

**Worksheet CEW-01: FORMAT FOR THE ESTIMATION OF CLOSURE COSTS**

**\*FILL IN THE BOXES. THE REST WILL BE CALCULATED FOR YOU\***

**Soil Cap Components**

**I. Slope & Fill**

		Calculation or Conversion	
a. Area to be capped	<input type="text"/> acres	$\times 4,840\text{yd}^2/\text{ac}$	0 yd <sup>2</sup>
b. Depth of soil needed for slope and fill	<input type="text"/> inches	$\times 1\text{yd}/36\text{in}$	0.00 yd
c. Quantity of soil needed		$a \times b$	0 yd <sup>3</sup>
d. Percentage of soil from off-site	<input type="text"/>		
e. Purchase unit cost for off-site material	<input type="text"/> /yd <sup>3</sup>		
f. Percentage of soil from on-site		$(1 - d)$	100%
g. Excavation unit cost (on-site material)	<input type="text"/> /yd <sup>3</sup>		0
h. Total soil unit cost		$(d \times e) + (f \times g)$	\$0.00 /yd <sup>3</sup>
i. Hauling, Placement and Spreading unit cost	<input type="text"/> /yd <sup>3</sup>		0
j. Compaction unit cost	<input type="text"/> /yd <sup>3</sup>		
k. Total soil unit cost		$h + i + j$	\$0.00 /yd <sup>3</sup>
l. Soil subtotal		$k \times b$	\$0
m. Percent compaction	<input type="text"/>		
<b>Total Slope &amp; Fill Cost</b>		$l \times (1 + m)$	<b>\$0</b>

**II. Infiltration Layer Soil**

*Infiltration Soil Cost*

a. Area to be capped	<input type="text"/> acres	$\times 4,840\text{yd}^2/\text{ac}$	0 yd <sup>2</sup>
b. Depth of infiltration soil needed	<input type="text"/> inches	$\times 1\text{yd}/36\text{in}$	0.00 yd
c. Quantity of infiltration soil needed		$a \times b$	0 yd <sup>3</sup>
d. Percentage of soil from off-site	<input type="text"/>		
e. Purchase unit cost for off-site material	<input type="text"/> /yd <sup>3</sup>		
f. Percentage of soil from on-site		$(1 - d)$	100%
g. Excavation unit cost (on-site material)	<input type="text"/> /yd <sup>3</sup>		
h. Total infiltration soil unit cost		$(d \times e) + (f \times g)$	\$0.00 /yd <sup>3</sup>
i. Hauling, Placement and Spreading unit cost	<input type="text"/> /yd <sup>3</sup>		
j. Compaction unit cost	<input type="text"/> /yd <sup>3</sup>		
k. Total infiltration soil unit cost		$h + i + j$	\$0.00 /yd <sup>3</sup>
l. Infiltration soil subtotal		$k \times b$	\$0
m. Percent compaction	<input type="text"/>		
n. <i>Subtotal Infiltration Soil Cost</i>		$l \times (1 + m)$	<b>\$0</b>

*Soil Admixture Cost*

o. Area to be capped	<input type="text"/> acres	$\times 4,840\text{yd}^2/\text{ac}$	0 yd <sup>2</sup>
p. Soil admixture unit cost	<input type="text"/> /yd <sup>2</sup>		
q. <i>Subtotal admixture cost</i>		$a \times b$	<b>\$0</b>

*Soil Testing*

r. Area to be capped	<input type="text"/> acres		
s. Testing unit cost	<input type="text"/> /acre		
t. <i>Subtotal soil testing cost</i>		$a \times b$	<b>\$0</b>
<b>Total Infiltration Soil Cost (soil, admixtures, and testing)</b>		$n + q + t$	<b>\$0</b>

**III. Erosion Control / Protective Cover Soil**

a.	Area to be capped	<input type="text"/>	acres	x 4,840yd <sup>2</sup> /ac	0 yd <sup>2</sup>
b.	Depth of soil needed	<input type="text"/>	inches	x 1yd/36in	0.00 yd
c.	Quantity of soil needed			a x b	0 yd <sup>3</sup>
d.	Percentage of soil from off-site	<input type="text"/>			
e.	Purchase unit cost for off-site material	<input type="text"/>	/yd <sup>3</sup>		
f.	Percentage of soil from on-site			(1 - d)	100%
g.	Excavation unit cost (on-site material)	<input type="text"/>	/yd <sup>3</sup>		
h.	Total erosion/protective soil unit cost			(d x e) + (f x g)	\$0.00 /yd <sup>3</sup>
i.	Hauling, Placement and Spreading unit cost	<input type="text"/>	/yd <sup>3</sup>		
j.	Compaction unit cost	<input type="text"/>	/yd <sup>3</sup>		
k.	Total soil unit cost			h + i + j	\$0.00 /yd <sup>3</sup>
l.	Erosion/Protective soil subtotal			k x b	\$0
m.	Percent compaction	<input type="text"/>			
	<b>Total Erosion Control/Protective Cover Soil Cost</b>			l x (1 + m)	<b>\$0</b>

**IV. Vegetative support soil (Topsoil)**

a.	Area to be capped	<input type="text"/>	acres	x 4,840yd <sup>2</sup> /ac	0 yd <sup>2</sup>
b.	Depth of topsoil needed	<input type="text"/>	inches	x 1yd/36in	0.00 yd
c.	Quantity of topsoil needed			a x b	0 yd <sup>3</sup>
d.	Percentage of topsoil from off-site	<input type="text"/>			
e.	Purchase unit cost for off-site material	<input type="text"/>	/yd <sup>3</sup>		
f.	Percentage of topsoil from on-site			(1 - d)	100%
g.	Excavation unit cost (on-site material)	<input type="text"/>	/yd <sup>3</sup>		
h.	Total topsoil unit cost			(d x e) + (f x g)	\$0.00 /yd <sup>3</sup>
i.	Hauling, Placement and Spreading unit cost	<input type="text"/>	/yd <sup>3</sup>		
j.	Total soil unit cost			h + i	\$0.00 /yd <sup>3</sup>
	<b>Total Topsoil Cost</b>			c x j	<b>\$0</b>

**V. Vegetative Cover**

a.	Area to be vegetated	<input type="text"/>	acres		
b.	Vegetative cover (seeding) unit cost	<input type="text"/>	/acre		
c.	Erosion control matting unit cost	<input type="text"/>	/acre		
	<b>Total Vegetative Cover Cost</b>			a x (b + c)	<b>\$0</b>

**Soil Cap Component Subtotal (I + II + III + IV + V): \$0**

**Geosynthetic Barrier & Infiltration Layers**

**VI. Flexible Membrane Liner**

				<u>Calculation or Conversion</u>	
a.	Quantity of FML needed	<input type="text"/>	acres	x 43,560ft <sup>2</sup> /ac	0 ft <sup>2</sup>
b.	Purchase unit cost	<input type="text"/>	/ft <sup>2</sup>		
c.	Installation unit cost	<input type="text"/>	/ft <sup>2</sup>		
d.	Total FML unit cost			b + c	
	<b>Total FML cost</b>			a x d	<b>\$0</b>

**VII. Geosynthetic Clay Liner**

a.	Quantity of GCL needed	<input type="text"/>	acres	x 43,560ft <sup>2</sup> /ac	0 ft <sup>2</sup>
b.	Purchase unit cost	<input type="text"/>	/ft <sup>2</sup>		
c.	Installation unit cost	<input type="text"/>	/ft <sup>2</sup>		
d.	Total GCL unit cost			b + c	\$0.00 /ft <sup>2</sup>
	<b>Total GCL Cost</b>			a x d	<b>\$0</b>

**Geosynthetic Layers Subtotal (VI + VII): \$0**

## Drainage Components

### VIII. Sand or Gravel Drainage

		Calculation or Conversion	
a.	Area to be capped		
	<input type="text"/>	acres	x 4,840yd <sup>2</sup> /ac
b.	Depth of sand or gravel needed		
	<input type="text"/>	inches	x 1yd/36in
c.	Quantity of drainage material needed		
	<input type="text"/>		a x b
d.	Percentage of media from off-site		
	<input type="text"/>		(1 - d)
e.	Purchase unit cost for off-site material		
	<input type="text"/>	/yd <sup>3</sup>	
f.	Percentage of material from on-site		
	<input type="text"/>		(d x e) + (f x g)
g.	Excavation unit cost (on-site material)		
	<input type="text"/>	/yd <sup>3</sup>	
h.	Total drainage material unit cost		
	<input type="text"/>	/yd <sup>3</sup>	
i.	Hauling, Placement and Spreading unit cost		
	<input type="text"/>	/yd <sup>3</sup>	
j.	Compaction unit cost		
	<input type="text"/>	/yd <sup>3</sup>	
k.	Total drainage material unit cost		
	<input type="text"/>		h + i + j
l.	Drainage material subtotal		
	<input type="text"/>		k x b
m.	Percent compaction		
	<input type="text"/>		
	<b>Total drainage material cost</b>		l x (1 + m)
			<b>\$0</b>

### IX. Geotextile

a.	Quantity of geotextile needed		
	<input type="text"/>	acres	x 43,560ft <sup>2</sup> /ac
b.	Purchase unit cost		
	<input type="text"/>	/ft <sup>2</sup>	
c.	Installation unit cost		
	<input type="text"/>	/ft <sup>2</sup>	
d.	Total geotextile unit cost		
	<input type="text"/>		b + c
	<b>Total Geotextile Cost</b>		a x d
			<b>\$0</b>

### X. Geonet Composite

a.	Quantity of geonet composite needed		
	<input type="text"/>	acres	x 43,560ft <sup>2</sup> /ac
b.	Purchase unit cost		
	<input type="text"/>	/ft <sup>2</sup>	
c.	Installation unit cost		
	<input type="text"/>	/ft <sup>2</sup>	
d.	Total geonet composite unit cost		
	<input type="text"/>		b + c
	<b>Total Geonet Composite Cost</b>		a x d
			<b>\$0</b>

### XI. Drainage Tile

a.	Length of drainage tile needed		
	<input type="text"/>	LF	
b.	Purchase unit cost		
	<input type="text"/>	/LF	
c.	Trenching and backfilling cost		
	<input type="text"/>	/LF	
d.	Total drainage tile unit cost		
	<input type="text"/>		b + c
	<b>Total Drainage Tile Cost</b>		a x d
			<b>\$0</b>

**XII. Drainage Channels (Stormwater Control)**

*Drainage benches and berms*

a. Size of drainage bench needed	<input type="text"/>	LF		
b. Drainage bench unit cost	<input type="text"/>	/LF		
c. <i>Subtotal drainage bench cost</i>			a x b	\$0
d. Size of drainage swale/berm needed	<input type="text"/>	LF		
e. Drainage swale/berm unit cost	<input type="text"/>	/LF		
f. <i>Subtotal drainage swale/berm cost</i>			d x e	\$0

*Rip Rap*

g. Quantity of Rip Rap needed	<input type="text"/>	yd2		
h. Rip rap unit cost	<input type="text"/>	/yd2		
i. <i>Total rip rap cost</i>			g x h	\$0

*Gabian Baskets*

j. Quantity of gabian baskets needed	<input type="text"/>	yd3		
k. Gabian basket unit cost	<input type="text"/>	/yd3		
l. <i>Subtotal gabian basket cost</i>			j x k	\$0

**Total Stormwater Control** c + f + i + l **\$0**

**Drainage Component Subtotal (VIII + IX + X + XI+ XII): **\$0****

**Landfill Gas and Groundwater Features**

**XIII. Landfill Gas Monitoring & Control Components**

Calculation

*Landfill Perimeter System*

a. Number of probes to be installed	<input type="text"/>	probes		
b. LFG probe unit cost	<input type="text"/>	/probe		
c. <i>Subtotal LFG probe cost</i>			a x b	\$0

*Landfill Control Systems*

d. Area to be closed	<input type="text"/>	acres		
e. Average number of vents per acre	<input type="text"/>	vents / acre		
f. LFG vent unit cost	<input type="text"/>	/vent		
g. <i>Subtotal LFG vent cost</i>			d x e x f	\$0
h. Length of header pipe needed	<input type="text"/>	LF		
i. Header pipe unit cost	<input type="text"/>	/LF		
j. Header pipe installation cost	<input type="text"/>	/LF		
k. <i>Subtotal LFG active vent hook-up</i>			h x (i + j)	\$0

**Total Landfill Gas Management Cost** c + g + k **\$0**

**XIV. Groundwater Monitoring Components**

a. Hydrogeologic study cost	<input type="text"/>			
b. Number of wells to be installed	<input type="text"/>	wells		
c. GW Monitoring Well unit cost	<input type="text"/>	/well		
d. Number of wells > 50 ft length	<input type="text"/>	wells		
e. Additional well length over 50 ft	<input type="text"/>	LF/well		
f. Unit cost for additional well length	<input type="text"/>	/LF		
<b>Total Groundwater Monitoring Well Cost</b>			a + (b x c) + (d x e x f)	<b>\$0</b>

**Landfill Gas & Groundwater Features Subtotal (XIII + XIV): **\$0****

**Miscellaneous**

		Calculation	
<b>XV. Removal and Disposal of Stockpiled Material</b>			
a.	Quantity of stockpiled materials	<input type="text"/> yd <sup>3</sup>	
b.	Loading and Hauling unit cost	<input type="text"/> /yd <sup>3</sup>	
c.	Disposal unit cost	<input type="text"/> /yd <sup>3</sup>	
d.	<b>Total Removal/Disposal Cost</b>	$a \times (b + c)$	<b>\$0</b>
<b>XVI. Erosion/Sediment Control</b>			
a.	Quantity of silt fence needed	<input type="text"/> LF	
b.	Silt Fence unit cost	<input type="text"/> /LF	
	<b>Total Silt Fence Cost</b>	$a \times b$	<b>\$0</b>
<b>XVII. Landfill Access Road</b>			
a.	Size of LF access road	<input type="text"/> yd <sup>2</sup>	
b.	Depth of gravel needed	<input type="text"/> inches	$\times 1\text{yd}/36\text{in}$ 0.0 yd
c.	Depth of asphalt needed	<input type="text"/> inches	$\times 1\text{yd}/36\text{in}$ 0.0 yd
d.	Total material needed	<input type="text"/>	$a \times (b + c)$ 0 yd <sup>3</sup>
e.	Road material unit cost	<input type="text"/> /yd <sup>3</sup>	
f.	Placement/Spreading unit cost	<input type="text"/> /yd <sup>3</sup>	
	<b>Total access road cost</b>	$c \times (d + e)$	<b>\$0</b>
<b>XVIII. Site Security</b>			
<i>Fencing</i>			
a.	Length of fencing needed	<input type="text"/> ft	
b.	Fence unit cost	<input type="text"/> /ft	
c.	<b>Subtotal fencing cost</b>	$a \times b$	<b>\$0</b>
<i>Gate or Barrier</i>			
d.	Number of gates required	<input type="text"/>	
e.	Gate unit cost	<input type="text"/> /gate	
f.	<b>Subtotal gate cost</b>	$d \times e$	<b>\$0</b>
<i>Closed Sign</i>			
g.	Number of signs required	<input type="text"/>	
h.	Sign unit cost	<input type="text"/> /gate	
i.	<b>Subtotal sign cost</b>	$g \times h$	<b>\$0</b>
	<b>Total site security cost</b>	$c + f + i$	<b>\$0</b>
<b>XIX. Mobilization / Demobilization</b>			
a.	Cost for mobilization/demobilization	<input type="text"/>	
	<b>Total mobilization/demobilization cost</b>		<b>\$0</b>

**Miscellaneous Subtotal (XV + ... + XIX): \$0**

**Closure Cost Subtotal (CCS):** (I + ... + XIX) **\$0**

**Contingency (10%):** CCS x 0.10 **\$0**

**Engineering & Documentation:**

Construction QA/QC (1%) CCS x 0.01 **\$0**

Closure Certification and CQA Report (1%) CCS x 0.01 **\$0**

Survey and as-builts (2%) CCS x 0.02 **\$0**

Cost for survey and deed notation

**Total Engineering & Documentation Costs** **\$0**

**Total Closure Cost:** CCS + Contingency + Engineering **\$0**

**Worksheet CEW-02: FORMAT FOR THE ESTIMATION OF POST-CLOSURE COSTS**

**\*FILL IN THE BOXES. THE REST WILL BE CALCULATED FOR YOU\***

**I. Groundwater Monitoring**

		<u>Calculation or Conversion</u>	
a. Total number of monitoring wells	<input type="text" value="5"/> wells		
b. Total number of sampling events/year	<input type="text" value="4"/> events/yr	a x b	20 samples/yr
c. Quantity of additional samples (e.g. QA/QC)	<input type="text" value="1"/> samples/event	a x c	5 samples/yr
d. Total samples per year		b + c	25 samples/yr
e. Analysis unit cost (Table 3.1 constituents)	<input type="text"/> /sample		
f. <i>Total Analysis cost</i>		d x e	\$0.00 /yr
g. GW Monitoring unit cost	<input type="text"/> /event		
i. <i>Total sampling cost</i>		f + (g x b)	\$0.00 /yr
j. Engineering fees & reports	<input type="text"/> /yr		
<b>Yearly Groundwater Monitoring Cost</b>		i + j	<b>\$0 /yr</b>

**II. Landfill Gas Monitoring, Maintenance, and Control**

a. Frequency of LFG compliance monitoring	<input type="text"/> events/yr		
b. LFG Monitoring unit cost	<input type="text"/> /event		
c. <i>Total perimeter LFG monitoring cost</i>		a x b	\$0 /yr
d. Frequency of surface monitoring (air permit)	<input type="text"/> events/yr		
e. Surface monitoring unit cost	<input type="text"/> /event		
f. <i>Total surface monitoring cost</i>		d x e	\$0 /yr
g. Control system operating unit cost	<input type="text"/> /yr		
h. Frequency of LFG control system inspections	<input type="text"/> events/yr		
i. Control system inspection cost	<input type="text"/> /event		
j. <i>Total control system cost</i>		g + (h x i)	\$0 /yr
<b>Yearly Landfill Gas Monitoring, Maintenance, &amp; Control Cost</b>		c + f + j	<b>\$0 /yr</b>

**III. Leachate Management**

a. Quantity of leachate generated	<input type="text"/> gal/yr		
<i>On-site Leachate Management or Pre-Treatment</i>			
b. On-site treatment operating unit cost	<input type="text"/> /gal		
c. <i>Total on-site management cost</i>		a x b	\$0 /yr
<i>Leachate Disposal</i>			
d. Private disposal unit cost	<input type="text"/> /gal		
e. POTW disposal unit cost	<input type="text"/> /gal		
f. Direct discharge to POTW unit cost	<input type="text"/> /gal		
g. Pump & Haul unit cost	<input type="text"/> /gal		
h. Subtotal leachate disposal unit cost		d + e + f + g	\$0.00
i. <i>Total leachate disposal cost</i>		a x h	\$0 /yr
j. Leachate sampling & analysis unit cost	<input type="text"/> /sample		
k. Frequency of leachate sampling & analysis	<input type="text"/> sample/yr		
l. <i>Total leachate sampling &amp; analysis cost</i>		j x k	\$0.00 /yr
<b>Yearly Leachate Management Cost</b>		c + i + l	<b>\$0 /yr</b>

**IV. Cap Maintenance & Repair**

a. Closed Landfill Area	<input type="text"/> acres		
<i>Mowing &amp; Fertilization</i>			
b. Mowing frequency	<input type="text"/> visits/yr		
c. Mowing unit cost	<input type="text"/> /acre/visit		
d. <i>Total mowing cost</i>		a x b x c	\$0 /yr
e. Fertilizer frequency	<input type="text"/> visits/yr		
f. Fertilizer unit cost	<input type="text"/> /acre/visit		
g. <i>Total fertilizer cost</i>		a x e x f	\$0 /yr

**Cap Erosion & Repair**

h. Area to reseed/year		33% x a	- acres
i. Reseeding unit cost	<input type="text"/>	/acre	
j. Total reseeding cost		h x i	\$0.00 /yr
k. Area of cap erosion/year		10% x a	0.0 acres
l. Cap erosion repair unit cost	<input type="text"/>	/acre	
m. Mobilization/Demobilization	<input type="text"/>	/yr	
n. Total cap erosion repair cost		(k x l) + m	\$0 /yr
<b>Yearly Cap Maintenance &amp; Repair cost</b>		<b>d + g + j + n</b>	<b>\$0 /yr</b>

**V. Sediment Basin Maintenance & Repair**

a. Sediment basin cleanout frequency, 1 per	<input type="text" value="3"/>	years	1 / a	0.33 event/yr
b. Sediment basin cleanout unit cost	<input type="text"/>	/event		
c. Mobilization/Demobilization	<input type="text"/>	/event		
d. Total sediment basin maintenance cost			a x (b + c)	\$0 /yr
e. Total number of stormwater sampling locations	<input type="text"/>	locations		
f. Stormwater sampling frequency	<input type="text"/>	events/yr		
g. Total number of stormwater samples			e x f	0 samples/yr
h. Analysis unit cost (VPDES permit parameters)	<input type="text"/>	/sample		
i. Total Analysis cost			g x h	\$0 /yr
j. Mobilization unit cost	<input type="text"/>	/event		
k. Technician field unit cost	<input type="text"/>	/event		
l. Total sampling cost			f x (j + k)	\$0.00 /yr
m. Engineering fees & reports	<input type="text"/>	/yr		
n. Total Stormwater Sampling & Analysis cost			i + l + m	\$0 /yr
<b>Yearly Sediment Basin Maintenance &amp; Repair</b>			<b>d + n</b>	<b>\$0 /yr</b>

**VI. Vector & Rodent Control**

a. Vector and rodent control unit cost	<input type="text"/>	/yr		
<b>Yearly Vector and Rodent Control Cost</b>			<b>a</b>	<b>\$0 /yr</b>

**VII. Post-Closure Care General Inspections**

a. General Inspection unit cost	<input type="text"/>	/inspection		
b. Number of inspections per year	<input type="text"/>			
<b>Yearly Post-Closure Care General Inspection Cost</b>			<b>a x b</b>	<b>\$0 /yr</b>

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**Annual Post-Closure Care Cost (APCC)** I + ... + VII \$0 /yr

**Length of post-closure care (LPCC)**  years

**Post-Closure Care Cost** APCC x LPCC \$0

**Engineering & Documentation** Engineering Sum \$0

Post-Closure Care Evaluation

Post-Closure Care Certification

Cost for survey and deed notation

(if not completed at time of landfill closure)

**FA Mechanism Maintenance Cost** /yr FA maintenance x LPCC \$0

**Total Post-Closure Care Cost** Post-Closure Cost + Engineering + FA Maintenance **\$0**