

USER GUIDE

Trimble® WM-Form™

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Agriculture Business Area

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Responsible Party:
Trimble Navigation
935 Stewart Drive
Sunnyvale CA 94085
Telephone: 1-408 481 8000

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Meerheide 45
5521 DZ Eersel, NL

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Introduction

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This user guide provides a reference for using Trimble® WM-Form™ .

About this guide

This guide is a reference for setting up and using WM-Form.

Technical assistance

If you cannot find the information you need in the product documentation, contact your local reseller.

Alternatively:

1. Go to the [Trimble website](#).
2. Under Support & Training, choose the appropriate category.

If you need to contact Trimble technical support, visit http://www.trimble.com/Support/Technical_Support.aspx.

WM-Form basics

In this chapter:

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Trimble® WM-Form™ enables you to use landforming techniques to create surface drainage. You can build an existing surface model from a field survey.

WM-Form benefits

The WM-Form land forming solution is a fully integrated solution that enables you to perform the following while minimizing the amount of earthworks:

- Survey
- Analysis
- Design
- Land forming

With WM-Form, you can create leveling, surface drainage and irrigation designs that optimize the field for effective water management. You can design variable-shaped fields based on:

- Existing topography
- Water needs of individual crops
- Individual farming practices

By using WM-Form, you can create designs for :

- Fields that previously were too hilly or expensive to level
- Fields that do not necessarily need to be flat, such as:
 - Sprinkler irrigated
 - Furrow irrigated
 - Drip irrigated
- Fields requiring topsoil conservation and adequate surface water runoff

WM-Form enables you to:

- Level fields in single or multiple planes using a best-fit or custom plane, or with multiple hinges
- Drain water in any direction or to a linear feature such as a ditch or existing drainage system
- Create multi-directional land forming designs
- Create section lines and design each section individually
- Generate multiple design variations for the field, then compare them in 3D view against the original topography
- Produce 2D cut/fill estimates and reports
- Generate job estimates on earthworks
- Export and upload designs for use with the Trimble FieldLevel™ II system

Data structure

Work space

When you work in WM-Form, you are working in a workspace, which consists of projects. A workspace can include multiple projects.

Project

Projects contain fields and any designs created for the fields.

Field

Fields can contain multiple designs for the field.

Design

Each design can contain at least one area you have created on the design, such as a pipe bed or level pad.

Design version

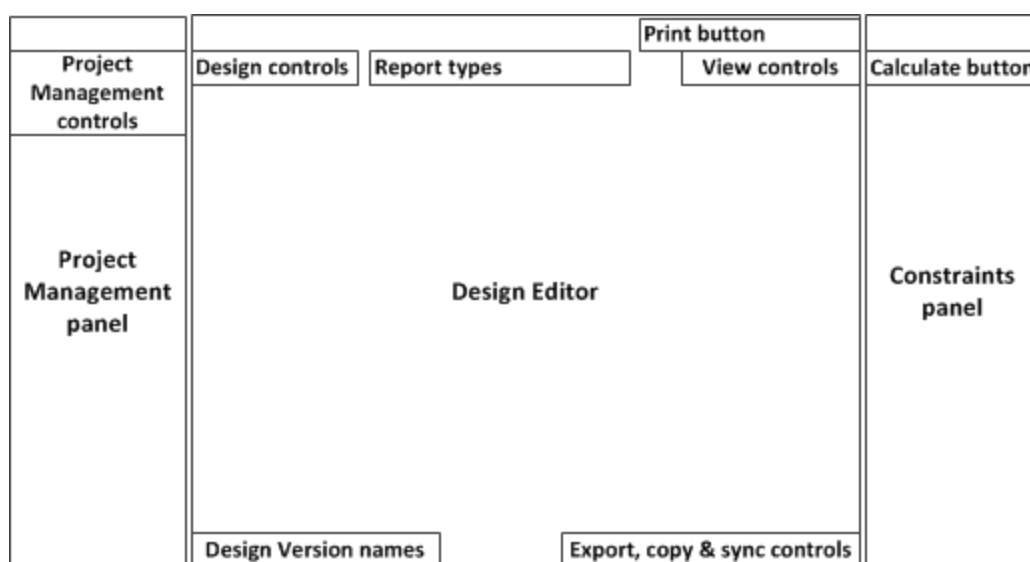
You can have multiple versions of a design in the *Reports Editor*. See [Design versions, 37](#).

Main views

WM Form has three main views:

- [Design Editor, 36](#)
- [Field Editor , 21](#)
- [Report Editor, 22](#)

Design Editor



To access the *Design Editor*, select a design in the Project Management file list and click [Design Editor](#).

In the *Design Editor*, you can:

- Manipulate, copy and export designs
- Add design data from other files to the design, such as features

Project Management panel

On the left-hand side of the window, the Project Management panel contains a list of the files you are currently working with. See [Project Management panel, 24](#).

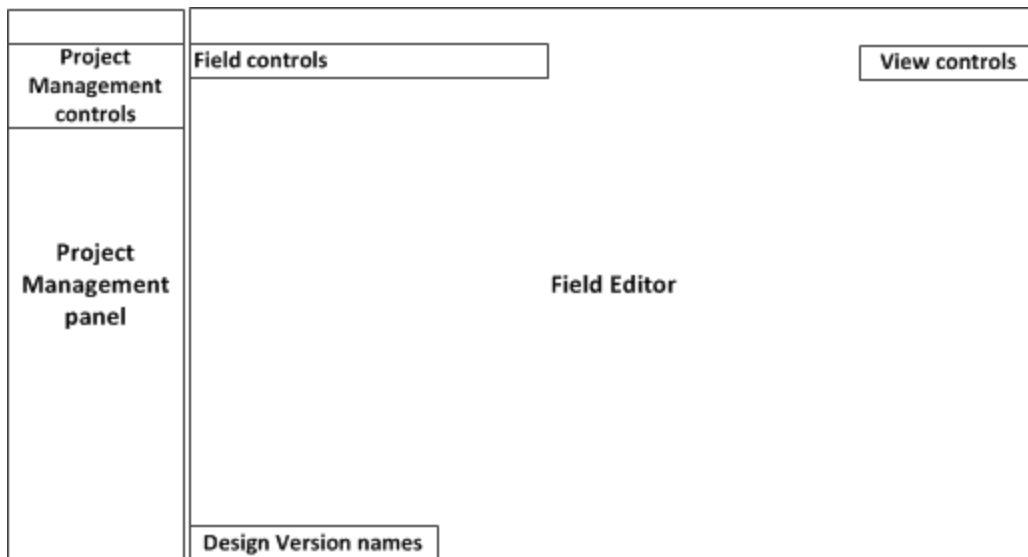
Constraints panel

In the constraints panel on the right-hand side of the *Design Editor*, you can enter constraints for on the design report.

Design controls

The design controls enable you to edit the design. See [Design Editor controls, 39](#).

Field Editor



To access the *Field Editor* for any field, select the name of the field from the file list in the Project Management panel.

The *Field Editor* panel shows the field along with a legend for elevation.

In the *Field Editor*, you can:

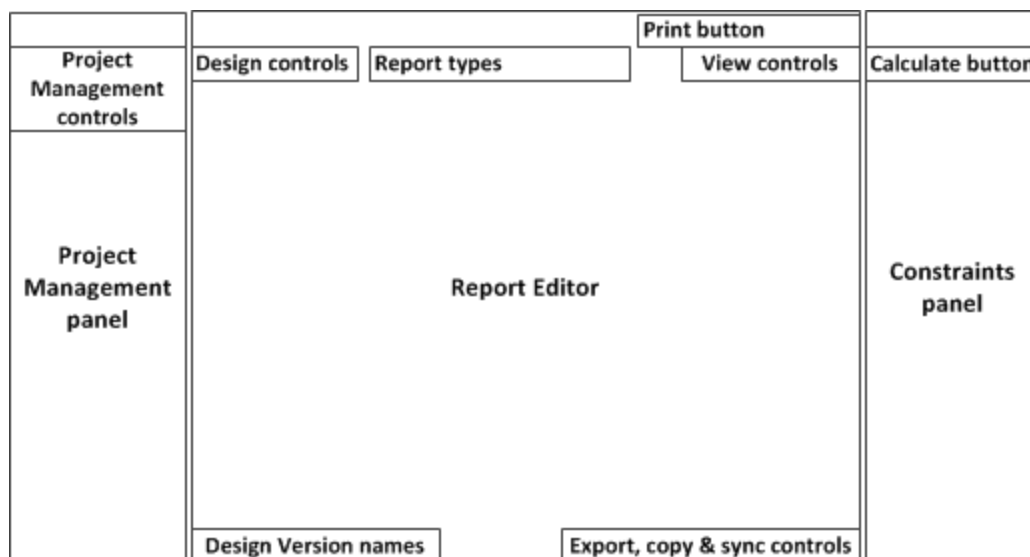
- Add benchmarks and survey points
- Add survey data

See [Field Editor, 30](#) and [Field Editor controls, 31](#).

Project Management panel

On the left-hand side of the window, the Project Management panel contains a list of the files you are currently working with. See [Project Management panel, 24](#).

Report Editor



You can access reports for each design. Depending on the report, you can use report controls to view different layers of the design.

To access a report, under the Reports section, select a design in the file list of the Project Management panel click on the type of report you want to see for the design. See [Report , 60](#).

Constraints panel

In the constraints panel on the right-hand side of the *Report Editor*, you can enter constraints for each type of design and section(s) of a design.

Project management

In this chapter:

Project Management panel	24
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Field surveys and their associated files are listed in the project management panel for you to access.





Project Management panel

The Project Management panel lists the data in your workspace file (*.mph) that includes:


- A project: The highest level of structure. A project can have multiple field survey files.
- Field survey file(s): One or more field survey files. A field survey file can have one or more designs associated with it.
- Design file(s): One or more designs you create for the field file.
- Survey data you import.
- Design data you created.

Controls


Project Management Control	Click to...
 Clear	Clear the workspace to use for another project.
 New Project	Create a new project.
 Open Project	Open a project.
 Save	Save the workspace.
 Save As	Save the workspace with another name.

Project Management Control	Click to...
	Access the User settings, 80.
User Settings	
	See information about the software.
Help About	
	Hide the Project Management panel.
Hide Panel	
	Show the Project Management panel
Show Panel	

Create a project

1. To create a project, in the Project Management controls click .
2. Click **New Project**. Tap **Next**.
3. Enter a name for the project and the field. Tap **Next**.
4. Import the field survey you want to use. Tap **Next**.
5. Choose the type of design you want to create:
 - Land Leveling: For planar designs
 - Drainage: For draining a field in any direction or to a ditch
 - Irrigation: For designing an irrigation pipeline and row oriented to a specific direction
 - Sub-Design Areas: For creating sub-design areas with multiple shapes in a single field
6. Confirm the project and field name. Tap **Next**.
7. WM-Form opens with the field displayed.

Open a project

1. To open a project, in the Project Management controls click  and choose the file you want to open.
2. When the system displays a message asking if you want to save the current workspace, click:
 - Yes: To save the workspace before opening a new project
 - No: To open a new project and not save the workspace
 - Cancel: To exit and not open a new project

Import field survey

To import a field for an existing project:

1. From the file list in the Project Management panel, right-click the name of the project.
2. Right-click the project you want to import the field into.
3. Click **New Field**.
4. In the New Field Wizard window, click **Next**.
5. Click **Browse** and choose the field survey file you want to import.
6. Click **Next**.
7. Select the Multiplane Settings for the field survey.

Setting	Explanation
File contains point IDs	Check the box if the file contains point IDs
Linear	<ul style="list-style-type: none">• Distance units are in Feet• Distance units are in Meters
Coordinate System	<ul style="list-style-type: none">• X,Y,Z• Y,X,Z• North, East and Elevation

8. Click **Next**.
9. Click the design type you want to create for the field survey.
10. Click **Next**.
11. Optionally, change the name of the field.
12. Click **Finish**.

Create a design

To create a design for a field survey you have already imported:

1. From the file list of the Project Management panel, right-click the name of the field survey.
2. Click **New Design**.
3. Click the design type you want to create.
4. The design displays under the name of the field survey.

Copy / clone items

To copy a field or design:

1. Select the field or design from the file list of the Project Management panel.
2. Right-click.
3. Select **Clone**.
4. Enter the name of the copy.
5. Click **OK**.

Rename items

To rename a workspace, field or design:

1. Select the project, field or design from the file list in the Project Management panel.
2. Right-click.
3. Select **Rename**.
4. Enter the new name.
5. Click **OK**.

Delete items



To delete a project, field or design:

1. Select the project, field or design from the file list in the Project Management panel.
2. Right-click and select **Delete**.
3. At the confirmation message, click **Yes**.

Note – If you delete a field, all designs for this field will also be deleted. If you delete a project, all fields and designs in this project will be deleted.

Save a workspace

To save a workspace, in the Project Management controls click:

-  to save the workspace under its current name
-  to save the workspace under a different name

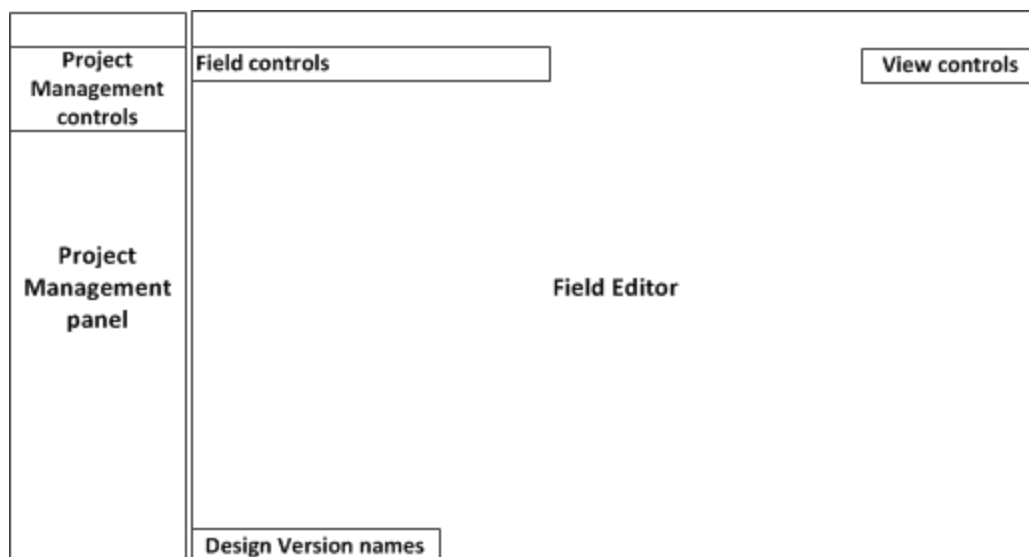
Field Editor

In this chapter:

Field Editor	30
Field Editor controls	31

In the *Field Editor*, you can make changes to the field survey.

Field Editor



In the *Field Editor*, you can edit the field to:

- Add benchmarks
- Add survey points
- Add survey data to the field from other files
- Measure distances on the design
- Zoom in and out of the design
- Move the design around (pan)

Any items you add to the field remain after you create a design of the field. Changes you make to the field will be included in all designs related to the field.

Project Management panel

On the left-hand side of the window, the Project Management panel contains a list of the files you are currently working with. See [Project Management panel, 24](#).

Field controls







The [Field Editor controls, 31](#) enable you to edit the field.


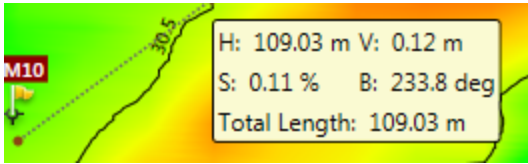


Field Editor controls

In the *Field Editor*, the controls available are:


- [Field controls](#)
- [View controls](#)




Field controls

Field Control	Click to...
	Add a benchmark to the field.
Benchmark	
	Add one or more survey points to the field.
Add Survey Point	
	Enable selection of items you have placed on the design, such as level pads, pipe beds, and so on.
Select	
	Undo the last action.
Undo	
	Redo the last action.
Redo	
	Toggle snapping. When the snap option is on, as you draw your shape, the point you are creating or editing will snap to another existing point.
Snap Option	

Field Control	Click to...
 Measure Distance	<p>Measure the distance between two or more points you select on the design.</p>  <ol style="list-style-type: none"> Click . On the design, click the point you want to start measuring from. Click the point where the measurement ends. The system displays the following: <ul style="list-style-type: none"> H: The horizontal distance between the currently measured two points V: The elevation difference between the last two points S: The slope of the line B: The bearing from the last set point Total length: The total length of all segments defined When you are finished measuring, press the Enter key. <p>To cancel the measurement, press the Escape key.</p>
 Add Survey Data	<p>Add external survey data to the field.</p>

View controls

View Control	Click to...
 Pan	<p>Move the field around in the view.</p>

View Control	Click to...
 Zoom	Enable zooming, then zoom in or out with the mouse wheel.
 Zoom to Area	Enable zoom area. After clicking, outline an area on the report to zoom in.
 Zoom to Fit	Zoom to fit. Zooms view to fill the window.

Copy / clone a field

You can copy a field to keep an unedited version of the field as a backup. Then you can manipulate the field without worry of altering the original field.

1. From the list in the Project Management panel, right-click on the field you want to copy.
2. Click **Clone**.
3. The field is copied as well as all of the designs related to the field.

Rename a field

To change the name of a field:

1. In the file list of the Project Management panel, right-click on the field you want to rename.
2. Click **Rename**.
3. When the Rename dialog displays, enter the name of the field and click **OK**.

Delete a field

To remove a field from the project:

1. In the file list of the Project Management panel, right-click on the field you want to delete.
2. Click **Delete**.
3. When the Delete Field confirmation message displays, click **OK**.

Design Editor

In this chapter:

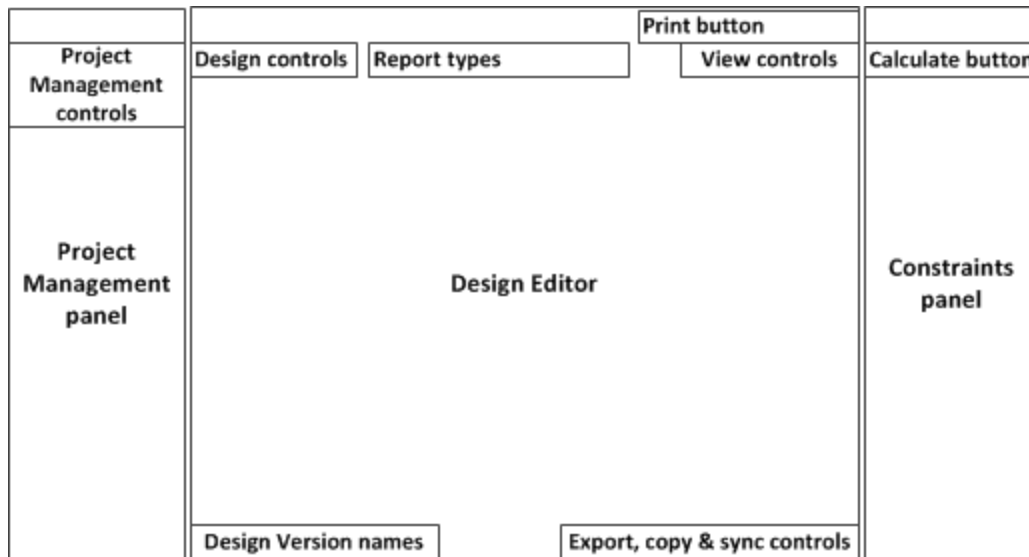
Design Editor	36
Design versions	37
Design Editor controls	39
Design types	42
Sub-design areas design	53

In the *Design Editor*, you can edit a design as well as a version of a design.

Design Editor

In the Design Editor, you manipulate the designs you create for a field. There are templates, or design types, for creating a design. See [Design types, 42](#).

Some controls in the Design Editor are specific to a design type. Others are common controls. See [Design Editor controls, 39](#).



Design versions

You can create multiple versions of one design so that you can:

- Make changes to each version
- Compare versions

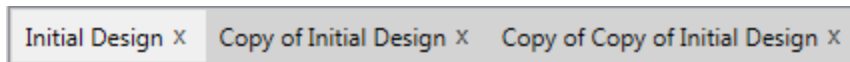
Create a new version

1. To create another version of the design currently displayed in either the Design Editor or



Reports, click

2. Rename the version if you do not want the default name.
3. The version name will show below the design or report area.



Right-click on the version name to rename or delete the version. You can also delete the version by clicking the X beside the version name.

Sync design versions

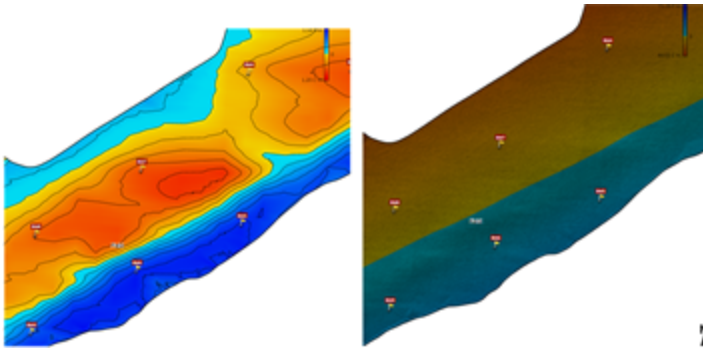
You can synchronize the perspective and zoom level at which you are viewing multiple design versions.

1. Create more than one version of the design.
2. Change the design constraints and click **Calculate** for each version.
3. For each version, choose the same type of report you want to view (for example, Cut Fill).
4. View one of the versions and change the perspective and zoom level to the one you want.



5. Click to sync the views for each version. The button changes to , indicating the views for all versions of the report type are in sync.









Design Editor controls


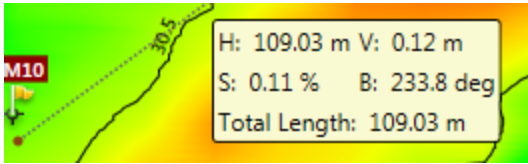


In the *Design Editor*, the controls are:

- [Common controls](#)
- [View controls](#)
- [Export, copy and sync controls](#)


Common controls




Common design controls are available for all [Design types](#), 42

Common Control	Click to...
 Select	Enable selection of items you have placed on the design, such as level pads, pipe beds, and so on.
 Undo	Undo the last action.
 Redo	Redo the last action.
 Snap Option	Toggle snapping. When the snap option is on, as you draw your shape, the point you are creating or editing will snap to another existing point.






Common Control	Click to...
 <p>Measure Distance</p>	<p>Measure the distance between two or more points you select on the design.</p>  <ol style="list-style-type: none"> Click . On the design, click the point you want to start measuring from. Click the point where the measurement ends. The system displays the following: <ul style="list-style-type: none"> H: The horizontal distance between the currently measured two points V: The elevation difference between the last two points S: The slope of the line B: The bearing from the last set point Total length: The total length of all segments defined When you are finished measuring, press the Enter key. <p>To cancel the measurement, press the Escape key.</p>
 <p>Add Design Data</p>	<p>Add external design data to the design.</p>

View controls

View Control	Click to...
 <p>Pan</p>	<p>Move the field around in the view.</p>

View Control	Click to...
 Zoom	Enable zooming, then zoom in or out with the mouse wheel.
 Zoom to Area	Enable zoom area. After clicking, outline an area on the report to zoom in.
 Zoom to Fit	Zoom to fit. Zooms view to fill the window.

Export, copy and sync controls

Design Control	Explanation
 Export	Click to export to a Trimble display.
 	Click to export to Sketchup.
 New Version	Click to create another version of the design currently in the design window.
 Not in Sync	Indicates the perspective and zoom level for the field and design are different.
 Sync	Indicates the perspective and zoom level for each version of the design are the same. See Design versions, 37 .

Design types

You can create these design types:

- [Drainage design, 42](#)
- [Irrigation design, 45](#)
- [Land leveling design, 48](#)
- [Sub-design areas design, 53](#)

Drainage design

Use a drainage design for drainage. In this design type, you can create:

Drainage

- [Ditches](#)
- [Exclusion zones](#)

Create a drainage design

To create a drainage design:

1. Right-click on the field name.
2. Select **New Design**, and then **Drainage**.

Create drainage

To create drainage on the design:

1. Select a drainage design you want to work with.
2. If you are not in the Design Editor, click [Design Editor](#).
3. Enter the [constraints](#) and click **Calculate** (or ALT + A).

Create a ditch


To create a ditch:

1. Select a drainage design you want to work with.
2. If you are not in the Design Editor, click [Design Editor](#).

3. Click  .

4. Click on the design to indicate the start of the ditch. Drag to the next point and click.
5. Continue dragging and clicking until you have completed the shape for the ditch.



If you have Snap Options  activated, the last point will snap to the first line. See [Design Editor controls, 39](#).


6. To indicate you are complete, you can:
 - Right-click and select **Complete**.
 - Press the Enter key.
7. To cancel the ditch creation, press the Escape key.
8. Use the [Design Editor controls, 39](#) to manipulate the design.
9. Enter the [constraints](#) and click **Calculate** (or ALT + A).

Create an exclusion zone

Exclusion zones are areas not included in the calculations for the design.

To create an exclusion zone:



1. Click .
2. Click on the design the point where you want the exclusion zone to begin.
3. Continue dragging and clicking until you have completed the shape for the zone.
4. Press the Enter key (or right-click and click **Complete**) when you are satisfied with the zone's shape and location.
5. To cancel the creation of the zone, press the Escape key.

Constraints

Note – To better see constraints in the sequence you want, you can reorder constraints by clicking and dragging them.

Volume constraints

Constraint	Explanation
Method of soil balancing	<ul style="list-style-type: none"> Balanced: Cut/fill ratio is balanced based on the ratio defined by you, Import: Import volume into balanced design. Export: Export volume export from balanced design. Free: Optimized surface without an import, export or balance constraints
Shrinkage	Percentage that soil increases in volume when it is excavated
Haul Bulkage	Percentage of the increase in volume of soil due to expansion and loosening occurring as a result of its excavation
Haul Compaction	Percentage of the decrease in volume of soil from its loose haulage or stockpiled state to its compacted state where it is placed
Limit Cut Depth	After checking the box, enter the value for cut depth limit.
Cut/Fill	Ratio of cut to fill volume for balancing the field design.

Slope Constraints

Constraint	Explanation
Minimum Slope	The minimum allowable slope
Maximum Slope	The maximum allowable slope


Irrigation design


For this design type, you can create:


- [Pipelines](#)
- [Exclusion zones](#)

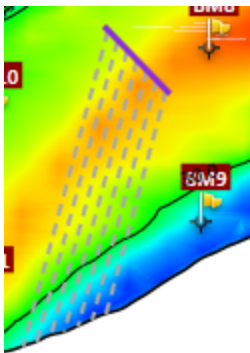
Create a pipeline

To create a pipeline:

1. Select an irrigation design you want to work with.
2. If you are not in the Design Editor, click [Design Editor](#).
3. Click .
4. Click on the design to indicate the start of the pipeline. Drag to the next point and click.
5. Continue with additional lines until you have completed the shape.
6. To indicate you are complete, you can:
 - Right-click and select **Complete**.
 - Press the Enter key.

If you have Snap Options  activated, the last point will snap to the first line. See [Design Editor controls, 39](#).

The estimated furrow layout displays after you define the pipeline. You can change the direction of the furrow layout by changing the downhill direction  in the Row Constraints.




7. To cancel the ditch creation, press the Escape key.
8. Use the [Design Editor controls, 39](#) to manipulate the design
9. Complete the [constraints](#) and click **Calculate** (or ALT + A).

Create an exclusion zone

Exclusion zones are excluded from all calculations for the design.

To create an exclusion zone:


1. Click .
2. Click on the design the point where you want the exclusion zone to begin.
3. Continue dragging and clicking until you have completed the shape for the zone.
4. Press the Enter key (or right-click and click **Complete**) when you are satisfied with the zone's shape and location.
5. To cancel the creation of the zone, press the Escape key.

Constraints

Volumes constraints

Constraint	Explanation
Method of soil balancing	<ul style="list-style-type: none"> Balanced: Cut/fill ratio is balanced based on the ratio defined by you, Import: Import volume into balanced design. Export: Export volume export from balanced design. Free: Optimized surface without an import, export or balance constraints
Shrinkage	Percentage that soil increases in volume when it is excavated
Haul Bulkage	Percentage of the increase in volume of soil due to expansion and loosening occurring as a result of its excavation
Haul Compaction	Percentage of the decrease in volume of soil from its loose haulage or stockpiled state to its compacted state where it is placed
Limit Cut Depth	After checking the box, enter the value for cut depth limit.

Row constraints

Setting	Explanation
Downhill Direction	Heading of water flow
	
Width	Maximum width the cross-slope is allowed to break over
Minimum Slope	The minimum allowable slope
Maximum Slope	The maximum allowable slope
Maximum Rate Change	Percentage of distance. Used to limit the design change over distance.

Cross slope

Setting	Explanation
Minimum Slope	The minimum allowable slope
Maximum Slope	The maximum allowable slope
Maximum Rate Change	Percentage of distance. Used to limit the design change over distance.

Land leveling design

Use a land leveling design for basic land leveling. In this design type, you can:

- [Add section lines](#)
- [Add to and edit information about section lines](#)
- [Rename a line](#)
- [Add a hinge](#)
- [Change hinge properties](#)
- [Create an exclusion zone](#)

Create a land leveling design

To create a land leveling design:

1. Right-click on the field name.
2. Select **New Design**, and then **Land Leveling**.

Add section lines

You can add:

- Single section lines that run from one boundary to another boundary of the design
- Section lines that join together to form a shape

To create one or more section lines:

1. Select a land leveling design you want to work with.
2. If you are not in the Design Editor, click [Design Editor](#).



3. Click .
4. Click on the design where the section line should start.
5. Drag the line to the point you want it to end and click again.
6. If you are finished drawing the line, you can:
 - a. Right-click and select complete.
 - b. Press the Enter key.
 - c. To cancel the line creation, press the Escape key.

7. If you want to continue drawing additional lines to create a shape:
 - a. Drag the line to the next point.
 - b. Continue with additional lines until you have completed the shape.



If you have Snap Options activated, the last point will snap to the first line. See [Design Editor controls, 39](#).

8. If you are finished drawing, you can:
 - a. Right-click and select complete.
 - b. Press the Enter key.
9. To cancel the line creation, press the Escape key.
10. Use the [Design Editor controls, 39](#) to manipulate the design.
11. Enter the [constraints](#) and click **Calculate** (or ALT + A).

Add to/change information about section lines

You can add information to section lines, including:

- A custom name
- Notes



1. Click if it is not already selected.
2. Right click the section line or shape until the points on the section line(s) display. The Section Line Properties window displays.
3. Edit the name and add notes.
4. When you are finished, click **OK**.

Rename a line

1. Place the mouse pointer over the line you want to rename.
2. Right-click and select **Rename**.
3. Enter the new name of the line and click **OK**.

Add a hinge

When two independent sections are designed into planes based on slope, orientation, and cut/fill balance, it does not mean that they join nicely on the section boundary. This is real problem for operators today as they cannot easily drive from one section to another when running FieldLevel II.

You can use hinges to:

- Hold slopes and cut/fill balance fixed: In this case, the planes will essentially remain the same, but new section boundaries will be created based on where the planes intersect.
- Hold cut/fill balance and boundaries fixed: In this case, modify the design slopes to allow the boundaries to join at the original locations. In some cases, it may be impossible depending on geometry, in which case we may need to apply some best fit algorithms to do the best we can.
- Hold cut/fill balance, boundaries and slopes fixed: When all three are selected, provide the result that Multiplane does today, i.e. planes do not join at the boundaries. Maybe this is not required as the customer can just choose not to apply the Plane Joiner tool.
- Hold slopes and boundaries fixed: In this case, the cut/fill balance will need to be modified to ensure the planes join at the boundaries.
- Hold slopes fixed: Modify the boundaries and cut/fill balance to all the planes to join.
- Hold boundaries fixed: Modify the cut/fill balance and slopes to join the planes.
- Hold cut/fill balance fixed: Modify the slopes and boundaries to allow the planes to join.

Where plane parameters are automatically modified, the user must be able to view the new parameters.

1. Select a land leveling design you want to work with.
2. If you are not in the Design Editor, click [Design Editor](#).



3. Click .
4. Click on the design where the hinge line should start.
5. Drag the line to the point you want the hinge to end and click again.

Change hinge properties

You can change:

- The coordinates of the hinge
- The type of hinge:
 - Fixed: The Z value is fixed at the existing elevation or at the Z value you defined.
 - Floating: The Z value floats to the optimal elevation.

To change properties of a hinge:




1. Click if it is not already selected.
2. Click the hinge to select it.
3. Right-click and select **Properties**. The Hinge Properties window displays.

4. Change any of the coordinates or change the hinge type.
5. Click **OK**.

Create an exclusion zone

Exclusion zones are excluded from all calculations for the design.

To create an exclusion zone:




1. Click .
2. Click on the design the point where you want the exclusion zone to begin.
3. Continue dragging and clicking until you have completed the shape for the zone.
4. Press the Enter key (or right-click and click **Complete**) when you are satisfied with the zone's shape and location.
5. To cancel the creation of the zone, press the Escape key.

Constraints

Volumes

Constraint	Explanation
(Type of volume)	<p>Balanced: The volume of soil removed and replaced remains the same.</p> <p>Import: The volume of soil added is greater than what is currently there.</p> <p>Export: The volume of soil removed is greater than what is currently there.</p> <p>Free: Optimized surface without an import, export or balance constraints</p>
Shrinkage	Percentage that soil increases in volume when it is excavated
Haul Bulkage	Percentage of the increase in volume of soil due to expansion and loosening occurring as a result of its excavation
Haul Compaction	Percentage of the decrease in volume of soil from its loose haulage or stockpiled state to its compacted state where it is placed
Cut/Fill	Ratio of cut to fill volume for balancing the field design.

Field (Custom)

Constraint	Explanation
Main Slope 	Move the arrow to the direction the main slope. Downhill Direction: Slope:
Cross Slope	Slope: Click  or  to toggle the direction of the cross slope.

Sub-design areas design

A design type of Sub-design areas allows you to create different kinds of sub-design areas on the design.

To create a Sub-Design Areas design:

1. Right-click on the field name.
2. Select **New Design**, and then **Sub-Design Areas**.

Constraints

Note – To better see constraints in the sequence you want, you can reorder constraints by clicking and dragging them.

Volumes

Volume Constraint	Explanation
(Type of volume)	Balanced: The volume of soil removed and replaced remains the same. Import: The volume of soil added is greater than what is currently there. Export: The volume of soil removed is greater than what is currently there. Free: Optimized surface without an import, export or balance constraints
Cut Fill Ratio	Percentage of cut / fill

Sampling Grid

Use the sampling grid to define the main slope heading.

Sampling Grid Constraint	Explanation
Orientation	Orientation of the grid the design is on. You can enter the degrees or move the arrow.
Spacing	The size of each grid

Sub-design area types

The types of areas you can create on a sub-design area type of design are:


- [Custom area, 54](#)
- [Exclusion zone area, 1](#)
- [Level pad area, 55](#)
- [Pipe bed area, 56](#)
- [Tail ditch area, 56](#)

Custom area

Use the custom area for general land leveling.

1. If you are not in the Design Editor, click [Design Editor](#).
2. In the file list of the Project Management panel, select the design you want to work with.



3. Click  and choose **Custom**. The mouse pointer changes to a pencil.
4. Click the point where you want the custom sub-design to begin.
5. Continue dragging and clicking until you have completed the shape for the custom sub-design.
6. Press the Enter key (or right-click and click **Complete**) when you are satisfied with the custom sub-design's shape and location.
7. Enter the constraints for the custom sub-design and click **Calculate** (or ALT + A).

Constraints

Note – To better see constraints in the sequence you want, you can reorder constraints by clicking and dragging them.

Constraint	Explanation
Main Slope	Minimum: The maximum percentage of slope Maximum: The minimum percentage of slope Max Change Rate: The maximum rate of change
Cross Slope	Minimum: The maximum cross slope percentage Maximum: The minimum cross slope percentage Max Change Rate: The maximum rate of change
Elevation	Minimum: Minimum elevation of the design Maximum: Maximum elevation of the design


Constraint	Explanation
Cut / Fill	Maximum Cut: The maximum amount of material that should be removed
	Maximum Fill: The maximum amount of material that should be replaced

Level pad area


Use this area type to create a level pad.

1. Choose the sub-design areas design you want to work with.
2. If you are not in the Design Editor, click [Design Editor](#).
3. In the file list of the Project Management panel, select the design you want to work with.



4. Click  and choose **Level Pad**. The mouse pointer changes to a pencil.
5. Click the point where you want the level pad to begin. Drag to the next point and click.
6. Continue dragging and clicking until you have completed the shape for the pad.



If you have Snap Options  activated, the last point will snap to the first line. See [Design Editor controls, 39](#).

7. Press the Enter key (or right-click and click **Complete**) when you are satisfied with the level pad shape and location.
8. To cancel the creation of the level pad area, press the Escape key.
9. Use the [Design Editor controls, 39](#) to manipulate the design
10. Complete the [constraints](#) and click **Calculate** (or ALT + A).


Constraints

Note – To better see constraints in the sequence you want, you can reorder constraints by clicking and dragging them.

Constraint	Explanation
Min. Elevation	The minimum elevation of the pad.
Max. Elevation	The maximum elevation of the pad.


Pipe bed area

Use this area type to create an irrigation pipe bed area for optimal placement of irrigation pipes for furrow irrigation.

1. If you are not in the Design Editor, click **Design Editor**.
2. In the file list of the Project Management panel, select the design you want to work with.
3. Click  and choose **Pipe Bed**. The mouse pointer changes to a pencil.
4. Click the point where you want the pipe bed to begin.
5. Continue dragging and clicking until you have completed the shape for the pipe bed.
6. Press the Enter key (or right-click and click **Complete**) when you are satisfied with the pipe bed's shape and location.
7. Enter the constraints for the pipe bed and click **Calculate** (or ALT + A).

Constraints

Note – To better see constraints in the sequence you want, you can reorder constraints by clicking and dragging them.


Constraint	Explanation
Downhill Direction 	Slope direction of the pipebed. Enter the degrees or use your mouse to move the direction arrow.
Minimum Slope	Percentage of minimum slope
Maximum Slope	Percentage of maximum slope

Tail ditch area

Use this area type to create designs for controlling runoff.


1. If you are not in the Design Editor, click [Design Editor](#).
2. In the file list of the Project Management panel, select the design you want to work with.



3. Click  and choose **Tail Ditch**. The mouse pointer changes to a pencil.
4. Click the point where you want the tail ditch to begin.
5. Continue dragging and clicking until you have completed the shape for the tail ditch.
6. Press the Enter key (or right-click and click **Complete**) when you are satisfied with the tail ditch's shape and location.
7. To cancel the tail ditch creation, press the Escape key.
8. Enter the constraints for the tail ditch and click **Calculate** (or ALT + A).

Constraints

Note – To better see constraints in the sequence you want, you can reorder constraints by clicking and dragging them.

Constraint	Explanation
Downhill Direction 	Degrees of downhill direction. Enter the degrees or use your mouse to move the direction arrow.
Minimum Slope	Percentage of minimum slope
Maximum Slope	Percentage of maximum slope

Reports

In this chapter:

Report	60
Constraints Summary Report	60
Cut Fill Report	62
Design Report	66
Design Summary Report	70
Proposed Design Report	72
Quote Report	75

WM-Form provides six report templates for all design types except irrigation.

Report

Reports contains the report types:

- [Constraints Summary Report, 60](#)
- [Cut Fill Report, 62](#)
- [Design Report, 66](#)
- [Design Summary Report, 70](#)
- [Proposed Design Report, 72](#)
- [Quote Report, 75](#)

Constraints Summary Report


This report has complete details on the constraints used in the design.

Constraints

Volume constraints

Constraint	Explanation
(Type of volume)	Balanced: The volume of soil removed and replaced remains the same. Import: The volume of soil added is greater than what is currently there. Export: The volume of soil removed is greater than what is currently there. Free: Optimized surface without an import, export or balance constraints
Cut/Fill	Ratio of cut to fill volume for balancing the field design.

Slope Constraints

Constraint	Explanation
Main Slope	 : Main slope heading. Enter the degrees or use your mouse to move the direction arrow. Slope: Percentage of slope
Cross Slope	Percentage of cross slope. Downhill Direction: Click the arrow to toggle the direction of the cross slope.

Design Totals

This section of the report indicates the design totals for the entire field or all sections.

Information	Explanation
Area	Measurement of the area in which the cut/fill will occur (whether a section or an entire field)
Cut	Quantity of material to remove
Fill	Quantity of material to fill
Total Moved	Total amount of material moved
Moved per Area	Total amount of material moved compared to the total area of the section or field
Import	Volume of soil to be imported to complete the design (if applicable)
Export	Volume of soil to be exported to complete the design (if applicable)

Volumes

This section of the report indicates the volumes for the entire field or all sections.

Information	Explanation
Type	The balance method used
Cut/Fill Ratio	The cut/fill ratio
Shrinkage %	Percentage of shrinkage

Information	Explanation
Haul Bulkage %	Percentage of the increase in volume of soil due to expansion and loosening occurring as a result of its excavation
Haul Compaction %	Percentage of the decrease in volume of soil from its loose haulage or stockpiled state to its compacted state where it is placed

Sections

This section of the report indicates the constraints for each section of the design.

Information	Explanation
Name	Name of the section
Slope %	Percentage of slope for the section
Downhill Direction %	Degrees of downhill direction
Cross Slope %	Percentage of cross slope
Cross Slope Downhill Direction %	Degrees of cross slope downhill direction
# of Point Constraints	The benchmarks used to define where a design points where the design must intersect. (The maximum allowed is 3 sections per area.)

Cut Fill Report

This report provides detailed information on cut/fill, including cut/fill information at grid intervals and what the cut/fill ratio is at a point. Controls specific to this report are:


- [Layer controls](#): View different layers of the design
- [View controls](#)
- [Export, copy and sync controls](#)

Constraints

Volume constraints

Constraint	Explanation
(Type of volume)	<p>Balanced: The volume of soil removed and replaced remains the same.</p> <p>Import: The volume of soil added is greater than what is currently there.</p> <p>Export: The volume of soil removed is greater than what is currently there.</p> <p>Free: Optimized surface without an import, export or balance constraints</p>
Cut/Fill	Ratio of cut to fill volume for balancing the field design.

Slope Constraints

Constraint	Explanation
Main Slope	<p>Downhill Direction  : Degrees of downhill direction. Enter the degrees or use your mouse to move the direction arrow.</p> <p>Slope: Percentage of slope</p>
Cross Slope	<p>Percentage of cross slope.</p> <p>Downhill Direction: Click the arrow to toggle the direction of the cross slope.</p>




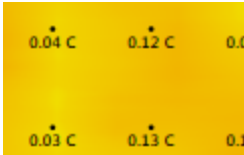


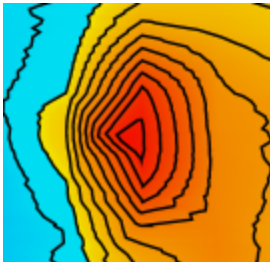
Report data


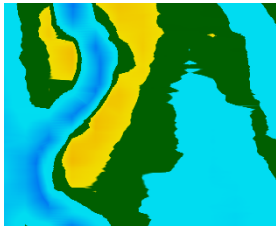
Information	Explanation
Area	Measurement of the area in which the cut/fill will occur (whether a section or an entire field)
Cut	Quantity of material to remove
Fill	Quantity of material to fill

Information	Explanation
Total Moved	Total amount of material moved
Moved per Area	Total amount of material moved compared to the total area of the section or field
Import	Volume of soil to be imported to complete the design (if applicable)
Export	Volume of soil to be exported to complete the design (if applicable)





Layer controls

Use the report controls to view different layers of the report.






Layer Control	Click to...
 Annotation Layer	Toggle the annotation layer on, showing benchmarks. 
 Surface Info	Toggle the surface info on, showing coordinate locations and numbers. 
 Surface Info Spacing	Define the spacing of the visible cut/fill point values. (Units depend on settings. See Units settings, 82.)
 Contours	Toggle on contours. 

Layer Control	Click to...
<div>0.1 ▾ m</div> <div>Contours Interval</div>	Change how close or far apart contours display. (Units depend on settings. See Units settings, 82.)
<div>  <div>On-Grade Band</div> </div>	Toggle to hide or view the neutral areas that do not require cut or fill. <div>  </div>
<div>0.1 ▾ m</div> <div>On-Grade Band Interval</div>	Change how close or far apart the on-grade bands display on the design. (Units depend on settings. See Units settings, 82.)

View controls

View Control	Click to...
<div>  <div>Pan</div> </div>	Move the field around in the view.
<div>  <div>Zoom</div> </div>	Enable zooming, then zoom in or out with the mouse wheel.
<div>  <div>Zoom to Area</div> </div>	Enable zoom area. After clicking, outline an area on the report to zoom in.
<div>  <div>Zoom to Fit</div> </div>	Zoom to fit. Zooms view to fill the window.

Export, copy and sync controls

Design Control	Explanation
 Export	Click to export to a Trimble display.
 	Click to export to Sketchup or Sketchup Pro 2014 or higher.
 New Version	Click to create another version of the design currently in the design window. See Design versions, 37 .
 Not in Sync	Indicates the perspective and zoom level for each version of the design are not in sync.
 Sync	Indicates the perspective and zoom level for each version of the design are the same. See Design versions, 37 .

Design Report

This report provides detailed information on cut/fill. Controls on this report are:


- [Layer controls](#): View different layers of the design
- [View controls](#)
- [Export, copy and sync controls](#)

Constraints

Volume constraints

Constraint	Explanation
(Type of volume)	<p>Balanced: The volume of soil removed and replaced remains the same.</p> <p>Import: The volume of soil added is greater than what is currently there.</p> <p>Export: The volume of soil removed is greater than what is currently there.</p> <p>Free: Optimized surface without an import, export or balance constraints</p>
Cut/Fill	Ratio of cut to fill volume for balancing the field design.

Slope Constraints

Constraint	Explanation
Main Slope	<p>Downhill Direction  : Degrees of downhill direction. Enter the degrees or use your mouse to move the direction arrow.</p> <p>Slope: Percentage of slope</p>
Cross Slope	<p>Percentage of cross slope.</p> <p>Downhill Direction: Click the arrow to toggle the direction of the cross slope.</p>




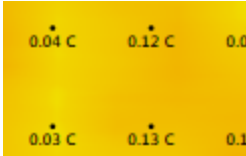


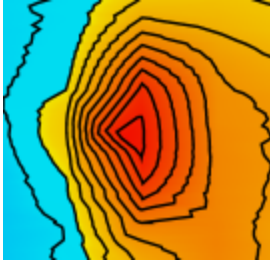
Report data

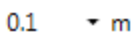
Information	Explanation
Graphic	Use the report layer controls to see different layers of the design.
Area	Measurement of the area in which the cut/fill will occur (whether a section or an entire field)
Cut	Quantity of material to remove

Information	Explanation
Fill	Quantity of material to fill
Total Moved	Total amount of material moved
Moved per Area	Total amount of material moved compared to the total area of the section or field
Import	Volume of soil to be imported to complete the design (if applicable)
Export	Volume of soil to be exported to complete the design (if applicable)





Layer controls

Use the report controls to view different layers of the report.



Layer Control	Click to...
 Annotation Layer	Toggle the annotation layer on, showing benchmarks. 
 Surface Info	Toggle the surface info on, showing coordinate locations and numbers. 
 Surface Info Spacing	Define the spacing of the visible cut/fill point values. (Units depend on settings. See Units settings, 82.)
 Contours	Toggle on contours. 




Layer Control	Click to...
 Contours Interval	Change how close or far apart contours display. (Units depend on settings. See Units settings, 82.)

View controls

View Control	Click to...
 Pan	Move the field around in the view.
 Zoom	Enable zooming.
 Zoom to Area	Enable zoom area. After clicking, outline an area on the report to zoom in.
 Zoom to Fit	Zoom to fit. Zooms view to fill the window.

Export, copy and sync controls

Report Control	Explanation
 Export	Click to export to a Trimble display.
	Click to export to Sketchup or Sketchup Pro 2014 or higher.

Report Control	Explanation
 New Version	Click to create another version of the design currently in the design window. See Design versions, 37 .
 Not in Sync	Indicates the perspective and zoom level for each version of the design are not in sync.
 Sync	Indicates the perspective and zoom level for each version of the design are the same. See Design versions, 37 .

Design Summary Report


This report has complete details on the design.

Constraints

Volume constraints

Constraint	Explanation
(Type of volume)	Balanced: The volume of soil removed and replaced remains the same. Import: The volume of soil added is greater than what is currently there. Export: The volume of soil removed is greater than what is currently there. Free: Optimized surface without an import, export or balance constraints
Cut/Fill	Ratio of cut to fill volume for balancing the field design.

Slope Constraints

Constraint	Explanation
Main Slope	 : Main slope heading. Enter the degrees or use your mouse to move the direction arrow. Slope: Percentage of slope
Cross Slope	Percentage of cross slope. Downhill Direction: Click the arrow to toggle the direction of the cross slope.

Design Totals

This section of the report indicates the design totals for the entire field or all sections.

Information	Explanation
Area	Measurement of the area in which the cut/fill will occur (whether a section or an entire field)
Cut	Quantity of material to remove
Fill	Quantity of material to fill
Total Moved	Total amount of material moved
Moved per Area	Total amount of material moved compared to the total area of the section or field
Import	Volume of soil to be imported to complete the design (if applicable)
Export	Volume of soil to be exported to complete the design (if applicable)

Volumes

This section of the report indicates the volumes for the entire field or all sections.

Information	Explanation
Type	
Cut/Fill Ratio	The cut/fill ratio
Shrinkage %	Percentage of shrinkage

Information	Explanation
Haul Bulkage %	Percentage of the increase in volume of soil due to expansion and loosening occurring as a result of its excavation
Haul Compaction %	Percentage of the decrease in volume of soil from its loose haulage or stockpiled state to its compacted state where it is placed

Sections

This section of the report indicates the information for each section.

Information	Explanation
Name	Name of the section
Area	Area of the section
Cut	Quantity of material to remove for the section
Fill	Quantity of material to fill for the section
Cut per Area	Total amount of material moved compared to the total area of the section or field
Primary Slope	Degrees and direction of primary slope
Cross Slope	Degrees and direction of cross slope
Composite Slope	Degrees and direction of composite slope

Proposed Design Report

The Proposed Design Report type shows a 3D view of the design or design version.

When you are in this report type, the mouse pointer changes to




.

Constraints

Volume constraints



Constraint	Explanation
(Type of volume)	<p>Balanced: The volume of soil removed and replaced remains the same.</p> <p>Import: The volume of soil added is greater than what is currently there.</p> <p>Export: The volume of soil removed is greater than what is currently there.</p> <p>Free: Optimized surface without an import, export or balance constraints</p>
Cut/Fill	Ratio of cut to fill volume for balancing the field design.

Slope Constraints






Constraint	Explanation
Main Slope	<p>Downhill Direction  : Degrees of downhill direction. Enter the degrees or use your mouse to move the direction arrow.</p> <p>Slope: Percentage of slope</p>
Cross Slope	<p>Percentage of cross slope.</p> <p>Downhill Direction: Click the arrow to toggle the direction of the cross slope.</p>

Controls and indicators






Control / Indicator	Explanation
Show Original	When checked, the view shows the original design
Show Proposed	When checked, the view shows the proposed design
Vertical Exaggeration	Moving up and down on this scale changes the exaggeration of the elevation

Control / Indicator	Explanation
	Indicates the position of the current view
	Indicates the position of the current view. T = Top view B = Bottom view E = East N = North S = South W = West

View controls

View Control	Click to...
 Pan	Move the field around in the view.
 Zoom	Enable zooming, then zoom in or out with the mouse wheel.
 Zoom to Area	Enable zoom area. After clicking, outline an area on the report to zoom in.
 Zoom to Fit	Zoom to fit. Zooms view to fill the window.
 View Top	Moves the design view to a view from directly above.

Export, copy and sync controls

Design Control	Explanation
 Export	Click to export to a Trimble display.
 Export	Click to export to Sketchup or Sketchup Pro 2014 or higher.
 Not in Sync	Indicates the perspective and zoom level for each version of the design are not in sync.
 Sync	Indicates the perspective and zoom level for each version of the design are the same. See Design versions, 37 .
 Not in Sync	Indicates the perspective and zoom level for each version of the design are not in sync.

Quote Report


This report provides information on how much soil to move and a rough estimate.

Constraints

Volume constraints

Constraint	Explanation
(Type of volume)	<p>Balanced: The volume of soil removed and replaced remains the same.</p> <p>Import: The volume of soil added is greater than what is currently there.</p> <p>Export: The volume of soil removed is greater than what is currently there.</p> <p>Free: Optimized surface without an import, export or balance constraints</p>
Cut/Fill	Ratio of cut to fill volume for balancing the field design.

Slope Constraints

Constraint	Explanation
Main Slope	<p>Downhill Direction  : Degrees of downhill direction. Enter the degrees or use your mouse to move the direction arrow.</p> <p>Slope: Percentage of slope</p>
Cross Slope	<p>Percentage of cross slope.</p> <p>Downhill Direction: Click the arrow to toggle the direction of the cross slope.</p>

Report data

Information	Explanation
Graphic	Indicates approximate elevation of areas in the field or section
Area	Measurement of the area in which the cut/fill will occur (whether a section or an entire field)
Cut	Quantity of material to remove

Information	Explanation
Fill	Quantity of material to fill
Total Moved	Total amount of material moved
Moved per Area	Total amount of material moved compared to the total area of the section or field
Import	Volume of soil to be added to complete the design (if applicable)
Export	Volume of soil to be removed to complete the design (if applicable)

Set Fee control







To quickly calculate the fee, click

Set Fee Setting	Explanation
Fixed Fee	Enter the fee.
Calculated Fee	Enter the cost per volume.






The calculation shows in the Design Totals at the bottom of the report.

View controls

View Control	Click to...
	Move the field around in the view.
Pan	
	Enable zooming, then zoom in or out with the mouse wheel.
Zoom	
	Enable zoom area. After clicking, outline an area on the report to zoom in.
Zoom to Area	

View Control	Click to...
	Zoom to fit. Zooms view to fill the window.
Zoom to Fit	

Export, copy and sync controls

Design Control	Explanation
	Click to export to a Trimble display.
Export	
	Click to export to Sketchup or Sketchup Pro 2014 or higher.
	Click to create another version of the design currently in the design window. See Design versions, 37 .
New Version	
	Indicates the perspective and zoom level for each version of the design are not in sync.
Not in Sync	
	Indicates the perspective and zoom level for each version of the design are the same. See Design versions, 37 .
Sync	

User settings


In this chapter:

User settings	80
Folders settings	81
General settings	81
Materials unit settings	81
Reports settings	81
Units settings	82

With user settings, you can customize various aspects of WM-Form.

User settings



To access user settings, in the Project Management panel, click  to open the User Settings window.

You can edit:

- [Folders settings, 81](#)
- [General settings, 81](#)
- [Materials unit settings, 81](#)
- [Reports settings, 81](#)
- [Units settings, 82](#)

Folders settings

Select the **Folders** tab and set where you want projects and exported files to be stored.

General settings

Select the **General** tab and enter how close you want line segments to be on a design to allow the end of one line to snap to (join with) the end of another line.

Materials unit settings

Select the **Materials** tab and choose the units you want to display in the system.

Setting	Explanation
Use cut fill ratio	Check the box if you want to use cut/fill ratio for materials
Material volume property to automatically calculate	<p>Choose the property you want the system to automatically calculate:</p> <ul style="list-style-type: none"> Shrinkage: A measure of the decrease in volume of material as it is excavated and extracted from its original state and placed into compacted earth fill. Haul Bulkage: A measure of the increase in volume of soil due to expansion and loosening occurring as a result of its excavation. Haul Compaction: A measure of the decrease in volume of soil from its loose haulage or stockpiled state to its compacted state where it is placed.
Show Cut/Fill volume as	<p>Choose whether you want the cut/fill volume to display as either:</p> <ul style="list-style-type: none"> Bank Volumes: The volume calculated by multiplying loose volume and the load factor. Loose Haul Volumes: The density state of soil after having been excavated and loosely placed into a stockpile, or into some container for the purpose of transporting it from one location to another. <p>Note – Cut/fill ratio and bank volumes are standards of the Agriculture industry.</p>

Reports settings

Select the **Reports** tab. To customize the report, enter text for:

- Title Line1
- Title Line2
- Title Line3
- Title Line4
- Title Line6

Browse to find an image file to enter for the Title Logo File.

Units settings

Select the Units tab and choose the units you want to display in the system.

Setting	Available Units
Area	The unit used for area measurement: <ul style="list-style-type: none"> • Acres - (ac) • Square Feet - (ft2) • Square Meters - (m2) • Hectares - (ha)
Distance	The unit used for distance: <ul style="list-style-type: none"> • International Feet - (ft) • Meters - (m)
Depth	The unit used for depth: <ul style="list-style-type: none"> • International Feet - (ft) • Inches - (in) • Centimeters - (cm)
Volume	The unit used for volume: <ul style="list-style-type: none"> • Cubic - (ft3) • Cubic Yards - (yd3) • Cubic meters - (m3)

Glossary

B

Bank

The condition of the soil in a natural state before it is disturbed.

Bank volume

The volume calculated by multiplying [loose volume](#) and the [load factor](#).

Benchmark

A permanent reference point on the field that relates to the master benchmark. There can be multiple benchmarks to a field. You can rename any benchmark except for the master benchmark.

Boundary

A boundary is a closed set of at least three line segments to form an enclosed area.

Break line

A line or polyline indicating where a change in the topography of a surface occurs. Break lines are used to create or edit surfaces so that the surfaces accurately reflect actual or design topography.

Bulkage

The increase in volume and decrease in density of soil or other material due to expansion. Bulkage is a common result when soil's original density is excavated from a job site and moved elsewhere.

C

Compaction

The process of using weight to compress soil to increase its density.

Compound slope

The compound slope tells you how much a plane tilts in both directions and is the true direction of fall.

Contour line

A set of lines on a topographic image that remain at the same elevation. Contour lines are derived from points that make up a surface. If you walk along a contour line you will remain at the same height and neither go uphill nor downhill.

Constraint

A parameter that is edited to change the design.

Cross slope

The cross slope is always perpendicular to the primary slope. For example, if a field is furrowed, the cross slope is the slope of the field across the furrows.

Cut

A cut is a point on the field where soil needs to be removed. A cut occurs when the existing area is higher than the proposed area surface.

Cut/fill map

A map with shading and/or a grid of measurements at an interval showing the elevation differences between two surfaces, such as an original ground surface and a design surface. Cut/fill maps are color-coded to indicate where earth needs to be cut or filled.

Cut/fill ratio

The cut/fill ratio is the amount of cut dirt that equals one volume of fill dirt. This ratio takes into account the amount of expansion or contraction that results when the dirt is cut.

Cut sheet

A report that shows visual points for cut/fill values and the design elevations.

D

Design surface

The intended surface that was designed, meaning the final surface after all earthworks have been completed.

E

Exclusion zone

A shape (polygon) that can exist anywhere on a field that is not used for design and not included in design calculations.

F

Field

An area of land area that is the focus of a particular design or area of work.

Fill

A point on the field where dirt must be added. A fill occurs when the existing area is lower than the proposed area surface.

Flow arrow

Flow arrows indicate the direction in which the water flows freely on a surface.

Furrow

Furrows are small, parallel channels made to carry water in order to irrigate the crop.

Furrow arrows

Arrows on the design that indicate the flow of irrigation water.

H

Haul bulkage

A measure of the increase in volume of soil due to expansion and loosening occurring as a result of its excavation.

Haul compaction

A measure of the decrease in volume of soil from its loose haulage or stockpiled state to its compacted state where it is placed.

Hinge line

A line segment used within the software to join fields/areas that are adjacent to each other in reality. A hinge line begins and ends on a boundary of a field or section area. Hinge lines are used in land leveling. A hinge line is a 2-point line that divides a field into two portions. These portions fold along the hinge.

I

Interior point

A point inside the field boundary.

L

Land forming

A type of design that smooths the land surface so that no areas of the field have an area steep enough to cause erosion and no areas too flat to cause ponding.

Land leveling

A type of design that shapes the land surface using large flat planes. These planes are inclined to drain water off the field to prevent ponding.

Load factor

An amount used to calculate bank volume. The load factor is calculated by dividing the loose volume by the bank density.

Loose volume

The density state of soil after having been excavated and loosely placed into a stockpile, or into some container for the purpose of transporting it from one location to another.

M

Master benchmark

A point at a known location in the field to which all other benchmarks are related. There can only be one master benchmark per field.

O

Original surface

An imported surface (also referred to as topo or existing surface). This is the shape of the land before it is leveled or formed.

P

Point ID

Line numbers at the beginning of every line in the file.

Polyline

A line made up of more than one line segments joined end to end.

R

Row

Rows on each side of a ridge have the same orientation (water flowing into rows on one side will flow 180 degrees out of phase with the other side).

S

Section area

A shape that subdivides a field created by boundary edges, section line edges and / or exclusion zone edges. Fields are subdivided into section areas for convenience or to help influence the final design.

Section line

One or more connected line segments. Each segment has a starting point and an end point. Section lines are used to create section areas in a field.

Shrinkage

The decrease in volume of soil due to contraction, settling and compaction. Also a measure of the decrease in volume of material as it is excavated and extracted from its original state and placed into compacted earth fill.

Shrinkage percentage

The percentage that soil decreases in volume when it is compacted.

Slope

An inclination from the horizontal or inclined face of a cutting, canal or embankment. A measure of the steepness, incline, grade/gradient, or constant rate of elevation change, of a surface. A higher slope value indicates a steeper incline. Slope is normally described by the ratio of the "rise" divided by the "run" between two points on a line.

Survey point

Elevations are measured at specific locations across a field. The point measured will have a location (x,y) and an elevation (z). The collections of surveyed points will approximate the actual surface of the field. The more points the more accurate the approximation.

Surface

A collection of points with elevation that describe the extent and elevation characteristics of an area of land.

Swell percentage

The percentage that soil increases in volume when it is excavated.

T

Topography

Also referred to as "topo", the general configuration of the land surface including relief and position of natural and man made features.

V

Volumetric report

A report that summarizes the proposed design elements.

W

Watershed boundary

Line signifying the outer edge of a given watershed area.

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