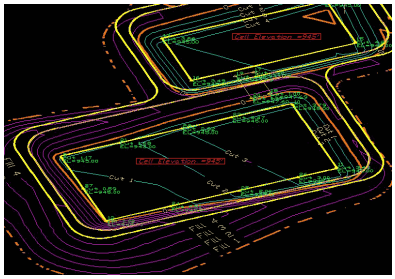
Cut and Fill Calculations

Calculation of the cut-and-fill volumes is an essential component to any site development project



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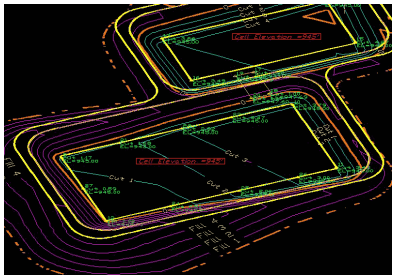
Cut and Fill Calculations

In addition, the computation of the compacted fill and the pond volume is essential.



2

Cut and Fill Calculations

- Compute the total cut-and-fill for the following site
- The original elevations are:

Cut and Fill Example
Rectangular Grid

x grid spacing = 10.0 ft
y grid spacing = 10.0 ft

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
2	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
3	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
4	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
5	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
6	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
7	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
8	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
9	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
10	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
11	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
12	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
13	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
14	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
15	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
16	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
17	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
18	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
19	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
20	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101

3

Cut and Fill Calculations

- Compute the total cut-and-fill for the following site
- The proposed elevations are:

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
2	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
3	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
4	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
5	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
6	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
7	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
8	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
9	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
10	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
11	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
12	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
13	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
14	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
15	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
16	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
17	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
18	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
19	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
20	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101

- With 10 ft. grid cells, the maximum outside slope (3:1) change per cell is 3.33 ft.

4

Cut and Fill Calculations

- Compute the total cut-and-fill for the following site
- The proposed elevations are:

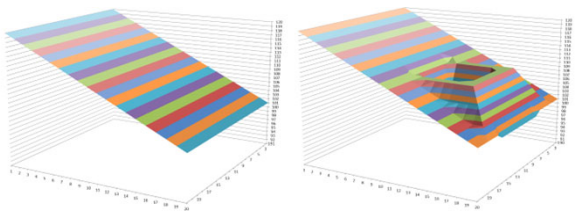
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
2	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
3	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
4	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103.3	103.3	101
5	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106.6	106.6	106.6	106.6	103.3	101
6	120	119	118	117	116	115	114	113	112	111	110	110	110	110	110	110	110	106.6	103.3	101
7	120	119	118	117	116	115	114	113	112	110	110	110	110	110	110	110	110	106.6	103.3	100
8	120	119	118	117	116	115	114	113	112	110	105	105	105	105	105	110	110	106.6	103.3	100
9	120	119	118	117	116	115	114	113	112	110	105	103	103	103	105	110	110	106.6	103.3	100
10	120	119	118	117	116	115	114	113	112	110	105	103	103	103	105	110	110	106.6	103.3	100
11	120	119	118	117	116	115	114	113	112	110	105	103	103	103	105	110	110	106.6	103.3	100
12	120	119	118	117	116	115	114	113	112	110	105	103	103	103	105	110	110	106.6	103.3	100
13	120	119	118	117	116	115	114	113	112	110	105	105	105	105	105	110	110	106.6	103.3	100
14	120	119	118	117	116	115	114	113	112	110	110	110	110	110	110	110	110	106.6	103.3	100
15	120	119	118	117	116	115	114	113	112	111	110	110	110	110	110	110	110	106.6	103.3	100
16	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106.6	106.6	106.6	106.6	103.3	101
17	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103.3	103.3	101
18	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
19	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
20	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101

- With 10 ft. grid cells, the maximum inside slope (2:1) change per cell is 5 ft.

5

Cut and Fill Calculations

Below is an Excel plot of the original elevations and the proposed elevations



6

Cut and Fill Calculations

To compute the cut-and-fill, compute the change in elevations (original elevations minus proposed elevations gives).

(+) indicates cut
(-) indicates fill

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.3	-1.3	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.6	-1.6	-2.6	-3.6	-1.3	0	
6	0	0	0	0	0	0	0	0	0	0	0	-1	-2	-3	-4	-5	-6	-3.6	-1.3	0
7	0	0	0	0	0	0	0	0	0	1	0	-1	-2	-3	-4	-5	-6	-3.6	-1.3	1
8	0	0	0	0	0	0	0	0	0	1	5	4	3	2	1	-5	-6	-3.6	-1.3	1
9	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5	-6	-3.6	-1.3	1
10	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5	-6	-3.6	-1.3	1
11	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5	-6	-3.6	-1.3	1
12	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5	-6	-3.6	-1.3	1
13	0	0	0	0	0	0	0	0	0	1	5	4	3	2	1	-5	-6	-3.6	-1.3	1
14	0	0	0	0	0	0	0	0	0	0	-1	-2	-3	-4	-5	-6	-3.6	-1.3	1	
15	0	0	0	0	0	0	0	0	0	0	-1	-2	-3	-4	-5	-6	-3.6	-1.3	1	
16	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.6	-1.6	-2.6	-3.6	-1.3	0	
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.3	-1.3	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

7

Cut and Fill Calculations

To account for compaction, increase the amount of material required for the fill areas

(+) indicates cut
(-) indicates fill

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

8

Cut and Fill Calculations

To account for compaction, increase the amount of material required for the fill areas

(+) indicates cut
(-) indicates fill

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.3	-1.3	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.6	-1.6	-2.6	-3.6	-1.3	0
6	0	0	0	0	0	0	0	0	0	0	0	-1	-2	-3	-4	-5	-6	-3.6	-1.3	0
7	0	0	0	0	0	0	0	0	0	1	0	-1	-2	-3	-4	-5	-6	-3.6	-1.3	1
8	0	0	0	0	0	0	0	0	0	1	5	4	3	2	1	-5	-6	-3.6	-1.3	1
9	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5	-6	-3.6	-1.3	1
10	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5	-6	-3.6	-1.3	1
11	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5	-6	-3.6	-1.3	1
12	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5	-6	-3.6	-1.3	1
13	0	0	0	0	0	0	0	0	0	1	5	4	3	2	1	-5	-6	-3.6	-1.3	1
14	0	0	0	0	0	0	0	0	0	0	-1	-2	-3	-4	-5	-6	-3.6	-1.3	1	
15	0	0	0	0	0	0	0	0	0	0	-1	-2	-3	-4	-5	-6	-3.6	-1.3	1	
16	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.6	-1.6	-2.6	-3.6	-1.3	0	
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.3	-1.3	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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Cut and Fill Calculations

If the change in elevation is negative, then increase the fill depth:

Compaction Factor = 15%

$$fill\ depth_{compacted} = \frac{fill\ depth}{1-(\%compaction)}$$

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.35	-1.53	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.71	-1.88	-3.06	-4.24	-1.53	0
6	0	0	0	0	0	0	0	0	0	0	0	-1.18	-2.35	-3.53	-4.71	-5.88	-7.06	-4.24	-1.53	0
7	0	0	0	0	0	0	0	0	0	1	0	-1.18	-2.35	-3.53	-4.71	-5.88	-7.06	-4.24	-1.53	1
8	0	0	0	0	0	0	0	0	0	1	5	4	3	2	1	-5.88	-7.06	-4.24	-1.53	1
9	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5.88	-7.06	-4.24	-1.53	1
10	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5.88	-7.06	-4.24	-1.53	1
11	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5.88	-7.06	-4.24	-1.53	1
12	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5.88	-7.06	-4.24	-1.53	1
13	0	0	0	0	0	0	0	0	0	1	5	4	3	2	1	-5.88	-7.06	-4.24	-1.53	1
14	0	0	0	0	0	0	0	0	0	0	-1.18	-2.35	-3.53	-4.71	-5.88	-7.06	-4.24	-1.53	1	
15	0	0	0	0	0	0	0	0	0	0	-1.18	-2.35	-3.53	-4.71	-5.88	-7.06	-4.24	-1.53	1	
16	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.71	-1.88	-3.06	-4.24	-1.53	0	
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.35	-1.53	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

10

Cut and Fill Calculations

Compute the cut and fill volumes.

$$Volume_{pond\ cell} = \frac{0+0+0+0}{4}(10\,\text{ft.})(10\,\text{ft.}) = 0\,\text{ft.}^3$$

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.35	-1.53	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.71	-1.88	-3.06	-4.24	-1.53	0
6	0	0	0	0	0	0	0	0	0	0	0	-1.18	-2.35	-3.53	-4.71	-5.88	-7.06	-4.24	-1.53	0
7	0	0	0	0	0	0	0	0	0	1	0	-1.18	-2.35	-3.53	-4.71	-5.88	-7.06	-4.24	-1.53	1
8	0	0	0	0	0	0	0	0	0	1	5	4	3	2	1	-5.88	-7.06	-4.24	-1.53	1
9	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5.88	-7.06	-4.24	-1.53	1
10	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5.88	-7.06	-4.24	-1.53	1
11	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5.88	-7.06	-4.24	-1.53	1
12	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5.88	-7.06	-4.24	-1.53	1
13	0	0	0	0	0	0	0	0	0	1	5	4	3	2	1	-5.88	-7.06	-4.24	-1.53	1
14	0	0	0	0	0	0	0	0	0	0	-1.18	-2.35	-3.53	-4.71	-5.88	-7.06	-4.24	-1.53	1	
15	0	0	0	0	0	0	0	0	0	0	-1.18	-2.35	-3.53	-4.71	-5.88	-7.06	-4.24	-1.53	1	
16	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.71	-1.88	-3.06	-4.24	-1.53	0	
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.35	-1.53	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

11

Cut and Fill Calculations

Compute the cut and fill volumes.

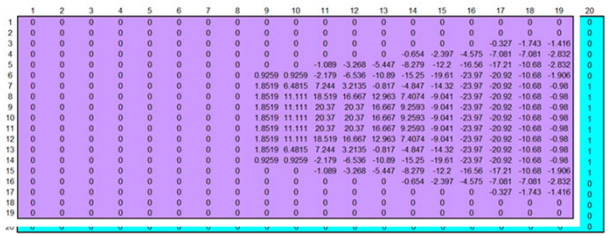
$$Volume_{pond\ cell} = \frac{-1.18-2.35-2.35-1.18}{4}(10\,\text{ft.})(10\,\text{ft.}) = 6.536\,\text{yd.}^3$$

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.35	-1.53	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.71	-1.88	-3.06	-4.24	-1.53	0
6	0	0	0	0	0	0	0	0	0	0	0	-1.18	-2.35	-3.53	-4.71	-5.88	-7.06	-4.24	-1.53	0
7	0	0	0	0	0	0	0	0	0	1	0	-1.18	-2.35	-3.53	-4.71	-5.88	-7.06	-4.24	-1.53	1
8	0	0	0	0	0	0	0	0	0	1	5	4	3	2	1	-5.88	-7.06	-4.24	-1.53	1
9	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5.88	-7.06	-4.24	-1.53	1
10	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5.88	-7.06	-4.24	-1.53	1
11	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5.88	-7.06	-4.24	-1.53	1
12	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5.88	-7.06	-4.24	-1.53	1
13	0	0	0	0	0	0	0	0	0	1	5	4	3	2	1	-5.88	-7.06	-4.24	-1.53	1
14	0	0	0	0	0	0	0	0	0	0	-1.18	-2.35	-3.53	-4.71	-5.88	-7.06	-4.24	-1.53	1	
15	0	0	0	0	0	0	0	0	0	0	-1.18	-2.35	-3.53	-4.71	-5.88	-7.06	-4.24	-1.53	1	
16	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.71	-1.88	-3.06	-4.24	-1.53	0	
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.35	-1.53	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

12

Cut and Fill Calculations

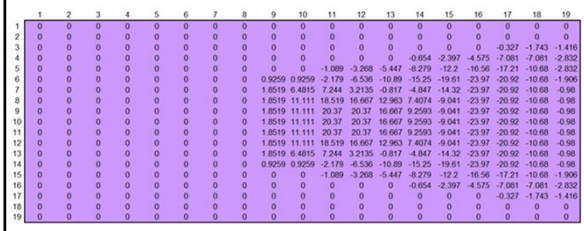
Compute the cut and fill volumes.



13

Cut and Fill Calculations

- Sum all the positive volumes to determine the total cut and sum all the negative volumes to determine the total fill.
- Use the Excel SUMIF functions



14

Cut and Fill Calculations

Excel SUMIF function:

- **SUMIF**(***range***, ***criteria***, *sum_range*)
- ***range*** is the range of cells you want evaluated
- ***criteria*** is the criteria in the form of a number, expression, or text that defines which cells will be added. For example, criteria can be expressed as 32, "32", ">32", "apples“
- *sum_range* are the actual cells to sum (not required)

15

Cut and Fill Calculations

In our work, the following uses of SUMIF are important:

- **SUMIF(B7:T25,">0")**

  Sum the values in cells B7:T25 if the values are greater than zero (positive volumes)

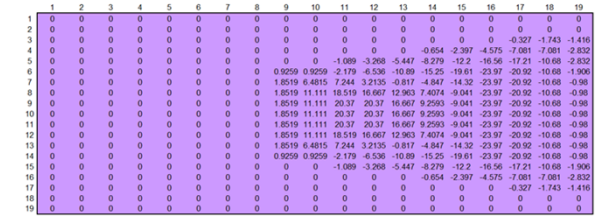
- **SUMIF(B7:T25,“<0")**

  Sum the values in cells B7:T25 if the values are less than zero or (negative volumes)

16

Cut and Fill Calculations

- Sum all the positive volumes to determine the total cut and sum all the negative volumes to determine the total fill.

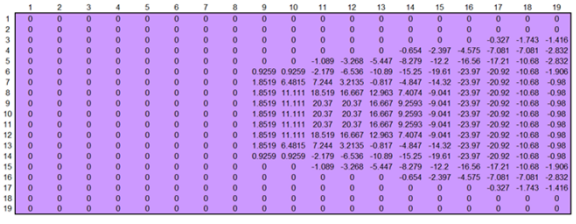


Total Cut =	417	yd³
Total Fill =	-914	yd³

17

Cut and Fill Calculations

- Sum all the positive volumes to determine the total cut and sum all the negative volumes to determine the total fill.



Total Cut =	417	yd³
Total Fill =	-914	yd³

18

Cut and Fill Calculations

Compute the cost of the cut-and-fill:
on-site cost is [total cut -total fill]*on-site cost ($2.50/ yd.^{3})

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.327	-1.743	-1.416
4	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.654	-2.397	-4.575	-7.081	-7.081	-2.832
5	0	0	0	0	0	0	0	0	0	0	-1.089	-3.268	-5.447	-8.279	-12.2	-16.56	-17.21	-10.68	-2.832
6	0	0	0	0	0	0	0	0	0.9259	0.9259	-2.179	-6.536	-10.89	-15.25	-19.61	-23.97	-20.92	-10.68	-1.906
7	0	0	0	0	0	0	0	0	1.8519	6.4815	7.244	3.2135	-0.817	-4.847	-14.32	-23.97	-20.92	-10.68	-0.98
8	0	0	0	0	0	0	0	0	1.8519	11.111	18.519	16.667	12.963	7.4074	-9.041	-23.97	-20.92	-10.68	-0.98
9	0	0	0	0	0	0	0	0	1.8519	11.111	20.37	20.37	16.667	9.2593	-9.041	-23.97	-20.92	-10.68	-0.98
10	0	0	0	0	0	0	0	0	1.8519	11.111	20.37	20.37	16.667	9.2593	-9.041	-23.97	-20.92	-10.68	-0.98
11	0	0	0	0	0	0	0	0	1.8519	11.111	20.37	20.37	16.667	9.2593	-9.041	-23.97	-20.92	-10.68	-0.98
12	0	0	0	0	0	0	0	0	1.8519	11.111	18.519	16.667	12.963	7.4074	-9.041	-23.97	-20.92	-10.68	-0.98
13	0	0	0	0	0	0	0	0	1.8519	6.4815	7.244	3.2135	-0.817	-4.847	-14.32	-23.97	-20.92	-10.68	-0.98
14	0	0	0	0	0	0	0	0	0.9259	0.9259	-2.179	-6.536	-10.89	-15.25	-19.61	-23.97	-20.92	-10.68	-0.98
15	0	0	0	0	0	0	0	0	0	0	-1.089	-3.268	-5.447	-8.279	-12.2	-16.56	-17.21	-10.68	-1.906
16	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.654	-2.397	-4.575	-7.081	-7.081	-2.832
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.327	-1.743	-1.416
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Total Cut = 417 yd^3
Total Fill = -914 yd^3

On-site Costs	Off-site Costs	Erosion	Total Costs
$ 3,328.70			

19

Cut and Fill Calculations

Compute the cost of the cut-and-fill:
IF [(cut + fill)>0, (cut + fill)*$3/yd.^{3}, |cut + fill|*$5/yd.^{3}]

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.327	-1.743	-1.416
4	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.654	-2.397	-4.575	-7.081	-7.081	-2.832
5	0	0	0	0	0	0	0	0	0	0	-1.089	-3.268	-5.447	-8.279	-12.2	-16.56	-17.21	-10.68	-2.832
6	0	0	0	0	0	0	0	0	0.9259	0.9259	-2.179	-6.536	-10.89	-15.25	-19.61	-23.97	-20.92	-10.68	-1.906
7	0	0	0	0	0	0	0	0	1.8519	6.4815	7.244	3.2135	-0.817	-4.847	-14.32	-23.97	-20.92	-10.68	-0.98
8	0	0	0	0	0	0	0	0	1.8519	11.111	18.519	16.667	12.963	7.4074	-9.041	-23.97	-20.92	-10.68	-0.98
9	0	0	0	0	0	0	0	0	1.8519	11.111	20.37	20.37	16.667	9.2593	-9.041	-23.97	-20.92	-10.68	-0.98
10	0	0	0	0	0	0	0	0	1.8519	11.111	20.37	20.37	16.667	9.2593	-9.041	-23.97	-20.92	-10.68	-0.98
11	0	0	0	0	0	0	0	0	1.8519	11.111	20.37	20.37	16.667	9.2593	-9.041	-23.97	-20.92	-10.68	-0.98
12	0	0	0	0	0	0	0	0	1.8519	11.111	18.519	16.667	12.963	7.4074	-9.041	-23.97	-20.92	-10.68	-0.98
13	0	0	0	0	0	0	0	0	1.8519	6.4815	7.244	3.2135	-0.817	-4.847	-14.32	-23.97	-20.92	-10.68	-0.98
14	0	0	0	0	0	0	0	0	0.9259	0.9259	-2.179	-6.536	-10.89	-15.25	-19.61	-23.97	-20.92	-10.68	-0.98
15	0	0	0	0	0	0	0	0	0	0	-1.089	-3.268	-5.447	-8.279	-12.2	-16.56	-17.21	-10.68	-1.906
16	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.654	-2.397	-4.575	-7.081	-7.081	-2.832
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.327	-1.743	-1.416
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Total Cut = 417 yd^3
Total Fill = -914 yd^3

On-site Costs	Off-site Costs	Erosion	Total Costs
$ 3,328.70	$ 2,485.29		

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Cut and Fill Calculations

- Compute erosion cost, count every cell with cut or fill.
- Use COUNTIF() * cell area * $0.25.ft^2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.327	-1.743	-1.416
4	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.654	-2.397	-4.575	-7.081	-7.081	-2.832
5	0	0	0	0	0	0	0	0	0	0	-1.089	-3.268	-5.447	-8.279	-12.2	-16.56	-17.21	-10.68	-2.832
6	0	0	0	0	0	0	0	0	0.9259	0.9259	-2.179	-6.536	-10.89	-15.25	-19.61	-23.97	-20.92	-10.68	-1.906
7	0	0	0	0	0	0	0	0	1.8519	6.4815	7.244	3.2135	-0.817	-4.847	-14.32	-23.97	-20.92	-10.68	-0.98
8	0	0	0	0	0	0	0	0	1.8519	11.111	18.519	16.667	12.963	7.4074	-9.041	-23.97	-20.92	-10.68	-0.98
9	0	0	0	0	0	0	0	0	1.8519	11.111	20.37	20.37	16.667	9.2593	-9.041	-23.97	-20.92	-10.68	-0.98
10	0	0	0	0	0	0	0	0	1.8519	11.111	20.37	20.37	16.667	9.2593	-9.041	-23.97	-20.92	-10.68	-0.98
11	0	0	0	0	0	0	0	0	1.8519	11.111	20.37	20.37	16.667	9.2593	-9.041	-23.97	-20.92	-10.68	-0.98
12	0	0	0	0	0	0	0	0	1.8519	11.111	18.519	16.667	12.963	7.4074	-9.041	-23.97	-20.92	-10.68	-0.98
13	0	0	0	0	0	0	0	0	1.8519	6.4815	7.244	3.2135	-0.817	-4.847	-14.32	-23.97	-20.92	-10.68	-0.98
14	0	0	0	0	0	0	0	0	0.9259	0.9259	-2.179	-6.536	-10.89	-15.25	-19.61	-23.97	-20.92	-10.68	-0.98
15	0	0	0	0	0	0	0	0	0	0	-1.089	-3.268	-5.447	-8.279	-12.2	-16.56	-17.21	-10.68	-1.906
16	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.654	-2.397	-4.575	-7.081	-7.081	-2.832
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.327	-1.743	-1.416
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Total Cut = 417 yd^3
Total Fill = -914 yd^3

On-site Costs	Off-site Costs	Erosion	Total Costs
$ 3,328.70	$ 2,485.29	$ 2,925.00	$ 5,814.00

21

Cut and Fill Calculations

- The final part of the detention pond evaluation for a set of proposed elevations is estimating the pond volume.
- For every pond design, the user will probably have to adjust this part of the computational process.
- First, compute the change in elevations between the assumed height of the pond when full and the proposed elevations.
- In most cases, the pond elevation is at least 1 ft. below the top of the embankment.

22

Cut and Fill Calculations

- The top of the embankment in this design is 110 ft.
- Compute pond level elevation – proposed elevations

Change in Elevations
Rectangular Grid
Pond water level = 109 ft.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
2	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
3	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
4	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	5.7	5.7	8
5	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	2.4	2.4	2.4	2.4	5.7	8
6	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	-1	-1	-1	-1	-1	-1	2.4	5.7	8
7	-11	-10	-9	-8	-7	-6	-5	-4	-3	-1	-1	-1	-1	-1	-1	-1	-1	2.4	5.7	9
8	-11	-10	-9	-8	-7	-6	-5	-4	-3	-1	4	4	4	4	4	-1	-1	2.4	5.7	9
9	-11	-10	-9	-8	-7	-6	-5	-4	-3	-1	4	6	6	6	4	-1	-1	2.4	5.7	9
10	-11	-10	-9	-8	-7	-6	-5	-4	-3	-1	4	6	6	6	4	-1	-1	2.4	5.7	9
11	-11	-10	-9	-8	-7	-6	-5	-4	-3	-1	4	6	6	6	4	-1	-1	2.4	5.7	9
12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-1	4	6	6	6	4	-1	-1	2.4	5.7	9
13	-11	-10	-9	-8	-7	-6	-5	-4	-3	-1	4	4	4	4	4	-1	-1	2.4	5.7	9
14	-11	-10	-9	-8	-7	-6	-5	-4	-3	-1	-1	-1	-1	-1	-1	-1	-1	2.4	5.7	9
15	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	-1	-1	-1	-1	-1	-1	2.4	5.7	9
16	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	2.4	2.4	2.4	2.4	5.7	8
17	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	5.7	5.7	8
18	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
19	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
20	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8

23

Cut and Fill Calculations

Next, identify the pond area by selecting the positive elevations within the embankment

Change in Elevations
Rectangular Grid
Pond water level = 109 ft.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
2	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
3	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
4	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	5.7	5.7	8
5	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	2.4	2.4	2.4	2.4	5.7	8
6	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	-1	-1	-1	-1	-1	-1	2.4	5.7	8
7	-11	-10	-9	-8	-7	-6	-5	-4	-3	-1	-1	-1	-1	-1	-1	-1	-1	2.4	5.7	9
8	-11	-10	-9	-8	-7	-6	-5	-4	-3	-1	4	4	4	4	4	-1	-1	2.4	5.7	9
9	-11	-10	-9	-8	-7	-6	-5	-4	-3	-1	4	6	6	6	4	-1	-1	2.4	5.7	9
10	-11	-10	-9	-8	-7	-6	-5	-4	-3	-1	4	6	6	6	4	-1	-1	2.4	5.7	9
11	-11	-10	-9	-8	-7	-6	-5	-4	-3	-1	4	6	6	6	4	-1	-1	2.4	5.7	9
12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-1	4	6	6	6	4	-1	-1	2.4	5.7	9
13	-11	-10	-9	-8	-7	-6	-5	-4	-3	-1	4	4	4	4	4	-1	-1	2.4	5.7	9
14	-11	-10	-9	-8	-7	-6	-5	-4	-3	-1	-1	-1	-1	-1	-1	-1	-1	2.4	5.7	9
15	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	-1	-1	-1	-1	-1	-1	2.4	5.7	9
16	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	2.4	2.4	2.4	2.4	5.7	8
17	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	5.7	5.7	8
18	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
19	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
20	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8

24

Cut and Fill Calculations

Next, identify the pond area by selecting the positive elevations within the embankment

Change in Elevations
Rectangular Grid Pond water level = 109 ft.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
2	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
3	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
4	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	5.7	5.7	8
5	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	2.4	2.4	2.4	2.4	5.7	8
6	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	-1	-1	-1	-1	-1	-1	2.4	5.7	8
7	-11	-10	-9	-8	-7	-6	-5	-4	-3	-1	-1	-1	-1	-1	-1	-1	-1	2.4	5.7	9
8	-11	-10	-9	-8	-7	-6	-5	-4	-3	-1	4	4	4	4	4	-1	-1	2.4	5.7	9
9	-11	-10	-9	-8	-7	-6	-5	-4	-3	-1	4	6	6	6	4	-1	-1	2.4	5.7	9
10	-11	-10	-9	-8	-7	-6	-5	-4	-3	-1	4	6	6	6	4	-1	-1	2.4	5.7	9
11	-11	-10	-9	-8	-7	-6	-5	-4	-3	-1	4	6	6	6	4	-1	-1	2.4	5.7	9
12	-11	-10	-9	-8	-7	-6	-5	-4	-3	-1	4	6	6	6	4	-1	-1	2.4	5.7	9
13	-11	-10	-9	-8	-7	-6	-5	-4	-3	-1	4	4	4	4	4	-1	-1	2.4	5.7	9
14	-11	-10	-9	-8	-7	-6	-5	-4	-3	-1	-1	-1	-1	-1	-1	-1	-1	2.4	5.7	9
15	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	-1	-1	-1	-1	-1	-1	2.4	5.7	9
16	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	2.4	2.4	2.4	2.4	5.7	8
17	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	5.7	5.7	8
18	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
19	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8
20	-11	-10	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8

25

Cut and Fill Calculations

Next, all cells should be eliminated outside the pond area, leaving one negative elevation completely around the proposed pond area.

Change in Elevations
Rectangular Grid Pond water level = 109 ft.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1																				
2																				
3																				
4																				
5																				
6																				
7											-1	-1	-1	-1	-1	-1	-1			
8											-1	4	4	4	4	4	-1			
9											-1	4	6	6	6	4	-1			
10											-1	4	6	6	6	4	-1			
11											-1	4	6	6	6	4	-1			
12											-1	4	6	6	6	4	-1			
13											-1	4	4	4	4	4	-1			
14											-1	-1	-1	-1	-1	-1	-1			
15																				
16																				
17																				
18																				
19																				

26

Cut and Fill Calculations

Next, compute the volume in each pond cell like we did the earthwork volume.

Change in Elevations
Rectangular Grid Pond water level = 109 ft.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1																				
2																				
3																				
4																				
5																				
6																				
7											-1	-1	-1	-1	-1	-1	-1			
8											-1	4	4	4	4	4	-1			
9											-1	4	6	6	6	4	-1			
10											-1	4	6	6	6	4	-1			
11											-1	4	6	6	6	4	-1			
12											-1	4	6	6	6	4	-1			
13											-1	4	4	4	4	4	-1			
14											-1	-1	-1	-1	-1	-1	-1			
15																				
16																				
17																				
18																				
19																				

$$Volume_{pond\ cell} = \frac{-1-1-1+4}{4}(10\,\text{ft.})(10\,\text{ft.}) = 25\,\text{ft.}^3$$

27

Cut and Fill Calculations

Next, compute the volume in each pond cell like we did the earthwork volume.

Change in Elevations
Rectangular Grid Pond water level = 109 ft.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1																				
2																				
3																				
4																				
5																				
6																				
7											-1	-1	-1	-1	-1	-1	-1			
8											-1	4	4	4	4	4	-1			
9											-1	4	6	6	6	4	-1			
10											-1	4	6	6	6	4	-1			
11											-1	4	6	6	6	4	-1			
12											-1	4	6	6	6	4	-1			
13											-1	4	4	4	4	4	-1			
14											-1	-1	-1	-1	-1	-1	-1			
15																				
16																				
17																				
18																				
19																				

$$Volume_{pond\ cell} = \frac{-1-1+4+4}{4}(10\,\text{ft.})(10\,\text{ft.}) = 150\,\text{ft.}^3$$

28

Cut and Fill Calculations

Continue this process to estimate the volume of the pond design.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1																			
2																			
3																			
4																			
5																			
6																			
7										25	150	150	150	150	150	25			
8										150	450	500	500	500	450	150			
9										150	500	600	600	600	500	150			
10										150	500	600	600	600	500	150			
11										150	500	600	600	600	500	150			
12										150	450	500	500	500	450	150			
13										25	150	150	150	150	150	25			
14																			
15																			
16																			
17																			
18																			
19																			

1 ft.^{3} = 7.48 gallons

Total Pond Volume = 13,200 ft.^{3}
98,736 gallons

Remember that a n x m set of elevations defined a n-1 x m-1 cell array

29

Cut and Fill Calculations

In Summary:

- The total cost of cut-and-fill is estimated at $6,264
- The estimated pond volume is 98,736 gallons
- The side slopes are within the design criteria

- Must ***decrease*** pond volume
- How?

30

Cut and Fill Calculations

In Summary:

- The only remaining cost will be erosion protection and location of the spillway protection
- Also, check to see if the spillway is on cut material not fill

31

Cut and Fill Calculations

To compute basic erosion control cost, assume that any cell where the elevation was changed should be covered.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
2	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
3	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
4	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103.3	103.3	101
5	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106.6	106.6	106.6	106.6	103.3	101
6	120	119	118	117	116	115	114	113	112	111	110	110	110	110	110	110	110	106.6	103.3	101
7	120	119	118	117	116	115	114	113	112	110	110	110	110	110	110	110	110	106.6	103.3	100
8	120	119	118	117	116	115	114	113	112	110	105	105	105	105	105	110	110	106.6	103.3	100
9	120	119	118	117	116	115	114	113	112	110	105	103	103	103	105	110	110	106.6	103.3	100
10	120	119	118	117	116	115	114	113	112	110	105	103	103	103	105	110	110	106.6	103.3	100
11	120	119	118	117	116	115	114	113	112	110	105	103	103	103	105	110	110	106.6	103.3	100
12	120	119	118	117	116	115	114	113	112	110	105	103	103	103	105	110	110	106.6	103.3	100
13	120	119	118	117	116	115	114	113	112	110	105	105	105	105	105	110	110	106.6	103.3	100
14	120	119	118	117	116	115	114	113	112	110	110	110	110	110	110	110	110	106.6	103.3	100
15	120	119	118	117	116	115	114	113	112	111	110	110	110	110	110	110	110	106.6	103.3	100
16	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106.6	106.6	106.6	106.6	103.3	101
17	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103.3	103.3	101
18	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
19	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
20	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101

One way to accomplished this computation is to look at the changes in elevation.

32

Cut and Fill Calculations

Count the number of cells where the elevation has changed.

(+) indicates cut
(-) indicates fill

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.3	-1.3	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.6	-1.6	-2.6	-3.6	-1.3	0	
6	0	0	0	0	0	0	0	0	0	0	-1	-2	-3	-4	-5	-6	-3.6	-1.3	0	
7	0	0	0	0	0	0	0	0	0	1	0	-1	-2	-3	-4	-5	-6	-3.6	-1.3	1
8	0	0	0	0	0	0	0	0	0	1	5	4	3	2	1	-5	-6	-3.6	-1.3	1
9	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5	-6	-3.6	-1.3	1
10	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5	-6	-3.6	-1.3	1
11	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5	-6	-3.6	-1.3	1
12	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5	-6	-3.6	-1.3	1
13	0	0	0	0	0	0	0	0	0	1	5	4	3	2	1	-5	-6	-3.6	-1.3	1
14	0	0	0	0	0	0	0	0	0	1	0	-1	-2	-3	-4	-5	-6	-3.6	-1.3	1
15	0	0	0	0	0	0	0	0	0	0	0	-1	-2	-3	-4	-5	-6	-3.6	-1.3	1
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.6	-1.6	-2.6	-3.6	-1.3	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.3	-1.3	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Use the COUNTIF Excel function

33

Cut and Fill Calculations

Excel COUNTIF function:

- **COUNTIF**(***range***, ***criteria***)
- ***range*** is the range of cells you want to count
- ***criteria*** is the criteria in the form of a number, expression, or text that defines which cells will be added.

  For example, criteria can be expressed as 32, "32", ">32", "apples“

34

Cut and Fill Calculations

Count the number of cells where the elevation has changed.

(+) indicates cut
(-) indicates fill

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.3	-1.3	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.6	-1.6	-2.6	-3.6	-1.3	0	
6	0	0	0	0	0	0	0	0	0	0	-1	-2	-3	-4	-5	-6	-3.6	-1.3	0	
7	0	0	0	0	0	0	0	0	0	1	0	-1	-2	-3	-4	-5	-6	-3.6	-1.3	1
8	0	0	0	0	0	0	0	0	0	1	5	4	3	2	1	-5	-6	-3.6	-1.3	1
9	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5	-6	-3.6	-1.3	1
10	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5	-6	-3.6	-1.3	1
11	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5	-6	-3.6	-1.3	1
12	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5	-6	-3.6	-1.3	1
13	0	0	0	0	0	0	0	0	0	1	5	4	3	2	1	-5	-6	-3.6	-1.3	1
14	0	0	0	0	0	0	0	0	0	1	0	-1	-2	-3	-4	-5	-6	-3.6	-1.3	1
15	0	0	0	0	0	0	0	0	0	0	0	-1	-2	-3	-4	-5	-6	-3.6	-1.3	1
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.6	-1.6	-2.6	-3.6	-1.3	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.3	-1.3	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

The number of cells where the elevation has changed is 117

35

Cut and Fill Calculations

The basic erosion costs are:

(+) indicates cut
(-) indicates fill

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.3	-1.3	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.6	-1.6	-2.6	-3.6	-1.3	0
6	0	0	0	0	0	0	0	0	0	0	0	-1	-2	-3	-4	-5	-6	-3.6	-1.3	0
7	0	0	0	0	0	0	0	0	0	1	0	-1	-2	-3	-4	-5	-6	-3.6	-1.3	1
8	0	0	0	0	0	0	0	0	0	1	5	4	3	2	1	-5	-6	-3.6	-1.3	1
9	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5	-6	-3.6	-1.3	1
10	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5	-6	-3.6	-1.3	1
11	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5	-6	-3.6	-1.3	1
12	0	0	0	0	0	0	0	0	0	1	5	6	5	4	1	-5	-6	-3.6	-1.3	1
13	0	0	0	0	0	0	0	0	0	1	5	4	3	2	1	-5	-6	-3.6	-1.3	1
14	0	0	0	0	0	0	0	0	0	1	0	-1	-2	-3	-4	-5	-6	-3.6	-1.3	1
15	0	0	0	0	0	0	0	0	0	0	0	-1	-2	-3	-4	-5	-6	-3.6	-1.3	1
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.6	-1.6	-2.6	-3.6	-1.3	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.3	-1.3	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

$$Cost_{erosion} = 117(10\,\text{ft.})(10\,\text{ft.})\left(\frac{\$2.50}{10\,\text{ft.}^2}\right) = \$2{,}925$$

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Cut and Fill Calculations

Cost Summary:

- The total cost of cut-and-fill is estimated at $6,264
- Erosion control cost is $2,925
- Not included are the cost of the spillway and spillway protection
- Depends on the location of the spillway and the material used to line the spillway

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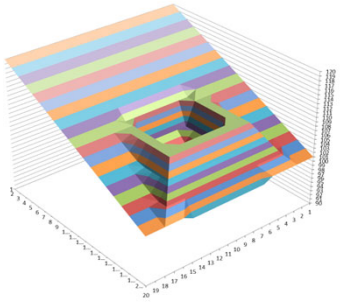
End of Cut-and-Fill 2



Any Questions?

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