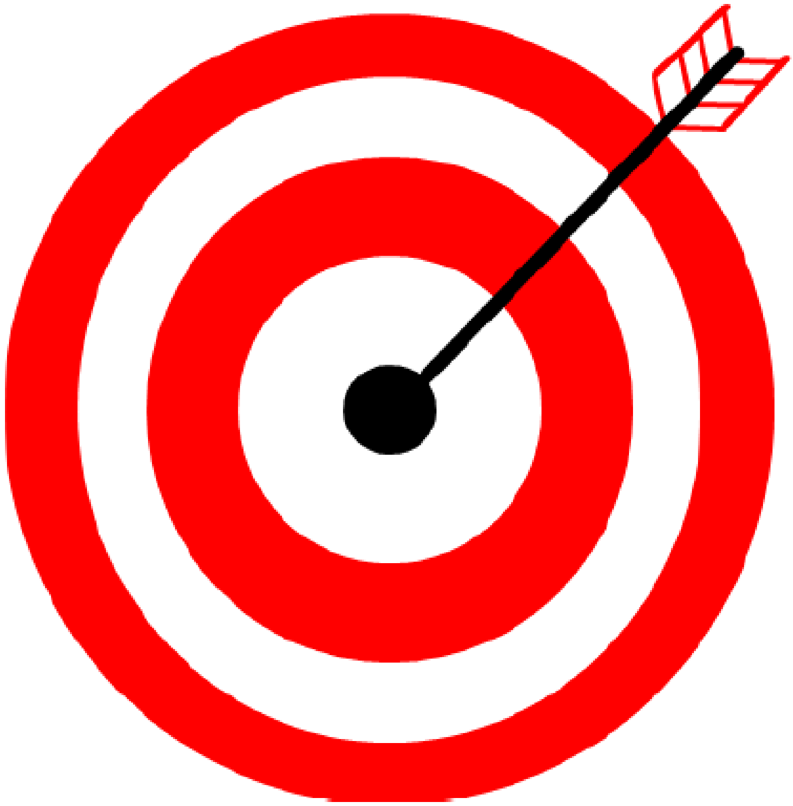

AIMM Version 4.X.X
Help Manual

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1 Welcome to AIMM

This help document will assist you in exploring the functionality of the AIMM program. You can browse the document or use the Index or Table of Contents to find the information you need.

2 Introduction

Technological developments within the irrigation industry have advanced significantly over the last few decades. Many of these developments have resulted in on-going improvements to water use efficiency, increased production, higher quality commodities and a decreased labour requirement for irrigation. The ultimate success of the application of this advancing technology remains with the water management skill level of the irrigation water user.

3 AIMM - What Is It?

The Alberta Irrigation Management Model is a software package, designed exclusively for use at the farm level to help producers in their irrigation scheduling decisions. The model simulates the growing conditions and crop water use of 54 different crops. The software is designed and built not only to serve as a management and record keeping tool for irrigation operations but as an irrigation management-training tool as well.

4 Output From AIMM

1) Graphical and tabular reports of daily year to date soil moisture conditions, evapotranspiration (crop water use), climate data, irrigation application amounts, surface run-off and deep percolation for any number of fields or sites within fields.

2) Predictive assessment on crop water requirements and irrigation timing for designated near-future time periods.

3) Record keeping for crop production information such as fertilizer and chemical use, seeding rate, crop yields, pumps and pumping record information, irrigation applications, and rainfall.

5 Installing AIMM

AIMM is exclusively a Windows based software application (**There is no iOS version). The most recent version of AIMM is available for download at https://acis.alberta.ca/acis/imcin/aimm.jsp click on the Download AIMM Software tab. Once download is complete, follow the prompts to install the program. The model installs to a default directory, but the directory can be changed at time of installation. AIMM requires SAP s Crystal Reports Viewer to function properly, both 32-bit and 64-bit versions are available as a free download at https://www.sap.com/canada/products/technology-platform/crystal-reports.html .

6 Menu Toolbar

6.1 File Tab:

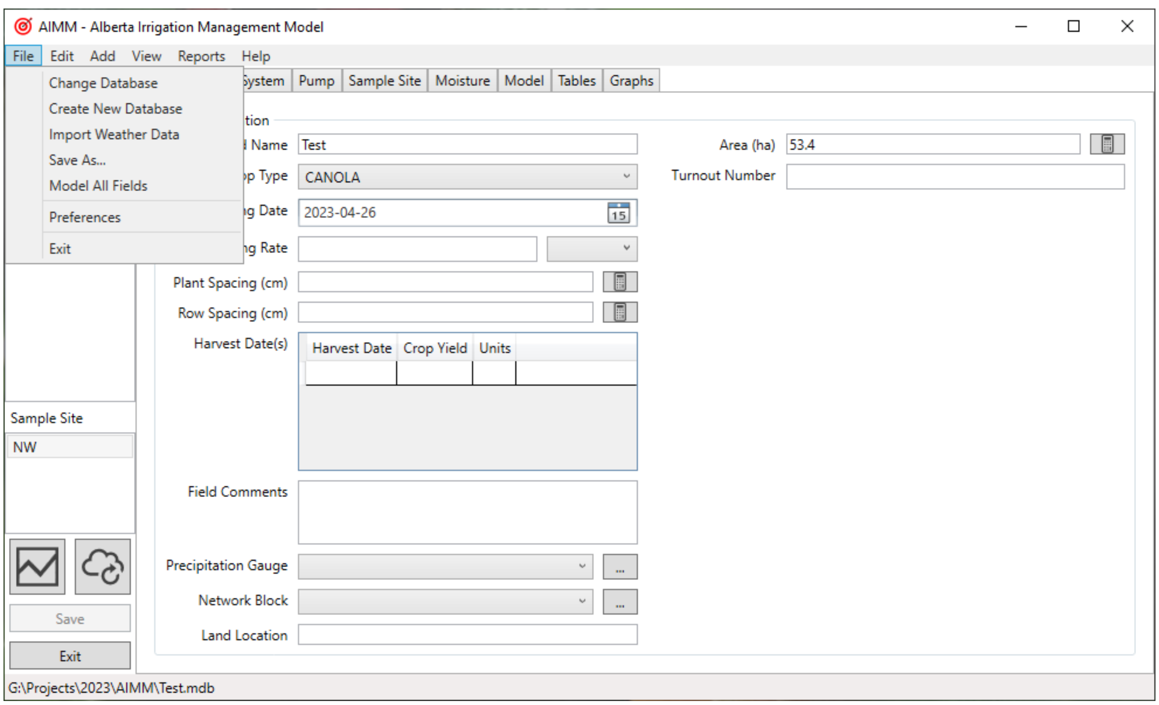


Figure 1. Choices under File tab on the main menu ribbon.

6.1.1 Change Database

Select Change Database if the database is not located in the default directory, or if you would like to choose another database. After clicking on Change Database, a window will appear, allowing you to browse to the location of a new database file (e.g., Test.mbd).

6.1.2 Create a New Database

Using this function will allow the user to generate a new database file. AIMM users can choose to create either a Microsoft Access database file (*.mdb) or the more recent version of Microsoft Access database file (*.adb) which is an abbreviated form of the (*.accdb) file extension. Either database file is compatible with AIMM.

6.1.3 Import Weather Data

Generally, the weather files required for AIMM model operation are available by clicking the download weather file icon . However, other weather data from stand-alone meteorological (Met) instruments in the field or Met data from another provider can be used providing they are properly formatted for use in AIMM (See Appendix IV for format requirements). Each field/site combination requires an average meteorological day (AMD) file (commonly referred to as long-term normals) and a weather file.

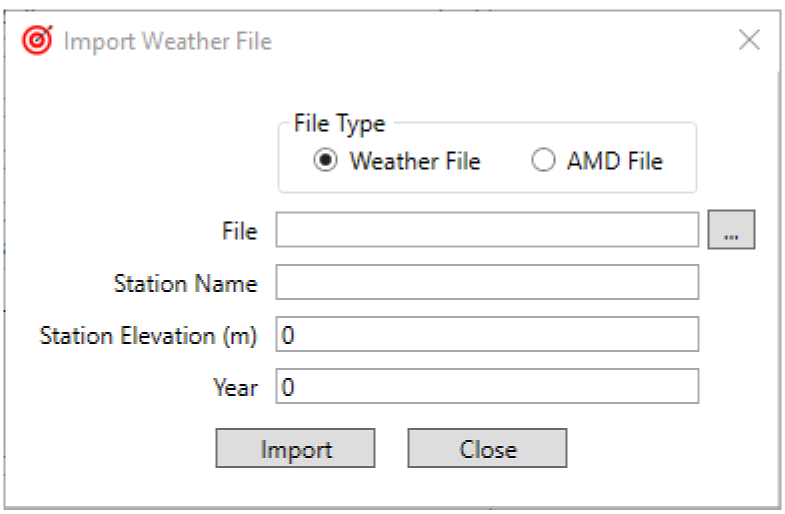


Figure 2. Import weather file entry dialog.

To import an alternate weather data file, rather than the default meteorological stations available in AIMM, click on the grey radio button  to browse to the file location containing the properly formatted (*.txt or *.csv) weather data file and click Open . Once the data file has been selected and you are back at the Import Weather File window, enter the Station Name , the Station elevation and the Year . Once all the fields have been filled, click Import to load the weather data to the database.

6.1.4 Save as

Selecting Save As . . . will allow you to save any database changes with the file name and file location of your choosing. You can change the name of the default **Test.mdb** to a more appropriate name. This is useful particularly if you plan to create several databases over multiple years.

6.1.5 Model All Fields

AIMM allows the user to model all the fields within the current database by selecting the Model All Fields option under the File tab. This option allows users the option to model all fields at once instead of modelling each field individually using the run model button .

6.1.6 Preferences

Users can choose whether to send error reports and usage statistics to Alberta Agriculture and Irrigation. Error reports help us to identify and fix issues that may occur over time within the software. Usage statistics help us to identify what software functionality is used more frequently and what parts are not being used. By default, the user preference boxes are checked.

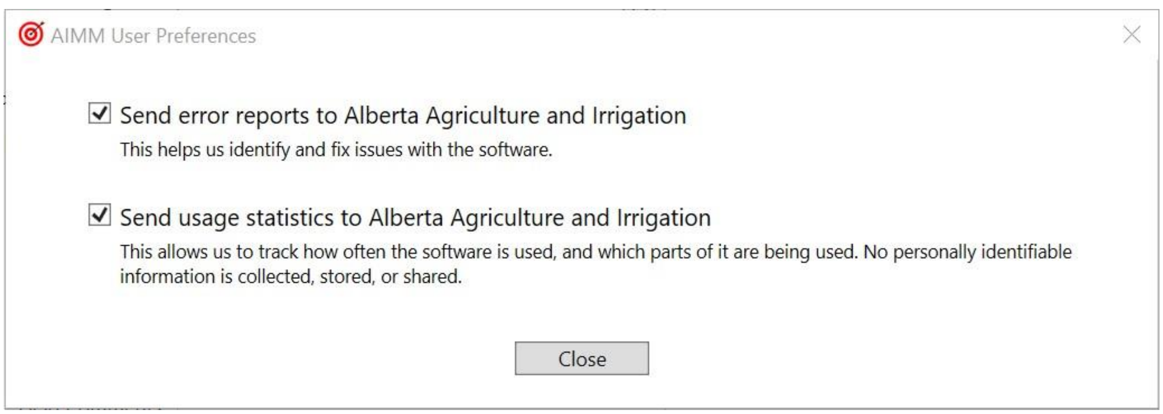


Figure 3. AIMM user preference window.

6.1.7 Exit

Selecting Exit closes AIMM.

6.2 *Edit Tab:*

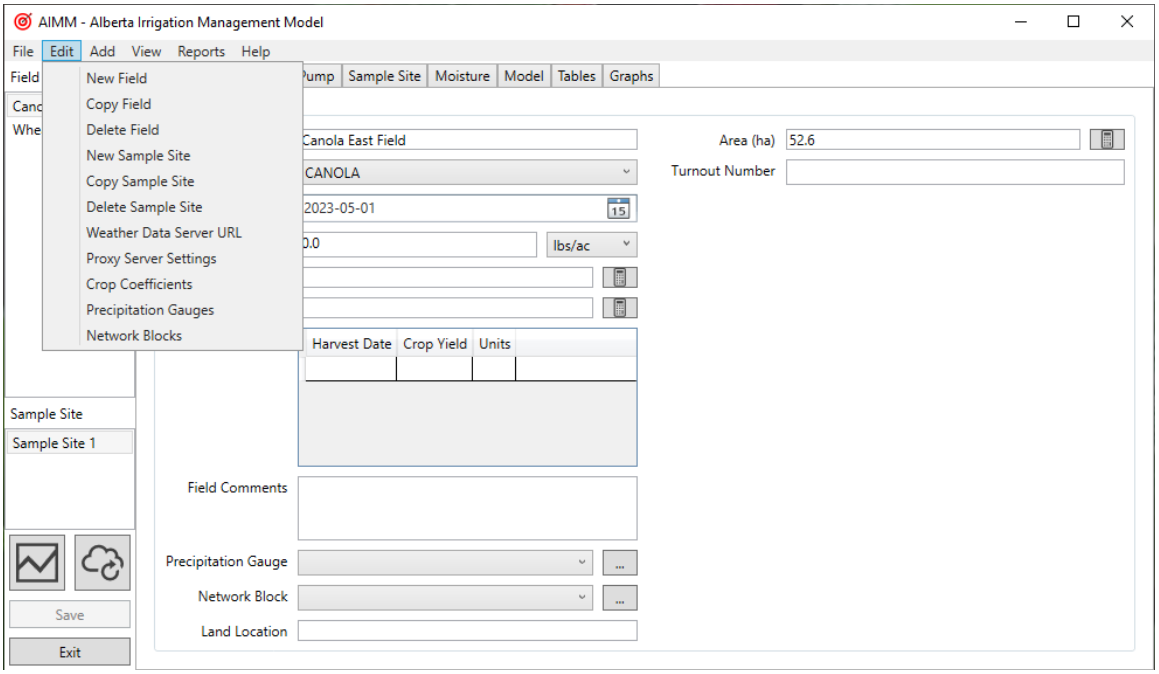


Figure 4. Options under Edit tab on the main menu ribbon.

6.2.1 New Field

Selecting New Field adds a new field to the database with the default name New Field. After a new field has been created the default field name can be changed from New Field to a new user preferred name, enter a new name into the text field next to the Field Name identifier. The new field name will update automatically in the Field window to the left. Before saving the new field, you must enter planting date, field area, crop type and system type found under the System tab.

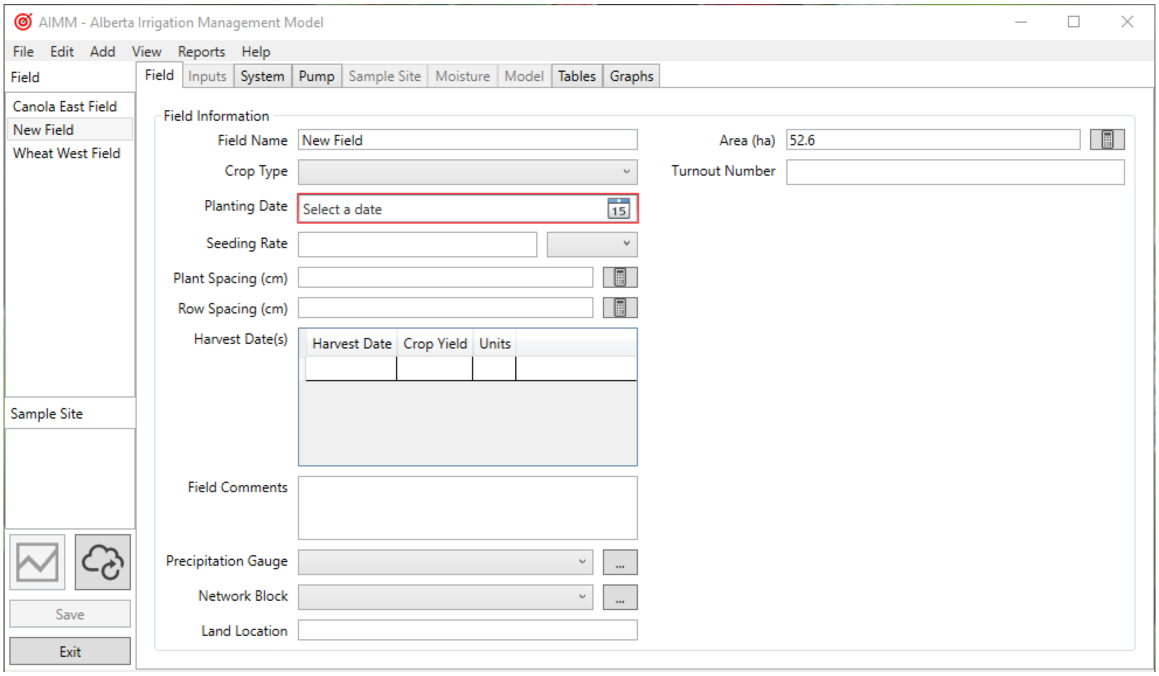


Figure 5. Window display after selecting New Field under the Edit tab on the main menu ribbon.

6.2.2 Copy Field

Selecting Copy Field allows you to copy the field opened in the Field window. Once selected Copy Field generates a new field with the same name with the addition (- Copy). The new field will also copy existing Sample Sites with a (- Copy) extension.

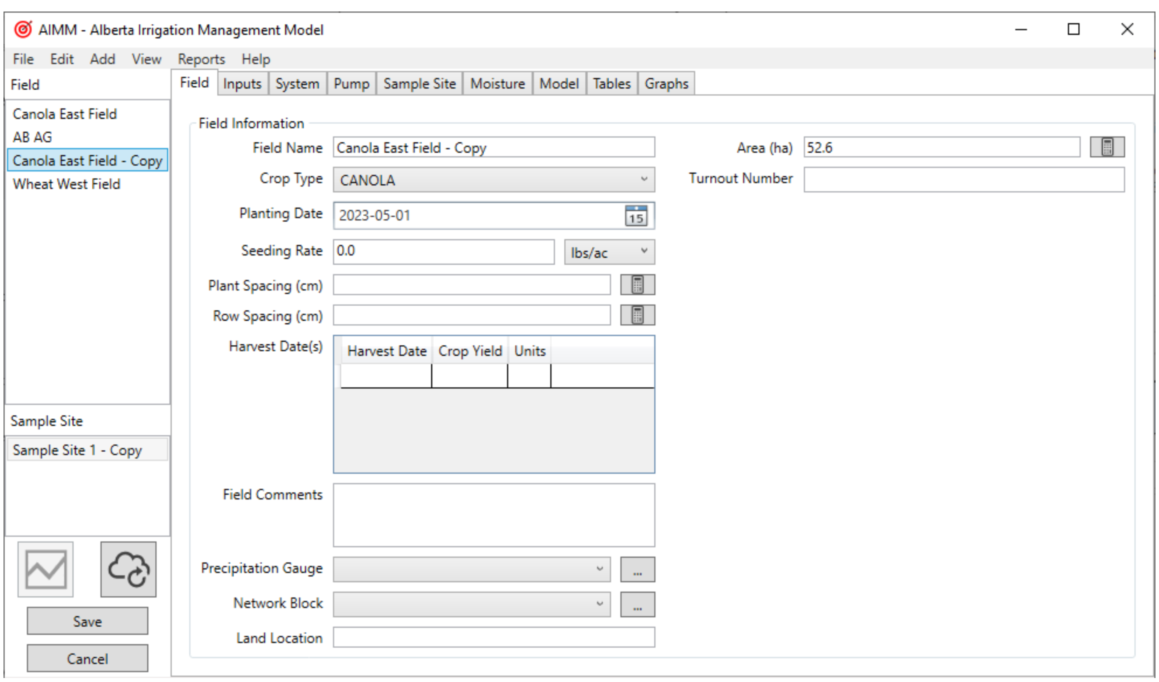


Figure 6. Copy Field under the Edit tab on the main menu ribbon.

This feature is beneficial when transferring one field over multiple years. The two things that require modifying are the planting date and the crop type as the rest of the field information remains static from year to year.

6.2.3 Delete Field

Choosing the Delete Field permanently deletes the selected Field from the database and any sample sites associated with the Field.

6.2.4 New Sample Site

Selecting New Sample Site simply creates a new sample site with the default name New Sample Site. A new name may be name given to the sample site by entering an alphanumeric name under the Sample Site tab (**Figure 7**). Each sample site is distinguished by a maximum soil root zone depth, an allowable soil moisture depletion value in percent, and a soil profile depth which includes profile depth in centimeters and a soil type. Each sample site is attached to a Field location. More than one sample site may be added to a single Field. This may arise if soil conditions are distinctly different one area of a field over another or there are topographic features (highs/lows) that the user would like to identify. These sample site differences may require infield irrigation timing and/or volume adjustments.

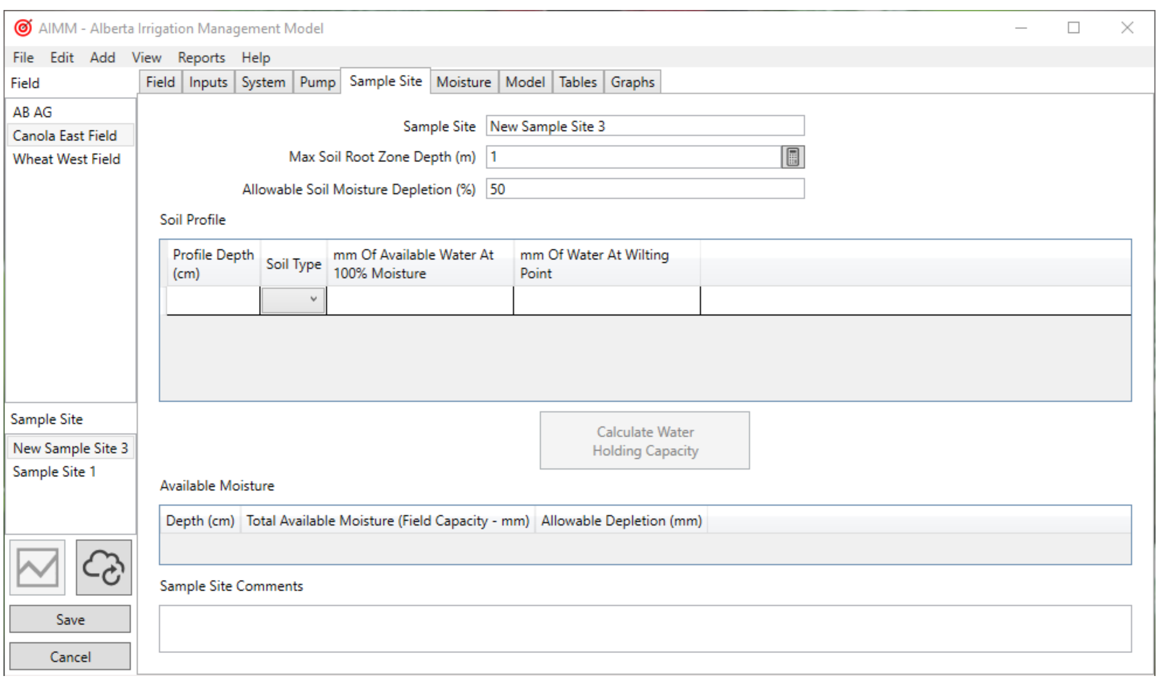


Figure 7. Output from New Sample Site tab under the Edit tab from the main menu ribbon.

6.2.5 Copy Sample Site

Selecting Copy Sample Site copies a Sample Site and adds it to your Sample Site list below the list of Fields on the left-hand side of the main window. Using the drop-down list, select which Sample Site is to be copied, then select Copy Sample Site from the Edit tab of the main menu ribbon. This will produce an Identical copy of the Sample Site you selected.

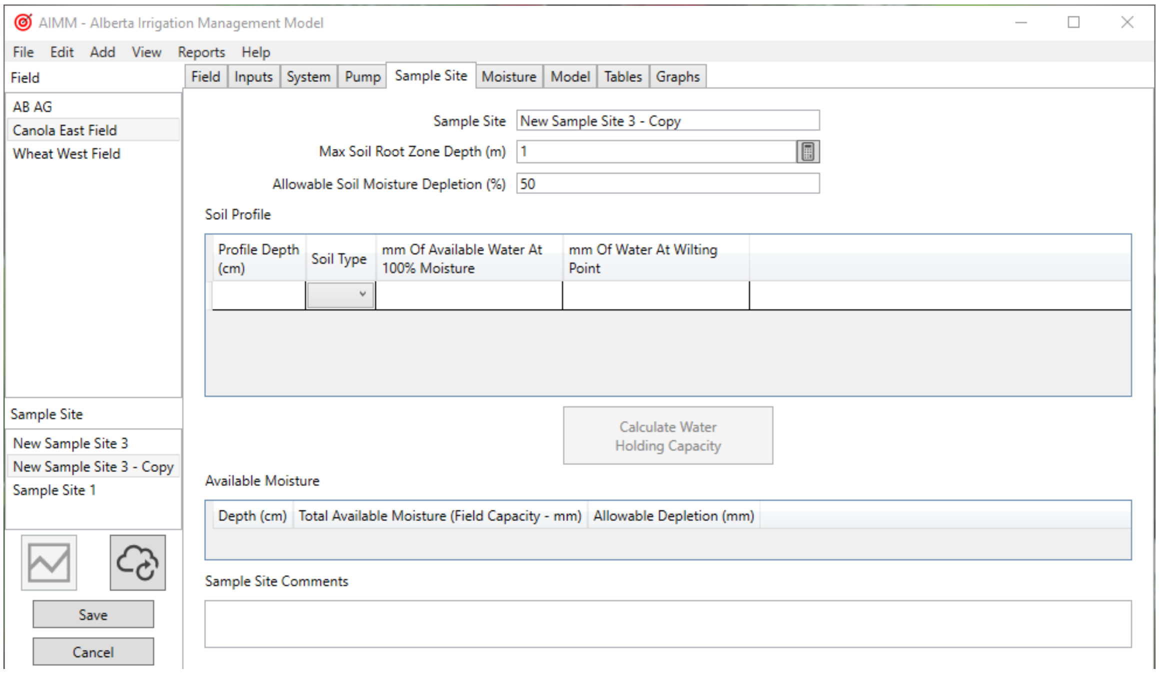


Figure 8. Output from Copy Sample Site under the Edit tab of the main menu ribbon.

6.2.6 Delete Sample Site

Delete Sample Site permanently deletes the currently selected sample site.

6.2.7 Weather Data Server URL

Selecting Weather Data Server URL allows the user to select a new weather data source instead of the default URL http://agriculture.alberta.ca/acis/imcin/aimm/ where AIMM s weather data is located. If local weather data is not available, check the Alberta Climate Information Service web site https://www.acis.alberta.ca/acis/weather-data-viewer.jsp for the weather station nearest to your location.

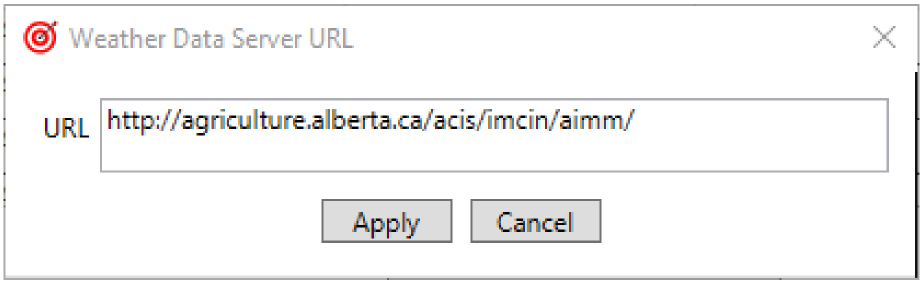


Figure 9. Weather Data Server URL edit window under the Edit tab of the main menu ribbon.

6.2.8 Proxy Server Settings

If connection to the internet is through a proxy server, it may be necessary to enter the proxy server s IP address to download weather data over the internet. Selecting Proxy Server Settings from the edit menu opens a Proxy Server Settings window (**Figure 10**). Simply enter the IP address of the proxy server and click Apply.

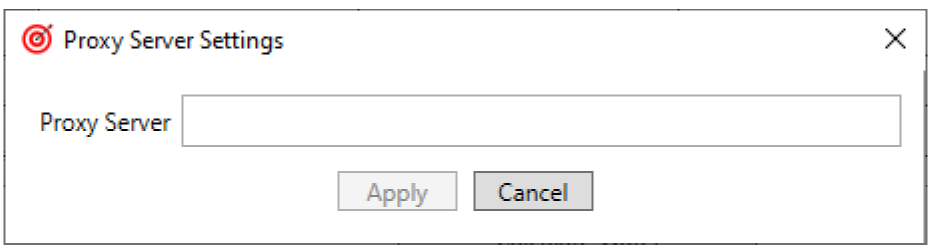


Figure 10. Proxy Server edit window under the Edit tab of the main menu ribbon.

6.2.9 Crop Coefficients

Crop coefficients are used in the model to define how a specific crop uses water compared to an alfalfa reference crop. Crop coefficients are unique to the crop grown, the reference evapotranspiration equation, and to the climatic area. Crop coefficients used in AIMM are calibrated for the semi-arid region of Southern Alberta.

Crop coefficients in AIMM use cumulative growing-degree-days (GDD[5]) as the independent axis when constructing the crop coefficient curve. Crop coefficients are evaluated and updated using a Bowen Ratio Energy Balance System. New crop coefficients are posted on our AIMM website once they become available. It is good habit, once each spring, to press the Update All Crop Coefficients icon to ensure the newest crop coefficients are available within the current database.

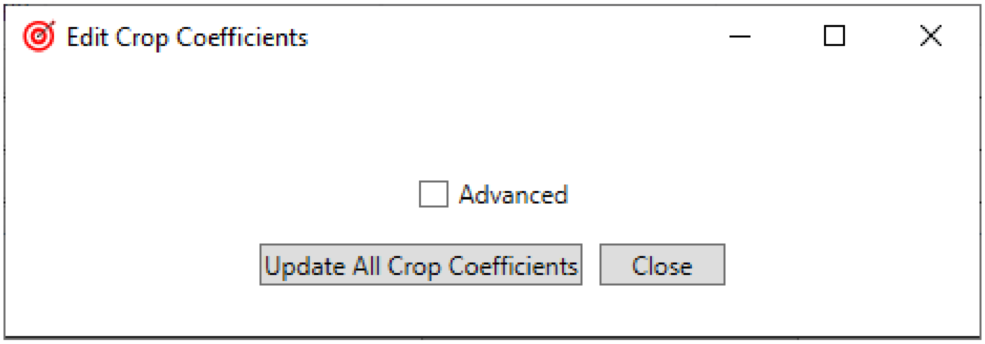


Figure 11. Edit crop coefficients options.

If the model is being applied to fields outside of Alberta, the area the crop coefficients were calibrated and validated for, the Advanced icon can be used to enter coefficients specific to your area of interest.

Figure 12. Advanced option for crop coefficients.

The crop coefficient equation is in the form of a 4th degree polynomial in the form of

$$kc = a + bx + cx^2 + dx^3 + ex^4$$

Where:

kc = crop coefficient (dimensionless)

x = cumulative growing degree days

a, b, c, d, e = coefficients specific to the crop grown (Barley in the example above).

Once the locally calibrated crop coefficients are entered, pressing the Save New Crop Coefficients icon will write the new GDD[5] coefficients into the database replacing the default coefficients.

6.2.10 Precipitation Gauges

This selection enables associating multiple fields to local precipitation gauges. For instance, if there is a centrally located precipitation gauge for monitoring rainfall events, associating fields to the precipitation gauge allows one entry of precipitation to be applied to the linked fields, eliminating the necessity for adding rainfall events to each field separately.

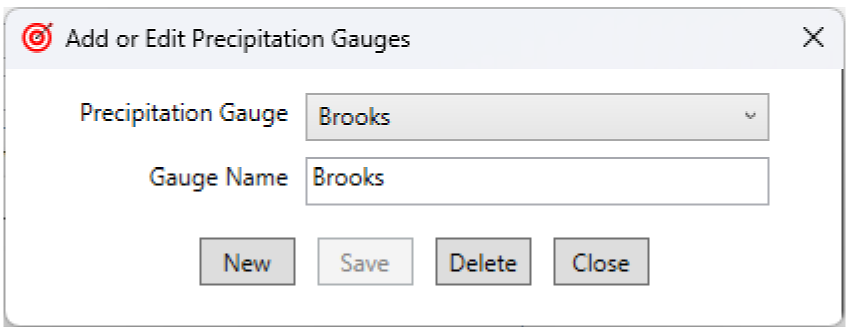


Figure 13. Precipitation gauge addition window.

When adding precipitation gauges, click New and the gauge name information can be added. The field presently being entered will be associated with the current gauge name, however if multiple gauges are being used, they will appear in the drop-down menu of the Precipitation Gauge selection after entry.

6.2.11 Network Block

This selection enables organizing multiple fields into blocks. It is a feature specific for fields located within an irrigation district where irrigation water is supplied through the districts canal distribution system. This helps to organize the information on who to call when a water order is placed.

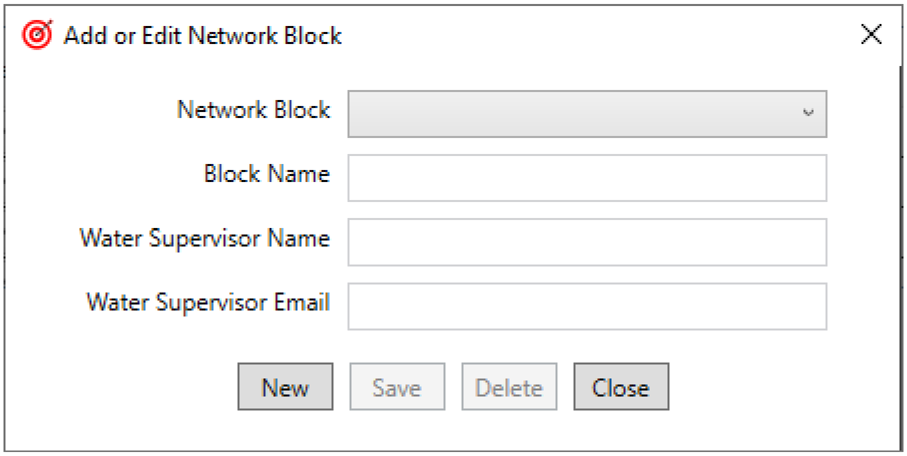


Figure 14. Network block dialog entry.

When entering the information, click on New to add the Block Name, Water Supervisor Name and Water Supervisor Email. The current field you are entering the information for will be associated with the network block information entered. As more network blocks are entered, they will appear in the drop-down menu entitled Network Block.

6.3 Add Tab

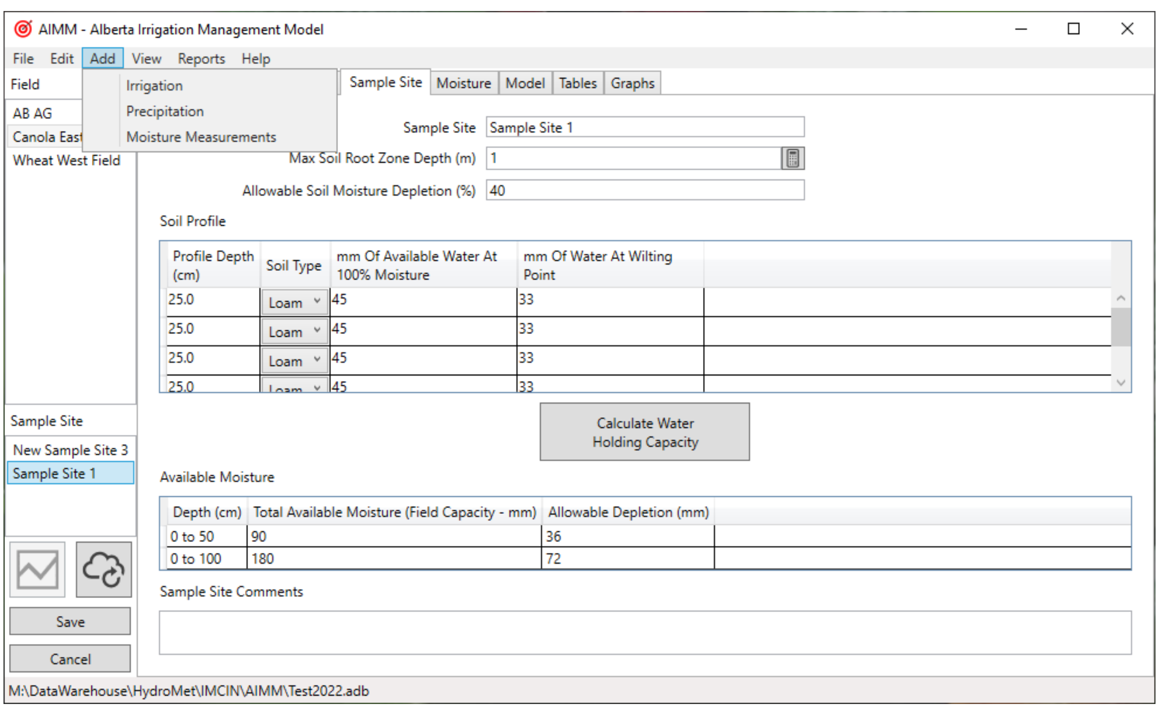
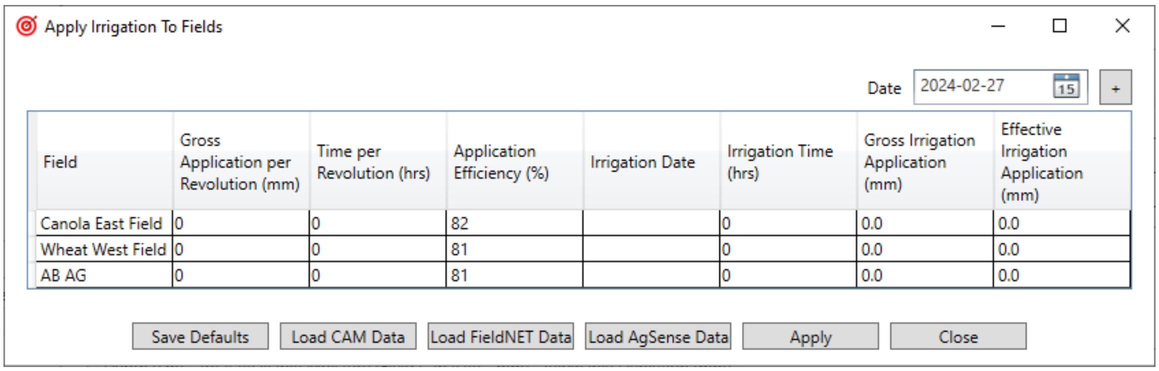


Figure 15. Options under Add on the main menu ribbon.

6.3.1 Irrigation

This option allows irrigations to be entered all in one interface without the need for highlighting each field in the database. Note: The field must be irrigated with center pivot irrigation to use this option.

For each field enter the gross application per revolution, time per revolution, application efficiency (if different than the default values), irrigation date, irrigation time (how long the irrigation was applied). The gross irrigation application and effective irrigation application will be calculated based on the center pivot operating characteristics, irrigation time and application efficiencies. Clicking the APPLY button will add the irrigations entered to the irrigation input under the Moisture Tab .


Apply Irrigation To Fields

Date 2024-02-27

Field	Gross Application per Revolution (mm)	Time per Revolution (hrs)	Application Efficiency (%)	Irrigation Date	Irrigation Time (hrs)	Gross Irrigation Application (mm)	Effective Irrigation Application (mm)
Canola East Field	0	0	82		0	0.0	0.0
Wheat West Field	0	0	81		0	0.0	0.0
AB AG	0	0	81		0	0.0	0.0

Save Defaults | Load CAM Data | Load FieldNET Data | Load AgSense Data | Apply | Close

Figure 16. Adding irrigations to multiple fields.

If a Valley® CAMS panel with the BaseStation software is part of your irrigation system, the application data from the BaseStation software in the form of a comma delimited file (.csv or .txt) can be entered directly into the Add Irrigation table by selecting the Load CAM Data button . The water report must include the columns listed in **Figure 17**. The user must ensure that the field names from the CAMS output files are identical to the field names entered into AIMM program (**Figure 16**).

Asplund	6/2/2006 8:59	6/2/2006 10:59	2	0	0	1200			0	Polled Interval
Betke N	6/1/2006 0:07	6/11/2006 0:10	2	0	0	1200			0	Polled Interval

Figure 17. Example of data output from the Valley™ BaseStation2 software.

If a Valley™ user is using AgSense® for pivot control and monitoring, an AgSense® report can be loaded into AIMM by selecting the Load AgSense® Data radio button. As with CAMS users the AgSense® user must ensure that the field names within the water report are identical to the field names entered into the AIMM program. The water report must include the columns listed in **Figure 18**. This will ensure proper integration into AIMM.

	Group Name	Serial	Alias	Total Hours Powered On	Hours Walking Wet	Minutes Walking Wet	Hours Walking Dry	Total Walking Hours	Gallons Pumped	Inches Applied
2	Group 0	111111	Gandalf	23.8	0	0	23.8	23.8	0	0
3	Group 0	111112	Yellow	23.49	0.06	3.6	23.43	23.49	3,916.73	0.38
4	Group 0	111113	Cabbage	23.68	0	0	23.68	23.68	0	0
5	Group 0	111114	Frodo	0	0	0	0	0	0	0
6	Group 0	111115	Bilbo	23.74	0	0	23.74	23.74	0	0

Figure 18. Example of data file from the Valley® AgSense® software.

If a Lindsay™ user is using FieldNET® for pivot control and monitoring, a FieldNET® water usage report can be loaded into AIMM by selecting the Load FieldNET® Data radio button. The FieldNET® user must ensure that the field names within the output file are identical to the field names entered into the AIMM program. The water report must include the columns listed in **Figure 19**. This will ensure proper integration into AIMM.

	Name	Reporting Method	Flow Rate Setting [gpm]	Irrigation Area [acre]	Hours Run	Total Water Usage	Unit
2	Elf	Flow Meter	1600	185		0	galX1000
3	Giant	Hours Running Wet	1900	260	437.2	49840.8	galX1000
4	Good	Hours Running Wet	900	90	248.92	13441.5	galX1000
5	Wasp	Hours Running Wet	650		308.05	12013.95	galX1000

Figure 19. Example of data file from the Lindsay® FieldNET® software.

6.3.2 Precipitation

This option provides for the addition of precipitation events by date to each precipitation gauge within the current database. After selecting the Apply radio button all fields associated with the precipitation gauge will be updated with the most recent precipitation additions.

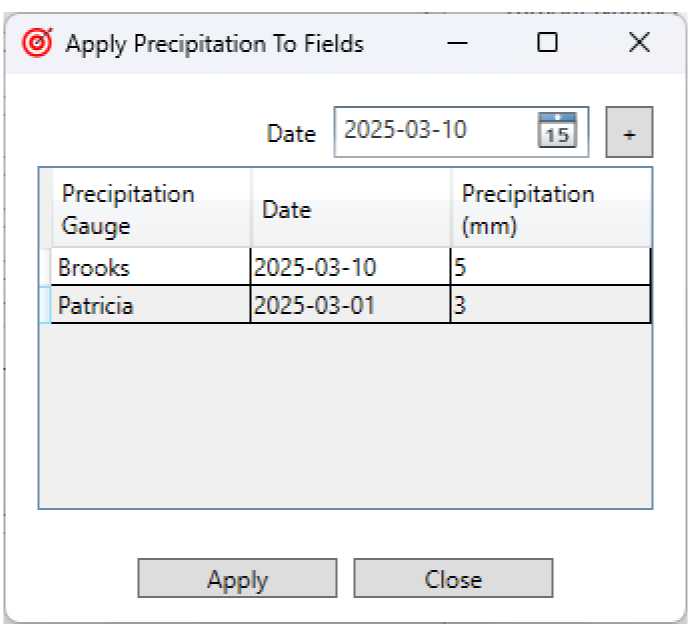


Figure 20. Adding precipitation amounts from local precipitation gauges.

6.3.3. Soil Moisture Measurements

This option provides for the bulk upload of soil moisture measurements. The upload file must be a .csv file, which includes the columns and headers listed in **Figure 22**. This option allows the user the ability to upload multiple soil moisture measurements without having to enter the soil moisture data one at a time.

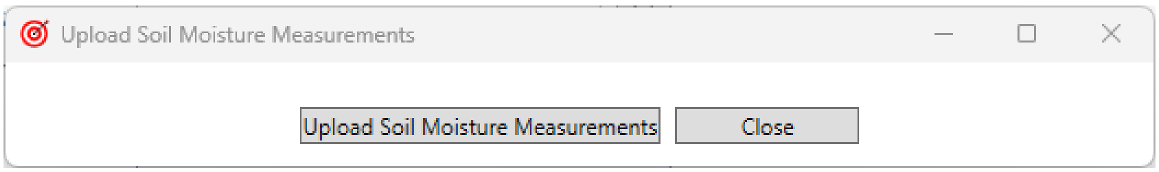
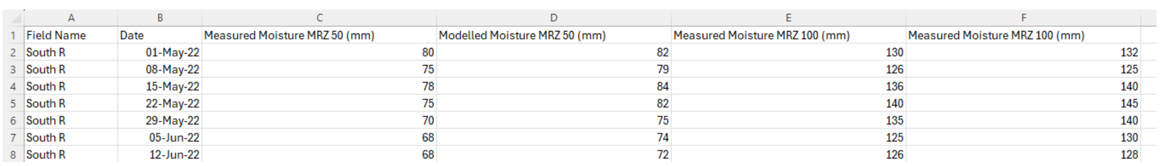


Figure 21. Adding bulk upload of soil moisture measurements.



	A	B	C	D	E	F
1	Field Name	Date	Measured Moisture MRZ 50 (mm)	Modelled Moisture MRZ 50 (mm)	Measured Moisture MRZ 100 (mm)	Measured Moisture MRZ 100 (mm)
2	South R	01-May-22	80	82	130	132
3	South R	08-May-22	75	79	126	125
4	South R	15-May-22	78	84	136	140
5	South R	22-May-22	75	82	140	145
6	South R	29-May-22	70	75	135	140
7	South R	05-Jun-22	68	74	125	130
8	South R	12-Jun-22	68	72	126	128

Figure 22. Example of soil moisture file format.

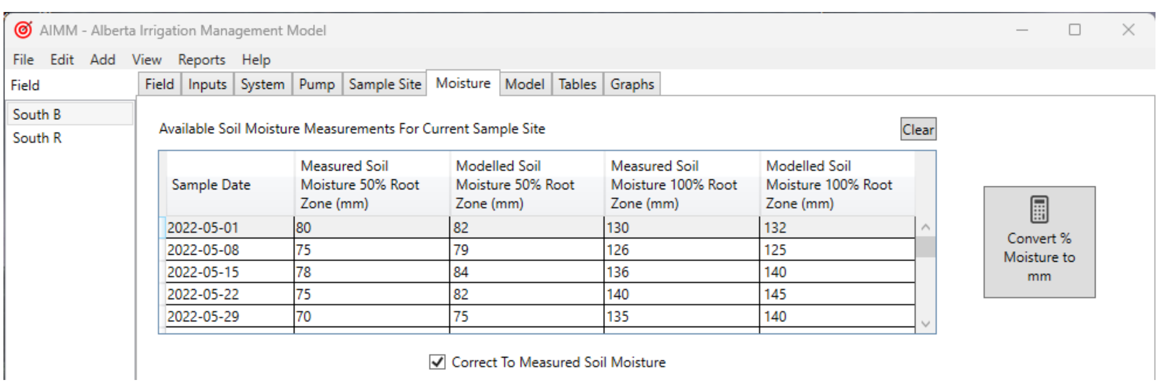


Figure 23. Soil moisture measurements are added to the Moisture Tab as illustrated above.

6.4 *View Tab:*

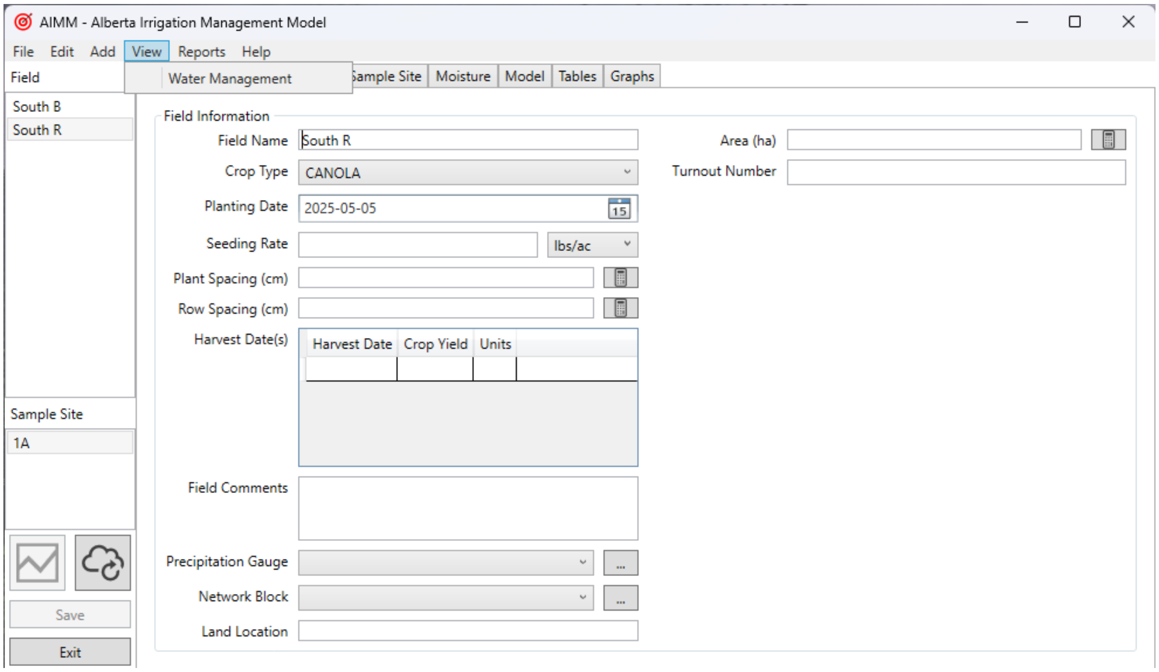


Figure 24. View Tab.

6.4.1 Water Management Report

This selection summarizes the information for all the fields entered in the database into one worksheet. Information summarized for each field includes, field capacity (based on soil texture), current moisture status, irrigation threshold based on the soil hydraulic properties, prediction date, whether an irrigation is required (No – appears in black, Yes – appears in red), Water On (check box), Water Order Date, and summaries for the season (Total Irrigation, Precipitation and Total Applied Moisture (summed from irrigation and precipitation)), and Last Sample Date (last date of manual soil moisture monitoring). There is also a check box for irrigation completion, an over irrigation indicator, planting date and finally a last irrigation date. Data can be viewed for the entire root zone (100% Maximum Root Zone) or the upper half of the root zone (50% of Maximum Root Zone), by toggling the selection at the top right-hand side of the window.

The irrigation trigger allows for the user to set how much reserve water, above the irrigation threshold, to retain in the soil profile while identifying an irrigation is required (data turns to red) (See explanation in Appendix 1).

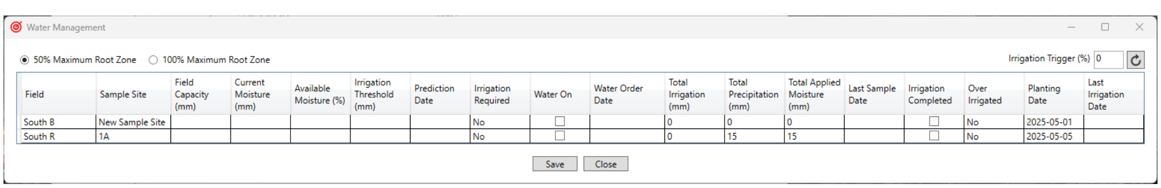


Figure 25. Water management summary for all fields and sites.

6.5 Reports Tab:

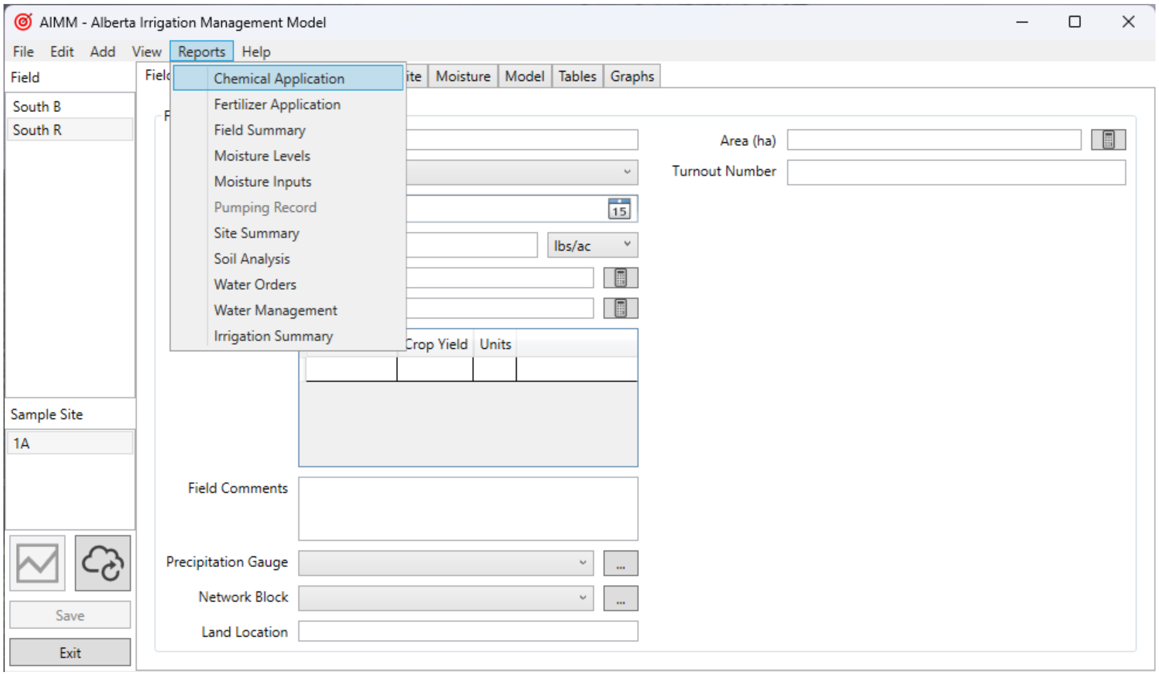


Figure 26. Options under Report tab.

The following options are available under the Reports Menu Option:

- Chemical Application
- Fertilizer Application
- Field Summary
- Moisture Levels
- Moisture Inputs
- Pumping Record
- Site Summary
- Soil Analysis
- Water Orders
- Water Management
- Irrigation Summary

The reports listed above were designed to provide a digital copy of AIMM inputs and model results. Once generated, reports can be sent to a printer or exported to a file. Export formats include Microsoft Word, Microsoft Excel and PDF (**Figure 26**). For more information, see section 6.5.1 (Viewing Reports).

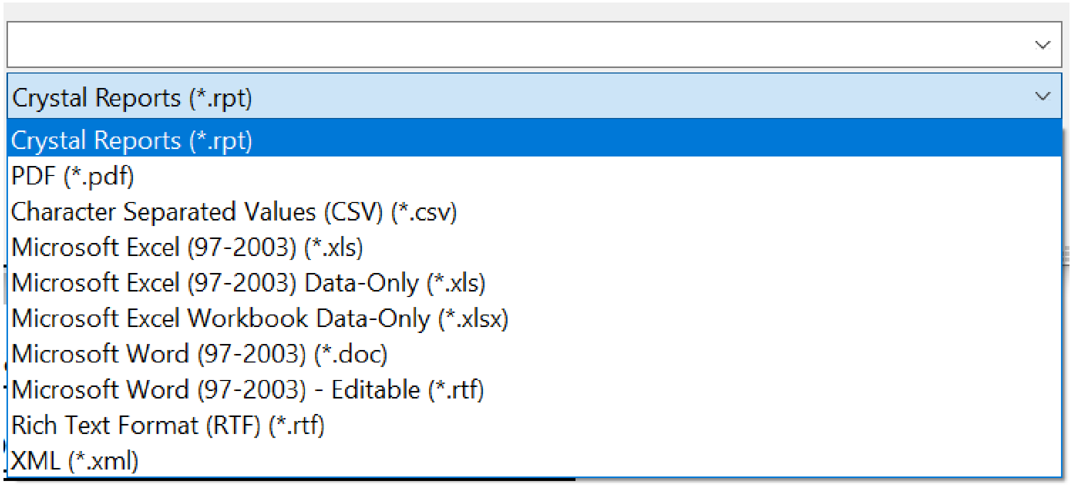


Figure 27. Report file export formats.

6.5.1 Viewing Reports

After clicking on the report of interest from the Reports menu, a new window will open containing the report. You can print or export the report in the file formats listed in **Figure 26**.

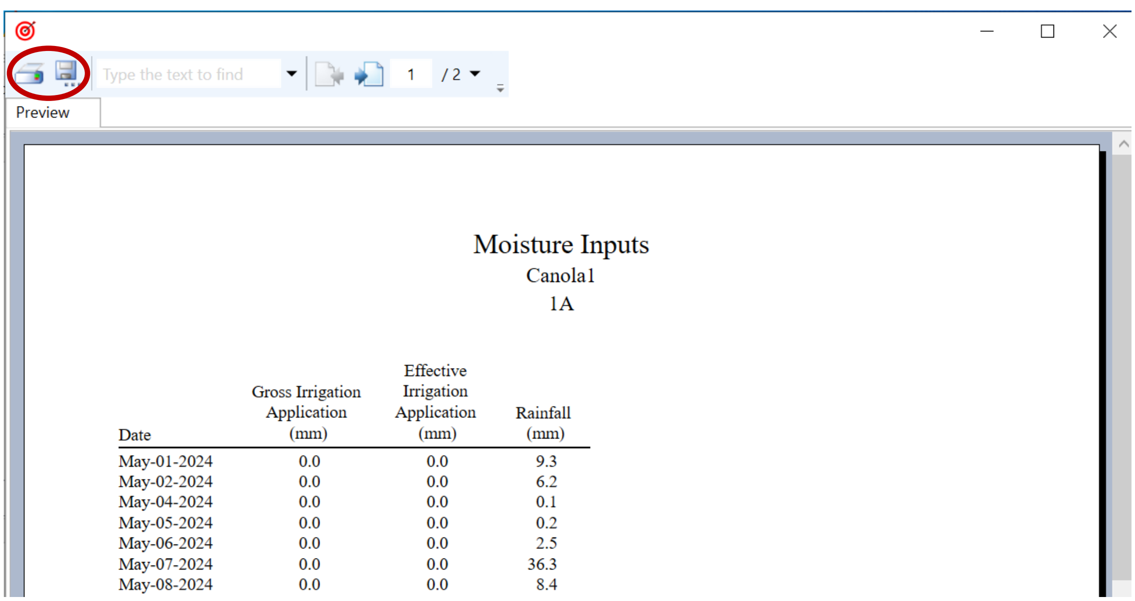


Figure 28. Example report.

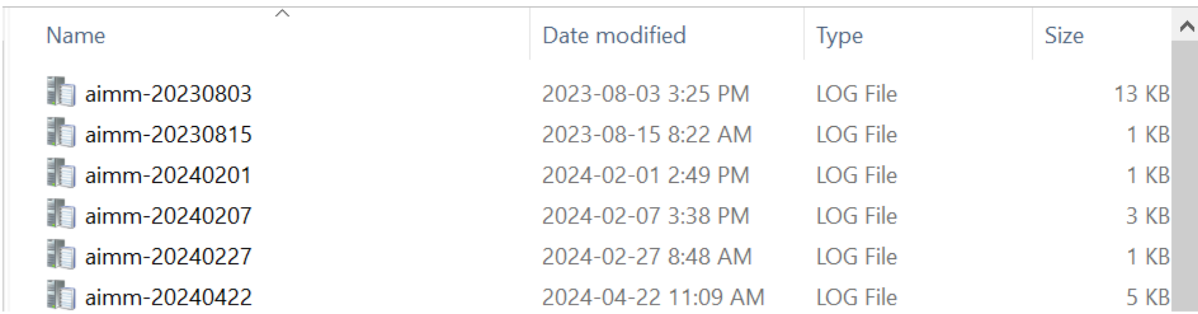
The report can be printed by selecting the printer icon or exported using the disk icon. Both icons are circled in red at the top left of the example report (**Figure 27**).

6.6 *Help Tab*

The Help Tab opens two options: 1) Open Log Folder, 2) About.

1) The Open Log Folder option directs the user to the log files (**Figure 28**), which catalogues error data for use in diagnosing problems within AIMM.

2) This option contains information on the current version of AIMM, the database version, and copyright information (**Figure 29**).



Name	Date modified	Type	Size
aimm-20230803	2023-08-03 3:25 PM	LOG File	13 KB
aimm-20230815	2023-08-15 8:22 AM	LOG File	1 KB
aimm-20240201	2024-02-01 2:49 PM	LOG File	1 KB
aimm-20240207	2024-02-07 3:38 PM	LOG File	3 KB
aimm-20240227	2024-02-27 8:48 AM	LOG File	1 KB
aimm-20240422	2024-04-22 11:09 AM	LOG File	5 KB

Figure 29. Help Tab – Open Log Folder.

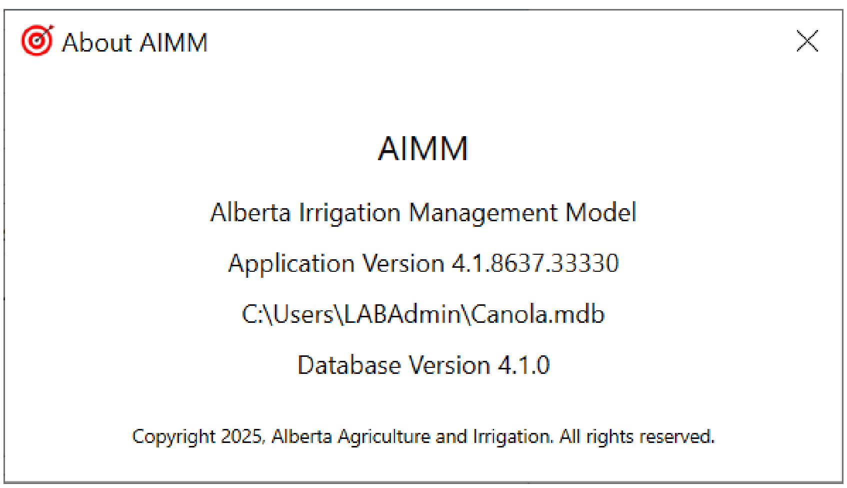


Figure 30. Help Tab – About.

For more help, please see section 17 Technical Support.

7 Getting Started

7.1 General Information on Entering Data

7.1.1 Conversion Tool

AIMM uses metric units for all the calculations. On many text boxes throughout AIMM, there is a conversion tool available where you can enter data using imperial units and they will be converted to the metric units for calculations within AIMM. For some input parameters the calculator is visible on the right edge of the input box (**Figure 30**). For others you must select the input box by clicking it, and the conversion tool will launch. When launched, simply type the value to be entered in the textbox labeled Convert , and then click on the corresponding unit you are entering. Only units that can be converted are listed below the value you just typed in (**Figure 31**). When finished, click the OK button to complete the conversion, or the Cancel button to cancel and leave the value unchanged.

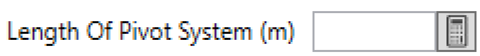


Figure 31. Conversion tool – input box and icon.

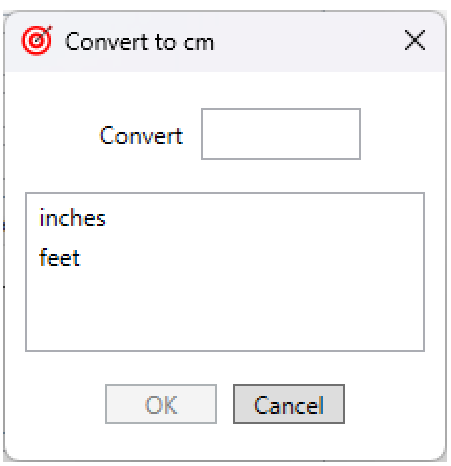


Figure 32. Conversion tool window.

7.1.2 Calendar Tool

Within several text boxes and grids throughout AIMM, there is a quick pick calendar tool for choosing a date. If you click inside a cell that requires a date the current date automatically appears and a  appears to the right of the date. By clicking on the  a blue and grey calendar appears (**Figure 32**). Once launched choose the corresponding date of interest. You can also add a date manually the date format is YYYY-MM-DD.

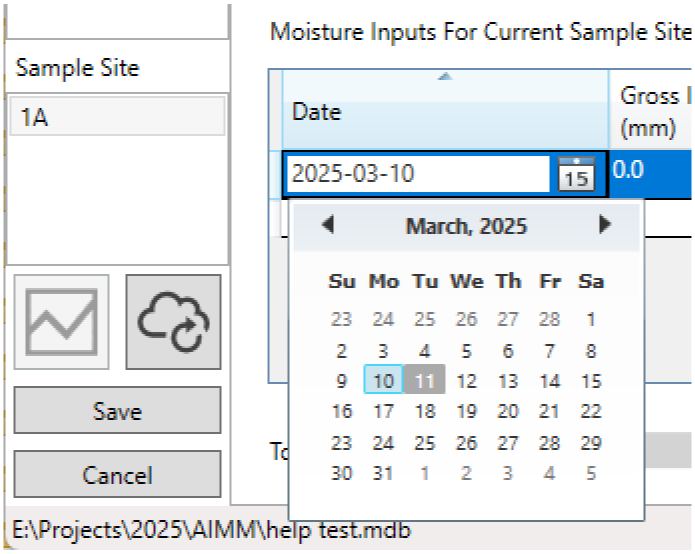


Figure 33. Calendar tool, embedded in the date input field above.

7.1.3 Time Picklist

If you find yourself under the Pump tab, a time picklist is available. When clicking on pumping on/off times a time picklist will appear. The time picklist displays a 24-hour clock in 15-minute intervals. Simply choose the corresponding time of interest in either AM or PM for your pump on/off times. For more information on the functionality of the Pump tab refer to the Pump tab description in section 11.

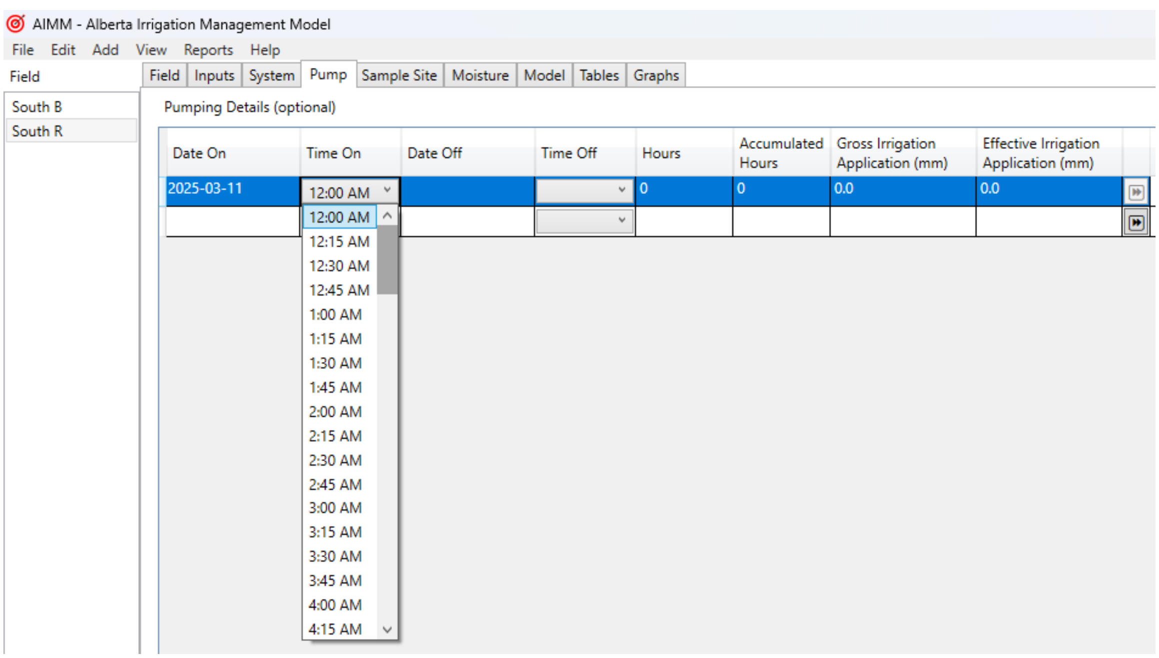


Figure 34. Time picklist tool.

7.1.4 Program Buttons

Figure 35. Program buttons.

7.1.4.1 Run Model Button

Click the Run Model button  to run the current model.

7.1.4.2 Weather Data Button

Click the Weather Data button  to download weather data from the Alberta Climate Information Service (ACIS) web site. A window will launch, containing all the available AIMM meteorological stations available for download (**Figure 36**). A single record or multiple records may be selected by clicking the check box associated with each station. Once all desired records are selected, click the Download button – wait for the download complete acknowledgement, and then click Exit.

If unsure of the nearest regional meteorological station, a map identifying the location of all regional stations in Southern Alberta is located at https://acis.alberta.ca/acis/weather-data-viewer.jsp.

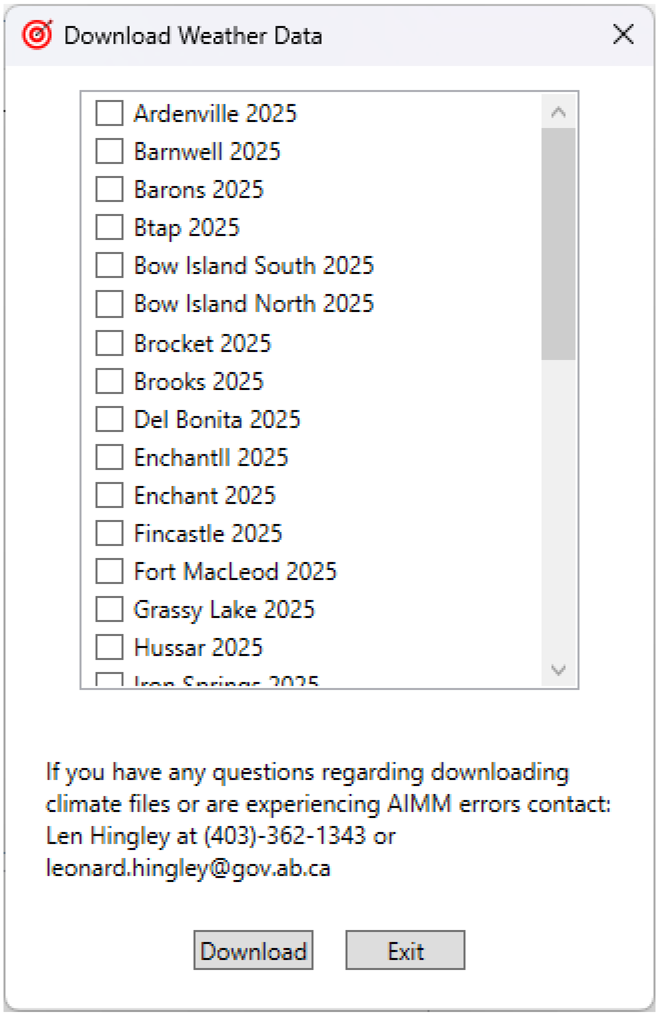


Figure 36. The Download Weather Data window.

7.1.4.3 Save Button

Whenever a change has been made, the file needs to be saved. Once saved, a model run can be carried out. It is important to remember that changes must be saved, or the model will not run. It is a good habit to click the Save button after entering data, and each time you move to a new input screen.

7.1.4.4 Exit Button

Click the Exit button to leave the program.

8 Field Tab

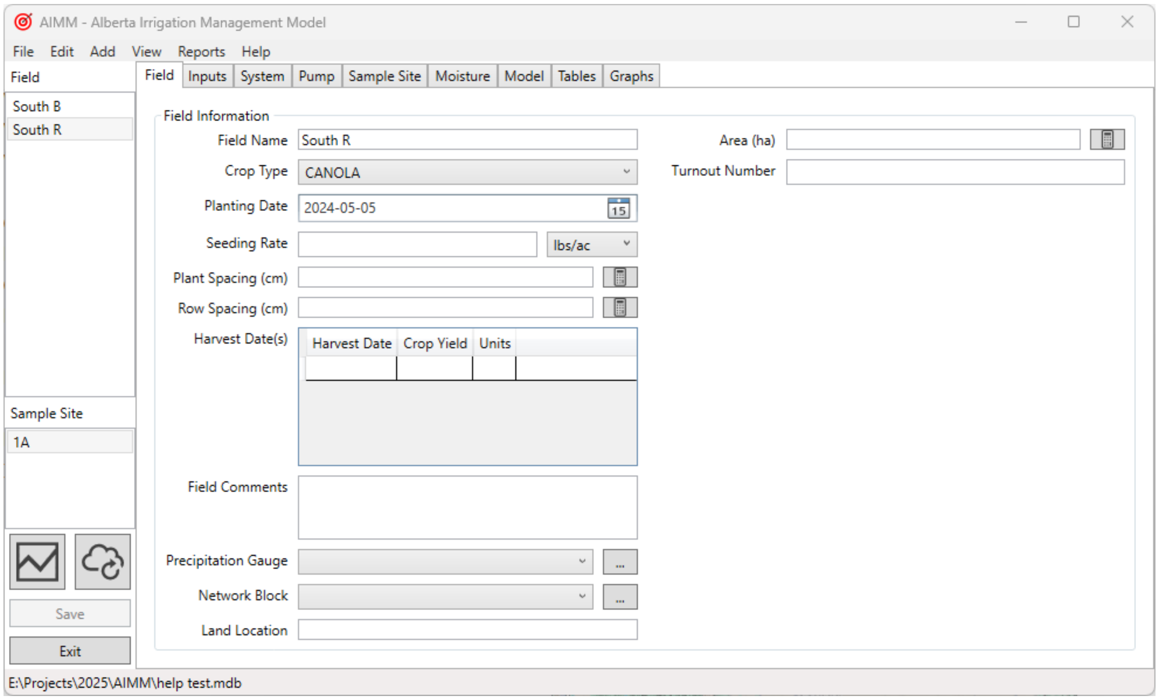
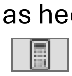


Figure 37. Field tab.

To create a new Field:

- Click on Edit, then New Field. Enter the Field Name and click Create Field button.
- Click on Edit, then New Sample Site. This will take you to the Sample Site tab. Enter the name (or number) for the sample site and fill in the remainder of the Sample Site input values refer to 12 Sample Site in this manual for more detailed information.
- Enter the field area as hectares. If you have the field area in another unit, click on the conversion tool . In the Convert to ha window, enter the numeric value of the measurement in the text box, then select the appropriate unit below, then click OK. The conversion tool can convert the field area from acres, square feet, square miles, square kilometers or square meters. Please note that area is displayed in hectares throughout the AIMM application.

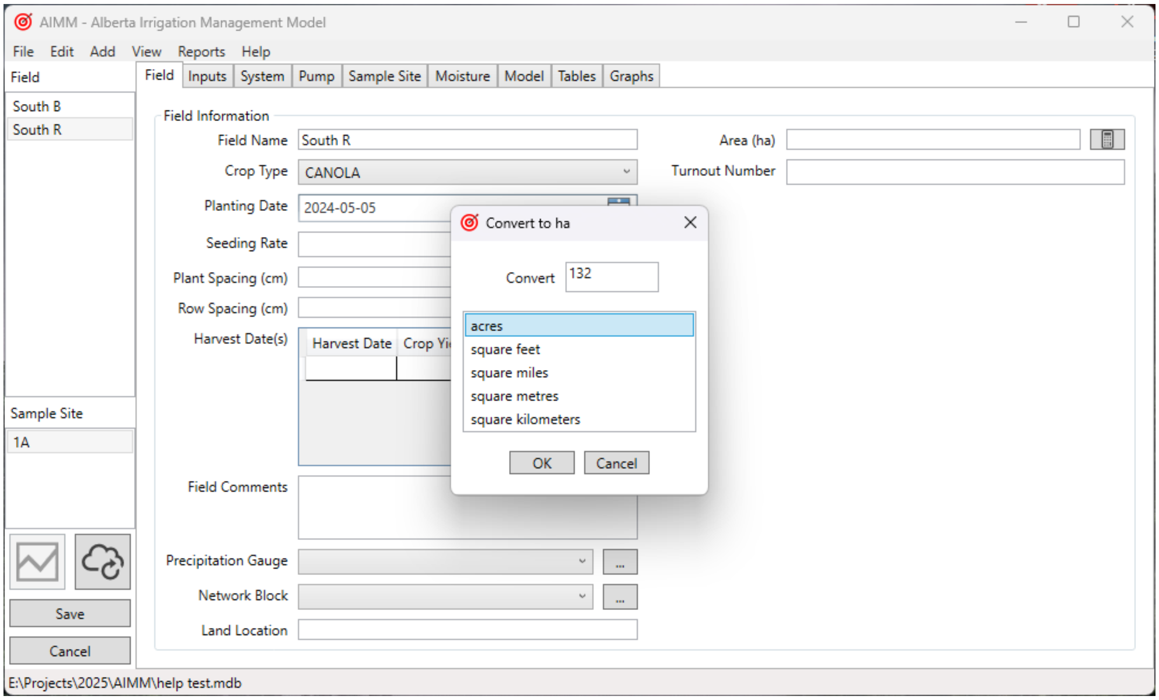


Figure 38. Field tab. Conversion tool for area.

- Select the Crop Type from the crop type picklist. This is done by clicking on the downward arrow on the right side of the input box. This will display all the crop options included in AIMM.
- Enter Planting Date by using the YYYY-MM-DD calendar convention or by clicking on  and selecting a date from the quick pick calendar option.
- If entering a field that will be connected to a local precipitation gauge, associate a Precipitation Gauge and/or Network Block to the field by clicking the icon  to the right of the picklist box. This will allow the user to connect multiple fields to one precipitation gauge and one network block (block of fields controlled by one water master). This input is not necessary if the multiple field option is not being used.

Please Note: For the model to run Field Name, Crop Type, Area, Planting Date, Sample Time, and are required inputs under the Field tab for AIMM operation. All other inputs are optional.

8.1 *Optional Inputs on the Field Tab*

The following are for information record keeping only and are not required to run the model.

- Enter the Seeding Rate, then select the picklist box to select units.
- Enter the value for the Plant Spacing in centimeters or use the conversion tool to convert inches or feet.
- Enter value for the Row Spacing in centimeters or use the conversion tool to convert inches or feet.
- Enter harvest date by using the YYYY-MM-DD calendar convention or by clicking on  and selecting the date from the quick pick calendar option. You may add the crop yield at end of season and use the picklist for units. Unit options are bu/ac, kg/ha, lb/ac, tonnes/ha, and tons/ac.
- Land location is for record keeping purposes only.
- Turnout number (only applicable in earlier versions of AIMM).

9 Inputs Tab

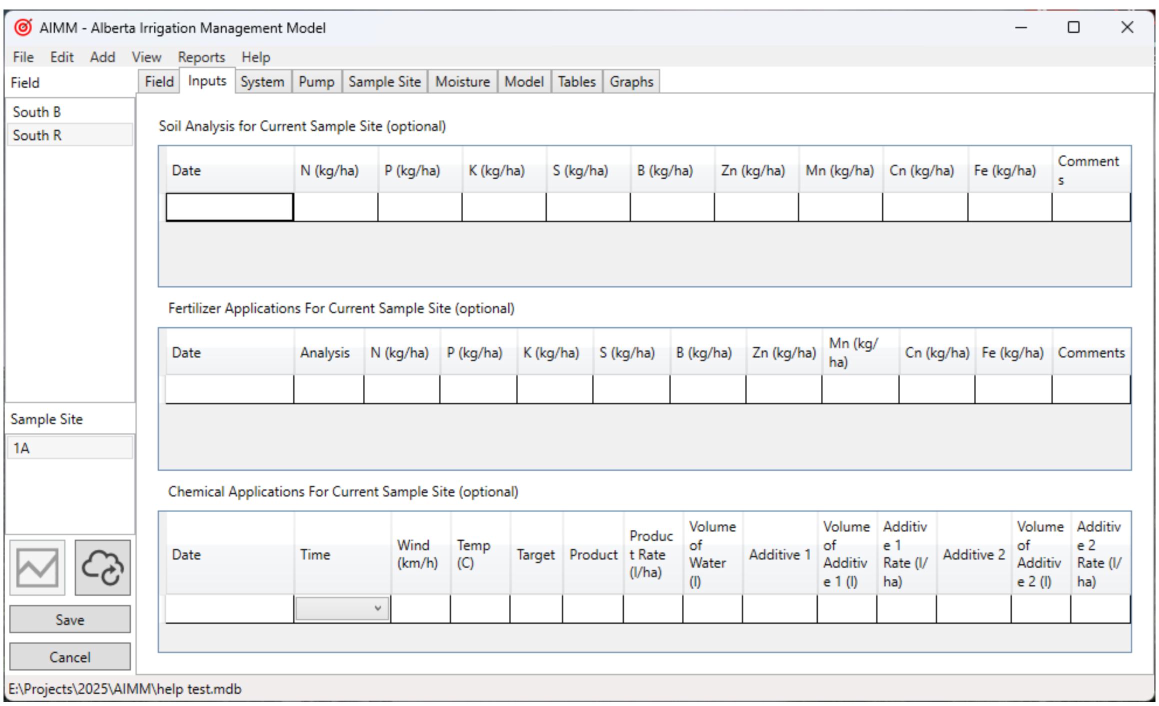


Figure 39. Inputs tab.

Information under this tab is for record keeping and/or information purposes only and not used in any model calculations.

- In the Soil Analysis , Fertilizer Applications , or Chemical Applications boxes, enter a date by using the YYYY-MM-DD calendar convention or clicking on 15 and selecting the date from the quick pick calendar option.
- For chemical applications enter product rates, water volumes and additives in l/ha and litres or launch the converter by clicking in the cell, then clicking on the calculator icon , once the converter is open enter the data to be converted and select the unit for conversion. For chemical applications you can also record time, windspeed and temperature.
- Enter kilogram per hectare values in the appropriate fertilizer and soil analysis boxes (e.g. N, P, K, S, etc.), or launch the converter by clicking in the cell, then clicking on the calculator icon . In the converter, enter the data to be converted, select the unit for conversion. Under the soil analysis and fertilizer applications pounds per acre is the only option for unit conversion.
- Additional information can be added in the comments section (climatic variances etc.)

10 System Tab

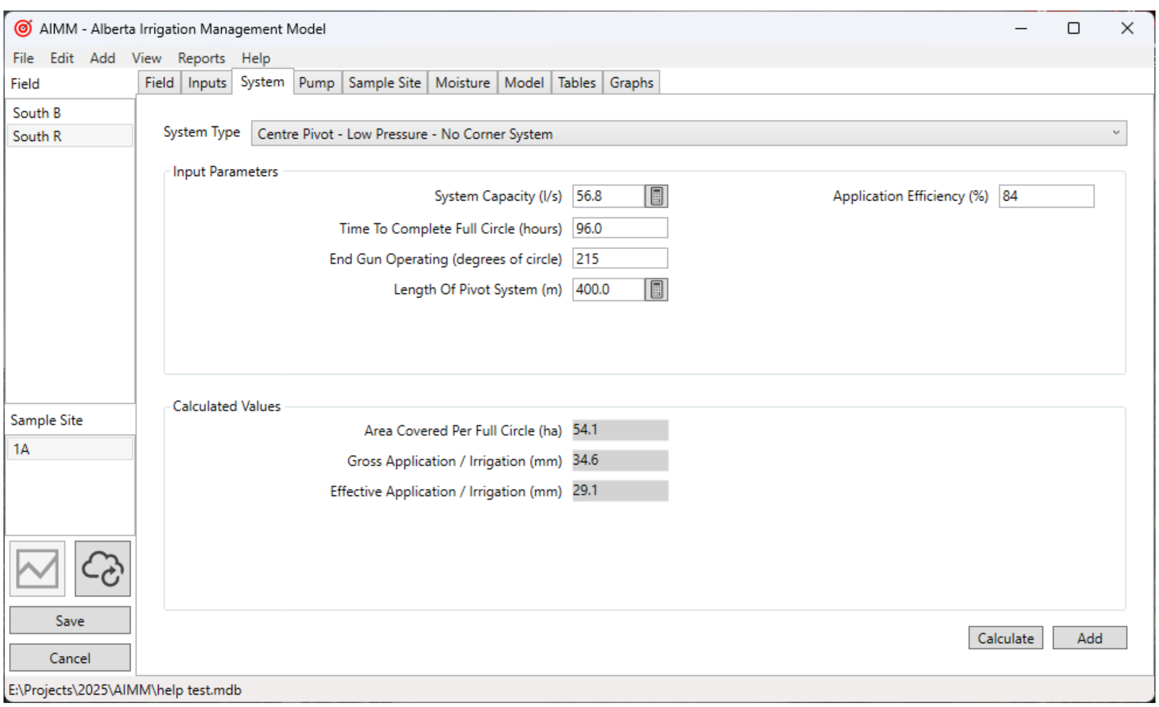


Figure 40. System tab.

10.1 System Type

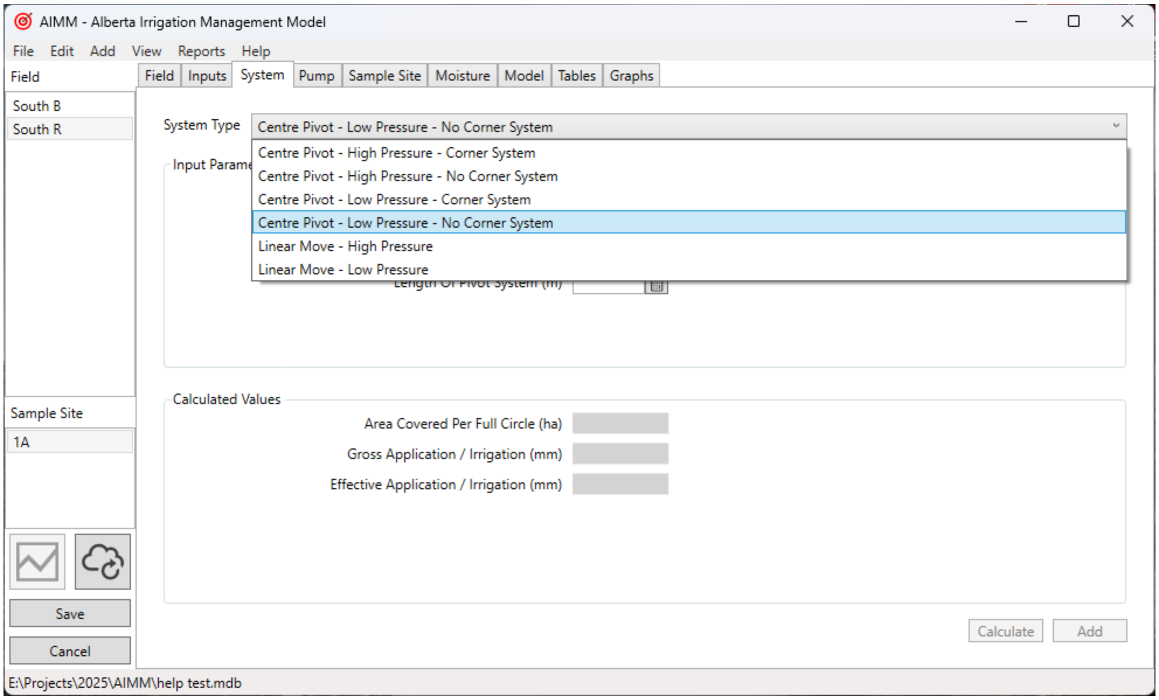
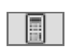


Figure 41. System Type.

Select the System Type from drop down box. Default values have been developed for each method of irrigation. If specific irrigation system information is available, this can be entered into any box in the Input Parameters section. To choose different units for System Capacity and Length of Pivot launch the conversion tool by clicking in the cell and then clicking on the calculator icon .

- The default value for Application Efficiency can be over-written with a new (or known) value.
- When all the boxes in the Input Parameter section have been filled, select the Calculate button at the bottom right-hand corner of the System tab. This will populate the remaining three boxes in the Calculated Values section.

11 Pump Tab

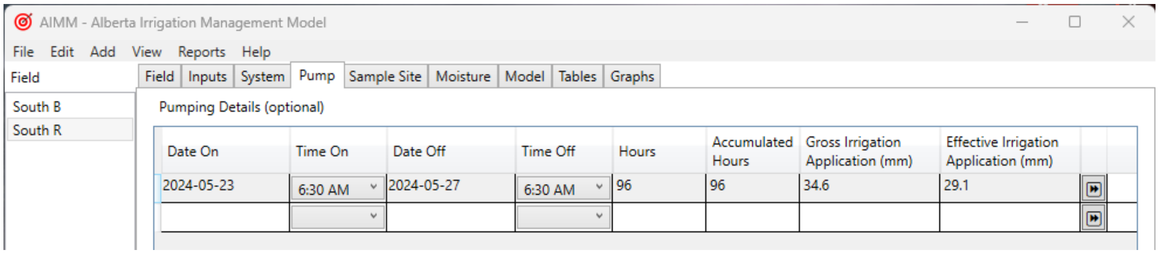


Figure 42. Pump tab.

Input under this tab can be used for the addition of irrigation applications, which are applied based on pump on-off times.

- Select the date range the pump will be active under the corresponding headings of Date On, Date Off. Enter the date enter a date by using the YYYY-MM-DD calendar convention or click on 15 and select the date from the quick pick calendar option for both Date On and Date Off boxes.
- Select the time interval the pump will be active under the corresponding headings of Time On, Time Off using the quick pick time selection tool.

Accumulated Hours, gross application (mm), and effective application (mm) are automatically calculated.

Gross irrigation and effective irrigation are calculated based on the irrigation system information from the Systems tab. The calculated gross and effective irrigation applications can be added to the Moisture Input grid under the Moisture tab by clicking the button to the right of the input boxes . A window confirming (**Figure 43**) an irrigation has been added to the Moisture inputs tab for the current sample site will appear after clicking the button.

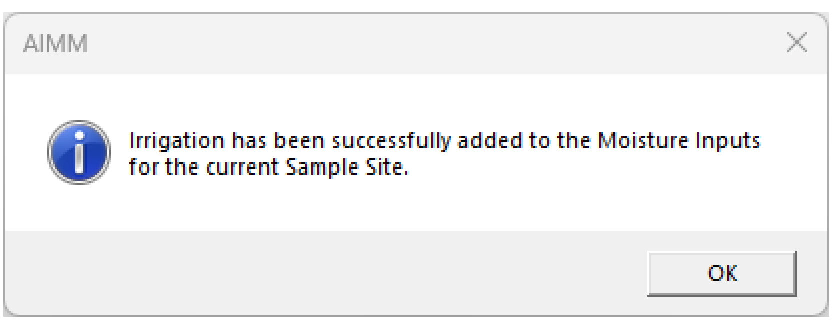


Figure 43. Pump tab irrigation addition confirmation.

12 Sample Site

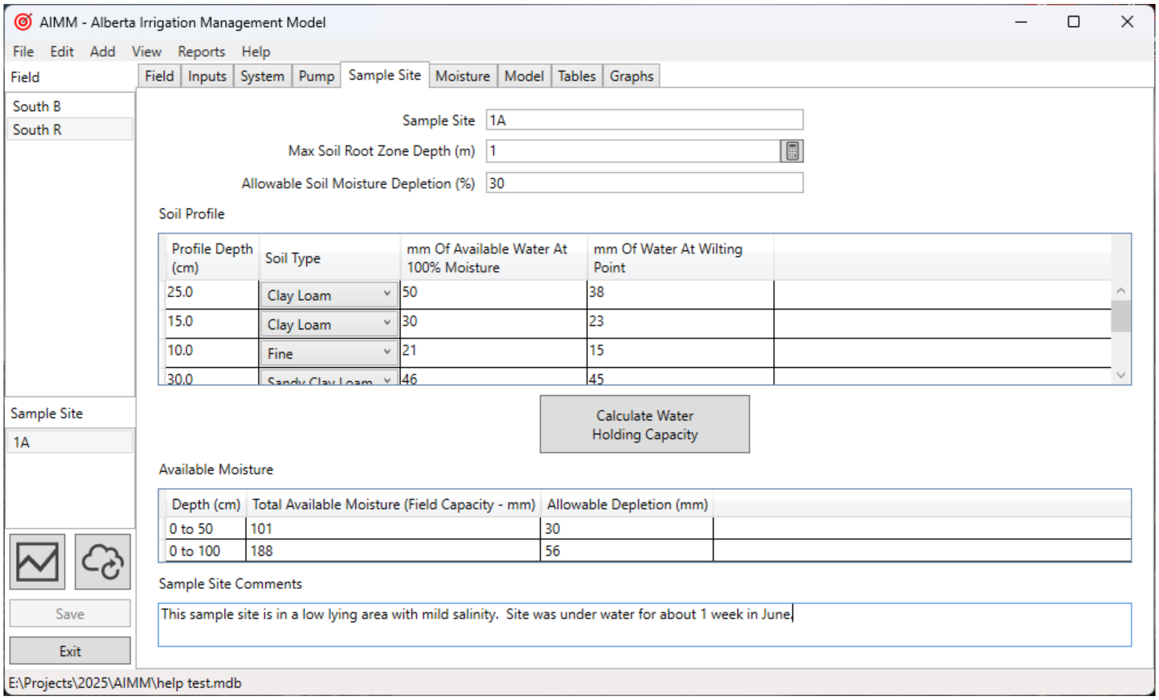


Figure 44. Sample Site tab.

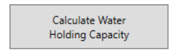
The input boxes under the Sample Site tab must be completed for proper operation of the model.

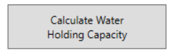
- The Sample Site text box is the name of the sample site to be used, from the corresponding Field (see Field Tab).
- The Maximum Soil Root Zone Depth (m) is by default set to one meter. You can enter your own value in meters based on the rooting depth of your crop or you may launch the conversion tool to enter a value in inches or feet.
- The Allowable Soil Moisture Depletion (%) is a default value that you can modify by selecting your own value. The lower the soil moisture depletion the lower amount of water that is depleted from your soil moisture profile before requiring irrigation. See Management Allowed Depletion in Appendix III for more information.
- Soil Profile

    1. Profile Depth - The user may add as many incremental depths as they believe representative of their soil sample site location, but *the total of the profile depths* ***must*** *match the maximum soil root zone depth*.

2. Soil Type - Soil type for each incremental depth must be classified by a soil type. Soil types can be selected by opening the picklist under the Soil type column. (See Appendix III for a flow chart to determine soil texture.)

- Once both a profile depth and associated soil type are entered the following columns, mm of Available Water at 100% and mm Of Water at Wilting Point , will be populated based on the soil type selected.

- After all profile depths and associated soil types are entered, the 

radio button must be clicked. After clicking the 

button the Total Available Moisture and Allowable Depletion columns under the Available water portion of the Sample Site tab will be populated.

- Under Sample Site Comments , enter any comments as needed.

- Save your changes before moving on to the next tab.

13 Moisture Tab

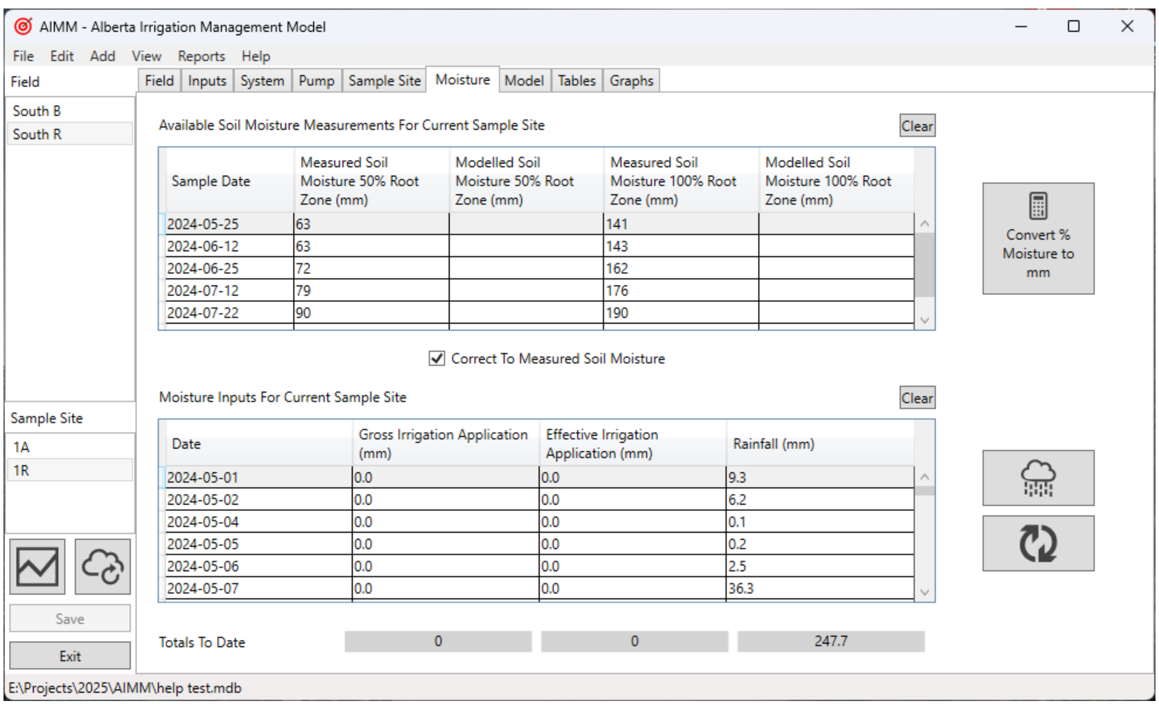
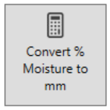


Figure 45. Moisture tab.

Soil moisture must be measured at least once at the start of the season to identify a starting soil moisture value for model simulations (See Appendix III, Figure III-3 for a flow chart to determine soil moisture using the hand-feel method).

- Clicking on the 

radio button (**Figure 45**) will open a second window (**Figure 46**). Soil moistures values can be added in either % Available or by % Volume (**Figure 46**). Soil moistures can be entered for each soil profile depth in the Measured Moisture table. To aid in determining how much soil moisture is available by percent refer to Appendix III Table III-2.

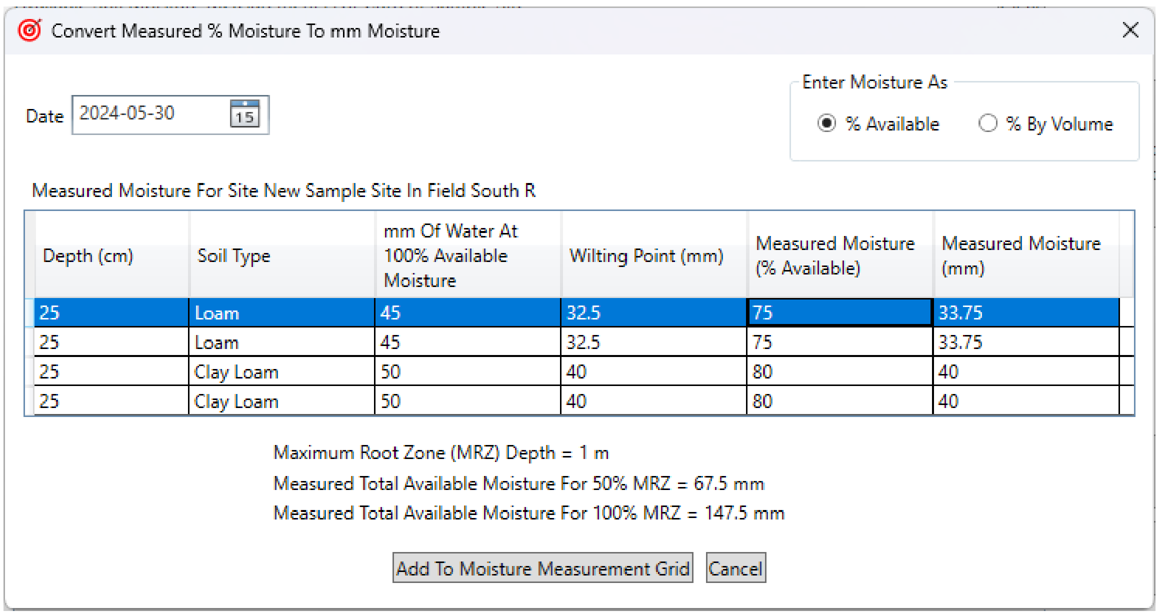


Figure 46. Converting percent soil moisture to millimeters.

- Once the first soil moisture reading has been added, measured soil moisture data can be entered throughout the season to check on model accuracy or to correct model predictions (**Figure 36**). If you want to use Measured Soil Moisture readings, the ☑ Correct To Measured Soil Moisture box must be checked, which is in the middle of the Moisture Tab page. Otherwise, the modeled soil moisture values in **Figure 45** will be used.

- For the moisture inputs for the Current Sample Site, the date can be either entered manually or by clicking the 

button to open the calendar and select the current date.

- The bottom half of the page with the heading Moisture inputs for Current Sample Site gross amounts of water applied can be added (**Figure 45**). These are irrigation amounts that are applied without considering the efficiency of the irrigation system applying the water. Check the System Tab if you are unsure of the gross application amount for your system.

- Effective irrigation application is calculated by multiplying the Gross Irrigation Application by the Application Efficiency (**Figure 40**). If you have made a change to the application efficiency value in the Systems tab, make sure to click on the  radio button. Clicking this radio button recalculates the effective irrigation application amounts based on the new application efficiency.

13.1 Precipitation Inputs

Rainfall amounts can be obtained either from local precipitation gauges (See 5.2.10 Precipitation Gauges and 5.3.2 Add Precipitation) or local weather stations. The  radio button opens the current weather file, where you can select dates when rainfall occurred (**Figure 47**). A range of rainfall events can be selected by clicking the least recent rainfall event, and then while holding down the Shift key, click the most recent rainfall event. You can also select multiple rainfall events by holding down the Ctrl key and clicking on the rainfall events using the right button on the mouse. After all the dates you are interested in have been selected click on the Add to Moisture Input Grid button to populate the rainfall column.

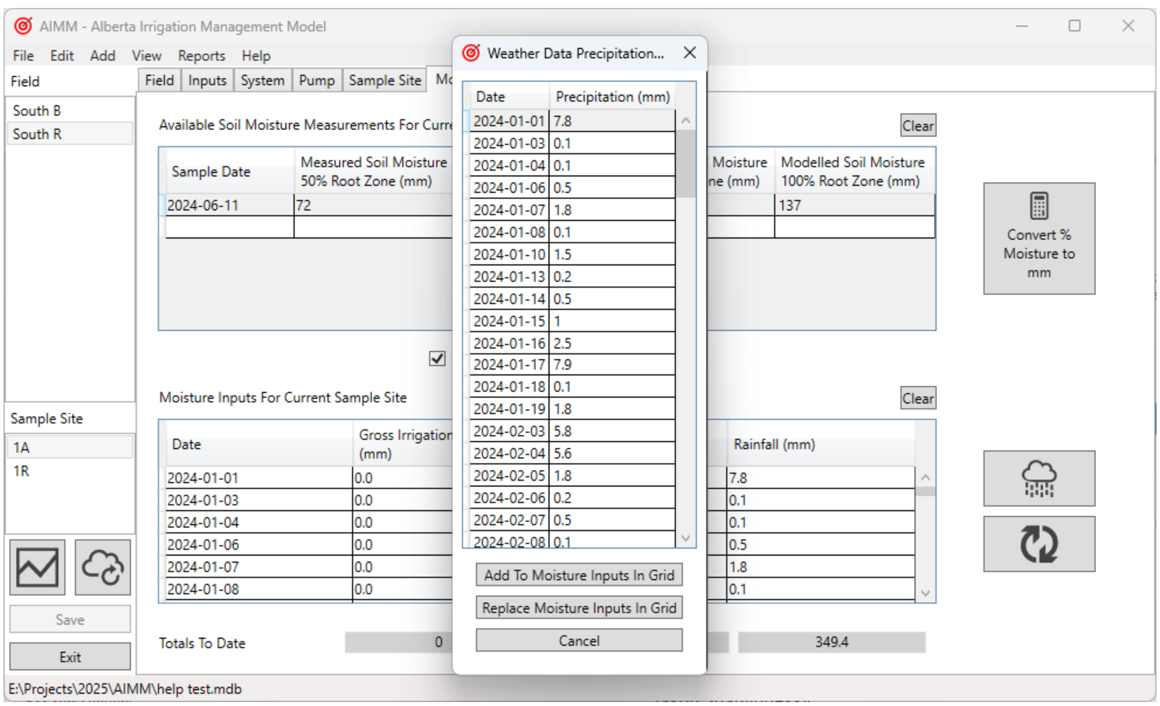


Figure 47. Adding rainfall using the  button under the Moisture tab.

14 Model Tab

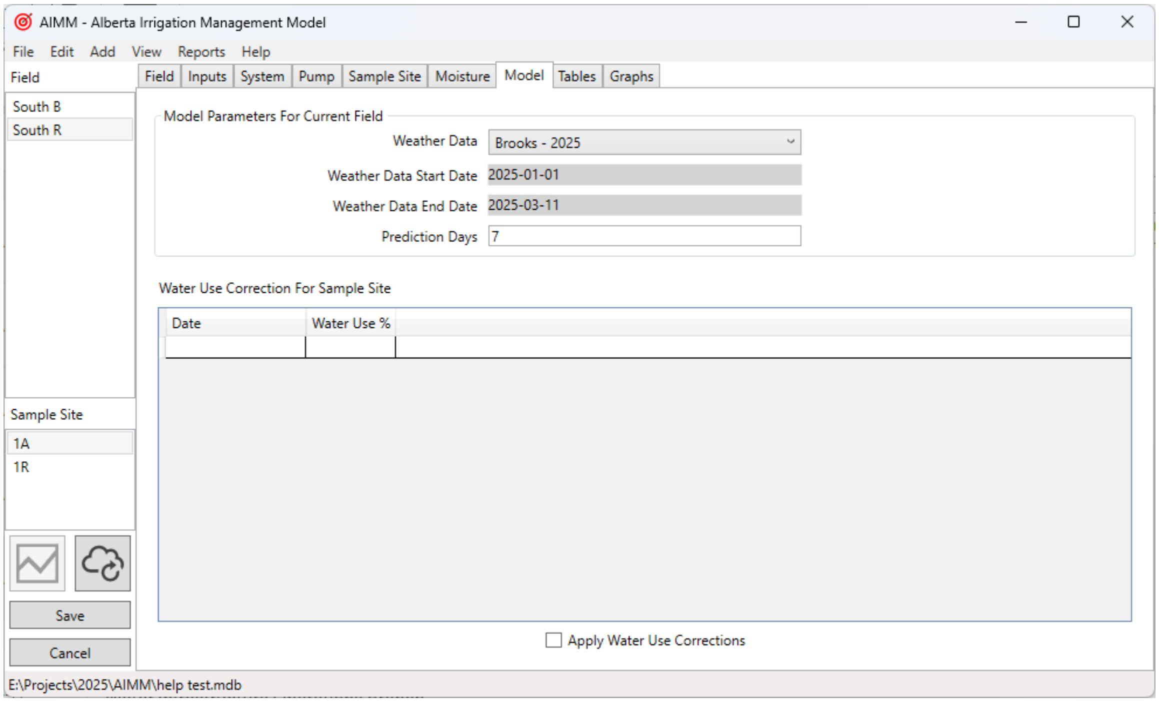


Figure 48. Model tab.

- Select the appropriate Weather Data (year and location) from drop down box. If unsure of the nearest regional meteorological station, a map identifying the location of all regional stations is located at https://acis.alberta.ca/acis/weather-data-viewer.jsp.

- To add Weather Data options to the current list of meteorological stations in the Weather Data picklist, click on the Retrieve Weather Data icon  on the bottom left hand side of the main window in AIMM. Next select the location/locations you are interested in and click on the download button at the bottom of the window (**Figure 49**).

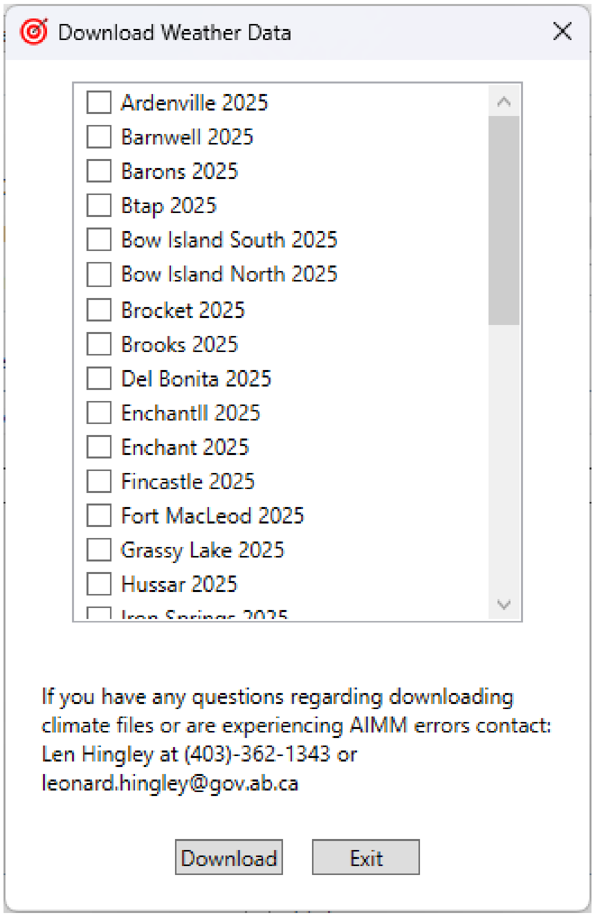


Figure 49. Download weather data window.

- The Weather Data Start Date and Weather Data End Date are taken from the weather file and do not need to be adjusted.
- Enter the interval you wish to predict soil water depletion in the Prediction Days text box. The most common suggestion is 7 days in advance. It is advised not to choose a prediction date no further than 14 days ahead.
- AIMM s prediction of crop water use is based on a healthy crop, free of disease, actively growing and full canopy coverage. If the user finds the model over-predicting soil moisture depletion, evapotranspiration can be reduced by a percentage. Two examples of where this is used is for hail damage or poor germination. Click Apply Water Use Corrections and fill in the date and the percentage of the reduction (**Figure 50**).
- In the Water Use Correction for Sample Site section, enter a date using the YYYY-MM-DD format or by double clicking on date box, and then clicking on the calendar tool icon  and selecting the appropriate date.

- Under Water Use % , you can enter any number from 0 to 100. Once the reduced percentage is applied you must select the Apply Water Use Corrections check box at the bottom of the page.

- Water use correction example – on July 1, 2024, had a hail event that reduced plant populations by 25%. Water use will not be optimum for a while so reduced water use to 75% of optimum on that date. If the crop recovers and it is expected crop water use has recovered, can change the water use percent back up to 100% at a later date, August 1, 2024, in **Figure 50**.

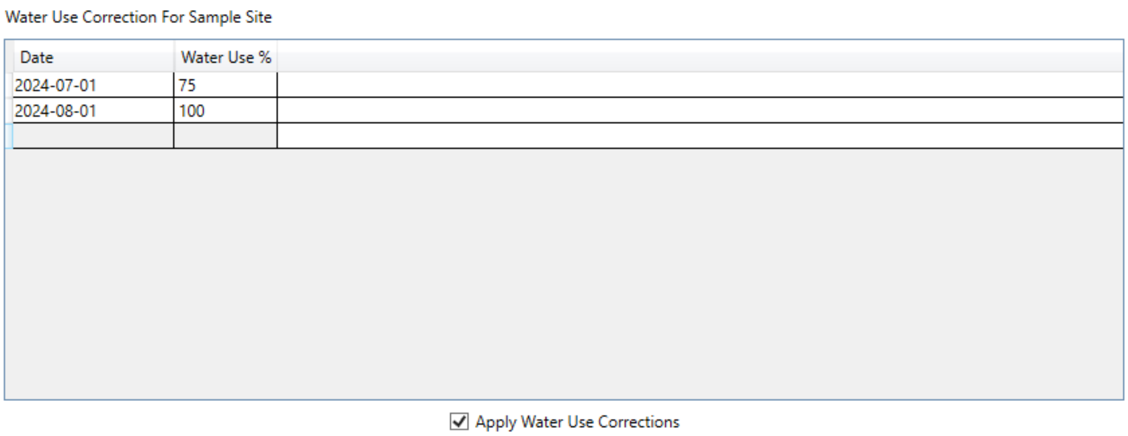


Figure 50. Applying water use corrections.

- Once all the inputs have been entered, click the Save button and then the Run Model button.

15 Table Tab

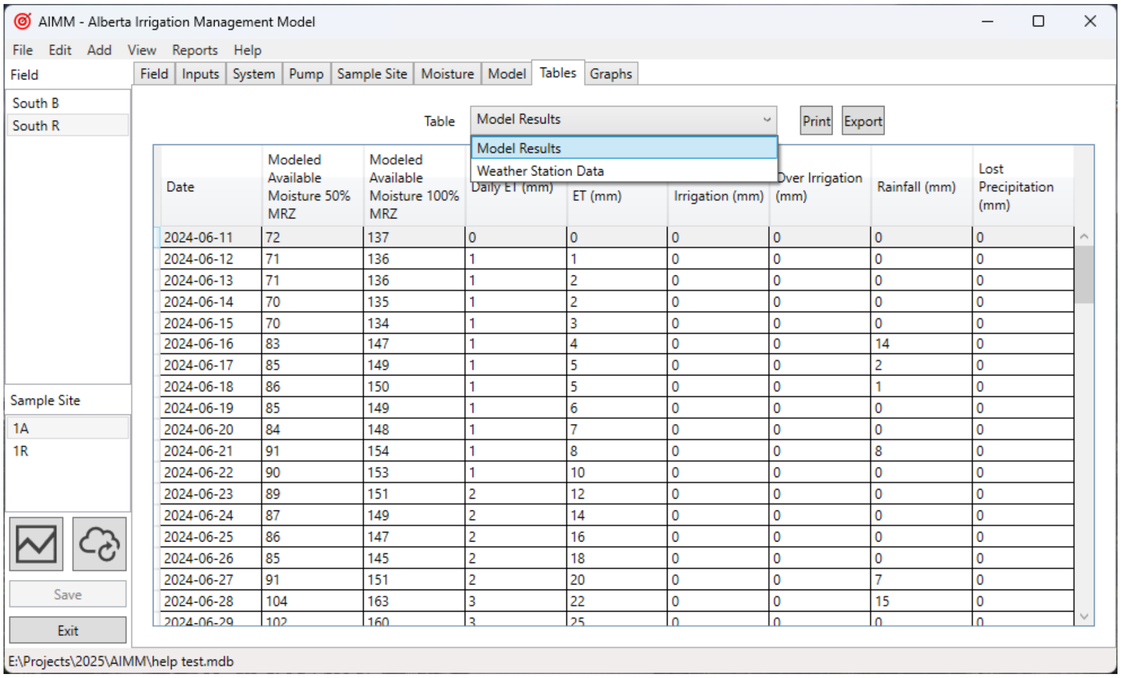


Figure 51. Options for output under the Table tab

- Select either Model Results or Weather Station Data from drop down box to view the selected data in the tables (**Figure 51)**.
- Tables can be either printed or exported as a .txt or .csv file. When exporting a file, be sure to name the file and select the directory where the data is to be stored.

16 Graphs Tab

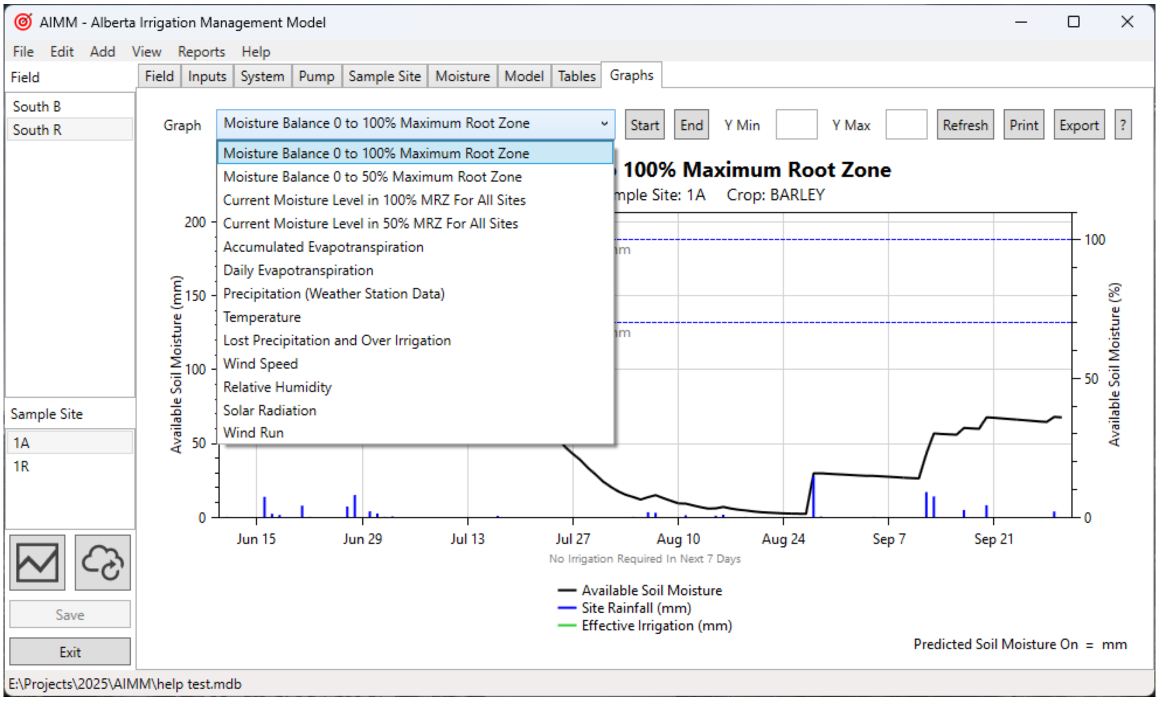
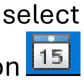


Figure 52. Options for output under the Graphs tab.

- Select the graph to be viewed from drop down menu there are thirteen options to choose from; moisture balance at 100% and 50% of the maximum root zone (MRZ), current moisture level in 100% and 50% of the MRZ for all sites, and a list of meteorological data from the weather station selected in the Model tab.

- The Start and End buttons allow you to look at specific segments within the graph. When you click Start , a calendar icon  opens and you can select a start date for viewing data. Similarly, selecting End launches a calendar icon  and you can select an end date for viewing data. The start and end date must be within the first and last day of the weather file.

- Graphs can be printed or exported as a .png files. When exporting a graph be sure to name the file and select the directory to where the data is to be stored.
- Note: If you left click anywhere on the crop-water-use line, the exact date and soil moisture value in (mm) will be displayed in a yellow text box.
- Note: See Appendix V for interpretation of each of the graphs.

17 Technical Support

If you are experiencing difficulties downloading climate data or a problem with the AIMM software contact:

Len Hingley @ (403) 362-1343 – leonard.hingley@gov.ab.ca

18 APPENDIX 1

50% MRZ - calculates soil moisture based on the upper 50% of the root zone. (Table 1 in Appendix III)

100% MRZ - calculates soil moisture based on 100% of the root zone. (Table 1 in Appendix III).

Plant Available Moisture – the quantity of moisture available for plant use (see explanation in Appendix III).

Average Meteorological Day (AMD) – a weather set containing mean daily values for an entire year. Based on an average of daily values for the total years of record for the station. If the station does not have multiple years of records, the nearest meteorological station with multiple years of records is used.

Corrected to Measured Soil Moisture – if this option (Moisture Tab) is selected for the current sample site, the model will be corrected to the measured soil moisture values on the days for which measured values exist.

Crop Coefficients – are a function of crop characteristics, rate of crop development, length of growing season, climatic conditions, the time of planting, and the available soil moisture.

Crop coefficients must be adjusted to account for available soil moisture. Potential Evapotranspiration (PE) is reduced when the soil moisture level is not at capacity. PE is modified by the ratio of the logarithm of the remaining soil moisture to the maximum available to the crop in the root zone. Minimum Kc value has been set to 0.1. The crop coefficient equations used in this model were obtained from Agriculture and Agri-Food Canada publications, (Foroud and Hobbs, 1983, Foroud and Beke, 1981).

Correction for Soil Moisture (Buchleiter et al. 1988)

$$Kc_a = \frac{Kc \times \log\left(\left(\frac{AW}{AWM}\right) \times 100 + 1.0\right)}{\log 101.0}$$

where Kc_a = crop coefficient adjusted for available soil moisture

Kc = crop coefficient

AW = soil water remaining in profile (mm)

AWM = maximum soil water available to crop within the root zone of a given soil type (mm)

Date Off – the day when the irrigation system is turned off.

Date On – the day when the irrigation system is turned on.

Deep Percolation – any water (irrigation and rainfall) that moves below the root zone and becomes unavailable for crop use. This water is considered lost. Water movement is calculated in two phases:

1. In the first phase, if the amount of irrigation and rainfall is greater than the water holding capacity of the upper zone, water percolates from the upper zone into the lower zone. The amount of water above field capacity is added to the lower zone.
2. In the second phase, if the amount of water added is greater than the water holding capacity of the lower zone, water will then move out of the lower zone. Water that moves out of the lower zone is considered lost from the root zone and is accounted for as a percolation loss. The model allows the root zone to exceed the field capacity by 10% in consideration of saturated hydraulic conductivity (Shayya et al. 1991).

Elevation – the elevation of weather station above sea level in meters.

ET (evapotranspiration) – the loss of water from the earth s surface through the combined process of evaporation and transpiration.

Field Capacity – refers to water content in a field soil after the drainage rate has become negligible.

Gross Irrigation Application - the total amount of water applied by an irrigation system.

Growing Degree Day (GDD^5) –the average daily temperature minus the base temperature (5^0C)

$$GDD = \left(\frac{(MaxTemp + MinTemp)}{2} \right) - 5$$

If the minimum temperature is below 0°C, GDD = 0

Harvest Date – the date at which the crop has been cut, swathed, or desiccated. Can be specified by user in the field tab or can be left blank and the harvest date will then be set to the last day of the growing degree/crop coefficient curve. The user must specify harvest dates for any forage crop (alfalfa, barley silage under seeded, grass hay, brome hay, tame pasture, timothy hay, milk vetch, grass seed, and turf sod).

Irrigation Threshold – is a percentage of the total available water that can be used by a crop, prior to starting irrigation – often referred to as management allowed depletion.

Irrigation Trigger – used in the Water Management table under View – Water Management in the menu toolbar. The irrigation trigger is set as a percentage above the irrigation threshold to facilitate notification for water delivery providers. Trigger level is determined by:

$$TriggerLevel = IrrigationThreshold + \frac{(FieldCapacity - IrrigationThreshold) \times TriggerValue}{100}$$

Example: Field Capacity – 250 mm, Irrigation Threshold – 125 mm, Trigger Value 10.

$$TriggerLevel = 125 + \frac{(250 - 125) \times 10}{100} = 125mm + 12.5mm = 137.5mm$$

The data line would turn red (requiring an irrigation) when the profile still has 12.5 mm moisture above the irrigation threshold or management allowed depletion. This allows the irrigator to arrange for water delivery or start the irrigation prior to reaching the irrigation threshold. The higher the irrigation threshold is set, the more water is retained in the profile prior to the data line turning red indicating irrigation is required.

Lost Precipitation – surface runoff from a rainfall event. Determined by maximum soil water storage of soil profile.

Lower Root Zone Moisture Use – percentage of water extracted from the lower half of the root zone. See Upper Root Zone Moisture Use for reference.

Management Allowable Depletion - a percentage of the total available water that can be used by a crop, prior to starting irrigation (See explanation in Appendix III).

Maximum Relative Humidity - maximum daily relative humidity (%) measured at 1.5 m above natural ground level.

Maximum Root Zone Depth – effective rooting depth (m) of a mature irrigated crop.

Maximum Temperature - maximum daily temperature (°C) measured at 1.5 m above natural ground level.

Measured Soil Moisture – measured amount of soil moisture (mm, VWC%, AWC%) present in the field.

Minimum Relative Humidity - minimum daily relative humidity (%) measured at 1.5 m above natural ground level.

Minimum root zone depth - depth to which a crop is seeded (cm).

Minimum temperature - minimum daily temperature (°C) measured at 1.5 m above natural ground level.

Model Start Date – the first day a measured soil moisture reading is entered into the model. It is recommended that a soil moisture measurement be taken at the time of seeding. Crop consumptive use is calculated from the time of the first soil moisture reading to the harvest date.

Modeled Moisture - amount of moisture present in the field as determined by the model.

Net Irrigation Application - the amount of moisture that is added to the soil.

$$\text{Net Irrigation Application} = \text{Gross Irrigation Application} \times \text{Efficiency Ratio}$$

Operating Capacity – flow rate of the irrigation system.

Operating Pressure – normal pressure at which the irrigation system is operated.

Operating Speed - speed at which the pump is operated.

Over-irrigation – any excess irrigation applications received, above what can be accepted beyond the 110% of field capacity limits, in both the upper and lower root zone.

PE Equations – the model currently uses the Priestley-Taylor and Modified Penman equations for calculating potential evapotranspiration. The Priestley-Taylor equation should be used when no wind data is available.

Priestley-Taylor:

$$E_p = \frac{\alpha \times \left(\frac{\Delta}{(\Delta + \gamma)} \right) \times (Rn - G)}{\lambda}$$ (Jensen et al. 1990)

Where:

α = calibration constant
Δ = slope of the saturation vapour pressure-temperature curve in kPa/°C
γ = psychrometric constant in kPa/°C
λ = latent heat of vaporization in MJ/kg
Rn = net radiation in MJ/m2/day

G = soil heat flux in MJ/m2/day

Modified Penman:

$$ET_r = \frac{(0.408\times\Delta\times(\mathrm{Rn}-\mathrm{G}))+\left(\gamma\times\left(\frac{1600}{(\mathrm{T}+273)}\right)\right)\times\mathrm{u}_2\times(\mathrm{es}-\mathrm{ea})}{\left(\Delta+\left(\gamma\times(1+(0.38\times\mathrm{u}_2))\right)\right)} \quad \text{(ASCE 2005)}$$

Where:

ET_r = ET for tall reference crop evapotranspiration (mm day^{-1})
Δ = slope of the saturation vapour pressure-temperature curve (kPa $°C^{-1}$)
Rn = net radiation in (MJ m^{-2} day^{-1})
G = soil heat flux in (MJ m^{-2} day^{-1})
γ = psychrometric constant (kPa $°C^{-1}$)
T = mean daily temperature (°C)
e_s = saturation vapour pressure (kPa)
e_a = actual vapour pressure (kPa)
u_2 = wind speed at 2 m height (m s^{-1})

This equation uses alfalfa as the reference crop.

Planting Date – used to establish when the growing degree day/crop coefficient curve is to begin.

Potential Evaporation (PE) – maximum amount of water that a crop can use. Generally determined daily. Theoretical equations are generally used to calculate PE.

Precipitation - to simplify how water moves in the soil profile, the assumption is made that whatever falls as rainfall (< 25mm) is 100% applied. The following is the criteria used for determining rainfall runoff (when rainfall is >25 mm):

Rainfall Events > 25mm (1.0 Inch): Infiltration (I)

$$Runoff = \text{Rainfall } (R) - \text{Infiltration } (I)$$

$$I = 0.9177 + 1.811 \times (log\, e\, R) - 0.0097 \times (log\, e\, R) \times \left(\frac{SM}{FC}\right) \times 100$$

(Baier and Robertson 1966)

Where:

R = Rainfall (inches)

SM = Soil Moisture (inches). Available soil moisture in the root zone at the end of day i-1, that is, at the morning observation of day i.

FC = Field Capacity (inches)

Prediction of Next Irrigation – forecasting of the next irrigation is based on end of current weather and the number of prediction days entered. If the soil moisture level drops below the irrigation threshold prior to the end of the weather file, the next irrigation will be set for the first day of the selected prediction day. If the soil moisture level remains above the irrigation threshold, the model will predict only to the number of days selected, and an irrigation during this time may not be forecast.

Root Zone Transition Date – the number of days after planting date required for the roots of a plant to enter the lower 50% of the maximum root zone. Dependent on crop type.

Soil Evaporation Loss – after harvest, water lost from the soil profile is set to a growing degree day/crop coefficient of 0.1 until end of the weather file.

Soil Name/Soil Type – texture of soil layer.

Soil Profile Depth – depth of soil layer.

Solar Radiation - incoming short-wave radiation measured at 1.5 to 2 m above natural ground level.

Station Name – location of weather station.

Time Off – the time when irrigation system is turned off

Time On – the time when the irrigation system is turned on

Total Available Moisture – is the amount of water that is held between field capacity and wilting point. Allowance has been made for the soil moisture to exceed field capacity by 10%. If the soil moisture is > 10% of field capacity, it is set it to 1.1* field capacity, with the excess water then lost to deep percolation.

Upper Root Zone Moisture Use – percentage of water extracted by roots in the upper portion of the root zone. (Pair, 1975)

Water Use % - default is 100%. Setting this to 100% represents no adjustment to ET. Any value less than 100% will reduce ET by that percentage. No value in the box means that there is no reduction to ET, same as 100% setting.

Weather Data – model requires daily maximum and minimum temperature, incoming solar radiation, wind travel, maximum and minimum relative humidity, and rainfall. If weather data from a source other than regional meteorological stations are available, they can be used in the AIM model. Weather files use a comma separated file format (.csv) and can be created or edited using most spreadsheet programs.

Wilting Point – is the soil water content below which plants growing in that soil remain wilted and do not regain turgor.

Wind - collected as wind run at 2 meters above natural ground level. If wind is collected at any other height, it can be adjusted using the wind power law:

$$W2 = W1 \times \left(\frac{Z2}{Z1}\right)^a$$ (Jensen et.al., 1990)

Where:

$W1$ = measured wind at height Z1 (m/s)

$W2$ = estimated wind at height Z2 (m/s)

$Z1$ = measured wind height (m)

$Z2$ = estimated wind at 2 m

a = constant of 0.2 (Jensen 1974)

19 Appendix II

Equations and Constants for Evapotranspiration Equations

α - calibration constant = 1.70

γ - psychometric constant $= \dfrac{(cp \times P)}{(0.622 \times \lambda)}$, kPa / ° C

Δ - slope of the saturation vapour pressure-temperature curve

$$= \left(0.200 \times \left(\left(\left(0.00738 \times T\right) + 0.8072\right)^7\right)\right) - 0.00116$$, kPa/ ° C

λ - latent heat of vaporization $= 2.501 - (0.00236 \times T)$, MJ/kg

cp - specific heat at a constant pressure = 0.001013, MJ/kg/ ° C

P - atmospheric pressure

P $= 101.3 \times \left(\dfrac{(T + 273.16) - (0.0065 \times H)}{(T + 273.16)^{5.256}} \right)$, kPa

Rn - net radiation

Rn (W/m^2) $= \left(\dfrac{0.63 \times Rs \times 1000 \times 1000}{43200} \right) - 40$

Rn (MJ/m^2) $= \mathrm{Rn(W/m^{\wedge}2)} \times \dfrac{43200}{1000}$, MJ/m^2

Rs - total incoming solar radiation, MJ/m^2

G - soil heat flux = 0, MJ/m^2 day

U2 - wind speed at 2m, m/s

W2 $= \left(\dfrac{U2}{0.01157407} \right)$, wind travel, km/day

T - mean daily temperature

T $= \left(\dfrac{T\max + T\min}{2} \right)$, °C

(ea-ed) - mean daily vapour pressure deficit

Sat(vp) $= \exp\left(52.58 - \left(\dfrac{6790.5}{TK} \right) - 5.03 \times \ln(TK) \right)$

Daily(vp) $= \dfrac{Satvp \times RHmean}{100}$

Vpd $= Satvp - Dailyvp$, kPa

TK $= T + 273$, °K

H - elevation, m

20 Appendix III

Total Available Moisture

Soils can hold water against the force of gravity due to soil matric potential or soil water tension. Therefore, even in situations where water is free to drain out of the root zone, a significant portion of the water will be held due to soil water tension. The amount of water held in the soil profile against the force of gravity after drainage is called field capacity.

The qualitative definition of field capacity is the maximum amount of water a soil profile can retain provided the profile is able to drain freely (no impeding layer of bedrock or water table within the profile). The quantitative definition of field capacity is the water retained in a soil sample after subjecting the sample to a negative pressure of –33 kPa (-10 kPa for sandy textured soils).

Plant roots extract water from the soil for photosynthesis and to retain turgor or stem and leaf strength and structure. As the soil dries, the water remaining in the soil is bound more tightly to the soil particles or tiny spaces within the soil matrix and can no longer be taken up by plant roots. When the plant roots can no longer extract water from the soil they wilt and eventually, if denied water, will die. At the point where the plant can no longer recover turgor once wilted, it is said to have reached its permanent wilting point. The quantitative definition of permanent wilting point soil moisture is the amount of water remaining in a soil sample after the soil is subjected to a suction of -1500 kPa. Permanent wilting point is an ill-defined concept since plants differ in their abilities to extract water from soils. Soil water between field capacity and wilting point is termed plant available water; available for plant roots to absorb for photosynthesis and transpiration (**Figure III-1**). Soil texture is the dominant soil feature that determines how much available water the soil can hold (**Table IIII-1**).

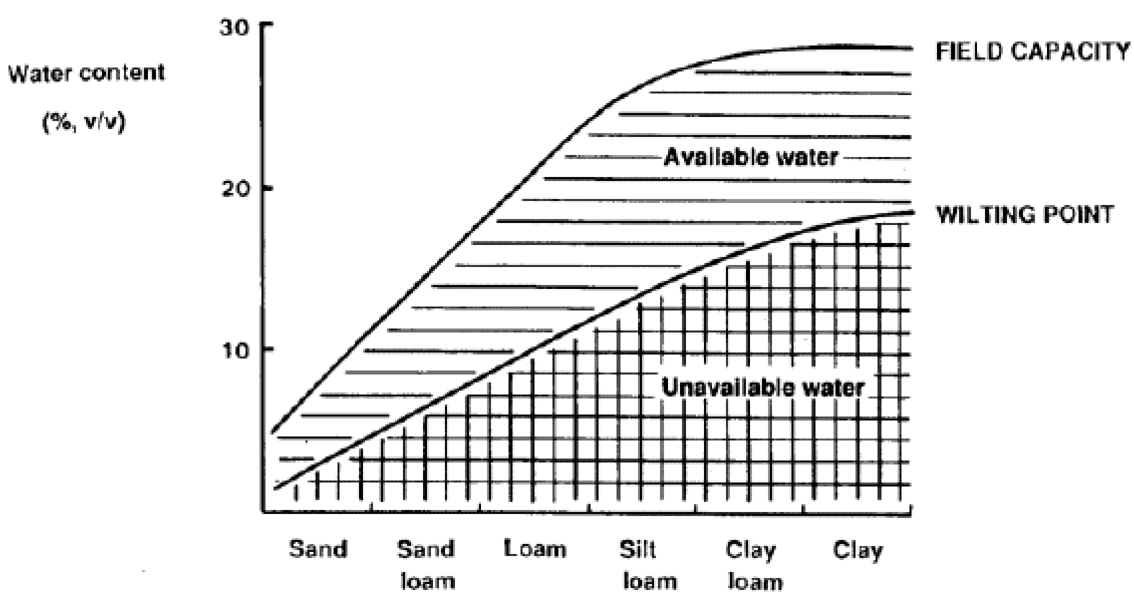


Figure III-1. Plant available moisture between field capacity and wilting point.

Soil Texture	Available moisture per 25 cm soil depth	Wilting point (mm of moisture per 10 cm of soil depth
Loamy Sand	28	6
Sandy Loam	35	8
Loam	45	13
Sandy Clay Loam	38	12
Silt Loam	50	11
Clay Loam	50	16
Silty Clay Loam	55	19
Sandy Clay	43	22
Silty Clay	53	22
Clay	48	22
Fine	52	25
Medium	45	16
Coarse	30	6

Table III-1. Available moisture for various soil textures.

Management Allowable Depletion

The extent an irrigator allows the available soil moisture to drop before irrigating depends on the crop grown and the irrigation system used. For most grain, oilseed and forage crops irrigated using surface or wheel move, the suggested management allowable depletion (MAD) is 50%. Management allowable depletion, for the same crops using centre pivot irrigation is 30%. The suggested management allowable depletion for potatoes is 30%. Some crops, such as sugar beet, alfalfa seed and chickpea require some soil moisture stress to maximize sugar content or encourage flowering for maximum pod development. The management allowable depletion will change throughout the irrigation season for these crops. Management allowable depletion in percent is displayed on the Y axis on the right-hand side of the graph, while available soil moisture in (mm) is displayed on the Y axis on the left-hand side of the graph (see **Figures III-2a & b**).

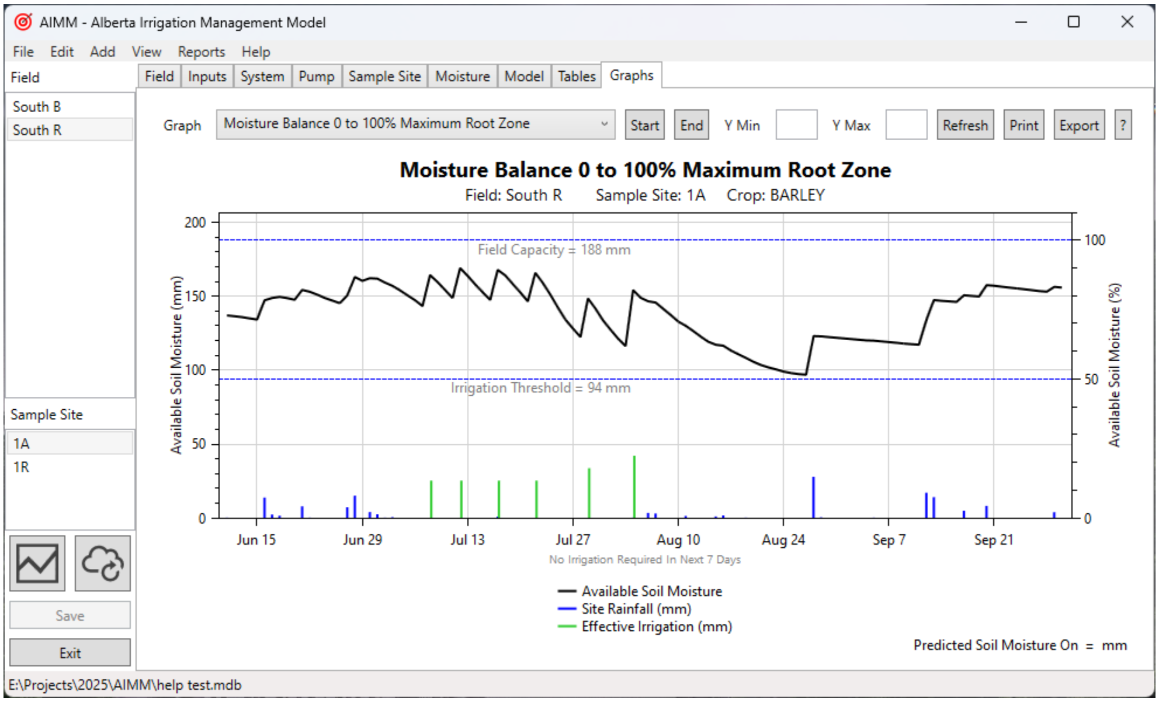


Figure III 2(a). Management allowed depletion set to 50%.

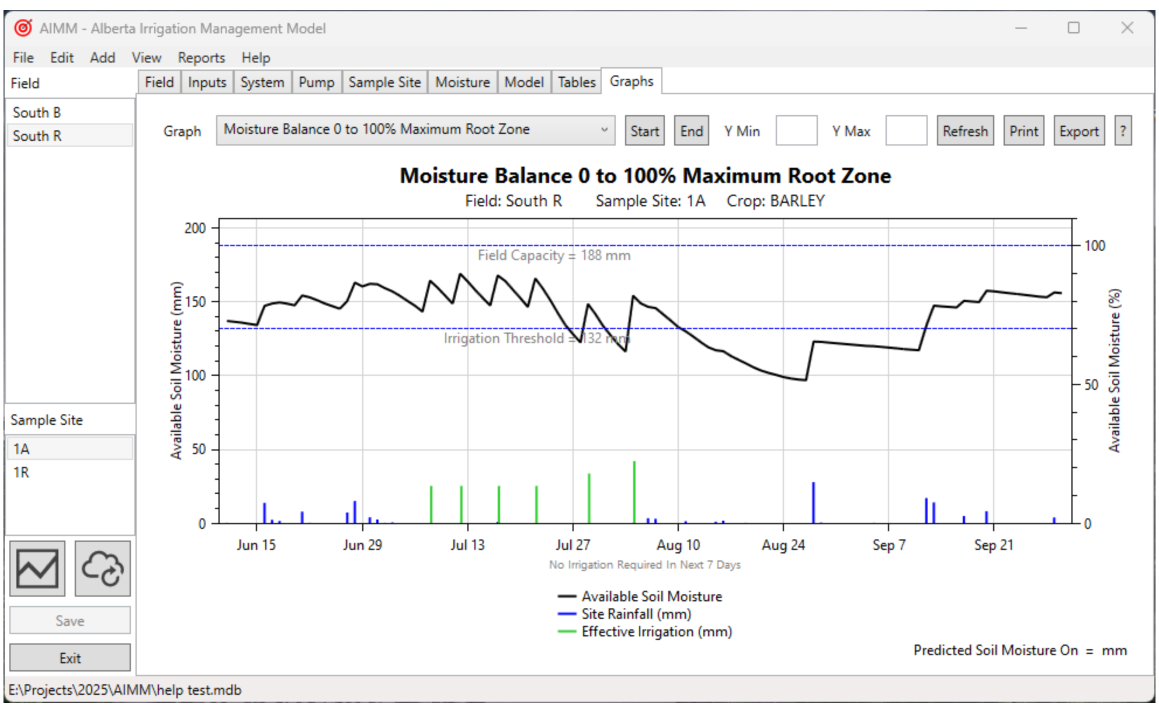


Figure III 2(b). Management allowed depletion set to 30%.

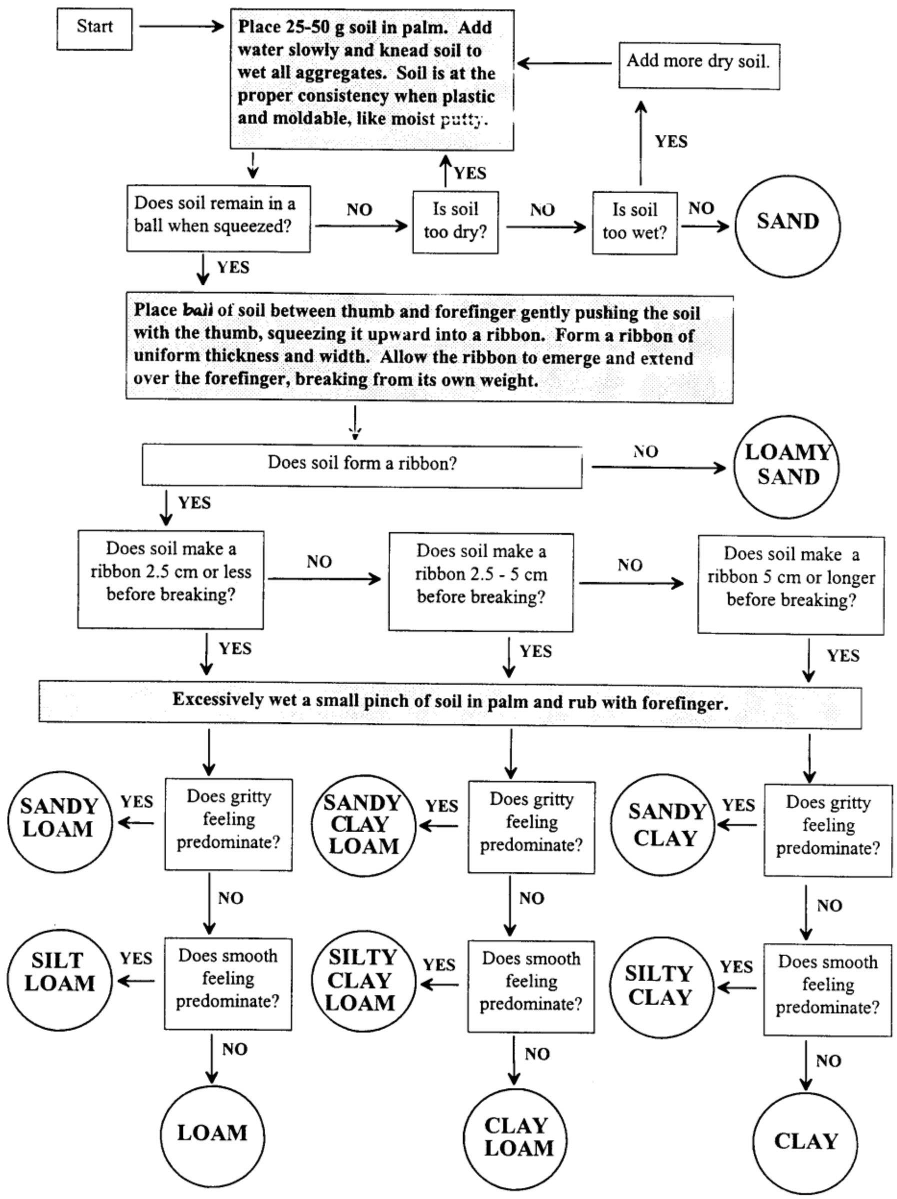


Figure III-3. Hand-feel determination of soil texture.

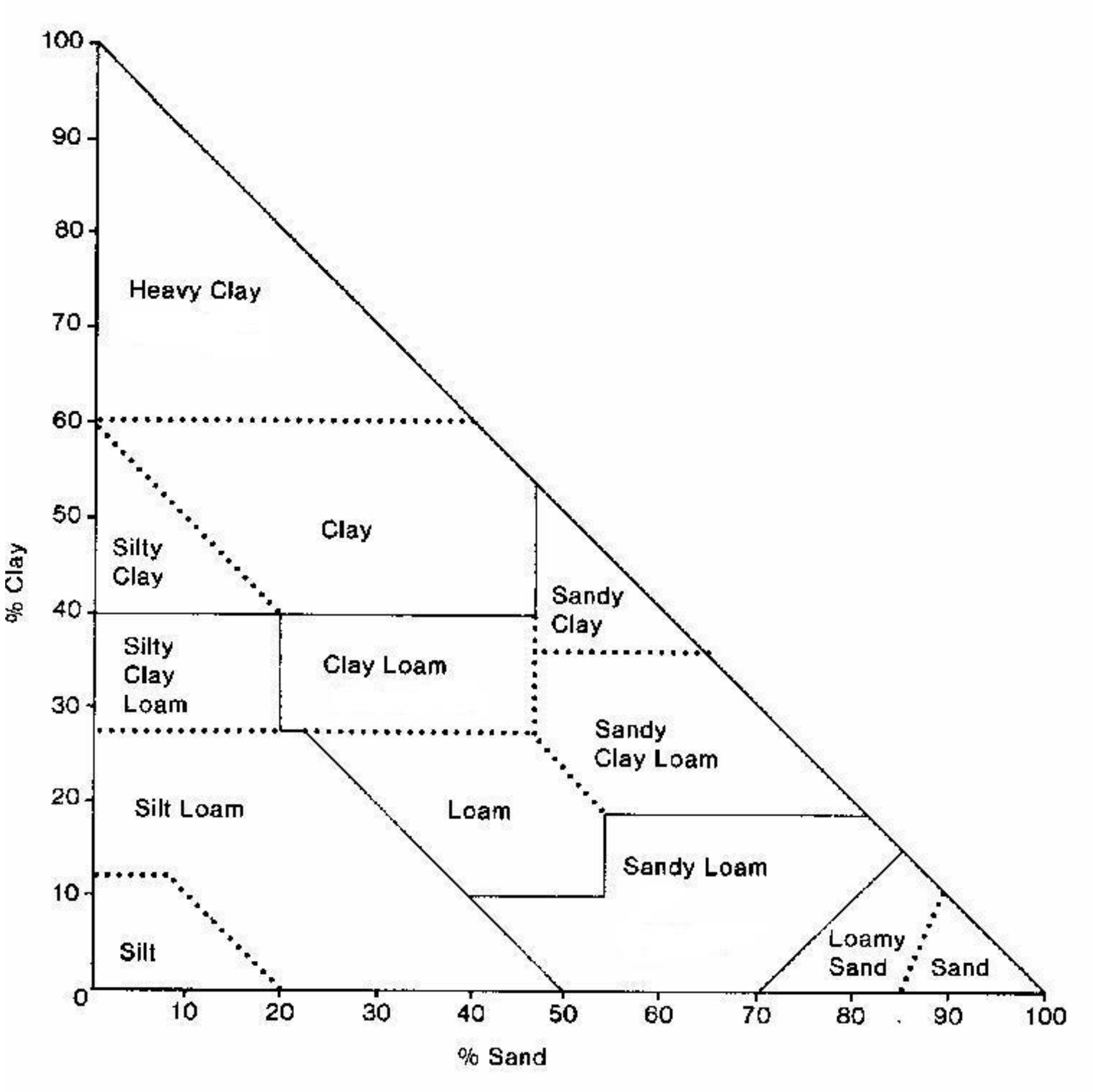


Figure III-4. Soil textural triangle.

	Soil Texture		
Estimate of Available Water	Sandy Loam	Loam/Silt Loam	Clay Loam/Clay
Above field capacity	Upon squeezing, no free water appears on soil but a wet outline of ball is left on hand. Soil will stick to thumb when rolled between thumb and forefinger.	Free water can be squeezed out.	Puddles; free water forms on surface
75-100%	Forms a weak ball but breaks easily when bounced in the hand. Will not slick.	Forms a ball, is very pliable. Slicks readily.	Easily ribbons out between thumb and forefinger, has a slick feeling.
50-75%	Tends to ball under pressure but will seldom hold together when bounced in the hand.	Forms a ball, somewhat plastic, will slick slightly with pressure	Forms a ball, will ribbon out between thumb and forefinger, has a slick feeling
25-50%	Appears to be dry, will not form a ball with pressure.	Somewhat crumbly but will hold together with pressure.	Somewhat pliable, will ball under pressure.
0-25%	Dry, loose, flows through fingers.	Powdery, sometimes slightly crusted but easily broken down into powdery conditions.	Hard, baked, cracked; difficult to break into powdery condition.

Table III-2. Hand-feel determination of available moisture for differing soil textures.

21 Appendix IV

Weather File Format

The weather file must be comma delimited (.csv) file in MS Excel and have the headings and data arranged in the format as shown below:

Year,Month,Day,TMAXC,TMINC,WINDKMD,PRECMM,RHMAX,RHMIN,SRKJD

2001,4,1,11.9,-3.8,314.5,0,92.5,32,16848

2001,4,2,8.9,-5.7,205.8,2.2,99.8,53.7,9590
2001,4,3,0.7,-2.4,214.5,0.8,106.3,77.5,8122

2001,4,4,3.4,-3.7,365.1,1,106.3,57.7,19354

2001,4,5,11.5,-4.2,481.9,0,95.8,38.3,20736

2001,4,6,12.6,-1.5,230.5,0,100.7,33,15984

2001,4,7,14.8,-4,216.2,0,103.2,32.9,19958

2001,4,8,13.1,0.7,227.1,0,97.2,34.9,16416

2001,4,9,12.9,-4.9,180.2,0.2,103.5,40.2,20822

2001,4,10,6.9,-0.1,327.6,0,103.6,41,11059

2001,4,11,5.2,-3.8,193.8,0,96,44.5,18144

2001,4,12,5.7,-5.4,384.5,0,104.9,60.3,9245

2001,4,13,13,-5.9,351.4,0.2,106.6,17.2,18662

2001,4,14,7.6,-3.2,184.7,0.2,98.6,40.5,10627

2001,4,15,4.4,-6.2,225.2,0,91.8,39.8,15293

TMAXC – maximum temperature in (°C)

TMINC – minimum temperature in (°C)

WINDKMD – wind speed in (km per day).

PRECMM – daily precipitation (mm)

RHMAX – maximum relative humidity (%)

RHMIN – minimum relative humidity (%)

SRKJD – incoming short-wave solar radiation (kJ per day)

22 Appendix V

Interpretation of the Graphical Output

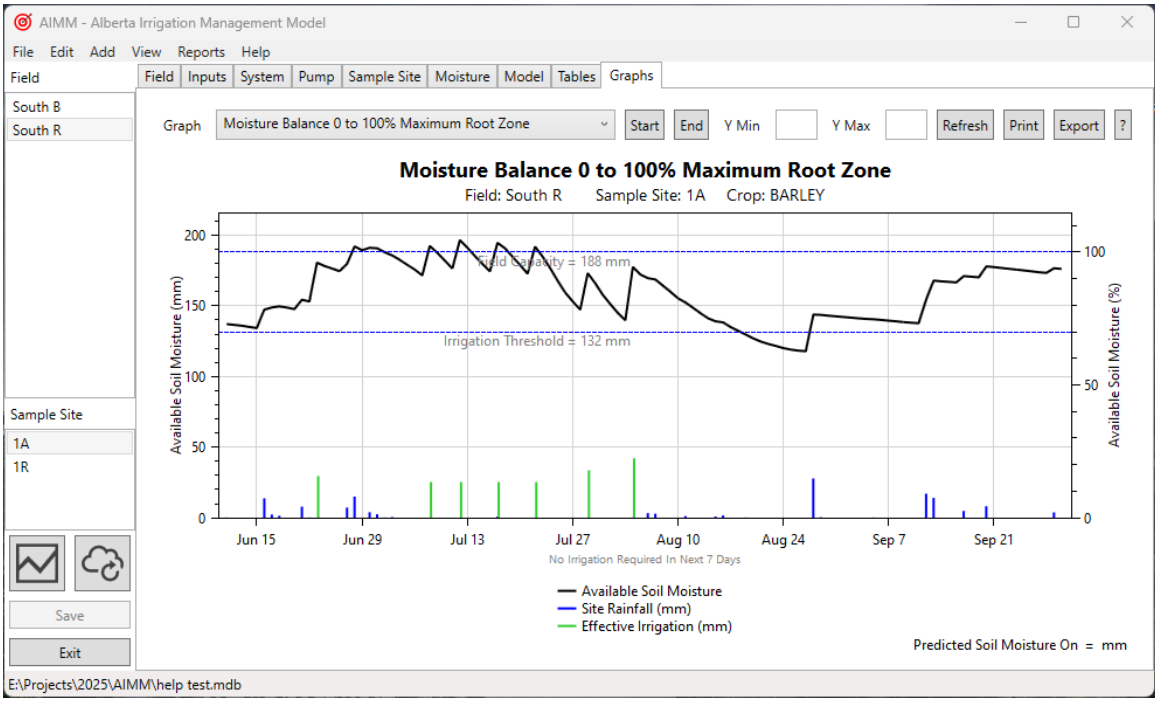


Figure V-1. Graph of moisture balance, 0-100% of maximum root zone.

- In **Figure V-1** and **Figure V-2** the irrigator should work at keeping available soil moisture (black line) between the two parallel blue lines**.** The top blue line represents field capacity (100% of available soil moisture), and the bottom blue line is set at 70% of field capacity or 30% manageable allowed depletion (MAD).
- When the solid black line peaks above field capacity water is either lost to run-off, ponding, or deep percolation. When the soil black line dips below MAD water should be applied by the irrigator to maintain optimum crop water use.

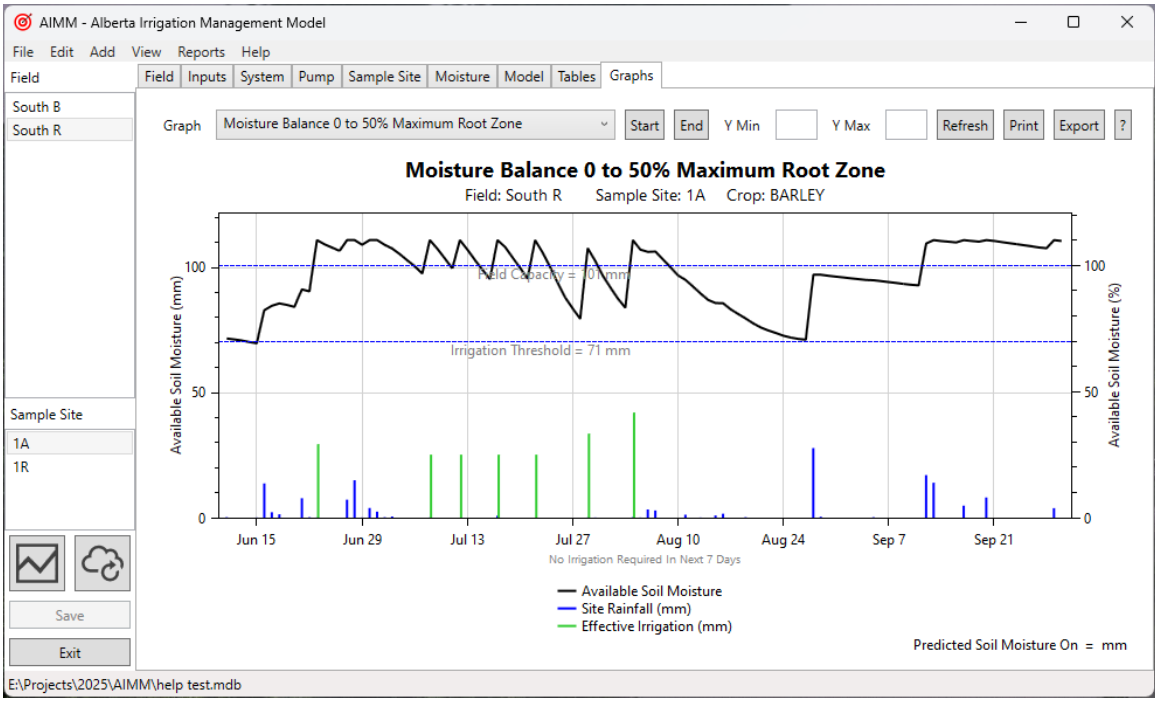


Figure V-2. Moisture balance, 0-50% of maximum root zone.

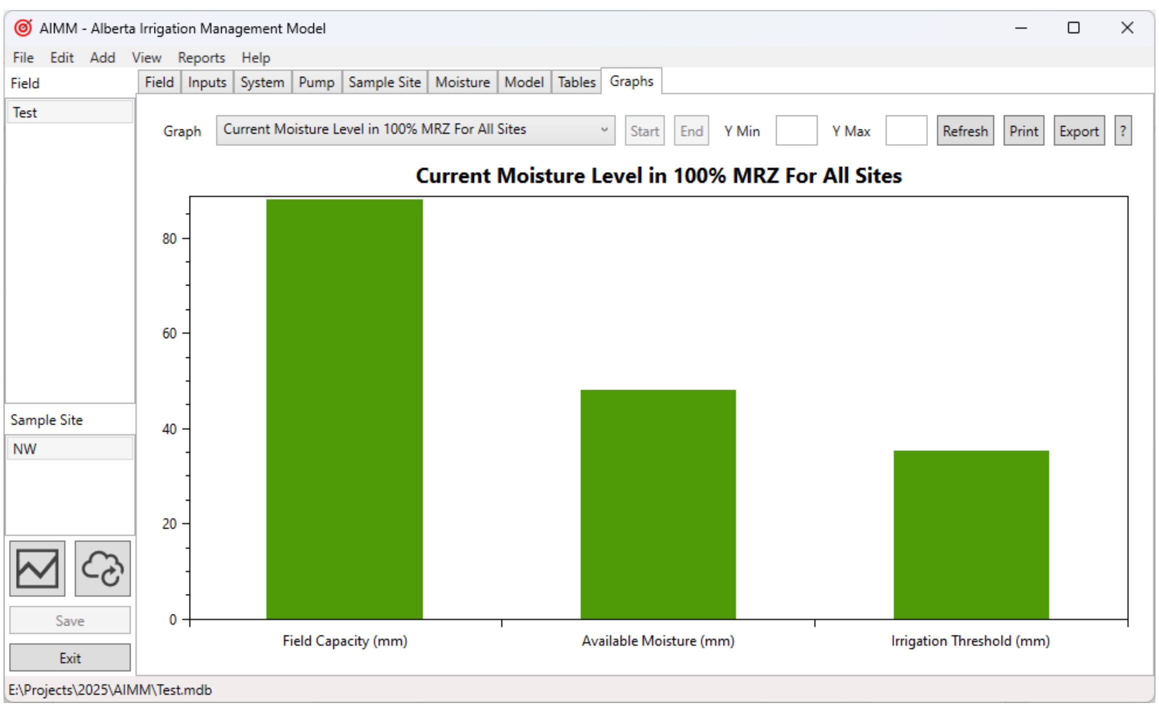


Figure V-3. Graph of current soil moisture level in maximum root zone.

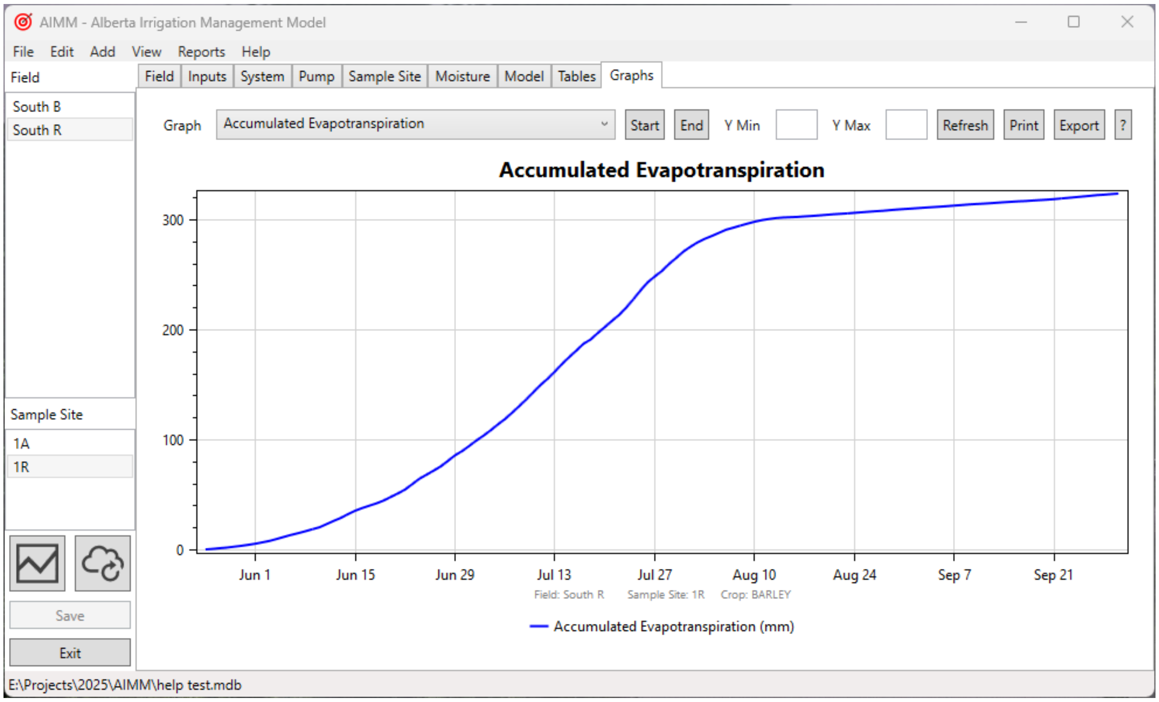


Figure V-4. Graph of accumulated evapotranspiration (crop water use).

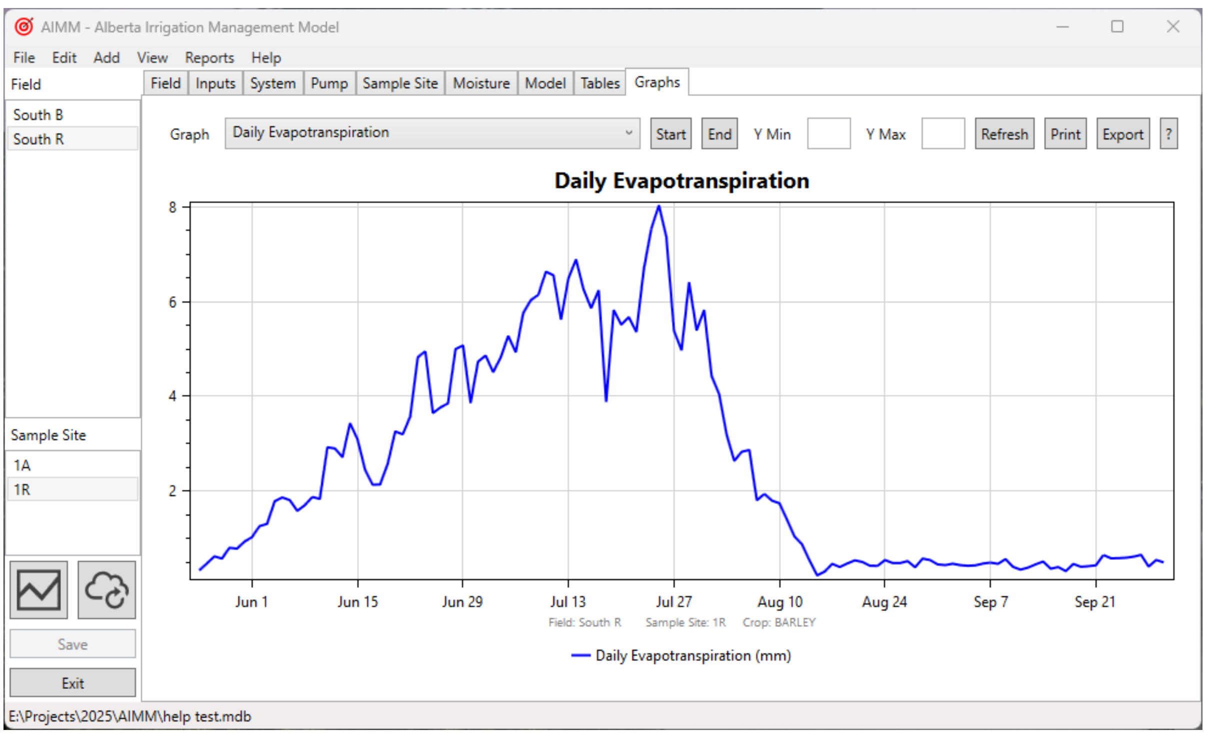


Figure V-5. Graph of daily evapotranspiration (crop water use).

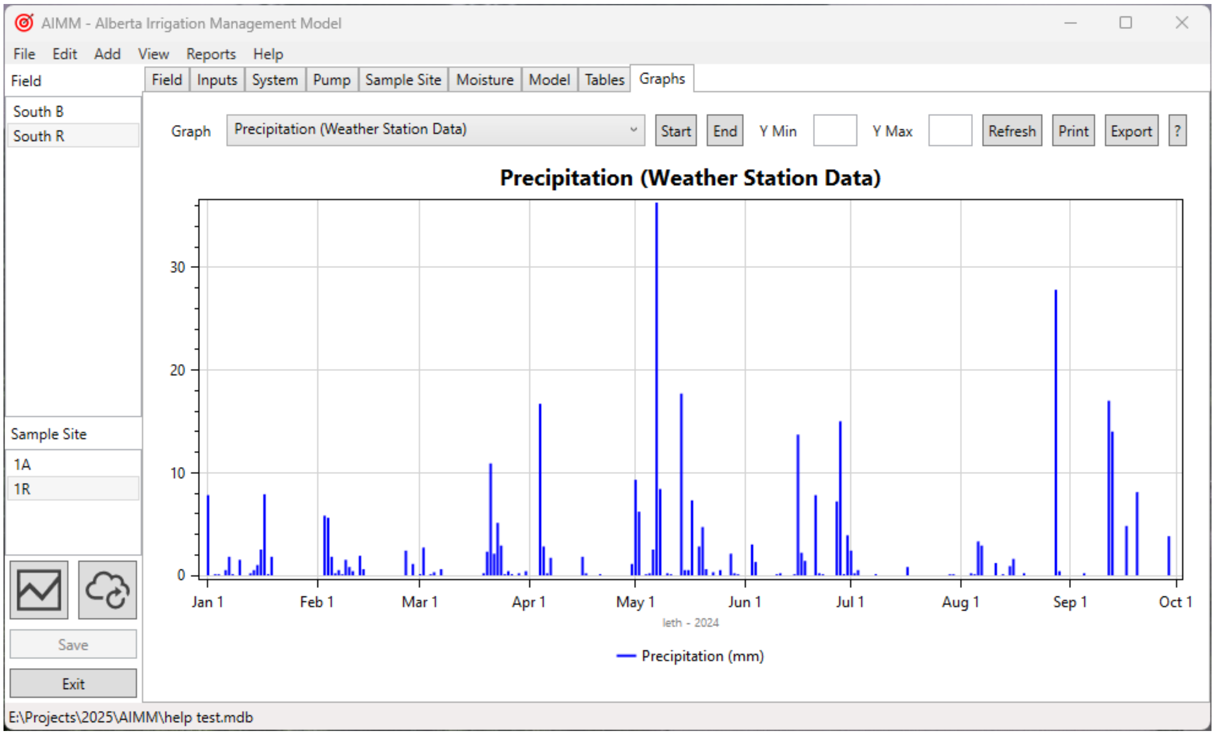


Figure V-6. Graph of daily rainfall amounts.

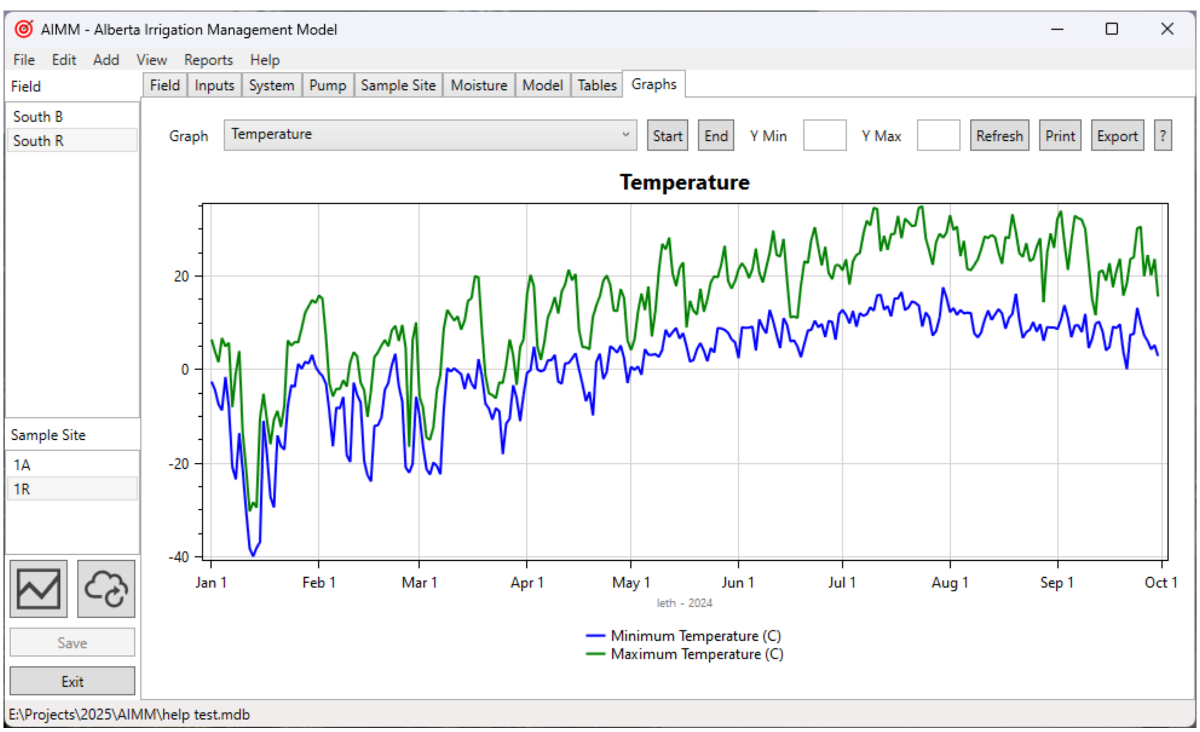


Figure V-7. Graph of daily maximum and minimum temperature in Celsius.

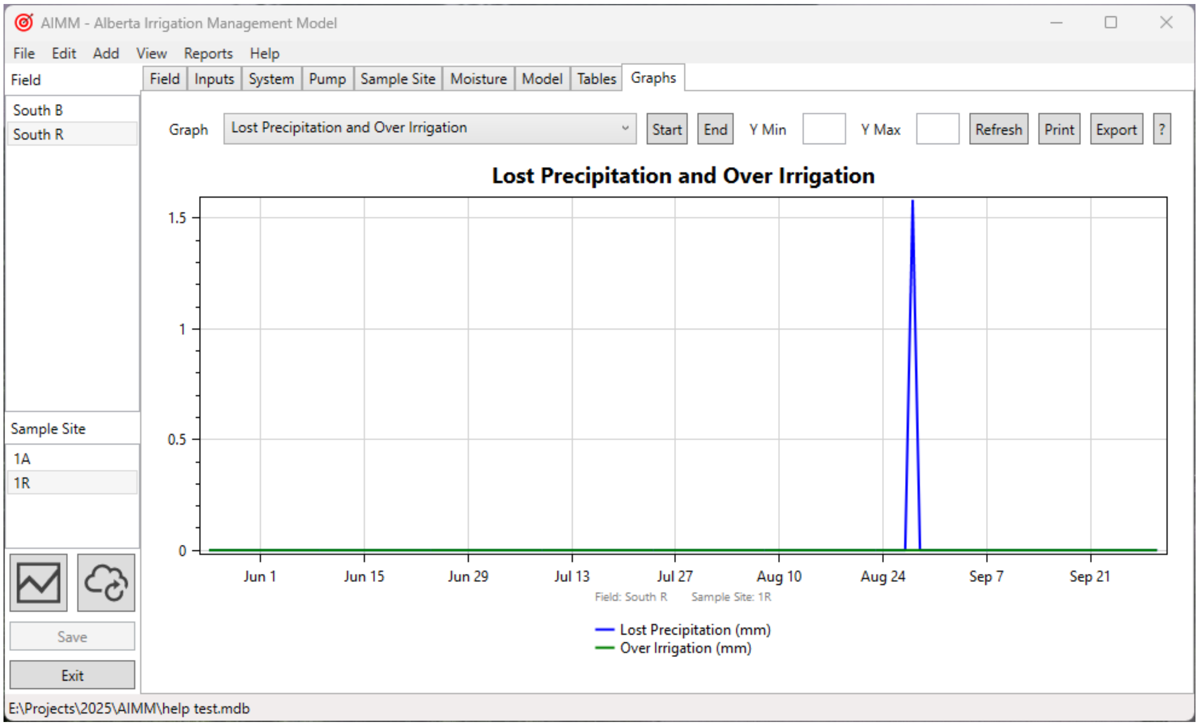


Figure V-8. Graph of lost precipitation or over irrigation in (mm).

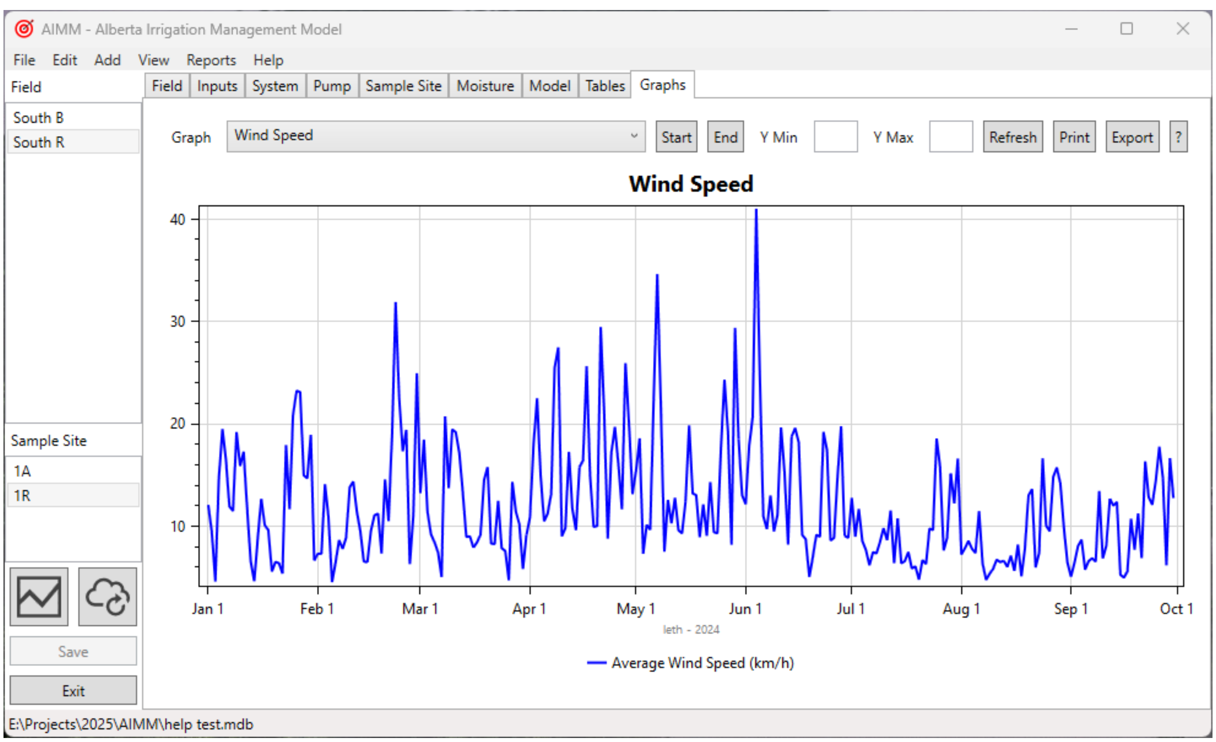


Figure V-9. Average wind speed in (km/h).

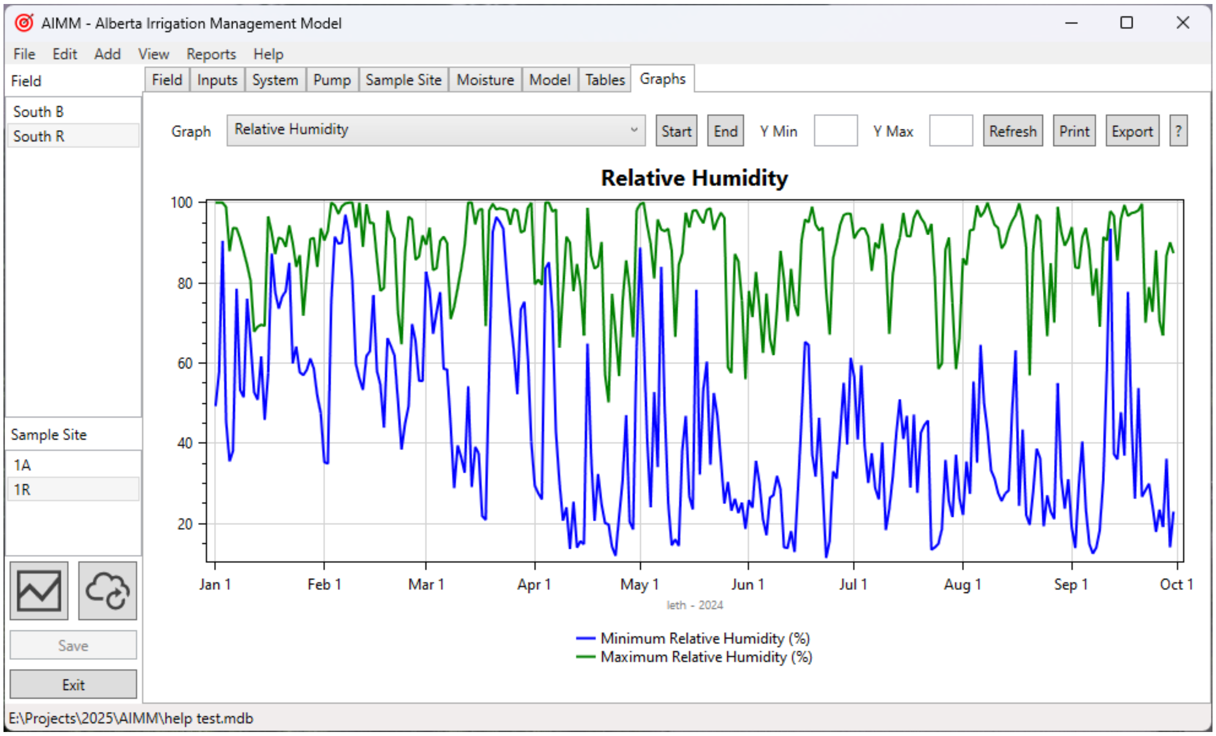


Figure V-10. Maximum and minimum relative humidity in (%).

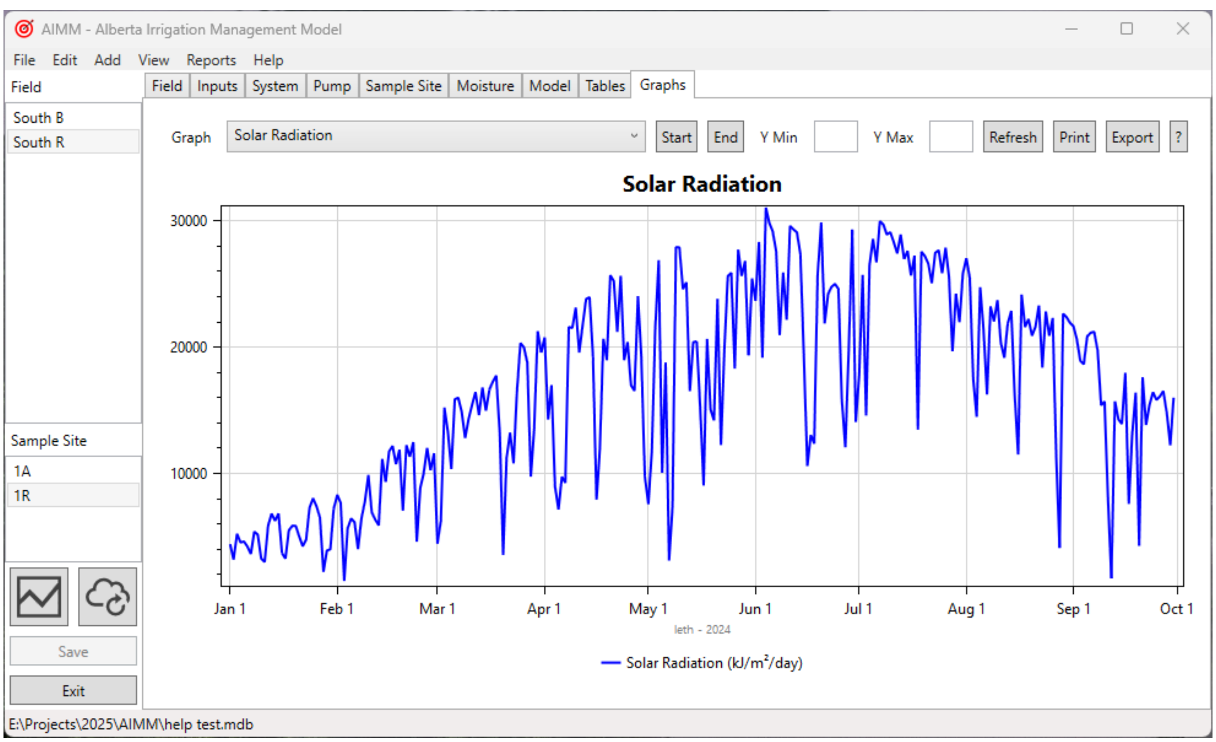


Figure V-11. Solar radiation (kJ/m^2/day).

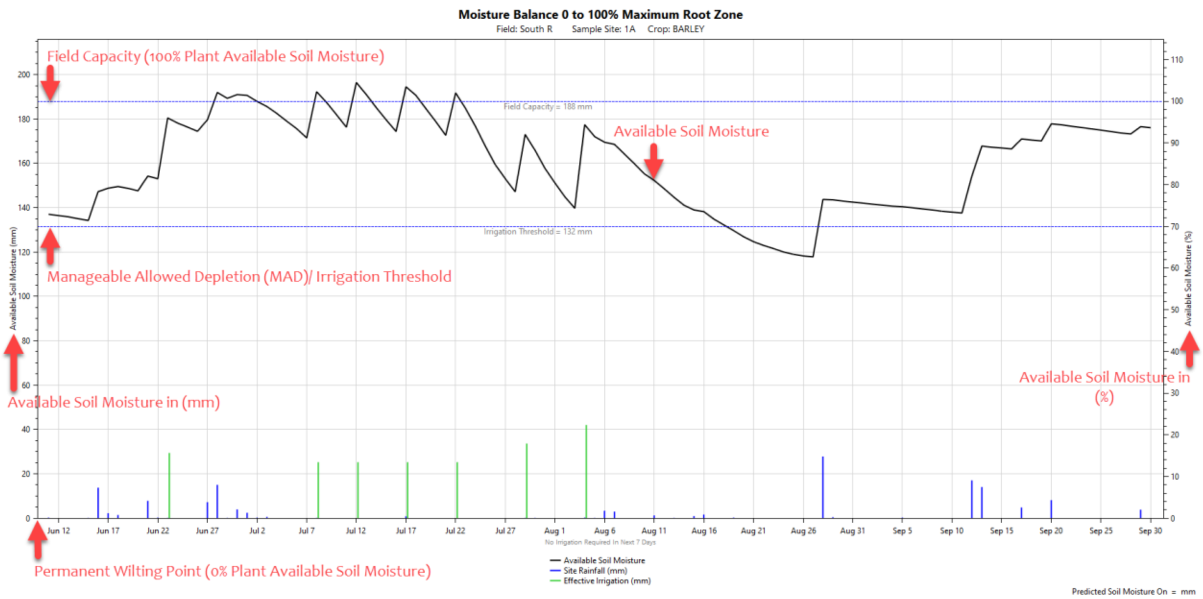


Figure V-12. Example of AIMM output graph – a guide to interpreting your graph.

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