Phone 563.556.8392
Toll-free 800.678.6565
Fax 563.556.5321
4131 Westmark Drive
Dubuque, IA 52002-2627
www.eaglepoint.com

# Eagle Point Solution to a Frequently Asked Question

**How to Design an Embankment with a Berm**

**Summary:**
This document explains the process of designing an embankment top, wave berm, core trench, and toes, and calculating earthwork volumes.

**Product:** Eagle Point Software™ 2002
**Release:** 2002 Q4 or 2.4.0 and greater
**Platform:** All
**Related documents:**



As always, should you have any questions regarding any phase of installation, contact Eagle Point Technical Assistance at (800) 477-0909.

**Notation Method**

Button to Press *Displayed Text* **Icon** Action {Text to Enter} *Menu Item…*

## Placing the Centerline & Top of Dam

1. In AutoCAD, click on the **Layer Manager Icon**.
2. Select the *C.Clin.Embk.New* layer. Set to Current.
3. Click OK close out of Layer Manager.
4. Click **Polyline** and draw a line that represents the centerline alignment for the embankment. This line is better if it is longer than the actual embankment.
5. From AutoCAD, click *NRCS/EP… Create Contours… Make User Defined…*.
6. Surface model should be Ognd. No checkmarks are usually used. Input the elevation for the end of the dam to tie into. E.g. {1104}.
7. Click Apply.
8. Input the elevation for the berm. E.g. {1099}.
9. Click Apply.
10. Click Close.
11. In AutoCAD, click on the **Layer Manager Icon**.
12. Select layers to freeze or turn off.
13. Select the *C.Plan.Embk* layer. Set to Current.
14. Click OK close out of Layer Manager.
15. Click AutoCAD's **Offset**. Input ½ of top width. E.g. {6}. Press Enter.
16. Select the line representing the centerline alignment. Press Enter.
17. Click on either side of the centerline.
18. Press Enter.
19. Click AutoCAD's **Trim**.
20. Select the contour line of the top of dam as the cutting edge. Press Enter.
21. Click to trim the ends of the line that goes past the contour. Press Enter.

22. Select the trimmed line. Right click and click *Properties*.
23. Pull down the layer to *C.Plan.Embk*.
24. From AutoCAD, click *NRCS/EP… Create Site Layout… 3D Feature Editor…*.
25. Select the trimmed line that is the edge of dam.
26. Input the correct end of dam elevation for point 1. E.g. {1104}.
27. Press Tab. Click the **Right Arrow**.
28. Input the correct end of dam elevation for point 2. E.g. {1104}.
29. Press Tab. Click the **Right Arrow**.
30. Add more points along the line to allow for more overfill at the deepest point. Click **Insert Points**.
31. Click *Divide into Segments*. Input number of segment desired. E.g. {3}.
32. Click Apply only once!
33. Click Close.
34. Click the **Right Arrow**.
35. Input the elevation of the new point 2 for the overfill. E.g. {1105.3}.
36. Press Tab. Click the **Right Arrow**.
37. Input the elevation of the new point 3 for the overfill. E.g. {1105.3}.
38. Press Tab.
39. Click Close.
40. From AutoCAD, click *NRCS/EP… Create Site Layout… 3D Offset…*.
41. Input the topwidth distance to offset. E.g. {12}.
42. Input the relative elevation {0}. Click Apply.
43. Select the embankment line by clicking near one end. When offset line is placed, it will be put on the right side of the line when looking towards the far end of the line if entered as {+12} or left side if entered as {–12}.
44. Click AutoCAD's **Extend**.
45. Select the top of dam contour line as the boundary edge. Press Enter.
46. Click the ends of the line to extend the contour. Press Enter.

**Placing the Toes and Pool Berm of the Dam**

1. From AutoCAD, click *NRCS/EP… Create Site Layout… Project Slopes to Surface Model…*.
2. Pull down to the original ground surface model name. E.g. {Ognd}.
3. Input the proper fill slope as a negative number. E.g. {-3} as H/V.
4. Uncheckmark *Erase all Existing Slope Projections…*.
5. Click Apply.
6. Select the downstream edge of the dam.
7. Click on the downstream side of the selected line.
8. Select the upstream edge of the dam.
9. Click on the upstream side of the selected line.
10. Press Enter.
11. Checkmark *Constant Elevation*. Input the Berm elevation. E.g. {1099}.
12. Click Apply.
13. Select the upstream edge of the dam.
14. Click on the upstream side of the selected line.
15. Press Enter. Click Close.
16. From AutoCAD, click *NRCS/EP… Create Site Layout… 3D Offset…*.
17. Input the pool berm width to offset. E.g. {10}.
18. Input the relative elevation {0}. Click Apply.
19. Select the catch line that was projected to the berm elevation by clicking near the left end of the dam.
20. Click Close.
21. Click AutoCAD's **Trim**.
22. Select the upstream toe catch line as the cutting edge. Press Enter.
23. Type E {Edge}. Type N {No Extend}.
24. Click to trim the ends of the pool berm catchline that goes past the toe. Press Enter.
25. Click AutoCAD's **Trim**.
26. Select the trimmed downstream edge of the pool berm as the cutting edge. Press Enter.

27. Click to trim the portion of the toe upstream of the pool berm. Press Enter.
28. Select the upstream slope projection lines that go upstream of the toe or downstream pool berm line. Press Delete.
29. From AutoCAD, click *NRCS/EP… Create Site Layout… Project Slopes to Surface Model…*.
30. Pull down to the original ground surface model name. E.g. {Ognd}.
31. Input the proper fill slope as a negative number. E.g. {-3} as H/V.
32. Uncheckmark *Constant Elevation* and *Erase all Existing Slope Projections…*.
33. Click Apply.
34. Select the upstream edge of the pool berm.
35. Click on the upstream side of the selected line.
36. Press Enter. Click Close.
37. When slope lines look correct, select all of the slope projection lines and change their layer property to *C.Topo.Embk.Slop*.

**Making the Outside Toes of the Dam into One Object**

1. Select all of the lines that represent the edges of the berms and the toe or top of dam. Right click.
2. Click *Properties*. Pull down the layer to *C.Plan.Embk*.
3. Press Esc.
4. In AutoCAD, click on the **Layer Manager Icon**.
5. Turn off or freeze layers so that only the *C.Plan.Embk* lines show.
6. Click OK close out of Layer Manager.
7. Click AutoCAD **3D Polyline**. **Draw** in lines that close the ends of the dam and wave berm (use Osnaps settings with endpoints).
8. From AutoCAD, click *NRCS/EP… Create Site Layout… 3D Join…*.
9. Select the lines representing the toes where the dam meets the original ground. Press Enter.
10. Select the toe to see if has all become one 3D Polyline. If not ends grips may need to be re-snapped to ends of adjoining lines.

**Preparing Surface Model Settings for the Embankment**

1. From AutoCAD, click *NRCS/EP… Create Contours… Manage Surface Model…*.
2. Click the **New Surface Model Icon**. This brings up New Surface Model box.
3. Click on the **Library icon** (looks like books on a shelf) and select the *Embankment* surface model. Click Load Prototype. Click Yes. Click Close.
4. Input a Description name. E.g. {Embk}, which would represent embankment.
5. Once you have settings done click OK.
6. Click Close to close out Manage Surface Models.

**Creating a Surface Model for the Embankment**

1. From AutoCAD, click *NRCS/EP… Create Contours… Triangulate Surface Model…*.
2. Pull down the name. E.g. *Embk*.
3. Pull down to set boundary line to *Select*.
4. Place a checkmark by *Display Model* if you want to see a temporary set of triangulation. Place a checkmark by *Place Triangles* if you want to have triangulation objects placed into the drawing.
5. Click Apply.
6. Use AutoCAD selection methods to pick the objects to triangulate. One way to do this is by drawing a selection window. Once objects are selected press the Enter key.
7. The command line should now ask you to select boundary. Select boundary by clicking with your mouse the toe of the dam.
8. Click Close on the Triangulate Surface Model.
9. From AutoCAD, click *NRCS/EP… Create Contours… Triangulate Surface Model…*.

**Verifying the Embankment Surface Model**

1. From AutoCAD, click *NRCS/EP… Create Contours… Make Intermediate & Index…*.
2. Verify the surface model name *Embk*.

3. Usually no checkmarks are place in any of the boxes.
4. Click Apply Contours will appear in CAD.
5. Click Close.
6. Review the contours to determine whether the surface model is correct.
7. From AutoCAD, click *NRCS/EP… Create Contours…Track Coordinates…*.
8. Verify the surface model name *Embk*.
9. Click Apply.
10. Move cursor around in CAD and elevations will be displayed.
11. Click Close.
12. From AutoCAD, click *NRCS/EP… Create Contours… Erase Existing Objects…*.
13. Checkmark *Contours* and any other items that have been placed into CAD. Click Apply. Click Close.

**Computing the Earthfill Volume for the Embankment**

1. From AutoCAD, click *NRCS/EP… Volumes… Calculate Prismoidal…*.
2. Pull down original surface model to *Ognd*.
3. Pull down final surface model to *Embk*.
4. Click Apply. Click the **Printer Icon** to print.
5. When done click Close.

**Computing the Earthfill Volume for the Embankment and Stripping**

1. From AutoCAD, click *NRCS/EP… Create Contours… Manage Surface Model…*.
2. Highlight *Ognd* surface model.
3. Click the **Copy Surface Model Icon**.
4. Checkmark *Displacemet Elevation*.
5. Input the stripping depth as a negative number. E.g. {-0.5}.
6. Input a name for the stripping depth. E.g. {Strp}.
7. Click the **Properties Icon**.
8. Pull down the surface model name between *Ognd* and *Strp* to verify that stripping is lower than the original ground. Click Close.
9. Click the **Modify Surface Model Icon**.
10. Click on the **Library icon** (looks like books on a shelf) and select the *Stripping* surface model. Click Load Prototype. Click Yes. Click Close.
11. Once you have settings done click OK.
12. Click Close to close out Manage Surface Models.
13. From AutoCAD, click *NRCS/EP… Volumes… Calculate Prismoidal…*.
14. Pull down original surface model to *Strp*.
15. Pull down final surface model to *Embk*.
16. Click Apply. Click the **Printer Icon** to print.
17. When done click Close.

**Core Trench Layout and Volumes**

**Creating the Core Trench Bottom Width and Catchlines**

1. Make sure that layers with the centerline of dam and user defined contour of the pool elevation are turned on and thawed.
2. From AutoCAD, click *NRCS/EP… Create Site Layout… Project Plan Objects…*.
3. Pull down to the original ground surface model name. E.g. {Ognd}.
4. Checkmark *Make Copy of Object…*.
5. Click Apply.
6. Select the centerline of the dam.
7. Press Enter.
8. Click Close.
9. Click AutoCAD's **Trim**.

10. Select the pool elevation line as the cutting edge. Press Enter.
11. Type E {Edge}. Type N {No Extend}.
12. Click to trim the ends of the core trench line that goes above the pool elevation. Press Enter.
13. From AutoCAD, click *NRCS/EP… Create Site Layout… 3D Offset…*.
14. Input ½ of the core trench bottom width to offset. E.g. {6}.
15. Input the relative elevation {-4}. Click Apply.
16. Select the trimmed CL of core trench near the left end.
17. Click Apply.
18. Select the trimmed CL of core trench near the right end.
19. Click Close.
20. Click the AutoCAD **3D Polyline Icon**.
21. Snap to the left end of the upstream core line (use Osnaps settings with endpoints).
22. Snap to the left end of the downstream core line. Press Enter.
23. Press Enter.
24. Snap to the right end of the upstream core line.
25. Snap to the right end of the downstream core line. Press Enter.
26. Select all of the lines that represent the edges of the core bottom. Right click.
27. Click *Properties*. Pull down the layer to *C.Topo.Cort.Feat*.
28. Press Esc.
29. Set the Current layer to *C.Topo.Cort.Feat*.
30. From AutoCAD Click *NRCS/EP… Create Site Layout… 3D Join…*.
31. Select the lines representing the core trench bottom. Press Enter.
32. Select the line to see if has all become one 3D Polyline. If not, endpoint grips may need to be re-snapped to ends of adjoining lines.
33. From AutoCAD, click *NRCS/EP… Create Site Layout… Project Slopes to Surface Model…*.
34. Pulldown to the original ground surface model name. E.g. {Ognd}.
35. Input the proper cut slope as a positive number. E.g. {1.5} as H/V.
36. Uncheckmark *Constant Elevation* and *Erase all Existing Slope Projections…*.
37. Click Apply.
38. Select the core trench.
39. Click on the outside of the selected line.
40. Press Enter. Click Close.
41. When slope lines look correct, select all of the slope projection lines and change their layer property to *C.Topo.Cort.Slop*.

**Preparing Surface Model Settings for the Core Trench**

1. From AutoCAD, click *NRCS/EP… Create Contours… Manage Surface Model…*.
2. Click the **New Surface Model Icon**. This brings up New Surface Model box.
3. Click on the **Library icon** (looks like books on a shelf) and select the *Core Trench* surface model. Click Load Prototype. Click Yes. Click Close.
4. Input a Description name. E.g. {Core}, which would represent the core trench.
5. Once you have settings done click OK.
6. Click Close to close out Manage Surface Models.

**Creating a Surface Model for the Core Trench**

1. From AutoCAD, click *NRCS/EP… Create Contours… Triangulate Surface Model…*.
2. Pull down the name - for example *Core*.
3. Pull down to set boundary line to *Select*.
4. Place a checkmark by *Display Model* if you want to see a temporary set of triangulation. Place a checkmark by *Place Triangles* if you want to have triangulation objects placed into the drawing.
5. Click Apply.
6. Use AutoCAD selection methods to pick the objects to triangulate. One way to do this is by drawing a selection window. Once objects are selected press the Enter key.

7. The command line should now ask you to select boundary. Select boundary by clicking with your mouse on the line that is the toe of the core trench.
8. Click Close on the Triangulate Surface Model.

**Verifying the Core Trench Surface Model**

1. From AutoCAD, click *NRCS/EP… Create Contours… Make Intermediate & Index…*.
2. Verify the surface model name *Core*.
3. Usually no checkmarks are place in any of the boxes.
4. Click Apply. Contours will appear in CAD.
5. Click Close.
6. Review the contours to determine whether the surface model is correct.
7. From AutoCAD, click *NRCS/EP… Create Contours…Track Coordinates…*.
8. Verify the surface model name *Core*.
9. Click Apply.
10. Move cursor around in CAD and elevations will be displayed.
11. Click Close.
12. From AutoCAD, click *NRCS/EP… Create Contours… Erase Existing Objects…*.
13. Checkmark *Contours* and any other items that have been placed into CAD. Click Apply. Click Close.

**Computing the Earthwork Volume for the Core Trench**

1. From AutoCAD, click *NRCS/EP… Volumes… Calculate Prismoidal…*.
2. Pull down stripping surface model to *Strp*.
3. Pull down final surface model to *Core*.
4. Click Apply. Click the **Printer Icon** to print.
5. When done click Close.

*Submitted by Norman Friedrich.*