains instances of it

A symbol definition can only be unloaded if the design does not contain any instances of it. Delete all instances of the symbol before unloading it.

INPT 12 : Select objects to make symbol, legend or template from before invoking tool

The Create Symbol, Make Legend and Save Template tools require selected objects to act on. Select the required objects then select the appropriate tool.

INPT 13 : Cannot explode hydraulic objects

Only geometric objects, i.e. objects with no hydraulic significance, can be exploded using the Explode tool.

INPT 14 : Cannot convert this type of object to an elevation

Only geometric objects that are points, symbols, lines, polylines and curves can be converted to elevations. An object other than these has been selected.

INPT 15 : This object is already an elevation!

A spot height or contour has been selected for the Convert to Elevations tool. It cannot be converted as it is already an elevation.

INPT 16 : Cannot resize hydraulic objects

Only geometric objects, i.e. objects with no hydraulic significance, can be resized using the Resize tool.

To resize pipes, tapes and spraylines delete them and place new ones in the design at the new length.

To resize outlets and other point hydraulic objects (including water supplies and junctions) change the base database symbol size and check the Update Database Symbol Size check box in *Settings\Miscellaneous*.

Junction, water supply and spot height sizes can be changed in *Settings\Irrigation Items* but existing ones will have to be deleted and re-entered for the new size to take effect.

INPT 17 : Select objects before invoking tool

The Spraylines To Tapes, Tapes To Spraylines, Change Type, Move Fills To Back, Make Active Area tools require objects to be selected before acting. Select required objects then select the appropriate tool.

INPT 19 : Hydraulic object placed not connected

The hydraulic object being moved has been placed rather than connected to another hydraulic object. This is usually due to trying to connect to another object of the same type e.g. Outlet to outlet, or to some other invalid connection.

INPT 20 : Legends must have a fill rectangle, placeholder text and line or symbol

Legend symbols consist of a fill rectangle, placeholder text and line (pipe legend) or symbol (sprinkler / valve legend). One or more of these entities is missing from the selected objects so a legend symbol cannot be created.

INPT 21 : Cannot overwrite existing definition while design contains instances of it

The name (or number) entered for a drawing, legend or template symbol is the same as an existing name and there are instances of that symbol in the design. Either delete the existing symbols in the design or give the symbol definition being created / saved a different name.

INPT 23 : Cannot break hydraulic objects

Only geometric objects, i.e. objects with no hydraulic significance, can be broken using the Break tool.

INPT 24 : Too many points in boundary. Maximum of 91 allowed

Design has a restriction that irrigation areas must not have more than 91 points. Re-enter the area using longer line segments and therefore fewer points.

INPT 25 : Cannot place selected sprinkler in area. Radius too small

Drippers and outlets with very small wetted radii or flow cannot be used for Autohead placement.

MAN 303 : Operating cycle time not entered

The operating cycle time for the design has not been entered in *Design|Design Parameters|Economic Parameters*. Enter a cycle time in days.

MAN 306 : Invalid time(s) entered

The operating times for the water supply or the zones are either outside of the management cycle time (see *Design|Design Parameters|Economic Parameters*) or the times entered are outside of the standard conventions used (0-23 for hours, 0-59 for minutes).
MAN 308 : No water supplies have been entered

A water supply for the design has not been entered into your design. If data for a water supply is to be entered or mainline design attempted, a water supply must be entered.

MAN 309 : The maximum number of water supplies has been exceeded

More than the maximum number of water supplies has been entered. You will have to reduce the number to the limit or less; IRRICAD File Handling Messages (Section 6.11.2).

MAN 326 : The maximum number of irrigation areas has been exceeded

The number of irrigation areas entered exceeds the limit; IRRICAD File Handling Messages (Section 6.11.2).

MAN 330-332 : Refer to IRRICAD File Handling Messages (Section 6.11.2)

MAN 335-337 : Refer to IRRICAD File Handling Messages (Section 6.11.2)

MAN 338 : More than one control valve connected to a zone

Each zone can have one control valve only. If more than one valve is connected to a zone the excess valves must be deleted, or more zones created.

MAN 339 : Mainline item in zone - refer to manual

An item normally associated with a mainline (e.g. pipe, headworks, valve-in-head sprinkler) is connected to a zone downstream of the zone control valve. As this cannot normally occur it suggests that design files have been corrupted.

Run Repair (*File|Repair*).

MAN 340 : Data not entered for all zones / system flows

On and off times have not been entered for all of the zones listed in the Zone Operating Times or the Assign System Flows... data entry screen.

Times for all zones must be entered to continue through mainline design.

MAN 341-343 : Refer to IRRICAD File Handling Messages (Section 6.11.2)

MAN 344 : The maximum number of system flows has been exceeded

The total number of system flows for the zones is greater than the limit (see IRRICAD File Handling Messages (Section 6.11.2)).

It will be necessary to reduce the number of on / off time combinations by perhaps timing some zones to operate at exactly the same time as other zones.

MAN 345 : Zone flow exceeds water supply maximum flow

The flow required for a zone is greater than the maximum water supply flow available (as specified when you entered the water supply). As the system cannot operate under this condition, reducing the number of outlets in the zone must reduce the flow requirement of the zone.

MAN 347 : No zones have been entered in design input

No zone control valves have been entered in to your design. Zones are defined by the name given to the zone control valves.

MAN 348 : System flow exceeds water supply maximum flow

The system flow resulting from the zone management (Zone Operating Times) exceeds the maximum flow available from all water supplies.

The operating times for the zones must be rescheduled so that the resulting flow required is less than the maximum flow available.

MAN 349 : System flow exceeds WS design flow, press Yes to accept, No to quit.

The system flow resulting from the zone management (Zone Operating Times) exceeds the maximum flow available from all water supplies.

The operating times for the zones must be rescheduled so that the resulting flow required is less than the maximum flow available.

MAN 350 : The same zone name has been used twice

Two or more zones have been given the same name.

Change the zone name given to the duplicate zone control valve (use the Change tool).

MAN 351 : Zone item in mainline - refer to manual

An object normally included as part of a zone has become part of the mainline system. IRRICAD has been structured to prevent this from happening. If it does, run Repair (*File|Repair*).

MAN 352 : The maximum number of mainline items has been exceeded

More than the maximum number of outlet types (valves, valve-in-heads etc) have been used in the mainline. Try to reduce the number of unique items to remove this error. If the problem occurs frequently, contact your servicing agent or AEI Software.

MAN 353 : Outlet not connected to a zone valve

A warning during the connectivity check that an outlet is not connected to a valve. If outlets are to be included in zones they must be connected to valves, either directly or through a pipe network.

MAN 355 : Times for system duties overlap

When specifying the system duty on / off times (Assign System Flows...) it is necessary to ensure that one set of duty times does not overlap with another.

MAN 356 : Zones are not permitted to span irrigation areas

When defining irrigation areas it is important to ensure that the area encompasses only complete zones. An area boundary must not divide a zone into two sections.

MAN 357 : Irrigation area not closed

An irrigation area must be completely closed. Make sure that the end of the boundary line forming the area is joined to the start point (use *Right-Click|Close* when drawing the last boundary line).

MAN 358 : Overlapping irrigation areas not allowed

The boundary of one irrigation area must not cross the boundary of any other irrigation area.

MAN 359 : The Number of irrigation areas within another exceeds the limit

Irrigation areas can be defined which completely enclose other irrigation areas. The maximum number of areas that can be enclosed by any other irrigation area is limited. Reduce the number of enclosed irrigation areas to this value (see IRRICAD File Handling Messages (Section 6.11.2)).

MAN 360 : No water supply available for system flow

This message results from a mismatch between the times when a water supply is available and the zone operating times. The solution is to change either the water supply availability (in *Design|Water Supply Times*) or the zone operating times (in *Design|Zone Operating Times*) to ensure that water is available during all zone operating times.

MAN 361 : Valve / Outlet / Sprayline not connected to water supply

A warning message that one of the items does not have a path back to the water supply. If this was intentional it is possible to proceed, but note that if a valve (or valve-in-head outlet) is not connected to the water supply the partial management option must be selected (Assign System Flows...) and the corresponding zone excluded from consideration (do not assign a system flow to this zone). Otherwise the design process will fail.

MAN 362 : Unable to find zone, please rerun management

This message will appear if design has been completed and then a zone deleted and an attempt made to re-run Design. Re-running Management (Zone Operating Times or Assign System Flows...) takes account of the deleted zone and Design will then run correctly.

MAN 364 : Outlet cannot be connected directly to water supply

Outlets are part of a zone e.g. downstream of a control valve. There must be a control valve between an outlet and the water supply.

MAN 365 : All Outlets / Valves connected

After running *Design*|*Check Outlet Connectivity*, IRRICAD is telling you that all hydraulic items in the design are connected.

MAN 366 : The maximum number of zones has been exceeded

IRRICAD has a limit for the number of zones that can be used a design (see Appendix A: IRRICAD Limits, Section 6.2).

MISC 1 : Value out of range

The value entered in the dialog is out of range. Enter a value within the range given.

MISC 4 : Too many selected objects to display all information

Too many objects have been selected for object info. Information will only be displayed for a limited number of them. Reduce the number of objects selected if you wish to see all the information for them.

OOP 1 : Object could not be read

IRRICAD has encountered an object or setting it cannot read while opening a design. Check the version numbers given. A newer version design cannot be read with an older version of IRRICAD.

OOP 7 : Invalid point number

IRRICAD has attempted to access a second point in a point object or a third point in a line object, for example. Try running Repair (*File|Repair*). If the problem persists contact your technical support.

PERM 164 : You cannot select the current item

An attempt is being made to select the assembly being created as an item in the assembly.

PERM 166 : More than one different outlet in assembly

Two or more different outlets have been selected in an outlet assembly. Only one is permitted.

PERM 167 : Curve fitting unsuccessful

The curve fitting routine is not able to handle the data as entered. Check that you have entered the data correctly. If this is correct make sure that the type of curve you are trying to fit can approximate the data. See Curve Fitting, Section 3.8.1.

PERM 168 : Cannot have negative or zero values for power curves

Negative data values cannot be used in the curve fitting utilities.

PERM 169 : Not enough points entered (Minimum 3)

At least three sets of data points must be entered (excluding the 0,0 points) for curve fitting to take place.

PERM 174 : This is low, please check your data

The r2 value is below 90%, which implies a bad fit. Recheck the data you have entered.

PERM 179 : Duplicate pressure entered: Please check data

Two identical pressure values have been entered. This is not valid for the relationship you are trying to generate.

PERM 192 : Same flow value entered twice: Please check data

Two identical flow rate values have been entered. This is not valid for the relationship you are trying to generate.

REP 500-502 : Refer to IRRICAD File Handling Messages (Section 6.11.2)

SENT NODRIVER : Sentinel Driver not found - reinstall

The sentinel driver has not been installed. With the IRRICAD installation CD in the CD_ROM drive, browse the CD for the Drivers folder. Open the folder and double-click on the Setup.exe file. This installation will recognize the operating system you are running. It is very quick. Try running the IRRICAD program again.

SENT NOTTHERE : Sentinel missing or faulty

The hardware protection device used to protect the IRRICAD program is not plugged into the computer parallel port, or has become damaged in some way. See the above message (SENT NODRIVER) to re-install. If a previous version of the driver has been installed to run IRRICAD this will need to be removed before installing the new driver. Check the correct installation for your dongle type has been used (see the ReadMe.txt about AB-B, EH-B or CG-B or BH-B type sentinels).

UTIL 1604 : Invalid group code in DXF file

UTIL 1605 : Invalid Y coordinate code in DXF file

In normal circumstances these conditions should not occur as they indicate that something is wrong with the DXF file you are trying to use. If possible, obtain another copy of the file from the original source and try again.

Index

<

<DEFAULT> 2:39, 2:104, 5:121

2

2 Point Rectangle 5:46

3

3 Point Circle 5:51

3 Point Rectangle 5:46

A

Add Nozzles .. (database button) 3:33

Add to Assembly .. (database button) 3:17

Aligning Arcs 2:67

Analysis Parameters 1:21, 2:92, 5:162

Analyze 2:16, 2:49, 2:66–2:67, 2:88–2:91, 5:172, 6:18

Analyze (Existing Sizes) 2:90, 5:168–5:170

Analyzing Existing Systems 2:66

Angular Dimension 2:115, 5:73

Arc Orientation 2:63, 2:68–2:69, 5:103

Arc tool 1:10, 5:55–5:57

centre start end 5:57

elliptical 5:57

start mid end 5:56

Arcs

aligning 2:67

Area 5:5, 5:134

arc orientation 2:63, 2:68–2:69, 5:103

arcs 2:62–2:65, 2:67–2:68, 5:103

Area tool 1:13, 2:65, 2:68–2:70, 2:77–2:78, 5:85–5:87

dialog details 5:85–5:87

Areas 2:33

odd shaped 2:69

Array Copy 1:12, 5:151

Assemblies 2:47, 2:82, 2:151–2:152, 3:16–3:19

creating 3:16, 3:28, 4:122, 6:28

example of construction 3:19

- listing components 3:5, 3:16–3:20, 5:191, 5:195, 5:201
- modifying 3:17, 4:124
- reporting 3:7, 3:10, 3:13, 5:190–5:191, 5:195
- usage codes 3:10, 5:191
- Assembly Construction 3:19
- Assign All Zones to One System Flow 2:15, 2:87, 5:166–5:167
- Assign Each Zone to a Unique System Flow 2:15, 5:166
- Assign System Flows to Zones 1:14, 2:15, 2:63, 2:86–2:87, 5:165, 5:166, 5:167
- Assigning System Flows to Zones 2:87
- Autohead 1:22, 2:64–2:65, 2:70
- Autohead tool 1:13, 5:85–5:87
- spacing 1:22, 2:65, 5:123
- AutoSave 2:10, 2:149, 5:131
- Available Line Types 1:22, 2:32, 2:48, 3:7, 3:16, 3:22, 5:125–5:127, 6:12

B

- Backup 1:19, 2:9, 2:149, 5:131
- Bill of Materials Reports 1:14, 1:16, 2:94, 5:162, 5:174, 5:194–5:199, 5:200
- bom 5:195–5:196
- bom by supplier 5:197
- bom with costs 5:196
- inventory 5:198
- inventory by description 5:198
- inventory by w/h code 5:197
- zone / mainline bom 5:195
- Birds Eye View 5:37
- Bitmap Import 2:23–2:24
- Bitmap Importing 5:17
- Bitmap settings 2:18, 5:135
- Block

- symbols 4:128
- user defined lat. direction 2:74
- Block of Symbols 1:12, 4:128, 5:151
- Block tool 1:13, 2:25, 2:54, 2:72, 2:75, 3:13, 5:39, 5:85–5:87
- dialog details 5:85–5:87
- user defined lat. direction 5:97, 5:99, 5:101–5:102
- BOM by Supplier Report 1:16, 5:197
- BOM Report 1:16, 5:195–5:196
- BOM with Costs Report 1:16, 5:196
- Break tool 5:154
- Bug Trapper 1:25

C

- Center Polygon 5:48
- Center Radius Circle 5:52
- Center Start End Arc 5:56–5:57
- Change
- spraylines to tapes 5:159
- tapes to spraylines 5:159
- Change Design 1:16
- Change tool 1:11, 2:26, 2:32, 2:41, 2:69, 5:4, 5:17, 5:39, 5:145–5:147
- Change Type tool 2:26, 2:35–2:36, 2:96, 5:147
- groups of items 2:35–2:36
- Check Outlet Connectivity 1:14, 2:16–2:17, 2:27, 5:164
- Circle tool 1:10, 5:50–5:52
- 3 point 5:51
- centre radius 5:52
- diameter 5:51
- ellipse 5:52
- Circular cursor 1:11, 2:12, 2:72, 2:75–2:77, 5:119, 5:128
- Clear Selection tool 5:141

Close 2:103, 5:3–5:4
 closed 2:16, 2:63, 2:103, 5:11, 5:44, 5:49
 Company settings 5:134
 Component
 connection codes 2:95
 connection types 2:149, 3:13–3:15, 6:24
 database symbols 3:15, 5:158
 description 3:7, 3:11
 disable 2:151, 3:4, 3:21
 enabled 2:26, 2:43, 2:59, 2:150, 3:12
 gender code 3:14
 group 3:4, 3:6–3:7, 3:9, 3:11, 3:12, 3:27, 3:42, 3:50, 5:146, 6:8
 line type 1:21, 2:48, 3:7, 3:13, 3:16, 3:22, 6:12
 pipe types 3:13–3:14, 3:26, 3:39, 5:89, 5:173, 6:9–6:10, 6:28
 plotting color 3:8
 retail price 3:11, 3:13, 3:53, 5:162, 5:200
 supplier cost code 3:7, 3:11
 symbol size 3:7, 3:15, 4:35, 4:50
 usage 3:10, 3:12, 3:21
 usage code 2:26, 2:151, 3:3–3:4, 3:7, 3:10–3:11, 3:12, 5:190, 5:195, 5:201
 warehouse code 3:7, 3:11
 wholesale cost 3:11, 3:13, 5:162
 Compress files 5:19
 Computer Selected 2:37, 2:51, 2:89, 6:18
 Computer selected pipe 2:13, 2:33, 2:49, 2:51, 5:91, 5:92–5:93, 5:98, 5:171, 6:18
 Computer sized pipe 2:13, 2:33, 2:36, 2:49, 2:51, 5:91, 5:92–5:93, 5:98, 6:18
 Computer Sizing 2:33, 2:48, 2:61–2:62, 2:89, 5:169, 5:171, 6:17
 Connected Spraylines 2:43–2:44, 2:53, 2:55, 2:88, 2:140, 5:94, 5:97, 5:157, 5:159, 5:183–5:184
 move sizes 5:156
 trim 5:155
 Connection codes 2:95
 Connection Types 2:149, 3:13–3:15, 6:24
 Continuous Bezier Curve 5:54
 Continuous Line 5:44
 Contour Importing 5:16
 Contour tool 1:10, 2:41, 5:82
 dialog 5:83
 Contours 2:41, 5:158, 5:167
 Control Valve 2:3, 2:14, 2:25, 2:48–2:52, 2:67, 2:79, 3:6, 5:5, 5:88, 5:108, 5:134, 5:182
 set pressure 2:51
 Control Valve tool 1:13, 5:39, 5:85–5:87
 dialog details 5:85–5:87
 Controller tool 1:13, 5:113
 dialog details 5:113
 Controllers 3:7, 3:37
 database details 3:37
 Convergence 5:163
 detailed analysis 5:163
 lp 5:162
 mainline analysis 5:163
 tapes 5:162
 Convert
 databases 5:19
 designs 1:9, 5:20
 plot layouts 1:9, 5:21

- symbols 5:20
- Convert Files 5:19
- convert templates 1:9
- Convert to Elevations tool 5:158
- Converting 1:9, 1:24, 5:15
 - file types 5:18
- Coordinate navigation 5:36
- Copy Design Base Information 1:19–1:20
- Copy tool 1:11, 5:148–5:152
 - array 1:12, 5:151
 - linear 5:149
 - multiple 5:152
 - radial 5:150
- Copying designs 5:15
- Copyright 2:6, 3:45
- Costing Reports 1:15, 1:14–1:15, 2:17, 2:95, 2:149, 5:190, 5:192, 5:193, 5:194, 5:199–5:200, 6:24
 - design summary 5:191–5:193
 - detailed costs 5:193
 - options 1:16, 5:200
 - zone / mainline detailed 5:192–5:194
 - zone / mainline summary 5:191
- Couplers 3:6, 3:27, 6:8
 - database details 3:27
 - end caps 3:27
- Create Sprayline Outlets 1:9
 - settings 5:132
 - tool 2:44, 2:74, 5:157
- Create Symbol tool 1:12, 1:19, 2:102, 3:15, 5:158
- Create Wetted Radii
 - settings 5:40, 5:132
 - tool 2:44, 5:157
- Creating 3:11, 3:15–3:18, 3:20, 3:31
- Creating and Modifying Assemblies 4:121

- Creating and Modifying Symbols 4:125
- Creating Assemblies 3:16
- Crosses 3:6, 3:29, 6:8, 6:24–6:25
 - database details 3:29
- Cursor settings 5:127
- Curve Fitting Utility 1:20, 2:47, 2:61, 2:80, 3:42
- Curve tool 1:10, 5:53–5:54
 - continuous bezier 5:54
 - single bezier 5:54
 - spline 5:55
- Cut Lasso tool 2:41, 2:55, 2:61–2:62, 2:72, 5:155
- Cut Pipe
 - tolerance 5:120
- Cut Pipe Factor 5:120
- Cut Pipe tool 2:25, 2:49, 2:61, 2:71, 2:77–2:78, 5:39, 5:85–5:87
 - dialog details 5:85–5:87
- CV Summary Report 1:15, 5:186
- Cycle Time 5:161

D

- Database 1:9, 1:19, 1:24, 5:15–5:16, 5:19, 5:118, 5:130–5:132, 5:146, 5:173, 5:179, 6:5, 6:20, 6:35
 - conversion 5:19
 - default 2:10, 2:102, 3:4, 3:41
 - loading 1:19, 2:10, 2:25, 3:41, 4:6
- Database Order
 - default 3:50, 6:8
- Database Reports 1:16
- Database Symbols 3:15, 5:78, 5:124, 5:130, 5:158
 - creating 2:101–2:102
 - screen size 2:102

Datum Dimension 2:121, 5:76
 Default Database 2:10, 2:102,
 3:4, 3:41
 Default Database Order 2:26,
 3:50, 6:8
 Default Name 2:51, 2:63, 2:79,
 5:3, 5:5, 5:106, 5:110,
 5:133–5:134
 Default Nozzle 2:45, 3:31–3:32,
 3:34
 Default Snap Mode 1:9–1:10,
 1:9–1:10, 2:25, 2:27–2:28,
 2:100, 5:6–5:7, 5:89, 5:119
 Defaults 1:20–1:22, 2:9, 2:33,
 2:87, 3:4, 5:82, 5:118,
 5:128, 5:130, 5:133, 5:160
 drawing 1:22
 edit 1:18, 1:20
 Delete .. (database button) 3:8
 Delete tool 1:11, 5:145
 Delete Type tool 1:11, 2:36,
 5:145
 Demand Points 2:43, 2:45–
 2:46, 2:81, 2:85, 2:88,
 3:30, 3:32, 5:85–5:87, 6:19
 Depth 2:26, 2:29–2:33, 2:63,
 5:89–5:93, 5:98, 5:100,
 5:104, 5:112, 5:173, 5:187,
 5:189
 Design 2:3, 2:55–2:59, 2:64,
 6:15
 analyze 2:11–2:13, 2:16, 2:49,
 2:66–2:67, 2:88–2:91,
 2:90, 5:168, 5:172, 6:18
 check outlet connectivity 1:14,
 2:15, 5:164
 computer sizing 2:33, 2:48,
 2:61–2:62, 2:89, 5:169,
 5:171, 6:17
 conversion 5:20
 detailed analysis 2:49, 2:51,
 2:58, 2:92, 5:168–5:172,
 6:18
 lp design 2:16–2:17, 2:48,
 2:52, 2:67, 2:88–2:91,
 2:90–2:91, 2:93, 5:161,
 5:168–5:170, 5:172
 mainline design 1:14, 2:17,
 2:91, 2:92, 5:168
 pressure compensating notes
 2:142
 printing 4:130
 valve analysis 1:14, 2:16,
 2:81–2:83, 5:169–5:170
 velocity design 2:16, 2:48,
 2:52, 2:67, 2:88–2:89,
 2:91–2:92, 2:153, 5:168–
 5:169, 5:172
 zone design 1:14, 2:16, 2:91–
 2:92, 5:168
 zone design configuration
 1:14, 2:51, 2:53, 2:67,
 2:88, 2:92, 2:94, 2:141–
 2:143, 5:171, 6:18
 Design Costing
 SummaryReport 1:16
 Design Detail settings 1:20,
 5:128
 Design Details 2:124
 Design flow 2:57, 5:110, 5:178,
 5:180
 Design headings 2:12, 5:129,
 5:176, 5:185–5:201, 5:190,
 5:195
 Design Input 1:10
 Design menu 5:160
 Design Parameters 1:13, 1:20–
 1:22, 2:9, 2:141, 2:143,
 5:160
 analysis 1:21, 2:92, 5:162
 economic 1:13, 1:20, 5:160–
 5:161

- hydraulic 1:21, 2:90–2:94, 5:161
- Design pressure 2:57–2:58, 2:143, 5:111
- Design process 2:9, 2:11, 2:36, 2:41–2:42, 2:50–2:51, 2:61, 3:3, 3:11–3:12, 3:37–3:38, 5:160, 5:199, 6:15
- Design Reports 1:10–1:15, 5:181
 - configuration 1:15, 5:201
 - cv summary 5:186
 - mainline configuration 5:201, 5:202
 - mainline full 1:15, 5:187
 - mainline pipe 1:15, 5:189
 - mainline summary 1:15, 5:189
 - system duty 1:15, 5:188
 - zone configuration 5:201
 - zone full 1:15, 5:182
 - zone outlet 1:15, 5:186
 - zone pipe 1:15, 5:187
 - zone summary 1:15, 2:16, 5:185
- Design Size 2:102, 3:16, 5:105, 5:110, 5:111, 5:117–5:118, 5:125, 5:130
- Design Summary Report 5:191–5:193
- Design Summary Report\lr 2:16
- Design Tutorials 4:3
- Designing 2:86
- Designs
 - conversion 1:9, 5:20
 - opening 5:28
 - printing 2:11, 2:17, 2:122, 2:131, 5:21–5:25, 5:129
- Detailed Analysis 2:49, 2:51, 2:67, 2:92, 5:168–5:172, 6:18
 - convergence 5:163
 - errors 2:153
 - flow close fraction 5:162
 - mainline 2:58
- Detailed Costing Report 1:16
- Detailed Costs Report 5:193
- Diameter Circle 5:51
- Diameter Dimension 2:116, 5:74
- Digitizer
 - reference points 4:133, 4:134
 - tablet mode 5:136–5:138
 - Wintab driver 2:8, 5:136
- Digitizer settings 1:10, 1:22, 2:4, 2:6–2:8, 2:18–2:21, 5:136–5:138
 - reference 2:19–2:21, 5:136, 5:138
 - scale 2:4, 2:8, 2:21, 5:136–5:137
- Digitizing 2:21, 2:40, 2:41, 5:17, 5:136–5:137
 - reference method 4:136
 - referencing 2:19–2:21, 5:137
 - scale method 4:135
- Digitizing plans 2:19–2:21, 4:133, 5:136, 5:138
- Dimension tool 2:105, 2:120, 5:63–5:76
 - angular 5:73
 - datum 5:76
 - diameter 2:116, 5:74
 - dimension settings 2:115–2:117, 5:63
 - dimension text settings 5:66, 5:72, 5:73, 5:74, 5:75
 - drawing properties 5:63, 5:105
 - leader 5:75
 - leader / datum drawing properties 5:69
 - leader / datum settings 5:69, 5:75, 5:76
 - linear 5:72
 - ordinate 2:117, 5:75
 - radial 2:116, 5:73
 - text tab 2:110

- Direct Distance Entry 5:42, 5:45
- Display Settings 5:125–5:127
- Done (mouse menu) 5:3–5:4
- DOS 1:6, 1:24, 3:23, 5:14, 5:131
 - commands in windows 1:9
 - removing 1:24
- Double Line 5:43
- Drawing Defaults 1:22
- Drawing Items
 - changing 2:31, 6:18
- Drawing Items settings 1:11, 1:22–1:23, 2:99, 2:103, 2:124, 2:130, 5:32–5:33, 5:126
- Drawing Properties 2:32, 2:39, 2:40, 2:69, 2:105, 2:125, 5:63, 5:69, 5:105, 5:124–5:125
- Drawing Right Click Menu 5:3
- Drawing template 4:130
- Drawing Template 5:82
- Drawing tools 1:7, 2:23, 2:98, 2:101, 5:125
- Drip tape 4:49
- Drip Tape Design 4:54–4:56
- Driplines 2:53, 2:55–2:56, 2:70, 2:74–2:75, 2:137–2:138, 6:18

E

- Economic Parameters 1:13, 1:20, 5:160–5:161
- Edit / View .. (database button) 3:8
- Edit Defaults 1:18, 1:20
- Edit Design Details 1:18, 1:20, 5:128
- Edit menu 5:30
- Edit Template 1:12, 2:128, 5:203

- Elbows / Bends 3:6, 3:28
 - database details 3:28
- Electrical
 - controller 1:13, 5:113
 - junction 5:116
 - light 1:13, 5:115
 - misc. electrical 1:13, 5:115
 - wire 1:13, 5:114
- Electrical menu 2:25, 5:113
- Elevation 2:11–2:12, 2:22, 2:32, 2:38, 2:40–2:43, 2:49, 2:53, 2:61, 2:88, 5:17, 5:83–5:84, 5:121, 5:167–5:168, 5:183, 5:188, 6:15
 - convert 5:84, 5:158
 - re-interpolate 1:14, 2:41, 2:43, 5:167
 - uneven contours 2:42
- Ellipse Circle 5:52
- Elliptical Arc 5:57
- End Caps 3:27
 - database details 3:27
- Enhancements 1:6–1:7
- Equation Calculations Used 6:30
- Errors
 - fitting selection 2:149, 5:191–5:193
 - messages 6:37
- Evenly Spaced Outlets 2:53
- Exiting the program 3:40, 5:29
- Explode tool 1:12, 5:153
- Exporting files 5:18

F

- F1 1:3
- F9 2:98
- Field
 - irregular 2:78
 - oval 2:77
 - rectangular 2:76

- sports field 2:64, 2:76
- File
 - compress 5:19
 - convert 5:19
 - exporting 5:18
 - importing 5:16
- File format 2:22, 2:123, 3:15, 5:14–5:16, 5:15, 5:18, 5:19–5:21
- File menu 3:39, 5:14
 - shortcut options 5:38
- Fill tool 5:61–5:62
 - boundary 5:62
 - seed 5:62
 - selection 5:61
- Fills 2:103
- Finish Adding .. (database button) 3:33
- Finish Assembly .. (database button) 3:18
- Fitting Selection errors 2:149, 5:191–5:193
- Fittings
 - change 2:151
 - change type 2:151
 - couplers 2:150, 3:6, 3:27
 - crosses 2:150, 3:6, 3:29, 6:24–6:25
 - elbows / bends 3:6, 3:28
 - end caps 3:27
 - lateral take offs 3:6, 3:14, 3:26
 - tees 3:6, 3:28
 - valve-under-head 2:151
- Fittings selection 4:107, 4:115
- Fittings Selection 2:17, 2:30, 2:52, 2:94, 2:149, 5:172, 6:20
- Fixed size pipes 2:93
- Flow Calc Type 3:23
 - iteration method 2:55, 3:23
 - new method 2:55, 3:23
- Flow Check 1:11, 2:50–2:51, 2:71, 5:124

- Flushing
 - tapes 2:135, 5:159

G

- Gender code 3:14
- Geometric properties 5:43, 5:45, 5:48, 5:50, 5:53, 5:56, 5:126
- Geometric Items
 - changing 2:31, 6:18
- Glossary 2:3
- Goto Coords 5:36
- Gravity system 2:58
- Grid 2:12
- Grid settings 1:11, 1:22, 2:28, 2:70, 2:72, 2:76, 5:123

H

- Hardware 2:5–2:6, 2:8, 5:24, 5:26, 5:136–5:137, 6:37
- Hardware Requirements 2:6
- Hatch tool 5:58–5:60
 - boundary 5:59
 - dialog 5:58
 - seed 5:60
 - selection 5:59
- Hatches 2:103
- Hazen-Williams C Values 6:7
- Help
 - F1 1:3
 - on-line help 1:3, 3:45–3:48
- Horticultural System 2:75
- Hydraulic 2:24–2:26, 2:38, 2:104, 5:131
 - snap tolerance 5:120
- Hydraulic Design Parameters 2:90
- Hydraulic Items 2:32
 - changing 2:31–2:32
 - connecting 2:14, 2:25–2:29, 2:25–2:29, 2:71, 2:77,

- 3:31, 5:6, 5:54, 5:119, 5:146, 5:164, 6:16
- entering 2:24–2:30, 2:24, 2:41, 2:105, 3:15–3:16, 5:5, 5:85, 5:119, 6:12
- placing 2:25–2:28, 2:25–2:29, 2:62–2:64, 5:5, 5:6, 5:119, 5:150, 5:161
- plan legend 5:81, 5:204
- reporting 5:201
- selection 2:25–2:31
- Hydraulic Junction 5:85–5:87
- Hydraulic Object Info 5:131
- Hydraulic Parameters 1:21, 2:94, 5:161
- Hydraulic Right Click Menu 5:3

I

- Import Contours 1:19, 2:22–2:23, 2:42
- Import Unit 2:22
- Importing
 - bitmap 2:23–2:24, 5:17
 - contours 1:19, 2:22–2:23, 2:42, 5:16
 - files 5:16, 5:135
- Importing Files 2:18, 2:22–2:24, 2:41–2:42
- Installation 1:3–1:4, 1:25, 2:5, 2:7–2:8, 2:10, 2:29, 2:46, 3:45, 5:129, 5:156
- Inventory 1:16
- Inventory by Description Report 1:16, 5:198
- Inventory by W/H Code Report 1:16, 5:197
- Inventory Report 5:198
- Invert Selection tool 5:141
- Irregular Polygon 5:49
- Irregularly shaped field 2:78

- Irrigation - Design Specific settings 1:22, 2:33, 3:4, 3:39, 5:40, 5:131
- Irrigation Area 2:33, 2:67–2:70, 2:68, 5:5, 5:134, 5:178, 5:206, 6:5
- arcs 2:62–2:65, 2:67–2:68, 5:103
- Irrigation Items settings 1:22–1:23, 2:9, 2:33, 2:42, 2:50, 2:65, 2:71, 2:102–2:103, 5:123
- Item description 3:11
- Item Selection 2:25–2:31
- Iteration method 2:55

J

- Job Reports 1:16
- Junction tool 2:41, 2:42, 2:61–2:62, 3:6, 5:85–5:87, 5:109, 5:116–5:117
- dialog details 5:85–5:87
- electrical 5:116
- hydraulic 5:104–5:105
- Junctions 1:22, 2:27, 2:32, 2:41, 2:58–2:59, 5:93, 5:105, 5:146, 5:155, 5:172, 5:173, 6:5, 6:15
- elevation 2:42, 2:49
- permanent 2:41, 2:42, 2:49, 2:61, 2:90, 5:91, 5:93, 6:16
- settings 1:22, 2:32, 2:103, 5:105, 5:155

K

- Keywords 2:127–2:129, 5:203, 6:31

L

- Lateral Take Offs 3:6, 3:14, 3:26
 - database details 3:26
- Laterals 1:21, 2:42, 2:70–2:72, 2:88, 3:22, 4:72, 5:85–5:87, 5:161, 5:184, 6:9
 - connecting 2:49
 - number of sizes 2:88, 5:171
 - spacing 2:72, 5:99, 5:102
- Layer Manager 5:121
- Layer settings 1:22–1:23, 2:32, 2:40, 2:44, 2:104, 2:132, 5:121, 5:122
- Layers 2:38–2:39
- Leader Dimension 2:120, 5:75
- Legends 2:124
- Light tool 1:13, 5:115
 - dialog details 5:115
- Lights 3:7, 3:37, 6:9
 - database details 3:37
- Limits 2:65, 2:86–2:88, 2:90, 2:93, 2:123, 2:142–2:143, 3:3, 5:34, 5:118–5:120, 5:123, 5:182, 6:5, 6:18, 6:38, 6:39, 6:42, 6:44, 6:71
- Line tool 1:10, 5:6, 5:42–5:44
 - continuous 5:44
 - double 5:43
 - polyline 1:10, 5:44
 - single 1:10, 5:43
- Line Types 1:21, 1:22, 2:32, 2:38–2:39, 2:42, 2:48, 2:105, 3:7, 3:13, 3:16, 3:22, 5:27, 5:125–5:127, 5:141, 6:12
- Line Widths 2:32, 2:38–2:39, 2:42, 2:48, 2:105, 5:125–5:127
 - geometric items 1:21
- Linear Copy 5:149

- Linear Dimension 2:115–2:117, 5:72
- Linking Nozzles to Outlets 3:33
- Looped Systems 2:16–2:17, 2:89, 5:169, 5:170, 6:16, 6:19

LP

- convergence 5:162
- LP Design 2:16–2:17, 2:48, 2:52, 2:67, 2:88, 2:90–2:91, 2:141, 5:161, 5:168–5:170
 - errors 2:152
 - limits 2:93

M

- Mainline 1:13, 2:3, 2:57–2:62, 5:5
 - junction 2:42–2:44
 - outlet 2:43–2:44, 2:79–2:81, 2:82, 5:106
 - pipe 2:25–2:29, 2:33
 - pump 1:13, 2:59, 5:111
 - sprayline 2:29, 5:133
 - water supply 1:13, 2:92, 5:110
- Mainline Analysis
 - convergence 5:163
- Mainline Design 2:17, 5:168
- Mainline Design Reports 1:15, 2:17
- Mainline Full Report 1:15, 2:58, 5:187
- Mainline menu 5:106
- Mainline Outlets 2:27, 2:48–2:57, 2:79, 2:87–2:88, 5:109
 - valve-in-head 2:3, 2:43, 2:79, 2:87–2:88, 5:106
- Mainline Pipe Report 1:15, 5:189
- Mainline pipes 2:48–2:49

Mainline Summary Report 1:15, 5:189
 Make Active Area 1:12, 5:204
 Make Legend 1:12, 2:125, 2:130, 5:204
 dialog 5:204
 Management 2:15, 2:86
 assign all zones to one system flow 5:166
 assign each zone to a unique system flow 5:167
 assign system flows to zones 1:14, 2:15, 2:63, 2:86–2:87, 5:165, 5:166, 5:167
 assigning system flows to zones 2:87
 cycle time 5:161
 partial 2:87, 5:166–5:167
 zone operating times 1:14, 2:15, 2:63, 2:86, 5:164, 5:179
 zones 2:90–2:91
 Management Reports 1:10–1:15, 2:62, 5:97, 5:102, 5:177–5:181
 system flows 1:15, 5:104, 5:179
 system management 1:15, 5:180
 water requirements 1:15, 2:62, 5:104, 5:180
 water supply 1:15, 5:178
 zone flows 1:15, 2:62, 5:178
 Managing Blocks 4:54–4:56
 Memory Requirements 2:6
 Menu
 design 5:160
 drawing right click 5:3
 edit 5:30
 electrical 5:113
 file 3:39, 5:14
 hydraulic 1:10–1:15
 hydraulic right click 5:3
 mainline 1:13, 5:5, 5:106
 plot template 5:203
 reports 5:176
 right click 5:3
 selection right click 5:3
 settings 5:118–5:119
 tools 5:139
 utilities 3:42
 view 3:41, 5:31
 zone 1:10–1:15, 5:85–5:86
 Merging databases 3:40
 Micro irrigation design 4:35
 Micro Irrigation design 4:63
 Misc. Electrical 3:38
 Misc. Electrical tool 1:13, 5:115
 dialog details 5:116
 Misc. Hydraulic Items 2:4, 2:52, 3:25
 Misc. Hydraulic tool 1:13, 5:85–5:87
 dialog details 5:85–5:87
 Miscellaneous
 database details 3:7, 3:38
 design details settings 5:129–5:131
 drawing settings 5:126
 settings 1:23, 3:15, 5:4, 5:129–5:131
 Miscellaneous settings 2:102
 Modify 2:32, 2:38, 5:3–5:4
 Modifying 3:11, 5:4, 5:26, 5:139
 Mouse 2:8, 2:12, 2:18–2:21, 2:28, 2:40–2:41, 2:69, 5:39, 5:138
 usage 1:22, 2:8, 2:18–2:21, 2:28, 2:40–2:41, 2:69, 5:6, 5:35, 5:37, 5:39, 5:138
 Move Fills to Back 2:127, 5:205
 Move Point tool 5:148
 Move Sizes tool
 connected spraylines 5:156

Move tool 1:11, 2:27, 2:48,
2:62, 5:81, 5:147–5:148,
5:156
Multiple Copy 5:152

N

Name settings 2:51, 2:63, 2:79,
5:88, 5:110, 5:133
New 3:39, 5:14
New .. (database button) 3:7
New Assembly .. (database
button) 3:16
New designs 5:14–5:15, 5:20,
5:118, 5:123, 5:125, 5:167,
5:203
New Features 1:6–1:7
New Users 1:4, 1:5, 2:5
Nomenclature 2:3–2:4
Nominal Pressure 2:89
Nozzles 2:35, 2:45, 2:64–2:65,
2:91, 2:140, 3:7, 3:10,
3:30–3:34, 5:87, 5:94,
5:98, 5:107, 6:9
database details 3:10

O

Object Info 2:42, 5:3–5:4
hydraulic 5:131
Odd-Shaped Areas 2:69
On-line Help 1:3, 3:45–3:48
Open designs 5:14, 5:118
Open existing 2:102, 3:39, 5:14,
5:127, 5:131
Operating System 1:19, 1:22,
2:6, 5:131
Operating Times
water supply 5:164
zone 5:164
Ordinate Dimension 2:117, 5:75
Other Electrics 3:7, 3:38
database details 3:38

Other Hydraulics 2:52, 3:6,
3:25, 6:16
database details 3:25, 3:42
Outlet
arcs 2:62–2:65, 2:67–2:68,
2:77–2:78, 3:34, 5:40,
5:103, 5:156
connectors 2:47, 2:83, 3:14,
3:35, 5:87, 5:107
default nozzle 2:45, 3:31–
3:32, 3:34
radius 3:10, 3:34, 3:42, 6:30
risers 2:47, 2:83, 3:14, 3:35,
5:87, 5:107
symbols 2:44
Outlet Connections 3:6, 3:35
database details 3:35
Outlet Connectors 2:47, 2:83,
3:14, 3:35, 5:87, 5:107
Outlet symbols 2:44, 5:132,
5:157
Outlet tool 1:13, 2:25, 2:43–
2:44, 2:78, 2:79–2:81,
5:39, 5:85–5:87, 5:106
dialog details 2:43–2:44,
5:85–5:87, 5:107
Outlets 2:3, 2:11, 2:14, 2:15,
2:26–2:27, 2:43, 3:3, 3:6–
3:7, 3:10, 3:14, 3:26, 3:30,
5:155–5:157, 5:164,
5:177–5:179, 6:10, 6:28
above ground level 2:48–2:49
arc orientation 2:63, 2:68–
2:69, 5:103
database details 2:3, 3:14,
3:30
demand points 2:43, 2:45–
2:46, 2:81, 2:85, 2:88,
3:30, 3:32, 5:85–5:87
evenly spaced 2:44, 2:48–
2:49, 2:53, 5:93–5:94
nominal pressure 2:89
pressure 2:89

spacing 2:72, 5:99–5:101
 sprayline 2:44, 2:74, 5:40,
 5:132–5:133, 5:157
 symbols 5:132, 5:157
 valve-in-head 2:3, 2:43, 2:79,
 2:87, 5:106, 5:109, 5:133,
 5:184
 wetted radius 2:46, 2:68, 2:69,
 2:76, 3:10, 3:34–3:35,
 5:40, 5:87, 5:94, 5:98,
 5:107, 5:125, 5:132, 5:156,
 5:186, 6:30
 oval field 2:77

P

Pan view 1:11, 5:31–5:39
 Partial Management 2:87,
 5:166–5:167
 Permanent junctions 2:41, 2:42,
 2:49, 2:61, 2:90, 5:91,
 5:93, 6:16
 Pipe 3:14
 computer sized 2:13, 2:33,
 2:36, 2:49, 2:51, 5:91,
 5:92–5:93, 5:98, 6:18
 cut pipe 2:25, 2:49, 2:61, 2:71,
 2:77–2:78
 elevations 2:11–2:12, 2:32,
 2:40–2:43, 2:42–2:43,
 2:49, 2:61, 2:88, 5:167–
 5:168, 5:183, 5:188, 6:15
 fixed size 2:93
 flow check 1:11, 2:50–2:51,
 2:71, 5:124
 submain 2:49, 2:141, 3:6,
 5:155, 5:172
 Pipe Fitting Matching Table
 3:14, 3:39, 5:173, 6:20,
 6:28
 Pipe tool 1:13, 2:25, 3:21, 5:39,
 5:85–5:87

dialog details 5:85–5:87
 Pipe Types 2:30–2:31, 3:13–
 3:14, 3:26, 3:39, 5:89,
 5:173, 6:9–6:10, 6:28
 Pipe Usage Codes 3:21
 Pipes 1:22, 2:3–2:4, 2:11–2:13,
 2:32, 3:6–3:7, 3:13, 3:21–
 3:24, 3:26–3:27, 5:81,
 5:155, 6:5–6:6, 6:10, 6:12,
 6:15–6:28
 computer selected 2:37, 2:51,
 2:89, 5:92, 5:171
 computer sized 2:51, 2:89,
 5:92, 5:171, 6:18
 computer sizing 2:33, 2:48,
 2:61–2:62, 2:89, 5:169,
 5:171, 6:17
 database details 3:13, 3:21–
 3:24, 5:187, 5:190
 plan legend 5:81, 5:204
 Pipes & Pipe Sizing 2:48
 Placement Aids 1:11
 Plan
 digitizing 2:19–2:21, 4:133,
 5:136, 5:138
 plot 2:7, 2:17, 2:130–2:131,
 5:81–5:82, 5:134, 5:203–
 5:205, 6:31
 Plot 2:7, 2:17, 2:130–2:131,
 6:31
 template 1:9, 1:12, 2:130–
 2:131, 5:81–5:82, 5:134,
 5:203–5:205, 6:31
 Plot layout 4:130
 Plot Layout tool 2:122, 2:128
 dialog 5:21, 5:24, 5:81
 Plot Layouts 2:17, 2:122, 2:127,
 2:128, 2:130–2:131, 5:21,
 5:24, 5:81–5:82, 5:127,
 5:203
 conversion 1:9, 5:21
 Plot Template 2:123

- legends 2:124
- Plot Template menu 5:203
- Plotters 2:6
- Plotting 2:17, 3:7, 5:26, 6:5
 - color 3:8
 - site data 1:17
- Point tool 1:10, 5:41
- Polygon tool 5:47–5:49
 - center 5:48
 - dialog 5:48
 - irregular 5:49
 - side 5:49
- Polyline 1:10, 5:44
- Pressure
 - valve 5:172
- Pressure regulating valves 2:14, 2:52, 3:25
- Printers 2:6
- Printing
 - dialog 5:22
 - plot layouts 2:122, 2:128, 4:130
 - reports 2:122
- Printing designs 2:11, 2:17, 2:122, 2:131, 4:130, 5:21–5:25, 5:129
- Pump tool 1:13, 2:59, 5:111
 - dialog details 5:111
- Pumped systems 2:58, 2:80
- Pumps 3:6, 3:29, 6:10, 6:30
 - database details 3:29, 3:42, 6:30

Q

- Quick analysis 2:88
- Quit .. (database button) 3:9

R

- Radial Copy 5:150
- Radial Dimension 2:116, 5:73
- Readme.txt 2:7–2:8

- Recently used files 5:28
- Rectangle tool 1:10, 5:45–5:46
 - 2 point 5:46
 - 3 point 5:46
- Rectangular field 2:76
- Redrawing screen 1:11, 5:39
- Reference method 2:21
- Reference point 2:19–2:21, 5:136, 5:138
- Re-interpolate Elevations 1:14, 2:41, 2:43, 5:167
- Remove Item .. (database button) 3:18
- Remove Nozzle .. (database button) 3:33
- Removing DOS 1:24
- Repair 1:20, 5:18
- Report Settings 1:22, 5:176
- Reporting of assemblies 3:7, 3:10, 5:190, 5:195
- Reports 1:10–1:15, 2:6, 2:11, 2:120, 3:7, 3:10, 3:37–3:39, 4:43, 5:128, 5:134, 5:176–5:180, 6:24
 - assemblies 3:7, 3:10, 5:190, 5:195
 - bill of materials 1:14, 1:16, 2:94, 5:194, 5:200
 - bom 1:16
 - bom by supplier 1:16
 - bom with costs 1:16
 - costing 1:15, 2:17, 2:95, 2:149, 5:190, 5:192, 5:193, 5:194, 5:199–5:200, 6:24
 - database 1:16
 - design 1:10–1:15, 5:181
 - design costing summary 1:16
 - design summary 2:16–2:17
 - detailed costing 1:16
 - detailed zone / mainline 1:16
 - inventory 1:16
 - inventory by description 1:16
 - inventory by w/h code 1:16

- job 1:16
- management 1:10–1:15, 2:62, 5:177–5:181
- printing 2:122
- view errors 1:14, 5:199
- zone / mainline 1:16
- zone flows 2:16–2:17
- Reports menu 5:176
- Resize tool 5:154
- Restart 2:27, 5:3
- Retail Price 3:11, 3:13, 3:53, 5:162, 5:200
- Right click menu 5:3
 - close 2:103, 5:3–5:4
 - default name 5:3, 5:5
 - done 5:3–5:4
 - drawing 5:3
 - hydraulic 5:3
 - modify 2:32, 2:38, 5:3, 5:4
 - object info 5:3–5:4
 - restart 5:3
 - selection 5:3
 - snaps 2:99–2:100, 5:3
 - stop 5:3, 5:5
- Ringmain Systems 5:170
- Riser 2:29–2:30, 2:47, 2:82–2:85, 3:6, 3:35–3:36, 5:86–5:87, 5:94, 5:106, 5:107, 5:172–5:173
- Riser Selection Rules 1:15, 2:30, 5:172
- Rotate tool 1:12, 2:69, 5:152
- Roughness factor 6:7

S

- Save Changes .. (database button) 3:8
- Save Template 1:12, 2:130, 5:205
- Saving designs 5:15, 5:131

- Saving Designs with a New Name or Path 5:15
- Scale 2:4, 2:8, 2:21, 2:113, 2:131, 5:22, 5:25, 5:58, 5:68, 5:81, 5:136–5:137
- digitizing 2:4, 2:8, 2:21, 4:135, 5:136–5:137
- dimension text 5:68
- drawing 2:131, 5:22, 5:25, 5:81
- hatch 5:58
- Scale plan 2:18–2:21, 2:41–2:42
- Screen Messages 6:33
- Search.ini 1:23
- Select
 - object 2:32
 - selection filter 2:38
- Select .. (database button) 3:18
- Select Nozzle .. (database button) 3:33
- Select tools 2:38–2:39
 - adjoining 5:144
 - all 5:143
 - clear selection 5:39, 5:141
 - crossing 5:143
 - invert selection 5:141
 - lasso 2:50, 5:39, 5:142
 - last 5:144
 - object 5:39, 5:140
 - screen 5:144
 - selection filter 2:39, 5:141
 - window 5:39, 5:142
- Selection Filter tool 2:38, 2:39, 5:141
- Selection Right Click Menu 5:3
- Selection Tools 5:142
- Set Valve Pressure 5:172
- Settings 1:9–1:10
 - bitmap 2:18, 5:135
 - company 5:134

- create sprayline outlets 1:9,
2:44, 5:132
- create wetted radii 5:40, 5:132
- cursor 5:127
- default snap mode 1:9–1:10,
1:9–1:10, 2:25, 2:27–2:28,
2:76, 2:100, 5:6–5:7, 5:89,
5:119
- design details 1:20, 5:128
- digitizer 1:10, 1:22, 2:4, 2:6–
2:8, 2:18–2:21, 5:136–
5:138
- display 5:125–5:127
- drawing items 1:11, 1:22–
1:23, 5:32–5:33, 5:126
- grid 1:11, 1:22, 2:28, 5:123
- irrigation - design specific
1:22, 3:4, 5:40, 5:131
- irrigation – design specific
3:39
- irrigation items 1:22–1:23,
2:50, 2:65, 5:123
- layers 1:22–1:23, 2:40, 2:132,
5:121, 5:122
- miscellaneous 1:23, 3:15, 5:4,
5:129–5:131
- miscellaneous design details
5:129–5:131
- miscellaneous drawing 5:126
- names 2:51, 2:63, 5:88, 5:110,
5:133
- reports 1:22, 5:176
- snap 1:9–1:10, 2:25, 2:27–
2:28, 2:49, 2:100, 5:6–5:7,
5:89, 5:119
- units 2:28, 5:128
- Settings menu 2:9, 5:117–5:118
- Show Fittings 2:17, 2:33, 2:37,
2:94–2:95, 2:151, 3:38,
5:146–5:147
- Show Flow 1:11, 2:65, 2:120,
3:23, 5:97, 5:102, 5:176–
5:177
- Side Polygon 5:49
- Simulating
 - multiple driplines 2:137
 - tapes 2:133
- Single Bezier Curve 5:54
- Single Line 1:10, 5:43
- Small Turf Design 4:86
- Snap settings 1:9–1:10, 1:9–
1:10, 2:25, 2:27–2:28,
2:49, 2:100, 5:6–5:7, 5:89,
5:119
- Snap to Grid 2:12
- Snaps 2:12, 2:99–2:100, 5:3
 - center 2:99, 5:11
 - closest 2:99, 5:11
 - endpoint 2:99–2:100, 2:107,
5:7
 - intersection 2:99, 5:9
 - midpoint 2:99–2:100, 2:107,
5:7
 - object 2:99, 5:9
 - parallel 2:100, 5:12–5:13
 - percent 2:99, 5:8
 - perpendicular 2:99–2:100,
5:7–5:8, 5:53
 - place 1:12, 2:25–2:28, 2:100,
5:5–5:6, 5:77
 - quadrant 2:99, 5:12
 - tangent 2:99, 5:10, 5:53
- Solid Set Sprinkler Design 4:77
- Solid Set Systems 2:76, 4:63
- Specified length 5:42, 5:45,
5:161
- Spline Curve 5:55
- Sports Fields 2:64, 2:76
 - irregularly shaped 2:78
 - oval 2:77
 - rectangular 2:76
- Spot Height tool 2:41, 5:83
 - dialog 5:84
- Spot heights 2:40, 2:41, 5:17,
5:83, 5:158, 5:167, 6:15
- settings 1:21

- Sprayline 1:9, 2:14, 2:42–2:44, 2:61, 2:81–2:82, 2:140, 3:21, 5:93, 5:100, 5:109, 5:155, 5:171–5:172, 5:183, 5:184, 5:186, 6:17–6:18
- block 5:97
- connected 2:43–2:44, 2:53, 2:55, 2:88, 2:140, 5:94, 5:97, 5:155, 5:157, 5:159, 5:183–5:184
- elevations 2:53
- mainline 2:53, 5:109, 5:133
- properties 5:94–5:96
- unconnected 2:42–2:44, 2:43–2:44, 2:53, 2:70, 2:75–2:76, 2:141, 5:94, 5:109
- Sprayline Outlets
 - creating 5:40
 - viewing 2:44, 2:74, 5:40
- Sprayline tool 1:13, 2:54, 2:70, 2:72, 2:75, 2:78, 3:13, 3:21, 5:85–5:87
- dialog details 5:85–5:87
- Spraylines 2:3–2:4, 2:26, 2:33, 2:53–2:56, 2:90, 2:133–2:135, 5:159
- Spraylines to Tapes tool 5:159
- Start Mid End Arc 5:56
- Status Bar 1:25–1:26, 2:35–2:36, 2:50, 2:65, 2:69, 2:71, 2:98, 3:41, 5:11, 5:39, 5:128, 5:140, 6:16
- Stop 5:3, 5:5
- Submain pipe 2:49, 2:141, 3:6, 5:155
 - number of sizes 5:172
- Supplier Code Multipliers 3:12–3:13, 3:39, 5:162, 5:199
- Supplier cost code 3:7, 3:11
- Support
 - technical 6:3
- Symbol

- conversion 5:20
- create 3:15
- orientation 2:69
- size 2:102, 3:7, 3:15, 5:105, 5:110, 5:117, 5:125, 5:130
- Symbol orientation 2:69
- Symbol size 2:102, 3:7, 3:15, 5:105, 5:110, 5:117, 5:125, 5:130
- Symbol tool 1:10, 2:100, 2:129, 5:21, 5:77, 5:127, 5:158
 - create 1:12, 1:19, 2:102, 5:158
 - dialog 5:77–5:78
 - load symbol 5:77–5:78
 - unload symbol 5:78
- Symbols
 - creating 4:125
 - modifying 4:126
 - outlet 2:44, 5:132, 5:157
- System Duty 1:15, 2:4, 5:182
- System Duty Report 1:15, 5:188
- System Flow 2:4, 2:11, 2:86–2:88, 3:37, 5:166, 5:187–5:188, 6:5
- System Flows Report 1:15, 5:104, 5:179
- System Management Report 1:15, 5:180

T

- Tablet mode 4:134
- Tablet Mode 2:18–2:21, 5:136–5:138
- Tape Block tool 5:85–5:87
 - dialog details 5:85–5:87
- Tape tool 2:55, 2:72, 2:74, 5:85–5:87
 - dialog details 2:72, 5:85–5:87
- Tapes 2:14, 2:26, 2:32, 2:53, 2:55–2:56, 2:70–2:71,

- 2:74, 2:133–2:136, 3:6,
3:14, 3:22, 3:23, 4:49,
5:159, 5:179, 5:182, 5:184,
5:187, 6:10–6:12, 6:17–
6:18
- convergence 5:162
- database details 2:14, 3:22,
3:23
- design notes 2:141
- inlet pressure 2:89
- Tapes to Spraylines tool 2:133,
2:137, 5:159
- Tapes Under Flushing 2:135,
5:159
- Technical support 6:3
- Tees 3:6, 3:28
 - database details 3:28
- Template
 - creating 4:139
 - edit 1:12, 2:128, 5:203
 - keywords 2:127–2:129, 5:203,
6:31
 - make active area 1:12, 5:204
 - make legend 1:12, 2:125,
2:130, 5:204
 - move fills to back 2:127, 5:205
 - plot template 2:123, 5:203
 - save 1:12, 2:130, 5:205
- Text tool 1:10, 1:12, 5:78
 - dialog 5:79
- Toolbar 2:25, 2:32, 3:41, 5:14,
5:38–5:39
 - hydraulic 5:38
 - main 5:38
- Tools
 - create sprayline outlets 2:44,
2:74, 5:157
 - create wetted radii 2:44, 5:40,
5:132, 5:156
- Tools menu 5:139
- Travelling Irrigator Systems
2:83
- Trim tool 5:156

- Trouble Shooting 2:149
- Turf 2:64, 2:75, 3:31, 3:36, 4:86
- Tutorial database 2:10
- Tutorials 1:5, 0:1
 - creating & modifying
assemblies 4:121
 - creating & modifying symbols
4:125
 - creating a new template 4:139
 - creating new symbols 4:125
 - digitizing plans 4:133
 - drip tape 4:49
 - Managing Blocks 4:54
 - micro irrigation 4:63
 - modifying existing symbols
4:126
 - reference method for digitizing
4:136
 - scale method for digitizing
4:135
 - setting up a block of symbols
4:128
 - small turf 4:86
 - solid set 4:77

U

- Unconnected Spraylines 2:42–
2:44, 2:43–2:44, 2:53,
2:70, 2:72, 2:75–2:79,
2:75–2:76, 2:82, 2:141,
5:94, 5:109, 5:155
- Undelete 5:30
- Undo 5:30
- Uneven Contours 2:42
- Unit settings 2:22, 2:28, 2:131,
5:128
- Updating Prices in the
Database 3:52
- Usage Codes 2:26, 2:151, 3:3–
3:4, 3:7, 3:10–3:11, 3:10,
3:12, 3:21, 5:195
- A 3:10, 5:191

- Pipes 3:21
- X 3:10, 5:191, 5:201
- User Defined 2:74, 5:97, 5:99,
5:101–5:102, 5:151
- Utilities 1:18, 1:20, 3:42
 - curve fitting 1:20, 3:42

V

- Valve Analysis 1:14, 2:16,
5:169–5:170
- Valve Pressure 5:172
- Valve-in-head 2:3, 2:43, 2:87,
5:106, 5:109, 5:133
- Valve-in-head outlets 2:79,
5:184
- Valves 2:51–2:52, 2:79, 3:6,
3:24, 5:88, 6:11, 6:30
 - database details 3:24, 3:42,
6:30
- Valve-Under-Head 5:184, 6:28
- Velocity Design 2:16, 2:48,
2:52, 2:67, 2:88–2:89,
2:91–2:92, 2:153, 5:168–
5:169, 5:172
 - looped systems 2:89, 5:170
- Version 1:7, 1:20, 1:24, 2:128,
3:45, 4:4–4:5, 5:15, 5:19–
5:21, 5:89, 5:135, 5:199,
6:36–6:38
- View Errors Report 1:14, 5:199
- View menu 3:41, 5:31

W

- Warehouse code 3:7, 3:11
- Water Requirements Report
1:15, 2:62, 5:104, 5:180
- Water Supplies 2:4, 2:11, 2:15,
2:32, 2:57–2:60, 2:90–
2:91, 5:5, 5:110, 5:133,
5:165, 6:5, 6:19

- design pressure 2:57–2:58,
5:111
- gravity system 2:58
- pumped systems 2:58, 2:80
- settings 1:21
- Water supply 4:104
- Water Supply 2:4, 2:13, 2:16–
2:17, 2:25–2:28, 2:38,
2:57–2:59, 2:80, 2:88–
2:92, 2:103, 5:109–5:111,
5:133–5:134, 5:187–5:189,
6:18
 - design flow 2:57, 5:110,
5:178, 5:180
 - design pressure 2:57–2:58,
5:111
 - flow check 1:11, 2:50–2:51,
2:71, 5:124
 - gravity system 2:58
 - pumped systems 2:58, 2:80
- Water Supply Report 1:15,
5:178
- Water Supply Times 1:14, 2:57,
5:164
- Water Supply tool 1:13, 5:110
- Wetted Radii
 - viewing 2:43, 2:76, 5:40
- Wetted radius 2:46, 2:68, 2:69,
2:76, 3:10, 3:34–3:35,
5:40, 5:87, 5:94, 5:98,
5:107, 5:125, 5:132, 5:156,
5:186, 6:30
- Wheel Line (Side Roll) Systems
2:81
- Wheel line design 4:99
- Wholesale Cost 3:11, 3:13,
5:162
- WinTab driver 2:8, 5:136
- Wire tool 1:13, 5:114
 - dialog details 5:114
- Wires 1:22, 2:32, 3:6, 3:36, 6:11
 - database details 3:36

Working Database 1:19, 2:10,
2:25–2:31, 2:102

X

X .. (database button) 3:9

Z

Zone 1:10–1:15, 2:3–2:4, 2:14–
2:15, 2:86–2:94, 3:6, 3:24–
3:25, 5:85–5:86, 6:5
area 1:13, 2:65, 2:68–2:70,
2:77–2:78, 5:85–5:87
autohead 1:13, 2:64, 2:70,
5:85–5:87
block 1:13, 2:14, 2:25, 2:54,
2:72, 2:75, 3:13, 5:85–5:87
control valve 1:13, 2:14, 5:85–
5:87
cut pipe 2:25, 2:49, 2:61, 2:71,
2:77–2:78, 5:85–5:87
junction 2:42, 5:85–5:87
misc. hydraulic 1:13, 5:85–
5:87
outlet 1:13, 2:14, 2:25, 2:43–
2:44, 2:78, 5:85–5:87
pipe 1:13, 2:14, 2:25, 2:29–
2:30, 3:21, 5:85–5:87
pipes 2:39
sprayline 1:13, 2:14, 2:29–
2:30, 2:54, 2:70, 2:72,
2:75, 2:78, 3:13, 3:21,
5:85–5:87
tape 2:14, 2:55, 2:72, 2:74,
5:85–5:87
tape block 2:14, 5:85–5:87
Zone / Mainline BOM Report
1:16, 5:195
Zone / Mainline Costing Report
1:16

Zone / Mainline Detailed Report
5:192–5:194

Zone / Mainline Summary
Report 5:191

Zone and Mainline Design 1:14,
2:17, 2:91, 2:92, 5:166–
5:167, 5:166–5:167, 5:170,
5:166–5:167, 5:166–5:167

Zone control valves 2:4, 2:87,
2:90, 6:17

Zone Design 2:16, 5:168

Zone Design Configuration
1:14, 2:51, 2:53, 2:67,
2:88, 2:92, 2:94, 2:141–
2:143, 5:171, 6:18

Zone Design Reports 2:16

Zone Flows Report 1:15, 2:16–
2:17, 2:62, 5:178

Zone Full Report 1:15, 5:182

Zone name 2:51

Zone Operating Times 1:14,
2:15, 2:63, 2:86, 5:164,
5:179

Zone Outlet Report 1:15, 5:186

Zone outlets 2:4, 2:43, 2:48–
2:57, 2:51

Zone Pipe Report 1:15, 5:187

Zone pipes 2:4, 2:33, 2:43,
2:48–2:49, 2:51, 3:13,
5:161

Zone Summary Report 1:15,
2:16, 5:185

Zones 2:3, 2:15, 3:24, 3:37, 6:5,
6:16–6:17

Zooms 5:3, 5:125–5:127

all 1:11, 5:31–5:39

in 1:11, 2:32, 5:31–5:39, 5:126

out 1:12, 2:102, 5:31–5:39,
5:126

previous 1:12, 5:31–5:39

selected 5:31–5:39

window 5:31–5:39