Plot Input Menu

Items under this menu control what appears in the plot created when you select Make Plot/Level... from the menu.

What to Plot

This line of input controls what gets plotted when you select Make Plot/Level 1, Level2, etc.

- Window defines the coordinates of the rectangular window within which the plot is made. The input for this cell should be four numbers delimited by commas: x minimum, y minimum, x maximum, y maximum. Alternately if this cell is left blank, the entire drawing will be shown, which includes model areas and areas covered by the basemap, if displayed. You may automatically set these coordinates to the current view by selecting Plot Input/ Set What to Plot/Window to Current View or using the right-click context menu to do the same. Zoom and pan to get the view you want before making this selection.
- Basemap defines if a basemap is to be displayed and how it will be displayed. If none is selected, no basemap is drawn. If either gray or color are selected, Anaqsim will draw the basemap listed under Basemap_file, displayed in either gray or in the original colors when a plot is made. The DXF (drawing exchange format) file is generally created by a CAD or GIS program. A basemap is very helpful for digitizing the coordinates of model features.
- Basemap_file defines the DXF file to be used as a basemap. Clicking on this cell opens a dialog where you select the DXF file to form the basemap. When making a plot, Anaqsim searches the path specified here for the DXF file. If that fails, it searches the directory where the model input file (*.anaq) is located a DXF file with the same name.
- Elements defines if model elements are drawn, and if so, how they are drawn. If none is selected, no elements are drawn. If Elements is selected, lines will be drawn along line boundaries and symbols will be drawn at wells, for elements in the level of the plot. For wells, the symbol that is drawn is a "+" symbol that is scaled to the plot window, and a circle that is the exact well radius. If the plot scale is large compared to the well radius, you may see the "+" but not the circle. When you pass the cursor over a well or line element, it is shown with a dotted line and a label pops up explaining what that element is. Elements (all levels) does the same, but plots elements in all model levels. Elements w/details adds circles at the corners of line boundaries and moving the cursor over one of the circles displays text information about the boundary condition at the corner. At the start and end points of line boundaries, these circles are slightly offset away from the start or end point, which is helpful when multiple line boundaries start/end at the same point. Elements w/details, control points does the same and also plots symbols at the locations of controls points (points where boundary conditions are met). These are collocation points along line boundaries (“x” symbols) and the basis points for spatially-variable area

source/sinks (“+” symbols).

- Checking Contours causes the plot to display contours in accordance with the settings defined under Plot Input/Contour Settings. Every fifth contour is drawn with a heavier line.
- Checking Pathlines causes the plot to display pathlines in accordance with the settings defined under Plot Input/Pathline Settings at the locations defined under Plot Input/Pathlines.
- Checking Vectors causes the plot to display vectors in accordance with the settings defined under Plot Input/Vector Settings.
- SVAS_polygons defines whether or not to draw the polygons that define the area covered by spatially-variable area sinks (SVAS) by polygon. If drawn, they can be selected and edited by moving vertexes, inserting vertexes, or deleting vertexes.
- AreaPathline_polygons defines whether or not to draw the polygons that define the areas where you are starting pathlines within areas. If drawn, they can be selected and edited by moving vertexes, inserting vertexes, or deleting vertexes.
- Checking Calibration causes the plot to display calibration information. For head calibration targets, residuals (modeled head - observed head) are plotted at the location of the observed head. The residual is plotted just below a small circle at the target location. When the cursor moves over the plotted residual, the calibration target label, modeled head, and observed head are also shown. Head calibration targets are defined under the Analysis Input/Calibration Targets/Head menu, where you can choose to display or not display specific head calibration targets. Velocity calibration data are also displayed, if the Show field is checked. For velocity targets, scaled horizontal velocity vectors are displayed - the observed and the modeled. When the cursor is over the velocity vectors, details about the horizontal and vertical velocities are displayed.
- Checking Analysis_Inputs causes the plot to display hydrograph points listed under Analysis Input/Hydrograph Points, lines entered under Analysis Input/Transient Line Conditions, polygons entered under Analysis Input/Vertical Leakage Over Polygon Area, and the line entered under Analysis/Conditions Along a Line, if there is one. When the cursor moves over any of these features, pop-up text explains what they represent. Hydrograph points and transient line condition lines are only drawn if their level matches the level plotted. The line associated with Conditions Along a Line plots regardless of the level of the plot.

Set Plot Window to Current View

Selecting this sets the plot view coordinates in the What to Plot/Window cell to the coordinates of the current plot window. Make this selection after using the zoom functions in the Plot View Menu to get the window you want for subsequent plots.

Set Plot Window to Entire Model

Selecting this sets the plot view coordinates in the What to Plot/Window cell to the limits of all elements in the current model, making the window for subsequent plots encompass the entire model extent.

Contour Settings

This selection lets you customize how contours are drawn.

- Surface is a drop-down list used to define what is contoured. You can chose to contour heads (h), the difference in head from this level to the level below (dh), the extraction (areally-distributed discharge per area due to leakage and storage fluxes), or the interface elevation in fresh/salt interface models. The (dh) option allows you to contour the head difference between levels in the active model. If you do this for a plot in level 1, it will contour the head difference between level 1 and level 2. This can be useful for showing vertical head gradients, where flow is upward or downward, etc, but is not used for showing drawdown.
- Points_Evaluate defines the number of points where the surface function (e.g. head) is evaluated before being fed into the contouring algorithm. Choosing a larger number here will make a smoother, more detailed contour plot, at the cost of more computation and time to plot.
- Subtract gives you the option of creating a contour plot of the difference between the active Anaqsim model and the surface contoured previously with a different run. To use this, you must save the grid of data that was used for the contoured surface of an earlier run. See Plot View Menu/Plot File Menu/Save Contour Grid Data to Binary File to learn how to save the surface data. If you select "no", the model contours only the specified surface of the present model. If you specify either of the two yes options, the plot will contour the difference between the surface of the active model and the saved surface (Anaqsim will ask for the file name of the saved surface). If you want a plot of drawdown comparing two Anaqsim runs, you would set Surface to "h" and set Subtract to one of the "yes" options, depending on whether you want drawdown displayed negative or positive.
- Increment defines the contour increment - the difference between adjacent contour levels. For example, if the contoured surface data ranged from 12.3 to 14.7, you left the Minimum and Maximum cells blank, chose an Increment of 0.1, the levels contoured would be 12.3, 12.4, 12.5...14.7. Anaqsim automatically uses a heavier line for every 5th contour (e.g. 12.5, 13.0, 13.5...) and labels these. If you set Increment to zero or a negative number, the increment will be determined automatically so that there will be about 25 contours total. This can be a good idea when you are uncertain of the range of values to contour.
- Minimum sets the minimum contour level. If this is left blank, the minimum contour level will be a multiple of Increment that is closest to the minimum value on the contoured surface.
- Maximum sets the maximum contour level. If this is left blank, the maximum contour level will be a multiple of Increment that is closest to the maximum value on the contoured surface.

Pathline Settings

These settings control the drawing of all flow pathlines you enter under Plot Input/Pathlines. In steady simulations, the pathlines are traced through a steady flow field. In transient simulations, pathlines are generally traced through the simulated transient flow field, and time along a pathline is synchronized with the simulation time. The exception is if you check Freeze_transient pathlines, as described below. The rest of this discussion of transient pathlines assumes Freeze_transient is not checked. Each time step in a transient model has a flow solution that, for the purposes of pathline tracing, applies from the start to the end of the time step. Transient pathlines are only traced during the simulated time window. Transient pathlines terminate when one of the following conditions occurs:

1. the simulation time along the pathline is less than 0 or greater than the total simulation time (sum of time period lengths),
2. the total elapsed time exceeds Total_time or,
3. the pathline exits the model or enters a well or linesink.

Steady pathlines terminate when condition 2 or 3 in the previous sentence is reached.

- Step_size defines the size of steps used in the algorithm that traces pathlines. Pathlines are composed of many small straight line segments, and the length of these little segments is defined by Step_size. The size of segments equals Step_size times the largest dimension (x or y) of the plot window size, which is either a) the distance across the window specified under Plot Input/What to Plot (Window), or if that field is blank, the distance across the entire model (the minimum window that spans all line boundaries). So, the definition of it changes as you change the settings of Plot Input/What to Plot/Window. Using a smaller Step_size causes smoother, more accurate pathlines at the cost of more computation time.
- If Time_markers is checked, arrows are plotted at specific time intervals along the pathlines drawn. This is useful for defining the capture zones of wells within certain time limits, or simulating solute transport times. When you move the cursor over an arrow, a text box pops up to display information about the elapsed time, domain, and elevation of the pathline at the location of the arrowhead. This allows you to know the 3D configuration of a pathline. The scale of the arrows is set as a fraction of the plot window size (similar to the step size as discussed above.
- Time_marker_increment is the amount of elapsed time between arrows that are drawn, if Time_markers is checked.
- Total_time is the total amount of time allowed on pathlines. This can be set to show, for example, the limits of the 2 year capture zone for a water supply well.
- Start_time is the simulation time at the starting points for pathlines in transient simulations. Simulation time starts at zero at the beginning of a transient simulation. For example, in a 300 day simulation, you could have the starting time for well pathlines be 300 days and trace pathlines upstream and the simulation time would decrease along the pathline. Alternatively, pathlines traced in the downstream direction have increasing simulation time along the pathline.

- If Freeze_transient is checked and this is a transient simulation, the pathlines will not be traced through the transient flow field, but instead will be traced through a "frozen" snapshot of flow field at the time Start_time, with pathlines traced as though this flow field existed indefinitely like a steady state flow field. This is generally not recommended, since the frozen flow field doesn't actually exist for longer than an instant. This option is offered because capture zone delineation rules in some states (e.g. Massachusetts) require such an analysis.
- Capture_constrain, if checked, allows you to plot only the pathlines that are captured by certain wells or internal line boundaries specified in the next two input items. Capture constrain only applies to pathlines traced in the downstream direction. This can be helpful for defining the capture zone of wells, stream reaches, drains, etc. For example, to define the zone of contribution to a well, you could start numerous pathlines at the water table within a polygon area, and constrain the displayed pathlines to those captured by the well. The staring points of those pathlines will define the zone of recharge captured by the well.
- Capture_wells allows you to select which well(s) you want the capture constraint to apply to. If you click the Select button, you can select one or more wells from among the list of wells - their labels will be displayed in this list. All three well types are included in this list: discharge-specified, discharge-specified (multi-domain), and head-specified. You should not mix well pathlines emanating from well with plots involving capture constraint at the same well. The well pathlines emanating from the well are not considered "captured" because in the tracing they start at the well, but don't end at the well.
- Capture_lines allows you to select which internal line boundaries you want the capture constraint to apply to. If you click the Select button, you can select one or more line boundaries from among the list of line boundaries - their labels will be displayed in this list. These types of line boundaries are included in this list: head-specified (internal, not external), discharge-specified, river, drain/fracture.

Pathlines can be displayed with three aspects:

- Starting points are plotted as circles and there is pop-up information about the starting point if you hover the mouse over the circle.
- Pathline traces.
- Arrowheads at each time marker, with pop-up information about the pathline at that point if you hover the mouse over it.

You can control which of these three is displayed in the plot by selecting View Manager from the Plot View Menu. You can toggle the display of these on/off by clicking on the Freeze column in the View Manager.

Vector Settings

These settings control the drawing of vectors. Vectors are computed using the domain's function for the discharge vector. When vectors are drawn, the center of the vector is at the spot where the vector was computed.

- Vector_Type is a drop-down list of possible vector types to draw: average linear velocity (v) [L/T], specific discharge (q) [L/T], or domain discharge (Q, equals q times saturated thickness) [L^2/T].
- Points_Evaluate defines the number of points where the vector will be computed and displayed. Select values in the lower end of the range for a plot that is not cluttered with too many vectors.
- Scale_Factor is a factor that controls the scale that the vectors are drawn to. Larger numbers here produce larger vectors. A value of 1 makes it so the largest vector drawn has a length equal to the spacing between points where vectors are evaluated.

Pathlines

This menu is where you specify the starting points and tracing directions of pathlines that are drawn. You can specify single pathlines, pathlines distributed along a line, or pathlines distributed along a circle. Well pathlines are like circle pathlines but linked to a particular well. Pathlines are demonstrated in detail in the tutorial videos at the website.

Single

This table allows input for single pathlines.

- Label is a text label that helps you keep track of multiple single pathlines.
- Direction is the direction that pathlines are traced from the starting point and it may be either upstream or downstream.
- X,Y are the coordinates of the starting point for the pathline. The coordinates are two real numbers delimited by a comma. You may digitize the coordinates with the Digitize/Point selection in the plot view menu.
- Start_level is the level(s) of the pathline at the start point(s). It is easiest to understand this parameter with some examples. A value of 1.0 starts a pathline at X,Y at the top of the domain that is level 1 at this location. A value of 2.25 starts a pathline at the elevation where 25% of the saturated thickness is above and 75% of the saturated thickness below in the domain that is level 2 at X,Y. A value of 2.99 starts a pathline with 99% of the saturated thickness above and 1% of the saturated thickness below, very near the base of the level 2 domain at X,Y. Pathlines are plotted for all levels encountered along the path, not just the start level or the plotted level which applies to the contours, vectors and information shown to the left of the plot. A single Start_level may be entered, or multiple levels may be entered separated by commas which starts an array of pathlines with the same x,y coodinates but at different levels. For example, you could enter "2.1, 2.3, 2.5, 2.7, 2.9" to start pathlines at five different elevations in level 2.

- Show is a checkbox that allows you to selectively display or not display this single pathline. In order for this pathline to appear in a plot, this must be checked **and Pathlines must be checked** in Plot Input Menu / What to Plot.

Line

This allows starting a number of pathlines equally spaced along segments of a polyline.

- Label is a text label that helps you keep track of multiple line pathlines.
- Direction is the same as defined for Pathline/Single.
- Coordinates are the coordinates of the polyline along which the pathlines start. Edit the coordinates by clicking the Edit button in this column. The coordinates are two or more lines, each with two real numbers delimited by a comma (X, Y). You may digitize the coordinates with the Digitize/Polyline selection in the plot view menu and then paste them in.
- Number is the number of pathlines to start in each segment of the polyline. This number of start points are equally spaced along each segment.
- Start_level is the level(s) of the pathlines at their start points(s). It is the same as defined for Pathline/Single. A single Start_level may be entered, or multiple levels may be entered separated by commas which starts an array of pathlines with the same x,y coodinates but at different levels. For example, you could enter "2.1, 2.3, 2.5, 2.7, 2.9" to start pathlines at five different elevations in level 2.
- Show is a checkbox that allows you to selectively display or not display these pathlines. In order for these pathlines to appear in a plot, this must be checked **and Pathlines must be checked** in Plot Input Menu / What to Plot.

Area

This allows starting a number of pathlines equally spaced within an area defined by a polygon. This can be useful for tracing pathlines from a source area, or for defining capture zones for wells.

- Label is a text label that helps you keep track of multiple area pathlines.
- Direction is the same as defined for Pathline/Single.
- Coordinates are the coordinates of the polygon that defines the area within which the pathlines start. Edit the coordinates by clicking the Edit button in this column. The coordinates are multiple lines, each with two real numbers delimited by a comma (X, Y). You may digitize the polygon coordinates with the Digitize/Polyline, Digitize/Circle, or Digitize/Ellipse selections in the plot view menu and then paste them in. You may also later edit the polygon graphically, moving, inserting, and deleting vertexes.
- Nesting_level is a parameter that allows you to nest several area pathline polygons inside each other, with different start point spacings. If you are not nesting or overlapping these, specify 1 for all. If you want to place a smaller polygon with denser or less dense spacing inside another polygon, use nesting level 1 for the larger polygon and nesting level 2 for the smaller one inside of it. You may nest up to 5 levels to drill down to finer

basis point spacing in the key areas (e.g. source area). The polygons with the higher nesting level overwrite the spacing and other inputs of lower nesting levels.

- Spacing defines the distance between pathline start points. Start points are spread out on a hexagonal array of points based on this spacing.
- Start_level is the level(s) of the pathlines at their start points(s). It is the same as defined for Pathline/Single. A single Start_level may be entered, or multiple levels may be entered separated by commas which starts an array of pathlines with the same x,y coodinates but at different levels. For example, if the source area you were trying trace spanned level 2, you could enter "2.1, 2.3, 2.5, 2.7, 2.9" to start pathlines at five different elevations in level 2.
- Show is a checkbox that allows you to selectively display or not display these pathlines. In order for these pathlines to appear in a plot, this must be checked **and Pathlines must be checked** in Plot Input Menu / What to Plot.

Circle

Circle pathlines start equally spaced on a circle that the user specifies. For wells, the well pathline is a better choice, since it is linked to the well and will move with the well if its location is changed.

- Label is a text label that helps you keep track of multiple circle pathlines.
- Direction is the same as defined for Pathline/Single.
- X,Y are the coordinates of the center of the circle. The coordinates are two real numbers delimited by a comma. You may digitize the coordinates with the Digitize/Point selection in the plot view menu.
- Radius is the radius of the circle. For a well, make sure this radius is larger than the well's radius, otherwise the pathlines will be terminated before they can start.
- Start_level is the level(s) of the pathlines at their start points(s). It is the same as defined for Pathline/Single. A single Start_level may be entered, or multiple levels may be entered separated by commas which starts an array of pathlines with the same x,y coodinates but at different levels. For example, you could enter "2.1, 2.3, 2.5, 2.7, 2.9" to start pathlines at five different elevations in level 2.
- Show is a checkbox that allows you to selectively display or not display these pathlines. In order for these pathlines to appear in a plot, this must be checked **and Pathlines must be checked** in Plot Input Menu / What to Plot.

Well

Well pathlines are like circle pathlines, but are linked to a specific well. When you move a well graphically, the reference to the well is maintained and pathlines will be drawn correctly. The circle that the pathlines start on is centered on the well center and has a radius that is 1.2 times the well radius. The direction of tracing is upstream if the well is extracting and downstream if the well is injecting.

- Well Label is the text label of the pumping well you want to trace from. Double click this cell to select from a list of all well labels.

- Number is the number of pathlines to start. Pathline start points are equally spaced around the circle centered on the well.
- Start_level is the level(s) of the pathlines at their start points(s). It is the same as defined for Pathline/Single. A single Start_level may be entered, or multiple levels may be entered separated by commas which starts an array of pathlines with the same x,y coodinates but at different levels. For example, you could enter "2.1, 2.3, 2.5, 2.7, 2.9" to start pathlines at five different elevations in level 2.
- Show is a checkbox that allows you to selectively display or not display these pathlines. In order for these pathlines to appear in a plot, this must be checked **and Pathlines must be checked** in Plot Input Menu / What to Plot.

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