Attachment G

Financial Assurance Cost Estimate

Southeast County Landfill
Financial Assurance
Closure and Long-Term Care Cost Estimates
Phases I-VI

Facility I.D. Number: SWD/29/41193
Permit Number: 35435-022-SO/01

Hillsborough County
Solid Waste Management Department (SWMD)
332 N. Falkenburg Road
Tampa, FL 33619

Florida Board of Professional Engineers
Certificate No. 00004892

SCS ENGINEERS

09215600.13 | February 2022

3922 Coconut Palm Drive, Suite 102
Tampa, FL 33619
813-621-0080

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PART 1
INTRODUCTION

SCS Engineers (SCS) has prepared this Financial Assurance Closure and Long-term Care Cost Estimates document for Phases I-VI, as required by Rule 62-701.630, Florida Administrative Code (FAC). Quantities and costs of items that have changed as a part of the revised Phase I-VI closure design have been recalculated. The Capacity Expansion Area (CEA) closure design has not undergone any changes as a part of the revised design and has not been included as a part of this estimate. An inflation factor update will be provided for the CEA prior to the March 1 deadline. The cost estimates were completed using Florida Department of Environmental Protection (FDEP) Form 62-701.900 (28) and signed by the authorized representative of the Owner of the facility and certified by the Engineer of Record. The Financial Assurance Cost Estimate Forms are provided in Part 2 of this report. Accompanying the cost estimate forms is an Explanation of Document Report provided in Part 3. The Explanation of Document Report includes general information regarding the cost estimates, the assumptions and calculations used in preparing the cost estimates, and the unit cost references associated with each line item. The source information for the cost references and contractors' quotes used in Part 3 is provided in Part 4, Unit Cost References. The references to the material quantities used in Part 3 are provided in Part 5, Materials Quantity References. SCS either requested unit costs from third-party vendors/contractors, or used unit costs from RS Means construction cost estimating database for the Tampa, Florida area.

PART 2
FINANCIAL ASSURANCE COST ESTIMATE FORMS

Print Form Reset Form

Florida Department of Environmental Protection

Bob Martinez Center
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

DEP Form # 62-701.900(28), F.A.C.
Form Title: Closure Cost Estimating Form For Solid Waste Facilities
Effective Date: January 6, 2010
Incorporated in Rule 62-701.630(3), F.A.C.

CLOSURE COST ESTIMATING FORM FOR SOLID WASTE FACILITIES

Date of DEP Approval: ______________

I. GENERAL INFORMATION:

Facility Name: Hillsborough County Southeast Landfill - Phases I-VI WACS ID: SWD/29/41193

Permit Application or Consent Order No.: 35435-022-SO/01 Expiration Date: 11/07/2023

Facility Address: 15960 CR 672 Lithia, FL 33547 (8.8 miles east of U.S. 301 on County Road 672)

Permittee or Owner/Operator: Hillsborough County Solid Waste Management Department

Mailing Address: P.O. Box 1110, Tampa, FL 33601

Latitude: 27 ° 46 ' 26 " Longitude: 82 ° 11 ' 01 "

Coordinate Method: AutoCAD Survey Datum: NAD 83

Collected by: SCS Engineers Company/Affiliation: SCS Engineers

Solid Waste Disposal Units Included in Estimate:** Remaining life from 2021 Remaining Capacity Report dated 8/27/2021

Phase / Cell	Acres	Date Unit Began Accepting Waste	Active Life of Unit From Date of Initial Receipt of Waste	If active: Remaining life of unit	If closed: Date last waste received	If closed: Official date of closing
Phases I-VI	162.4	1984	45.7	8.7**	N/A	N/A
Waste Tire Site	1,560 tn	N/A	N/A	N/A	N/A	N/A

Total disposal unit acreage included in this estimate: Closure: 162.4 Long-Term Care: 162.4

Facility type: (Check all that apply)
- ☒ Class I
- ☐ Class III
- ☐ C&D Debris Disposal
- ☐ Other: ______________

II. TYPE OF FINANCIAL ASSURANCE DOCUMENT (Check type)

- ☐ Letter of Credit*
- ☐ Insurance Certificate
- ☐ Escrow Account
- ☐ Performance Bond*
- ☒ Financial Test
- ☐ Form 29 (FA Deferral)
- ☐ Guarantee Bond*
- ☐ Trust Fund Agreement

* - Indicates mechanisms that require the use of a Standby Trust Fund Agreement

III. ESTIMATE ADJUSTMENT

40 CFR Part 264 Subpart H as adopted by reference in Rule 62-701.630, Florida Administrative Code, (F.A.C.) sets forth the method of annual cost estimate adjustment. Cost estimates may be adjusted by using an inflation factor or by recalculating the maximum costs of closure in current dollars. Select one of the methods of cost estimate ajustment below.

☐ **(a) Inflation Factor Adjustment** ☒ **(b) Recalculated or New Cost Estimates**

Inflation adjustment using an inflation factor may only be made when a Department approved closure cost estimate exists and no changes have occurred in the facility operation which would necessitate modification to the closure plan. The inflation factor is derived from the most recent Implicit Price Deflator for Gross National Product published by the U.S. Department of Commerce in its survey of Current Business. The inflation factor is the result of dividing the latest published annual Deflatory by the Deflator for the previous year. The inflation factor may also be obtained from the Solid Waste website www.dep.state.fl.us/waste/categories/swfr or call the Financial Coordinator at (850) 245-8706.

This adjustment is based on the Department approved closing cost estimate dated: ____________

Latest Department Approved **Closing Cost** Estimate:		Current Year Inflation Factor, ***e.g. 1.02***		Inflation Adjusted Closing Cost Estimate:
____________	×	______	=	____________

This adjustment is based on the Department approved long-term care cost estimate dated: ____________

Latest Department Approved Annual **Long-Term Care** Cost Estimate:		Current Year Inflation Factor, ***e.g. 1.02***		Inflation Adjusted Annual Long-Term Care Cost Estimate:
____________	×	______	=	____________

Number of Years of Long Term Care Remaining: × ____________

Inflation Adjusted Long-Term Care Cost Estimate: = ____________

Signature by: ☐ **Owner/Operator** ☐ **Engineer** (check what applies)

____________ Signature	____________ Address
____________ Name & Title	____________ City, State, Zip Code
____________ Date	____________ E-Mail Address
____________ Telephone Number	

IV. ESTIMATED CLOSING COST (check what applies)

☒ **Recalculated Cost Estimate** ☐ **New Facility Cost Estimate**

Notes: 1. Cost estimates for the time period when the extent and manner of landfill operation makes closing most exp

2. Cost estimate must be certified by a professional engineer.

3. Cost estimates based on third party suppliers of material, equipment and labor at fair market value.

4. In some cases, a price quote in support of individual item estimates may be required.

Description	Unit	Number of Units	Cost / Unit	Total Cost
1. Proposed Monitoring Wells	**(Do not include wells already in existence.)**			
	EA			
		Subtotal Proposed Monitoring Wells:		
2. Slope and Fill (bedding layer between waste and barrier layer):				
Excavation	CY			
Placement and Spreading	CY			
Compaction	CY			
On ~~Off~~ Site Material	CY	70,002	$5.49	$384,310.98
Delivery	CY			
			Subtotal Slope and Fill:	$384,310.98
3. Cover Material (Barrier Layer):				
Off-Site Clay	CY			
Synthetics - 40 mil	SY	840,020	$2.24	$1,881,644.80
Synthetics - GCL	SY			
Synthetics - Geonet	SY			
Synthetics - Other (explain)	LS	1	$2,121,775.13	$2,121,775.13
Geo-composite			Subtotal Cover Material:	$4,003,419.93
4. Top Soil Cover:				
On ~~Off~~ Site Material	CY	560,013	$4.80	$2,688,062.40
Delivery	CY			
Spread	CY			
			Subtotal Top Soil Cover:	$2,688,062.40
5. Vegetative Layer				
Sodding	SY	373,399	$3.08	$1,150,068.92
Hydroseeding	AC	88.1	$2,464.19	$217,095.14
Fertilizer	AC			
Mulch	AC			
Other (explain)				
			Subtotal Vegetative Layer:	$1,367,164.06
6. Stormwater Control System:				
Earthwork	CY			
Grading	SY			
Piping	LF			
Ditches	LF			
Berms	~~LF~~ CY	41,994	$5.49	$230,547.06
Control Structures	EA			
Other (explain)	LS	1	$3,849,945.00	$3,849,945.00
See Explanation (Part 3)			Subtotal Stormwater Control System:	$4,080,492.06

Description	Unit	Number of Units	Cost / Unit	Total Cost
7. Passive Gas Control:				
Wells	EA			
Pipe and Fittings	LF			
Monitoring Probes	EA			
NSPS/Title V requirements	LS	~~1~~		
			Subtotal Passive Gas Control:	
8. Active Gas Extraction Control:				
Traps	EA			
Sumps	EA			
Flare Assembly	EA			
Flame Arrestor	EA			
Mist Eliminator	EA			
Flow Meter	EA			
Blowers	EA			
Collection System	LF			
Other (explain)				
			Subtotal Active Gas Extraction Control:	
9. Security System:				
Fencing	LF			
Gate(s)	EA			
Sign(s)	EA	1	$2,000.00	$2,000.00
			Subtotal Security System:	$2,000.00
10. Engineering:				
Closure Plan Report	LS	1	$778,410.11	$778,410.11
Certified Engineering Drawings	LS	~~1~~		
NSPS/Title V Air Permit	LS	~~1~~		
Final Survey	LS	1	$66,791.87	$66,791.87
Certification of Closure	LS	~~1~~		
Other (explain)	LS	1	$7,500.00	$7,500.00
Permit Fee per chapter 62-701			Subtotal Engineering:	$852,701.98

Description	Hours	Cost / Hour	Hours	Cost / Hour	Total Cost
11. Professional Services					
	Contract Management		Quality Assurance		
P.E. Supervisor	1,440	$117.58	1,440	$117.58	$338,630.40
On-Site Engineer			720	$91.50	$65,880.00
Office Engineer	1,440	$86.31	720	$77.50	$180,086.40
On-Site Technician			6,912	$66.09	$456,814.08
Other (explain) Admin. Asst./Designer	2,880	$66.41			$191,260.80

Description	Unit	Number of Units	Cost / Unit	Total Cost
Quality Assurance Testing	LS	1	$250,000.00	$250,000.00
			Subtotal Professional Services:	$1,482,671.68

Subtotal of 1-11 Above: $14,860,823.09

12. Contingency 5 % of Subtotal of 1-11 Above $743,041.15

Subtotal Contingency: $743,041.15

Estimated Closing Cost Subtotal: $15,603,864.24

Description	Total Cost
13. Site Specific Costs	
Mobilization	$535,126.07
Waste Tire Facility	$234,000.00
Materials Recovery Facility	
Special Wastes	
Leachate Management System Modification	
Other (explain)	
Subtotal Site Specific Costs:	$769,126.07

TOTAL ESTIMATED CLOSING COSTS ($): $16,372,990.31

V. ANNUAL COST FOR LONG-TERM CARE

See 62-701.600(1)a.1., 62-701.620(1), 62-701.630(3)a. and 62-701.730(11)b. F.A.C. for required term length. For landfills certified closed and Department accepted, enter the remaining long-term care length as "Other" and provide years remaining.

(Check Term Length) ☐ 5 Years ☐ 20 Years ☒ 30 Years ☐ Other, ___ Years

Notes: 1. Cost estimates must be certified by a professional engineer.

2. Cost estimates based on third party suppliers of material, equipment and labor at fair market value.

3. In some cases, a price quote in support of individual item estimates may be required.

All items must be addressed. Attach a detailed explanation for all entries left blank.

Description	Sampling Frequency (Events / Year)	Number of Wells	(Cost / Well) / Event	Annual Cost
1. Groundwater Monitoring [62-701.510(6), and (8)(a)]				
Monthly	12			
Quarterly	4			
Semi-Annually	2	15	$450.00	$13,500.00
Annually	1			
			Subtotal Groundwater Monitoring:	$13,500.00
2. Surface Water Monitoring [62-701.510(4), and (8)(b)]				
Monthly	12			
Quarterly	4			
Semi-Annually	2	2	$450.00	$1,800.00
Annually	1			
			Subtotal Surface Water Monitoring:	$1,800.00
3. Gas Monitoring [62-701.400(10)]				
Monthly	12			
Quarterly	4	1	$1,680.71	$6,722.84
Semi-Annually	2			
Annually	1			
			Subtotal Gas Monitoring:	$6,722.84
4. Leachate Monitoring [62-701.510(5), (6)(b) and 62-701.510(8)c]				
Monthly	12			
Quarterly	4			
Semi-Annually	2			
Annually	1			
Other (explain) ______				
			Subtotal Leachate Monitoring:	

Description	Unit	Number of Units / Year	Cost / Unit	Annual Cost
5. Leachate Collection/Treatment Systems Maintenance				
<u>Maintenance</u>				
Collection Pipes	LF			
Sumps, Traps	EA	1	$750.00	$750.00
Lift Stations	EA	1	$750.00	$750.00
Cleaning	LS	1	$1,800.00	$1,800.00
Tanks	EA	1	$4,500.00	$4,500.00

Description	Unit	Number of Units / Year	Cost / Unit	Annual Cost
5. (continued)				
Impoundments				
Liner Repair	SY			
Sludge Removal	CY			
Aeration Systems				
Floating Aerators	EA			
Spray Aerators	EA			
Disposal				
Off-site (Includes transportation and disposal)	1000 gallon	2,442	$125.00	$305,250.00
		Subtotal Leachate Collection / Treatment Systems Maintenance:		$313,050.00
6. Groundwater Monitoring Well Maintenance				
Monitoring Wells	LF	1	$500.00	$500.00
Replacement	EA			
Abandonment	EA			
		Subtotal Groundwater Monitoring Well Maintenance:		$500.00
7. Gas System Maintenance				
Piping, Vents	LF	1	$5,000.00	$5,000.00
Blowers	EA	1	$1,200.00	$1,200.00
Flaring Units	EA	1	$400.00	$400.00
Meters, Valves	EA	1	$500.00	$500.00
Compressors	EA	1	$500.00	$500.00
Flame Arrestors	EA	1	$1,200.00	$1,200.00
Operation	LS	~~1~~		
		Subtotal Gas System Maintenance:		$8,800.00
8. Landscape Maintenance				
Mowing	AC	165.3	$264.84	$43,778.05
Fertilizer	AC	165.3	$202.99	$33,554.25
		Subtotal Landscape Maintenance:		$77,332.30
9. Erosion Control and Cover Maintenance				
Sodding	SY	13,807	$3.08	$42,525.56
Regrading	AC	2.85	$3,968.80	$11,311.08
Liner Repair	SY	1,255	$16.00	$20,080.00
Clay	CY	2,092	$5.90	$12,342.80
		Subtotal Erosion Control and Cover Maintenance:		$86,259.44
10. Storm Water Management System Maintenance				
Conveyance Maintenance	LS	1	$10,076.00	$10,076.00
		Subtotal Storm Water Management System Maintenance:		$10,076.00
11. Security System Maintenance				
Fences	LS	1	$500.00	$500.00
Gate(s)	EA			
Sign(s)	EA			
		Subtotal Security System Maintenance:		$500.00

Description	Unit	Number of Units / Year	Cost / Unit	Annual Cost
12. Utilities	LS	1	$3,000.00	$3,000.00
			Subtotal Utilities:	$3,000.00
13. Leachate Collection/Treatment Systems Operation				
Operation				
P.E. Supervisor	HR			
On-Site Engineer	HR			
Office Engineer	HR			
OnSite Technician	HR	96	$66.09	$6,344.64
Materials	LS	1	$1,000.00	$1,000.00
	Subtotal Leachate Collection/Treatment Systems Operation:			$7,344.64
14. Administrative				
P.E. Supervisor	HR	16	$117.58	$1,881.28
On-Site Engineer	HR			
Office Engineer	HR			
OnSite Technician	HR	96	$66.09	$6,344.64
Other (1 full time treatment plant operator & 2 part time laborers)	HR	4,160	$66.09	$274,934.40
			Subtotal Administrative:	$283,160.32
			Subtotal of 1-14 Above:	$812,045.54
15. Contingency	5	% of Subtotal of 1-14 Above		$40,602.28
			Subtotal Contingency:	$40,602.28

Description	Unit	Number of Units / Year	Cost / Unit	Annual Cost
16. Site Specific Costs				
			Subtotal Site Specific Costs:	

ANNUAL LONG-TERM CARE COST ($ / YEAR): $852,647.82

Number of Years of Long-Term Care: 30

TOTAL LONG-TERM CARE COST ($): $25,579,434.48

VI. CERTIFICATION BY ENGINEER

This is to certify that the Cost Estimates pertaining to the engineering features of this solid waste management facility have been examined by me and found to conform to engineering principles applicable to such facilities. In my professional judgment, the Cost Estimates are a true, correct and complete representation of the financial liabilities for closing and/or long-term care of the facility and comply with the requirements of Rule 62-701.630 F.A.C. and all other Department of Environmental Protection rules, and statutes of the State of Florida. It is understood that the Cost Estimates shall be submitted to the Department annually, revised or adjusted as required by Rule 62-701.630(4), F.A.C.

Signature

3922 Coconut Palm Drive, Ste. 102
Mailing Address

Kollan L. Spradlin, SR. Project Professional
Name and Title (please type)

Tampa, FL 33619
City, State, Zip Code

02/02/2022
Date

kspradlin@scsengineers.com
E-Mail address (if available)

FL PE #82852
Florida Registration Number
(please affix seal)

KOLLAN LEE SPRADLIN
LICENSE
No. 82852
STATE OF
FLORIDA
PROFESSIONAL ENGINEER
02/02/2022

813-621-0080
Telephone Number

VII. SIGNATURE BY OWNER/OPERATOR

Signature of Applicant

332 N. Falkenburg Road
Mailing Address

Kimberly A. Byer, SWMD Director
Name and Title (please type)

Tampa, FL 33619
City, State, Zip Code

ByerK@HillsboroughCounty.org
E-Mail address (if available)

813-612-7718 Ext. 43131
Telephone Number

PART 3
EXPLANATION OF DOCUMENT REPORT

CLOSURE AND LONG-TERM CARE COST ESTIMATES REPORT

February 2022

Note that some of the quantities have been obtained from previously calculated Financial Assurance Cost Estimates (FACE) included as part of the Operation Permit Minor Modification Application, dated November 2018. Quantities and costs of items that have changed as a part of the revised closure design have been recalculated.

GENERAL INFORMATION AND ASSUMPTIONS

Closure Area Phases I-VI

Surface area of Phase I-VI = 162.4 acres

The 3D surface area of Phases I-VI at closure = 165.3 acres
(Obtained from CAD Civil 3-D)

For Closure Items 2 through 4, assume an overall loss factor of 5% to count for soil losses & testing, geosynthetics losses & testing, and miscellaneous materials uses (such as installation of anchor trenches) during construction. Following quantities for geosynthetics & soils are calculated using a 5% loss factor.

Geosynthetics:

Area (with 5% loss factor) = 173.6 acres = 7,560,177 ft^2 = 840,020 yd^2

Soils:
7,560,177 ft^2 x 0.25 ft (3”) cover = 1,890,044 ft^3 / 27 = 70,002 yd^3
7,560,177 ft^2 x 0.5 ft (6”) cover = 3,780,089 ft^3 / 27 = 140,003 yd^3
7,560,177 ft^2 x 1.5 ft (18”) cover = 11,340,266 ft^3 /27 = 420,010 yd^3
7,560,177 ft^2 x 2.0 ft (24”) cover = 15,120,355 ft^3/27 = 560,013 yd^3

Unit Cost Estimations and Calculations:

All unit costs are explained in the following parts for each item. The RS Means 2022 Online Cost Database was used to estimate some unit costs. The cost references for third-party contractors’ quotes, recent construction costs at the SCLF, and RS Means pages, have been provided in Part 4.

The final cover for the landfill will consist of 12 inches of intermediate cover material over the landfilled waste, a 40-mil LLDPE geomembrane, geocomposite drainage layer, 18 inches of protective cover, and 6 inches of topsoil.

CLOSURE COSTS

Item No. 1 Proposed Monitoring Wells

No additional monitoring wells are proposed for closure of the landfill.

Item No. 2 Slope and Fill

The slope and intermediate cover will be maintained during the operation of the landfill. During closure, there will be a need to shape and compact the intermediate cover existing at the time of closure. It is assumed that, on average, approximately three inches of soil will need to be installed during closure for fine grading. This assumption was used to generate grading/compaction costs associated with the intermediate cover. Also, soil quantities were increased by an additional 5% to account for shrinkage & bulking losses.

<u>Phases I to VI</u>: Quantity of 3" soil fill = 66,668 CY * 1.05 = 70,002 CY

Soil cost is based on third-party contractors' quotations for landfill closure projects at the SCLF and similar landfill facilities in Florida. Two quotes from different contractors were used to calculate the average unit cost for the soil. For this submittal, on-site soils are available for cover soil and fill material, per February 2015 revisions to FDEP 62-701.630(3)(d).

- Soil unit cost from 2022 contractor quotes (on-site source) = $5.49 per CY

Item No. 3 Barrier Layer

The landfill barrier layer will consist of a 40-mil textured LLDPE (linear low-density polyethylene) geomembrane.

<u>Phases I to VI</u>: Quantity of 40-mil textured LLDPE = 840,020 SY

Quantity of 330-mil drainage geocomposite = 426,620 SY

Quantity of 300-mil drainage geocomposite = 413,399 SY

Geosynthetics costs are based on third-party contractors' quotations. Two quotes from different contractors were used to calculate the average unit cost for the installed geosynthetics.

- Geomembrane unit cost from 2022 contractor quotes = $2.24 per SY
- 300-mil Drainage geocomposite unit cost from 2022 contractor quotes = $2.47 per SY
- 330-mil Drainage geocomposite unit cost from 2022 contractor quotes = $2.58 per SY

Item No. 4 Final Cover Material

The quantity for this item was based on 24 inches of top vegetative soil layer above the geosynthetics (18 inches of protective cover plus 6 inches of topsoil). In addition, soil quantities were increased by 5% to account for shrinkage & bulking losses.

<u>Phases I to VI</u>: Quantity of 24" topsoil layer = 533,346 CY * 1.05 = 560,013 CY

Topsoil cost is based on third-party contractors' quotations for landfill closure projects at the SCLF and similar landfill facilities in Florida. Two quotes from different contractors were used to calculate the average unit cost for the soil. On-site soils are available for cover soil and fill material, per February 2015 revisions to FDEP 62-701.630(3)(d).

- Topsoil unit cost from 2022 contractor quotes (on-site source) = $4.80 per CY

Item No. 5 Vegetative Cover

Phases I-VI:
Hydroseeding quantity based on top of crown area of final build out for Phases I-VI = 426,222 SY = 88.1 AC

Sodding quantity based on side slopes 3D surface area = (total 3D surface area – top of crown area) = 165.3 AC – 88.1 AC = 77.1 AC = 373,399 SY

Hydroseeding cost is based on 2022 RS Means data for Tampa, FL.

- Hydroseeding unit cost from RS Means = $56.57 per 1,000 SF = $2,464.19 per AC

Sodding cost is based on an average of two 2022 third-party contractor quotations received on landfill closure projects for the SCLF and similar landfill facilities in Florida.

- Sodding unit cost from 2022 contractor quotes = $3.08 per SY

Item No. 6 Stormwater Control Systems

Phases I-VI:

Berms:

Embankments (stormwater berms for closure top of crown) are 17 square feet cross-section for the top slope with a total length of 8,024 ft taken from the Phase I-VI Closure Design Drawings (included in Part 5).

Embankments (stormwater berms for side slopes of closure) are 35 square feet cross-section for the side slope with a total length of 28,498 ft taken from the Phase I-VI Closure Design Drawings (included in Part 5).

Total quantity of fill soil required = (17 SF x 8,024 LF) + (35 SF x 28,498 LF) = 1,133,838 CF = 41,994 CY

The unit cost for the structural fill/soil is assumed the same as that of Item 2, or $5.49 per CY.

Other:

Downchutes: A typical downchute for Phase I-VI is comprised of two major components (see typical downchute detail provided in Part 5): 300-mil double-sided geocomposite and 6” thick grout filled fabric revetment (GFFR). The area for each downchute was calculated in AutoCAD Civil 3D and the total area for all 11 downchute structures is 97,361 SF.

Unit cost of installed 300-mil double-sided geocomposite is assumed same as Item No. 3. Unit cost of 6” GFFR is based on the average value of two quotes provided by contractors in 2022 and is $11.00 per SF.

Control Structures: The control structure is comprised of the velocity dissipater gabions (three feet wide by three feet tall).

Total length of gabions = 42 ft (Downchute 1) + 42 ft (Downchute 2) + 30 ft (Downchute 4) + 36 ft (Downchute 6) + 30 ft (Downchute 7) + 30 ft (Downchute 8) + 36 ft (Downchute 9) + 72 ft (Downchute 11) = 318 ft; therefore, plan area of gabions = 318 ft x 3 ft = 954 SF = 106 SY.

Unit cost of gabions is based on RS Means: $243.54 per SY.

<u>Composite Drain Pipe</u>: The composite pipe consists of a 4-inch perforated HDPE pipe surrounded by a layer of #54 gravel to a total diameter of 12 inches. The gravel is then wrapped in geotextile. The total length of the composite drain is estimated to be 48,444 feet (see composite drain detail provided in Part 5).

Unit cost per linear foot is based on the total cost, installed, of the composite drain (HDPE pipe, gravel, and geotextile). The installed unit cost is based on the average value of two quotes provided by third-party contractors in 2022 and is $42.50 per LF.

The composite drain discharge pipes consist of 4" SDR 17 HDPE pipe and the total length pipe is 5,064 feet. The unit cost is based on the average value of two quotes provided by third-party contractors in 2022 and is $20.50 per LF.

See Table 1 below for the total cost and individual breakup of "Other" costs. Note that 10% contingency is added to account for any miscellaneous storm water control activities required during closure such as temporary stormwater control measures. This total cost is added as a lump sum amount on the FDEP Form.

Table 1. Breakup of "Other" Costs for Phase I to VI

Item	Component	Quantity	Unit	Unit Cost	Total
Downchutes	Geotextile (double lined)	97,361	SF	$2.47	$240,482
Downchutes	6" GFFR	97,361	SF	$11.00	$1,070,971
Control Structure	Gabions	118	SY	$243.54	$25,815
Composite Drain	Geotextile, Gravel Fill, and 4" Perforated HDPE Pipe	48,444	LF	$42.50	$2,058,870
Composite Drain Discharge	4" HDPE Pipe	5,064	LF	$20.50	$103,812
Subtotal					$3,499,950
				10% Contingency	$349,995
				Total	$3,849,945

Item No. 7 Gas Controls: Passive

No passive gas collection system is proposed as the facility has an active gas collection system installed.

Item No. 8 Gas Control: Active Extraction

Although an expansion of the active gas collection system is included as a part of the Phase I-VI Closure Design Drawings, a functional active gas collection system is currently in place. The system expansion was included as a part of the Phase I-VI Closure Design Drawings to facilitate design around existing infrastructure and to plan for installation prior to liner placement. The expansion will provide additional gas as a part of a separate, non-closure-related, project.

Therefore, the gas collection system installation is considered as part of the operational costs of the facility. Note that the Southeast County Landfill is a Title V facility that falls under the New Source Performance Standards (NSPS) compliance, and therefore, an active gas collection system is required by the regulations. The facility has an active gas collection system installed in Phases I-VI and Sections 7, 8, and 9.

Item No. 9 Security System

Perimeter fencing, gates, and signs already exist at the facility. A $2,000 lump sum is allocated in the cost estimates for additional signs or fence modifications required at the time of closure.

Item No. 10 Engineering Permitting and Design

The closure permit application (including plan report), engineering drawings, and certification of closure reports will be required as part of the landfill closure. All three services are included under the closure plan report for financial assurance purposes. SCS reevaluated the working hours estimated to complete these services for this cost estimate.

In accordance with Rule 62-701.610(3), a final survey of the Class I landfill will be required. The final survey cost for Phases I-VI is based on 2022 RS Means data for Tampa, FL, and is estimated to be $66,791.87 to account for an area of 162.4 AC.

- Final survey unit cost from RS Means = $411.28 per AC

The facility already falls under NSPS compliance and has an assigned Title V permit; therefore, no cost has been considered. Closure permit fee is based on Chapter 62-701.

Item No. 11 Construction-Phase Engineering

The hours shown in Item 11 include professional services required during construction (submittal review, site visits, and quality testing review). SCS reviewed the working hours estimated in the November 2018 cost estimates and found the numbers to be conservative for financial assurance purposes. These working hours are repeated in the current estimates using updated rates.

Item No. 12 Contingency

A contingency of 5% is added to the sub-total of Items 1-11.

Item No. 13 Site-Specific Cost

Mobilization & Insurance: A mobilization & insurance cost is assumed as approximately 5% of the construction cost.

Waste Tire Processing Facility: The Waste Tire Processing Facility (WTPF) has a total annual intake of 1,560 tons of tires (source: May 2020 Permit Renewal Application). Based on the annual intake quantities from the May 2020 Permit Renewal Application, and the average disposal cost of $150 per ton provided by Hillsborough County, the total cost of closing the waste tire facility is approximately $234,000.

LONG-TERM CARE COSTS:

In accordance with Rule 62-701.630(3)(a), F.A.C., the owner or operator of a Class I facility shall continue to monitor and maintain the facility for 30 years from the date of closure.

Item No. 1 Groundwater Monitoring

Phases I to VI: There are 15 wells that are included in regular semi-annual groundwater monitoring for the Phase I to VI area at the facility.

SCS evaluated unit sampling cost for various similar landfill facilities and conservatively estimated the unit cost of sampling to be $450 per location per monitoring event.

Item No. 2 Surface Water Monitoring

There are four surface water monitoring locations at the facility that are required to be monitored and analyzed semiannually. SCS evaluated unit sampling cost for various similar landfill facilities and conservatively estimated the unit cost of sampling to be $450 per location per monitoring event. Note that we assume half the cost applies to Phases I to VI.

Item No. 3 Gas Monitoring

Quarterly gas monitoring is split into two separate tasks:

Gas Probes & Buildings: Perimeter gas probes and on-site buildings are monitored with LandGEM or other similar equipment. LandGEM rental cost is approximately $200 per day (see Attachment 4). On-site technician ($66.09 hourly rate, see Attachment 4) will require 10 hours for sampling & reporting results to the department. Therefore, total cost for the sampling event = $200 (equipment) + $660.90 (technician) + $250 (miscellaneous expenses) = $1,110.90.

Surface Emissions Monitoring (SEM): Surface emissions monitoring will be performed with MicroFID or similar equipment. The equipment's daily rental rate is approx. $200 (see Attachment 4). It requires approximately 20 hours for the technician to perform the SEM and another 8 hours to compile and submit the report to the department. Therefore, total cost of the SEM event = $400 (equipment) + $1,850.52 (technician) = $2,250.52.

The total cost of quarterly gas monitoring is estimated to be $3,361.42. Note that we assume half the cost applies to Phases I to VI ($1,680.71).

Item No. 4 Leachate Monitoring (Class I Only)

Per Chapter 62-701 of the Florida Administrative Code (FAC), annual leachate monitoring is no longer required and therefore, is not included as part of the long-term care cost estimates.

Item No. 5 Leachate Collection/Treatment Systems Maintenance

Collection Pipe: Based on a quotation from Florida Jetclean, the cost of jet cleaning is estimated at $15,000 (=$250 per hour x 60 hours). Assuming that pipe cleaning will be required once every five years, the annualized cost of jet cleaning the collection pipes is $3,000. Note that we assume half the cost applies to Phases I to VI ($1,500/yr).

Assuming video inspections will be required for 12 hours once every five years, annualized video inspection cost is $600 (= $250 per hour x 12 hours / 5 years). Note that we assume half the cost applies to Phases I to VI ($300/yr).

Tanks: Inspection and cleaning services for the effluent and leachate storage tanks are assumed to be $45,000 every 5 years = $9,000 /yr. Note that we assume half the cost applies to Phases I to VI ($4,500/yr).

Disposal: Leachate generation is expected to decrease following the application of the closure geomembrane and cover material. Although Hydrologic Evaluation of Landfill Performance (HELP) Model results indicate that post-closure leachate generation is negligible, SCS has conservatively calculated the post-closure leachate generation of Phase I-VI using data and guidelines contained within EPA publication *Assessment Recommendations for Improving the Performance of Waste Containment Systems EPA/600/R-02/099*.

SCS has calculated the total post-closure leachate generation of Phase I-VI to be 73,245,703 gallons which equal an average annual leachate generation rate of 2,441,523 gallons through the 30-year post-closure care period. A detailed calculation of the annual leachate generation rate with applicable excerpts of the above referenced EPA document is provided in Part 5.

The cost of disposal was assumed as $125 per 1,000 gallons based on an existing contract between the County and a third-party leachate hauler. Per SCS's experience in similar projects at other landfill facilities in Florida, the unit cost is appropriate for leachate hauling and disposal.

Sumps & Lift Stations: For financial assurance purposes, an amount of $1,500 per year for Phase I-VI was allocated for the maintenance of sumps and lift stations.

Note that the Leachate Treatment and Reclamation Facility will close operations for long-term care. All leachate generated will be stored in the leachate and effluent tanks and hauled off-site for treatment. Therefore, no costs have been allocated for the maintenance of impoundments & aeration systems.

Item No. 6 Maintenance of Groundwater Monitoring Wells

$500 per year is provided for groundwater well maintenance.

Item No. 7 Gas System Maintenance

To estimate the cost of maintaining the active gas collection system, maintenance of the well field and flare station were taken into consideration. Routine maintenance includes replacing the thermocouples in the flare stack every few months, inspecting and cleaning the flare arrestor, and replacing the bearings on the blower. An annual lump sum amount of $5,000 was allocated for the installation of replacement wells. Note that after the landfill closure, landfill gas generation should decrease, and thus, any need for replacement wells should also decrease. An amount of $1,200 per year was budgeted for replacement of the blower every fifteen years. Also, $500 each was budgeted for maintenance of the compressor and meters & valves, $400 for the maintenance of the flaring units, and $1,200 for the flame arrestors. Note that the above gas system maintenance costs have been considered as part of Phases I-VI for financial assurance purposes.

Item No. 8 Landscape

The cost for this item is based on mowing both the landfill areas at an estimated frequency of four times a year and fertilizing once a year. See Part 4 of this report for a backup of these costs.

<u>Mowing</u>:

Unit cost from RS Means 2022 riding mower, 48” – 58”

[($1.52/ MSF) x (1 MSF/ 1000 SF) x (43,560 SF/ 1 AC)] = $66.21/AC. Mowing is projected to occur four times per year, for an annual cost of $264.84/AC/YR.

<u>Fertilization</u>: Unit cost from RS Means 2022

[($4.66/ MSF) x (1 MSF/ 1000 SF) x (43,560 SF/ 1 AC)] = $202.99/AC/YR. Fertilization will occur annually.

Item No. 9 Erosion Control & Cover Maintenance

To account for erosion control and cover maintenance in the post-closure care period, reconstruction of the final cover (including sod, liner, and soil fill material) and re-grading were considered. Annual average soil losses of 2,092 CY & 444 CY were calculated using the universal soil loss equation (USLE) for Phases I to VI and CEA Sections 7 to 9 respectively. This is a conservative value since it is assumed that 60% of the ground is covered by vegetation. Please refer to Part 6 for a further explanation of the USLE equation.

For liner repair, it is assumed that 10% of the total liner area will require repair.

<u>Phase I to VI</u>:

For financial assurance purposes, it is assumed that soil will erode in channels that will cut an average of six inches deep into the final cover.

- Sodding: 2,092 CY * 110% machinery disturbance / (0.5 FT average depth) = 13,807 SY
- Regrading: 2.85 AC = 124,265 SF = 2,092 CY * 27 CF/CY * 110% machinery disturbance / (0.5 FT average depth)
- Liner: 1,255 SY = 11,297 SF = 2,092 CY * 27 CF/CY * 10% / 0.5 FT
- Soil: 2,092 CY

Sodding cost is based on Item 5 of the Closure Cost Estimates ($3.08/SY).

Regrading cost: Unit cost is based on RS Means 2022

[($0.82/SY) x (SY/ 9 SF) x (43,560 SF/ AC)] = $3,968.80 / AC

Liner repair cost is assumed to be $16/SY. This assumption is based on materials cost of geosynthetics (see Item 3 of the Closure Cost Estimates) and miscellaneous costs associated with the repairs.

Soil Cost of vegetative topsoil is based on Item 4 of the Closure Cost Estimates ($4.80/CY).

Item No. 10 Stormwater Management System Maintenance

As in Item 9, the eroded soil volume calculated in the USLE was used in the cost estimate for soil excavation from the stormwater pond.

A cost of $4.25 per CY for excavation of sediment, debris, and vegetation was used from a contract for a nearby landfill. An additional $2,370 was added to the cost to account for cleaning of inlets, culverts, and additional stormwater appurtenances once every 5 years, split evenly between Phases I-VI and the CEA. The total cost of conveyance maintenance for the landfill is estimated as follows.

<u>Phase I to VI</u>: [($4.25/CY * 2,092 CY) + $1,185] = $10,076.00.

The stormwater maintenance cost sheet is provided in Part 4.

Item No. 11 Security System Maintenance

An amount of $500 per year is allocated for fence & other repairs.

Item No. 12 Utilities

Utilities cost is assumed as $500 per month ($6,000 annually). Note that we assume half the cost applies to Phases I to VI ($3,000).

Item No. 13 Leachate Systems Operation

The leachate collection system at the facility will require an on-site technician for maintenance. The cost of an onsite technician has been estimated at $66.09/hour for 16 hrs/month. In addition to the technician cost, an amount of $2,000 is budgeted for any materials required for general maintenance. It should be noted that we assume half the cost applies to Phases I to VI ($1,000).

Item No. 14 Administrative

Professional engineering services expected during the long-term care period include semiannual and water quality technical reports, ten-year closure permit renewal applications, and inspections required by FDEP rules for closure permits. SCS reviewed the working hours estimated in the November 2018 cost estimates and found the allotted quantity to be conservative for financial assurance purposes. These working hours remain unchanged in the current estimates; however, hourly rates have been revised to reflect the rates Hillsborough County and SCS have contractually agreed upon.

Item No. 15 Contingency

A contingency of 5% is included with the total cost of Items No. 1 - 14.

PART 4
UNIT COST REFERENCES

Hillsborough County- Southeast County Landfill
Class I Landfill - Financial Assurance Closure Cost
Average of Third Party Quotations[1]

Closure Item	Approximate Quantity	Unit	Unit Cost		
			Southeast Contracting	COMANCO	Average[2]
3" Intermediate Cover Soil Layer (on-site soils)	85,409	CY	$ 2.98	$ 8.00	$5.49
Topsoil (18" Cover Soil & 6" Top Vegetative Soil from on-site	683,269	CY	$ 3.09	$ 6.50	$4.80
Textured 40-mil LLDPE	1,024,903	SY	$ 0.72	$ 3.75	$2.24
300-mil Double-sided Geo-Composite	631,189		$ 0.94	$ 4.00	$2.47
330-mil Double-sided Geo-Composite	393,714	SY	$ 1.15	$ 4.00	$2.58
Sodding	406,305	SY	$ 2.65	$ 3.50	$3.08
Rainwater toe drain system (geotextile, 4" Perforated HDPE SDR 17 pipe, gravel about 0.7 CF of gravel per ft of pipe)	48,444	LF	$ 58.00		$58.00
6" thick Fabriform for Rainwater downchutes	97,361	SF	$ 12.00		$12.00
4" SDR 17 HDPE Pipe	5,064	LF	$ 23.00		$23.00

Note:
1. Quotes were received from 3rd party contractors for the SCLF and similar landfill facilities in Florida
2. Average cost was used for FACE

From:	secontracting@windstream.net
To:	Arney, Trent
Cc:	Biss, KaLeigh
Subject:	RE: Request for Unit Cost Data - Southeast County Landfill
Date:	Thursday, January 13, 2022 11:35:44 AM

This email originated from outside of SCS Engineers. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Earl Holmes
President
Southeast Environmental Contracting, Inc.
5667 Val Del Road
Hahira, GA 31632
229-794-3330
www.southeastenvironmental.com

From: Arney, Trent <TArney@scsengineers.com>
Sent: Thursday, January 13, 2022 10:39 AM
To: Earl Holmes <secontracting@windstream.net>; Earl Holmes <earl@southeastenvironmental.com>
Cc: Biss, KaLeigh <KBiss@scsengineers.com>
Subject: Request for Unit Cost Data - Southeast County Landfill

Earl,

I am working on the financial assurance for the Closure Permit Application for the Southeast County Landfill in Hillsborough County, FL. As per FDEP requirements, I need to provide 3rd party quotes for items included in this cost estimate. Would you be able to provide quotes for the following items on a unit price basis based on the following assumptions:

- Assume on-site borrow source for cover soil and topsoil and use off-road trucks for hauling.
- Estimate typical on-site haul distance of approximately 1 mile, if necessary
- All costs shall include material transportation and installation
- These costs shall be based on current (2022) prices

I provided a table below to assist. If you could email it back to me with the unit cost column filled out, I would appreciate it greatly.

Closure Item	Approximate Quantity	Unit	Unit Cost
3" Intermediate Cover Soil Layer (on-site soils)	85,409	CY	2.98
Topsoil (18" Cover Soil & 6" Top Vegetative Soil from on-site source)	683,269	CY	3.09

Textured 40-mil LLDPE	1,024,903	SY	.72
300-mil Double-sided Geo-Composite	631,189	SY	.94
330-mil Double-sided Geo-Composite	393,714	SY	1.15
Sodding	406,305	SY	2.65
Rainwater toe drain system (geotextile, 4" Perforated HDPE SDR 17 pipe, gravel about 0.7 CF of gravel per ft of pipe)	48,444	LF	58.00
6" thick Fabriform for Rainwater downchutes	97,361	SF	12.00
4" SDR 17 HDPE Pipe	5,064	LF	23.00

Please let me know if you have any questions or need any additional information. Thank you for your assistance on this.

Thanks,

Trent

Trent Arney, EIT
Staff Professional
SCS Engineers
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(813)804-6704 (Office)
tarney@scsengineers.com
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Driven By Client Success

From: Danielle Meador
To: Arney, Trent
Cc: Biss, KaLeigh; estimatingadmin
Subject: RE: Request for Unit Cost Data - Southeast County Landfill
Date: Tuesday, January 11, 2022 11:32:12 AM
Attachments: image001.png
image002.png
image003.png
image004.png
image005.png
image006.png

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Good Morning,

Below please find our cost estimate for the Hillsborough Southeast County Landfill based off the items and quantities provided:

Hillsborough Southeast County Landfill Cost Estimate			
Construction Item / Description	**Approx. Qty**	**Units**	**Unit Price Range**
3" Intermediate Cover Soil Layer (on-site soils)	85,409	CY	$8.00
Topsoil (18" Cover Soil & 6" Top Vegetative Soil from on-site source)	683,269	CY	$6.50
Textured 40-mil LLDPE	1,024,903	SY	$3.75
300-mil Double-sided Geo-Composite	631,189	SY	$4.00
330-mil Double-sided Geo-Composite	393,714	SY	$4.00
Sodding	1,024,903	SY	$3.50

Please let us know if you have any questions.

Thank you,

Danielle Meador | Estimating/Operations Administrator
COMANCO
4301 Sterling Commerce Dr. | Plant City, FL 33566
Office: 813-988-8829 | Fax: 813-988-8953
E-mail: dmeador@comanco.com | web: https://link.edgepilot.com/s/7e3011b7/QQ6tQUG7fUesoNOnxlOLmg?u=http://www.comanco.com/

From: Arney, Trent <TArney@scsengineers.com>
Sent: Monday, January 10, 2022 11:49 AM
To: Danielle Meador <dmeador@comanco.com>
Cc: Biss, KaLeigh <KBiss@scsengineers.com>
Subject: Request for Unit Cost Data - Southeast County Landfill

Danielle,

I am working on the financial assurance for the Closure Permit Application for the Southeast County Landfill in Hillsborough County, FL. As per FDEP requirements, I need to provide 3rd party quotes for items included in this cost estimate. Would you be able to provide quotes for the following items on a unit price basis based on the following assumptions:

- Assume on-site borrow source for cover soil and topsoil and use off-road trucks for hauling.
- Estimate typical on-site haul distance of approximately 1 mile, if necessary

- All costs shall include material transportation and installation
- These costs shall be based on current (2022) prices

I provided a table below to assist. If you could email it back to me with the unit cost column filled out, I would appreciate it greatly.

Closure Item	Approximate Quantity	Unit	Unit Cost
3" Intermediate Cover Soil Layer (on-site soils)	85,409	CY	
Topsoil (18" Cover Soil & 6" Top Vegetative Soil from on-site source)	683,269	CY	
Textured 40-mil LLDPE	1,024,903	SY	
300-mil Double-sided Geo-Composite	631,189	SY	
330-mil Double-sided Geo-Composite	393,714	SY	
Sodding	1,024,903	SY	

Please let me know if you have any questions or need any additional information. Thank you for your assistance on this.

Trent Arney, EIT
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https://link.edgepilot.com/s/f5eb3c54/mhyNLSnD806Tpm4cQB5pmw?u=http://www.scsengineers.com/
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Biss, KaLeigh

From:	Wiesman, Ronald <WiesmanR@hillsboroughcounty.org>
Sent:	Tuesday, January 18, 2022 8:45 AM
To:	Arney, Trent
Cc:	Biss, KaLeigh
Subject:	RE: Waste Tire Disposal Cost

Hello Trent,

We were closed for the holiday yesterday so here is the data.

Leachate = .125¢ per gallon
Tires low = $125 per ton.
Tires high = $175 per ton.

Ron

From: Arney, Trent <TArney@scsengineers.com>
Sent: Monday, January 17, 2022 9:44 AM
To: Wiesman, Ronald <WiesmanR@hillsboroughcounty.org>
Cc: Biss, KaLeigh <KBiss@scsengineers.com>
Subject: RE: Waste Tire Disposal Cost

Hey Ron,

Just checking in to get the updated waste tire disposal fee. Also one final question: what is the current hauling fee per gallon for leachate?

Trent Arney, EIT
Staff Professional
SCS Engineers
(256)529-9615 (C)
(813)804-6704 (Office)
tarney@scsengineers.com

From: Arney, Trent
Sent: Tuesday, January 11, 2022 3:50 PM
To: Wiesman, Ronald <WiesmanR@hillsboroughcounty.org>
Cc: Ruiz, Larry <RuizLE@HillsboroughCounty.ORG>; Biss, KaLeigh <KBiss@scsengineers.com>
Subject: Waste Tire Disposal Cost

Ron,

We are updating the Financial Assurance for the closure and would like to update the waste tire facility closure cost with updated storage quantities. To that end, what is the current removal cost?

Thanks,

Trent

Trent Arney, EIT
Staff Professional
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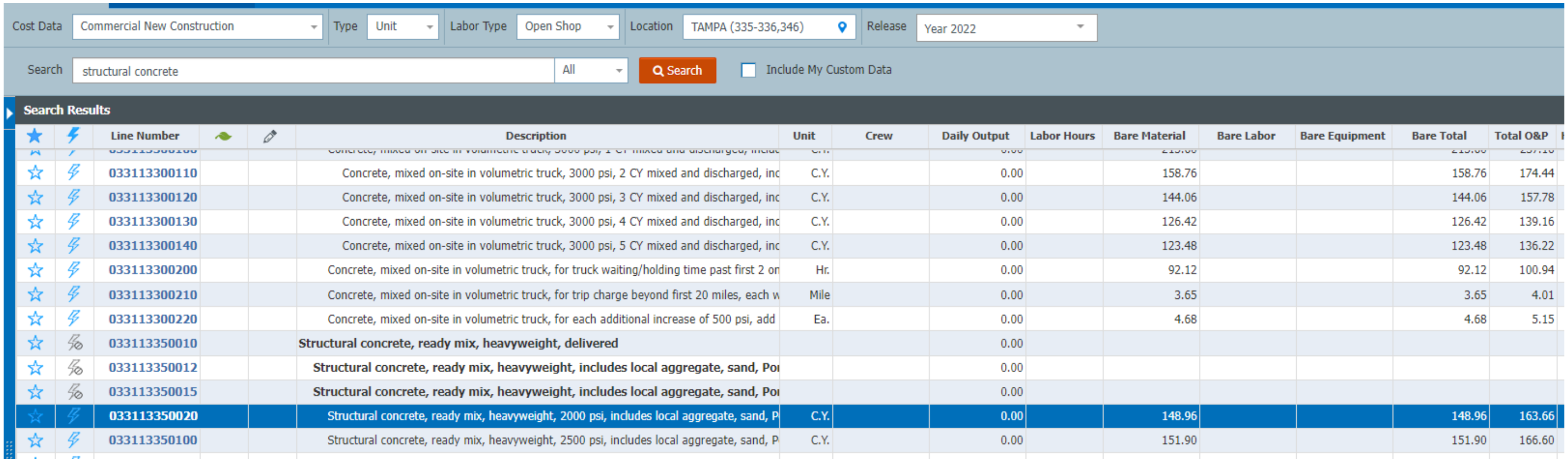
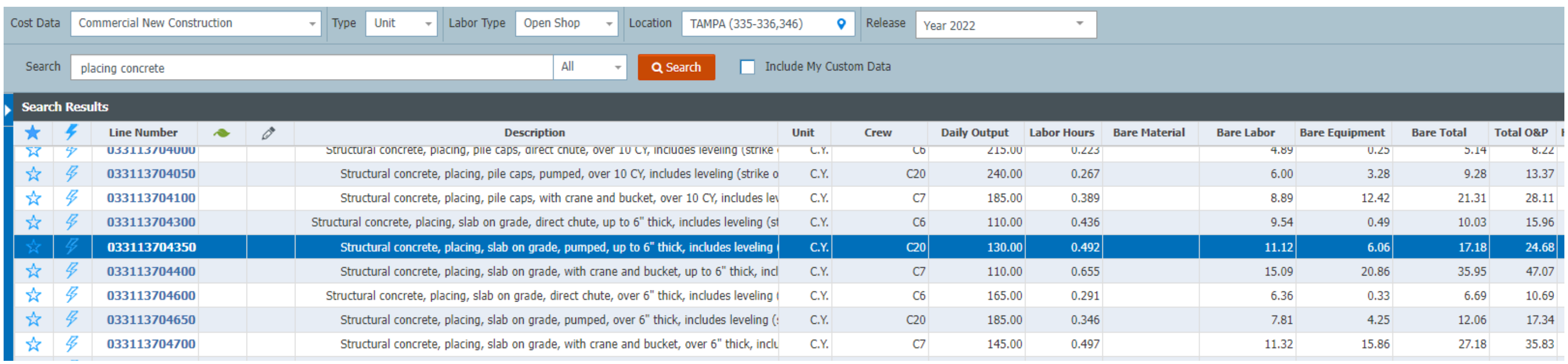
Concrete



Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total	Total O&P
033113300110	Concrete, mixed on-site in volumetric truck, 3000 psi, 2 CY mixed and discharged, inc	C.Y.		0.00		158.76			158.76	174.44
033113300120	Concrete, mixed on-site in volumetric truck, 3000 psi, 3 CY mixed and discharged, inc	C.Y.		0.00		144.06			144.06	157.78
033113300130	Concrete, mixed on-site in volumetric truck, 3000 psi, 4 CY mixed and discharged, inc	C.Y.		0.00		126.42			126.42	139.16
033113300140	Concrete, mixed on-site in volumetric truck, 3000 psi, 5 CY mixed and discharged, inc	C.Y.		0.00		123.48			123.48	136.22
033113300200	Concrete, mixed on-site in volumetric truck, for truck waiting/holding time past first 2 or	Hr.		0.00		92.12			92.12	100.94
033113300210	Concrete, mixed on-site in volumetric truck, for trip charge beyond first 20 miles, each w	Mile		0.00		3.65			3.65	4.01
033113300220	Concrete, mixed on-site in volumetric truck, for each additional increase of 500 psi, add	Ea.		0.00		4.68			4.68	5.15
033113350010	**Structural concrete, ready mix, heavyweight, delivered**			0.00						
033113350012	**Structural concrete, ready mix, heavyweight, includes local aggregate, sand, Poi**			0.00						
033113350015	**Structural concrete, ready mix, heavyweight, includes local aggregate, sand, Poi**			0.00						
033113350020	Structural concrete, ready mix, heavyweight, 2000 psi, includes local aggregate, sand, P	C.Y.		0.00		148.96			148.96	163.66
033113350100	Structural concrete, ready mix, heavyweight, 2500 psi, includes local aggregate, sand, P	C.Y.		0.00		151.90			151.90	166.60

Concrete Placement



Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total	Total O&P
033113704000	Structural concrete, placing, pile caps, direct chute, over 10 CY, includes leveling (strike	C.Y.	C6	215.00	0.223		4.89	0.25	5.14	8.22
033113704050	Structural concrete, placing, pile caps, pumped, over 10 CY, includes leveling (strike o	C.Y.	C20	240.00	0.267		6.00	3.28	9.28	13.37
033113704100	Structural concrete, placing, pile caps, with crane and bucket, over 10 CY, includes lev	C.Y.	C7	185.00	0.389		8.89	12.42	21.31	28.11
033113704300	Structural concrete, placing, slab on grade, direct chute, up to 6" thick, includes leveling (st	C.Y.	C6	110.00	0.436		9.54	0.49	10.03	15.96
033113704350	Structural concrete, placing, slab on grade, pumped, up to 6" thick, includes leveling (	C.Y.	C20	130.00	0.492		11.12	6.06	17.18	24.68
033113704400	Structural concrete, placing, slab on grade, with crane and bucket, up to 6" thick, incl	C.Y.	C7	110.00	0.655		15.09	20.86	35.95	47.07
033113704600	Structural concrete, placing, slab on grade, direct chute, over 6" thick, includes leveling (	C.Y.	C6	165.00	0.291		6.36	0.33	6.69	10.69
033113704650	Structural concrete, placing, slab on grade, pumped, over 6" thick, includes leveling (:	C.Y.	C20	185.00	0.346		7.81	4.25	12.06	17.34
033113704700	Structural concrete, placing, slab on grade, with crane and bucket, over 6" thick, inclu	C.Y.	C7	145.00	0.497		11.32	15.86	27.18	35.83

Concrete Fiber Reinforcement

Cost Data: Commercial New Construction | Type: Unit | Labor Type: Open Shop | Location: TAMPA (335-336,346) | Release: Year 2022

Search: fiber reinforcing | All | Search | Include My Custom Data

Search Results

Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total	Total O&P
032121110250	Reinforcing bars, glass fiber reinforced polymer, #6 bar, 0.372 lb/LF, incl labor for access	L.F.	4 Rodm	8300.00	0.004	1.93	0.13		2.06	2.34
032121110300	Reinforcing bars, glass fiber reinforced polymer, #7 bar, 0.497 lb/LF, incl labor for access	L.F.	4 Rodm	7900.00	0.004	2.38	0.13		2.51	2.84
032121110350	Reinforcing bars, glass fiber reinforced polymer, #8 bar, 0.497 lb/LF, incl labor for access	L.F.	4 Rodm	7400.00	0.004	2.16	0.14		2.30	2.61
032121110400	Reinforcing bars, glass fiber reinforced polymer, #9 bar, 0.800 lb/LF, incl labor for access	L.F.	4 Rodm	6800.00	0.005	3.92	0.15		4.07	4.57
032121110450	Reinforcing bars, glass fiber reinforced polymer, #10 bar, 1.08 lb/LF, incl labor for access	L.F.	4 Rodm	5800.00	0.006	3.57	0.18		3.75	4.22
032121110500	Reinforcing bars, glass fiber reinforced polymer, for bends, add	Ea.		0.00		1.50			1.50	1.65
032405000000	**Reinforcing fibers**			0.00						
032405300010	**Fibrous reinforcing, synthetic fibers**			0.00						
032405300100	Fibrous reinforcing, synthetic fibers, add to concrete	Lb.		0.00		5.61			5.61	6.15
032405300110	Fibrous reinforcing, synthetic fibers, add to concrete, 1-1/2 lb./C.Y.	C.Y.		0.00		8.67			8.67	9.52
032405700010	**Fibrous reinforcing, steel fibers**			0.00						
032405700140	**Fibrous reinforcing, steel fibers, ASTM A850, Type V, continuously deformed, add**			0.00						
032405700150	Fibrous reinforcing, steel fibers, ASTM A850, Type V, continuously deformed, add to pric	Lb.		0.00		1.10			1.10	1.20
032405700205	Fibrous reinforcing, steel fibers, ASTM A850, Type V, continuously deformed, 1-1/2" long	C.Y.		0.00		5.48			5.48	6.02
032405700210	Fibrous reinforcing, steel fibers, ASTM A850, Type V, continuously deformed, 1-1/2" lc	C.Y.		0.00		10.96			10.96	12.03
032405700215	Fibrous reinforcing, steel fibers, ASTM A850, Type V, continuously deformed, 1-1/2" lc	C.Y.		0.00		16.43			16.43	17.96
032405700220	Fibrous reinforcing, steel fibers, ASTM A850, Type V, continuously deformed, 1-1/2" lc	C.Y.		0.00		22.00			22.00	24.25
032405700225	Fibrous reinforcing, steel fibers, ASTM A850, Type V, continuously deformed, 1-1/2" lc	C.Y.		0.00		27.39			27.39	30.08
032405700230	Fibrous reinforcing, steel fibers, ASTM A850, Type V, continuously deformed, 1-1/2" lc	C.Y.		0.00		32.78			32.78	36.37
032405700235	Fibrous reinforcing, steel fibers, ASTM A850, Type V, continuously deformed, 1-1/2" lc	C.Y.		0.00		38.17			38.17	42.21
032405700240	Fibrous reinforcing, steel fibers, ASTM A850, Type V, continuously deformed, 1-1/2" lc	C.Y.		0.00		44.00			44.00	48.04
032405700250	Fibrous reinforcing, steel fibers, ASTM A850, Type V, continuously deformed, 1-1/2" lc	C.Y.		0.00		54.78			54.78	60.17
032405700275	Fibrous reinforcing, steel fibers, ASTM A850, Type V, continuously deformed, 1-1/2" lc	C.Y.		0.00		82.17			82.17	90.70
032405700300	Fibrous reinforcing, steel fibers, ASTM A850, Type V, continuously deformed, 1-1/2" lc	C.Y.		0.00		109.56			109.56	120.33
033113351460	Structural concrete, ready mix, for synthetic fiber reinforcing (1 lb/CY), add	C.Y.		0.00		8.23			8.23	9.07

Fertilizing

Cost Data: Commercial New Construction | Type: Unit | Labor Type: Open Shop | Location: TAMPA (335-336,346) | Release: Year 2022

Search: fertilizing | All | Search | Include My Custom Data

Search Results

Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total	Total O&P
320190130010	**Fertilizing**			0.00						
320190130100	Fertilizing, dry granular, 4 lb./M.S.F., hand spread	M.S.F.	1 Clab	24.00	0.333	3.68	8.86		12.54	18.44
320190130110	Fertilizing, dry granular, 4 lb./M.S.F., push rotary	M.S.F.	1 Clab	140.00	0.057	3.68	1.51		5.19	6.52
320190130112	Fertilizing, dry granular, 4 lb. per 1076 feet squared, push rotary	Ea.	1 Clab	130.00	0.062	3.68	1.63		5.31	6.71
320190130120	Fertilizing, dry granular, 4l b./M.S.F., tractor towed spreader, 8' spread	M.S.F.	B66	500.00	0.016	3.68	0.54	0.52	4.74	5.50
320190130130	Fertilizing, dry granular, 4 lb./M.S.F., tractor towed spreader, 12' spread	M.S.F.	B66	800.00	0.010	3.68	0.34	0.33	4.35	4.96
320190130140	Fertilizing, dry granular, 4 lb./M.S.F., truck whirlwind spreader	M.S.F.	B66	1200.00	0.007	3.68	0.22	0.21	4.11	4.66
320190130180	Fertilizing, hydro spread, water soluble, 1.5 lb./MSF, with small power mulcher	M.S.F.	B64	600.00	0.027	3.77	0.76	0.93	5.46	6.40
320190130190	Fertilizing, add for weed control	M.S.F.		0.00		0.49			0.49	0.54

Fine Grading

Cost Data: Commercial New Construction | Type: Unit | Labor Type: Open Shop | Location: TAMPA (335-336,346) | Release: Year 2022

Search: fine grading | All | Search | Include My Custom Data

Search Results

Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total	Total O&P
312216000000	**Fine grading**			0.00						
312216100010	**Fine grading, finish grading**			0.00						
312216100011	Fine grading, finish grading granular subbase for highway paving, +/- 1"	S.Y.	B32C	8000.00	0.006		0.19	0.30	0.49	0.64
312216100012	Fine grading, finish grading, small area, to be paved with grader	S.Y.	B11L	400.00	0.040		1.25	1.87	3.12	4.08
312216100100	Fine grading, for roadway, base or leveling course, large area, 6,000 S.Y. or more	S.Y.	B11L	2000.00	0.008		0.25	0.38	0.63	0.82
312216100200	Fine grading, grade subgrade for base course, roadways	S.Y.	B11L	3500.00	0.005		0.14	0.21	0.35	0.46
312216101020	Fine grading, loam or topsoil fine grade for large area, 15,000 S.Y. or more	S.Y.	B32C	5000.00	0.010		0.30	0.48	0.78	1.01

Gabions

Cost Data: Commercial New Construction | Type: Unit | Labor Type: Open Shop | Location: TAMPA (335-336,346) | Release: Year 2022

Search: gabion | All | Search | Include My Custom Data

Search Results

Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total	Total O&P
024113902100	Selective demolition, retaining walls, stone filled gabions, 12' x 3' x 3'	Ea.	B13	6.00	8.000		227.97	339.50	567.47	743.69
313600000000	**Gabions**			0.00						
313613000000	**Gabion boxes**			0.00						
313613100010	**Gabion boxes**			0.00						
313613100400	Gabion boxes, galvanized steel mesh mats or boxes, stone filled, 6" deep	S.Y.	B13	200.00	0.240	32.65	6.86	10.14	49.65	58.24
313613100500	Gabion boxes, galvanized steel mesh mats or boxes, stone filled, 9" deep	S.Y.	B13	163.00	0.294	59.12	8.40	12.46	79.98	92.85
313613100600	Gabion boxes, galvanized steel mesh mats or boxes, stone filled, 12" deep	S.Y.	B13	153.00	0.314	65.48	8.94	13.29	87.71	101.05
313613100700	Gabion boxes, galvanized steel mesh mats or boxes, stone filled, 18" deep	S.Y.	B13	102.00	0.471	137.33	13.44	19.89	170.66	194.86
313613100800	Gabion boxes, galvanized steel mesh mats or boxes, stone filled, 36" deep	S.Y.	B13	60.00	0.800	153.71	22.88	33.95	210.54	243.54

Seeding

Cost Data: Commercial New Construction | Type: Unit | Labor Type: Open Shop | Location: TAMPA (335-336,346) | Release: Year 2022

Search: seeding | All | Search | Include My Custom Data

Search Results

Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total	Total O&P
329219132200	Seeding, aerial operations, seed and liquid fertilizer, lawn seed	Acre	B58	50.00	0.480	460.11	12.94	99.91	572.96	637.60
329219140010	**Seeding athletic fields**			0.00						
329219140020	Seeding athletic fields, seeding athletic field mix, 8 lb. per M.S.F., push spreader	M.S.F.	1 Clab	8.00	1.000	28.17	24.80		52.97	71.29
329219140100	Seeding athletic fields, seeding athletic field mix, 8 lb. per M.S.F., tractor spreader	M.S.F.	B66	52.00	0.154	28.17	4.84	5.00	38.01	44.39
329219140200	Seeding athletic fields, seeding athletic field mix with mulch and fertilizer, 8 lb. per	M.S.F.	B81	80.00	0.200	30.99	5.35	12.37	48.71	56.57
329219140400	Seeding athletic fields, seeding birdsfoot trefoil, 0.45 lb. per M.S.F., push spreader	M.S.F.	1 Clab	8.00	1.000	3.42	24.80		28.22	44.06
329219140500	Seeding athletic fields, seeding birdsfoot trefoil, 0.45 lb. per M.S.F., tractor spreade	M.S.F.	B66	52.00	0.154	3.42	4.84	5.00	13.26	17.16

Gravel Fill

Cost Data: Commercial New Construction | Type: Unit | Labor Type: Open Shop | Location: TAMPA (335-336,346) | Release: Year 2022

Search: gravel fill | All | Search | Include My Custom Data

Search Results

Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total	Total O&P
312323143300	Backfill, structural, sand and gravel, 105 HP dozer, 300' haul, from existing stockpile,	L.C.Y.	B10W	465.00	0.017		0.62	1.38	2.00	2.51
312323144000	Backfill, structural, sand and gravel, 200 HP dozer, 50' haul, from existing stockpile, exclude	L.C.Y.	B10B	2500.00	0.003		0.12	0.52	0.64	0.75
312323144200	Backfill, structural, sand and gravel, 200 HP dozer, 150' haul, from existing stockpile,	L.C.Y.	B10B	1225.00	0.007		0.23	1.07	1.30	1.55
312323144400	Backfill, structural, sand and gravel, 200 HP dozer, 300' haul, from existing stockpile,	L.C.Y.	B10B	805.00	0.010		0.36	1.63	1.99	2.35
312323145000	Backfill, structural, sand and gravel, 300 HP dozer, 50' haul, from existing stockpile, exclude	L.C.Y.	B10M	3170.00	0.003		0.09	0.49	0.58	0.70
312323145200	Backfill, structural, sand and gravel, 300 HP dozer, 150' haul, from existing stockpile,	L.C.Y.	B10M	2200.00	0.004		0.13	0.72	0.85	1.01
312323145400	Backfill, structural, sand and gravel, 300 HP dozer, 300' haul, from existing stockpile,	L.C.Y.	B10M	1500.00	0.005		0.19	1.06	1.25	1.47
312323150020	Borrow, material only, bank run gravel	Ton		0.00		35.47			35.47	39.11
312323150500	Borrow, bank run gravel, haul 2 miles, haul, spread with 200 H.P. dozer	Ton	B15	1100.00	0.025		0.81	2.54	3.35	4.10
312323151000	Borrow, bank run gravel, hand spread	Ton	A5	33.00	0.545		14.68	2.49	17.17	26.88
312323160050	Fill by borrow and utility bedding, for pipe and conduit, crushed or screened bank run gr	L.C.Y.	B6	150.00	0.160	56.39	4.62	2.12	63.13	71.72
312323170500	Fill, gravel fill, compacted, under floor slabs, 4" deep	S.F.	B37	10000.00	0.005	0.60	0.13	0.03	0.76	0.90
312323170600	Fill, gravel fill, compacted, under floor slabs, 6" deep	S.F.	B37	8600.00	0.006	0.89	0.16	0.03	1.08	1.27
312323170700	Fill, gravel fill, compacted, under floor slabs, 9" deep	S.F.	B37	7200.00	0.007	1.47	0.18	0.04	1.69	1.97
312323170800	Fill, gravel fill, compacted, under floor slabs, 12" deep	S.F.	B37	6000.00	0.008	2.07	0.22	0.04	2.33	2.69
312323171000	Fill, gravel fill, compacted, under floor slabs, alternate pricing method, 4" deep	E.C.Y.	B37	120.00	0.400	44.57	11.19	2.13	57.89	69.76

Mowing

Cost Data: Commercial New Construction | Type: Unit | Labor Type: Open Shop | Location: TAMPA (335-336,346) | Release: Year 2022

Search: mowing | All | Search | Include My Custom Data

Search Results

Line Number	Description	Unit	Crew	Daily Output	Labor Hours	Bare Material	Bare Labor	Bare Equipment	Bare Total	Total O&P
311313101000	**Selective tree and shrub removal, selective clearing brush mowing, tractor with**			0.00						
311313101020	Selective tree and shrub removal, selective clearing brush mowing, light density, tract	Acre	B84	2.00	4.000		142.27	108.64	250.91	351.44
311313101040	Selective tree and shrub removal, selective clearing brush mowing, medium density, t	Acre	B84	1.50	5.333		190.53	144.53	335.06	466.92
311313101080	Selective tree and shrub removal, selective clearing brush mowing, heavy density, tra	Acre	B84	1.00	8.000		287.04	216.31	503.35	703.57
320190190010	**Mowing**			0.00						
320190191650	**Mowing, mowing brush, tractor with rotary mower**			0.00						
320190191660	Mowing, mowing brush, light density, tractor with rotary mower	M.S.F.	B84	22.00	0.364		12.98	9.85	22.83	32.04
320190191670	Mowing, mowing brush, medium density, tractor with rotary mower	M.S.F.	B84	13.00	0.615		22.05	16.64	38.69	54.11
320190191680	Mowing, mowing brush, heavy density, tractor with rotary mower	M.S.F.	B84	9.00	0.889		31.62	24.25	55.87	78.26
320190192000	Mowing, mowing brush/grass in highway/airport medians, tractor with rotary mower	M.S.F.	B84	13.00	0.615		22.05	16.64	38.69	54.11
320190192010	Traffic safety, flashing truck for highway/airport median mowing	Day	A2B	1.00	8.000		241.28	329.80	571.08	758.95
320190194050	Mowing, lawn mowing, improved areas, 18" - 22", power mover	M.S.F.	1 Clab	65.00	0.123		3.27		3.27	5.32
320190194100	Mowing, lawn mowing, improved areas, 22" - 30", power mover	M.S.F.	1 Clab	110.00	0.073		1.93		1.93	3.14
320190194150	Mowing, lawn mowing, improved areas, 30" - 32", power mover	M.S.F.	1 Clab	140.00	0.057		1.51		1.51	2.47
320190194160	Mowing, lawn mowing, improved areas, 36" - 44", riding mower	M.S.F.	B66	300.00	0.027		0.90	0.87	1.77	2.42
320190194170	Mowing, lawn mowing, improved areas, 48" - 58", riding mower	M.S.F.	B66	480.00	0.017		0.57	0.54	1.11	1.52
320190194175	**Mowing, lawn mowing, with tractor & attachments**			0.00						
320190194180	Mowing, lawn mowing, 3 gang reel, 7', with tractor & attachments	M.S.F.	B66	930.00	0.009		0.29	0.28	0.57	0.78
320190194190	Mowing, lawn mowing, 5 gang reel, 12', with tractor & attachments	M.S.F.	B66	1200.00	0.007		0.22	0.21	0.43	0.61
320190194200	Mowing, lawn mowing, rough terrain, 5', with tractor & attachments, cutter or sick	M.S.F.	B66	210.00	0.038		1.28	1.24	2.52	3.46
320190194210	Mowing, lawn mowing, smooth terrain, 5', with tractor & attachments, cutter or sic	M.S.F.	B66	340.00	0.024		0.79	0.77	1.56	2.13
320190194220	Mowing, lawn mowing, drainage channel, 5', with tractor & attachments, cutter or	Mile	B66	5.00	1.600		54.08	51.90	105.98	145.42
320190194250	Mowing, lawn mower, rotary type, (all sizes), sharpen	Ea.	1 Clab	10.00	0.800		21.22		21.22	34.53
320190194260	Mowing, lawn mower, rotary type, repair or replace part	Ea.	1 Clab	7.00	1.143		30.37		30.37	49.50
320190195000	Mowing, edge trimming, with weed whacker	L.F.	1 Clab	5760.00	0.001		0.03		0.03	0.06

SCS ENGINEERS HILLSBOROUGH COUNTY FEE SCHEDULE

Labor Category	Rate
Principal/Business Unit Director	$232.51
Project Director	$160.52
Senior Project Advisor	$201.50
Senior Project Manager	$170.61
Project Manager II	$154.30
Project Manager I	$138.70
Project Advisor	$162.75
Senior Project Professional II	$137.95
Senior Project Professional I	$117.58
Project Professional II	$108.52
Project Professional I	$91.50
Designer	$98.33
Staff Professional II	$86.31
Staff Professional I	$83.79
Senior Superintendent	$137.76
Data Analyst	$95.82
Senior Technician	$90.85
Associate Staff Professional	$77.50
Designer/Drafter	$64.09
Technical Associate	$54.81
Technician	$66.09
Secretarial/Clerical	$66.41

General Terms:

1. The hourly rates provided in the above table are the currently approved rates for SCS' Hillsborough County Active and Proposed Landfills General Engineering Contract.
2. The above rates include salary, overhead, administration, and profit. Other direct expenses, such as analyses of air, water and soil samples, reproduction, travel, subsistence, subcontractors, computers, and other reimbursable fees, are billed in accordance with the attached reimbursable fee schedule.

ATTACHMENT B
SCS ENGINEERS REIMBURSABLES FEE SCHEDULE PROFESSIONAL SERVICES FOR ACTIVE AND PROPOSED LANDFILL FACILITIES

Equipment	Unit	Unit Cost ($)
Auger - Handheld	Daily	5.00
Field Tablet	Daily	5.00
Vehicle	Daily	85.00
Vehicle	Weekly	400.00
Field Truck	Daily	95.00
Field Truck	Weekly	425.00
Field Truck	Monthly	1,400.00
Four Gas Meter	Daily	15.00
Four Gas Meter	Weekly	75.00
GEM 2000 NAV/5000 NAV/Envision Gas Analyzer(s)	Daily	185.00
GEM 2000 NAV/5000 NAV/Envision Gas Analyzer(s)	Weekly	555.00
GEM 2000 NAV/5000 NAV/Envision Gas Analyzer(s)	Monthly	2,775.00
GEM 5000 w/ H_2S/CO	Daily	200.00
GEM 5000 w/ H_2S/CO	Weekly	600.00
GEM 5000 w/ H_2S/CO	Monthly	3,000.00
SEM 500/TVA 2020/TDL 500/ Site FID Emissions Monitor	Daily	200.00
SEM 500/TVA 2020/TDL 500/ Site FID Emissions Monitor	Weekly	600.00
SEM 500/TVA 2020/TDL 500/ Site FID Emissions Monitor	Monthly	3,000.00
GPS Equipment - Handheld	Daily	25.00
GPS Equipment - Handheld	Weekly	75.00
GPS Equipment - Handheld	Monthly	375.00
Q Rae Gas Analyzer O_2/H_2S/CO/Combustibles	Daily	50.00
Micro Max Gas Analyzer O_2/H_2S/CO/COI Combustibles	Daily	50.00
Magnehelic Pressure Meter	Daily	10.00
Digital Readout Thermocouple	Daily	25.00
Personal Air Sampling Pump (PAS)	Daily	25.00
Tedlar Bag (10-Liter)	Each	40.00
Non-Contaminating Air Sampling Pump	Daily	25.00

Interface Probe	Daily	50.00
MiniRae 2000/3000 PID	Daily	150.00
MiniRae 2000/3000 PID	Weekly	450.00
MiniRae 2000/3000 PID	Monthly	2,250.00
RKI Eagle II	Daily	150.00
RKI Eagle II	Weekly	450.00
RKI Eagle II	Monthly	2,250.00
Air Sampling Station	Daily	50.00
Air Sampling Station	Weekly	150.00
Air Sampling Station	Monthly	750.00
Groundwater Equipment Kit	Daily	250.00
GW Sampling Equipment - Supplemental	Filter	13.00
Nuclear Gauge	Daily	50.00
Nuclear Gauge	Weekly	150.00
Soil Sampling Equipment Kit	Daily	50.00
Surface Water Equipment Kit	Daily	100.00
Trimble Equipment Kit	Daily	50.00
Trimble Equipment Kit	Weekly	200.00
Trimble Equipment Kit	Monthly	750.00
Turbidity Meter / Peristaltic Pump	Daily	30.00
Turbidity Meter / Peristaltic Pump	Weekly	80.00
Water Level Meter / Interface Probe	Daily	25.00
Water Level Meter / Interface Probe	Weekly	75.00
Water Level Meter / Interface Probe	Monthly	375.00
Water Level Meter w/ Temperature	Daily	45.00
Water Level Meter w/ Temperature	Weekly	135.00
Water Level Meter w/ Temperature	Monthly	675.00
100' Temperature Probe	Daily	15.00
100' Temperature Probe	Weekly	45.00
100' Temperature Probe	Monthly	225.00
Hydrogen Sulfide Meter	Daily	190.00
Hydrogen Sulfide Meter	Weekly	570.00
Hydrogen Sulfide Meter	Monthly	2,850.00
YSI 556 Meter/Micropurge Flow Cell	Daily	110.00
YSI 556 Meter/Micropurge Flow Cell	Weekly	320.00
Turbidity Meter	Daily	25.00
Turbidity Meter	Weekly	75.00
Turbidity Meter	Monthly	375.00
Vacuum Box/Carbon Canister and Blower	Daily	150.00
Dewatering Pump (Trash Pump)	Daily	45.00
Dräger Detector Tubes/Pump	Each	20.00
Teflon Well Bailer	Each	25.00

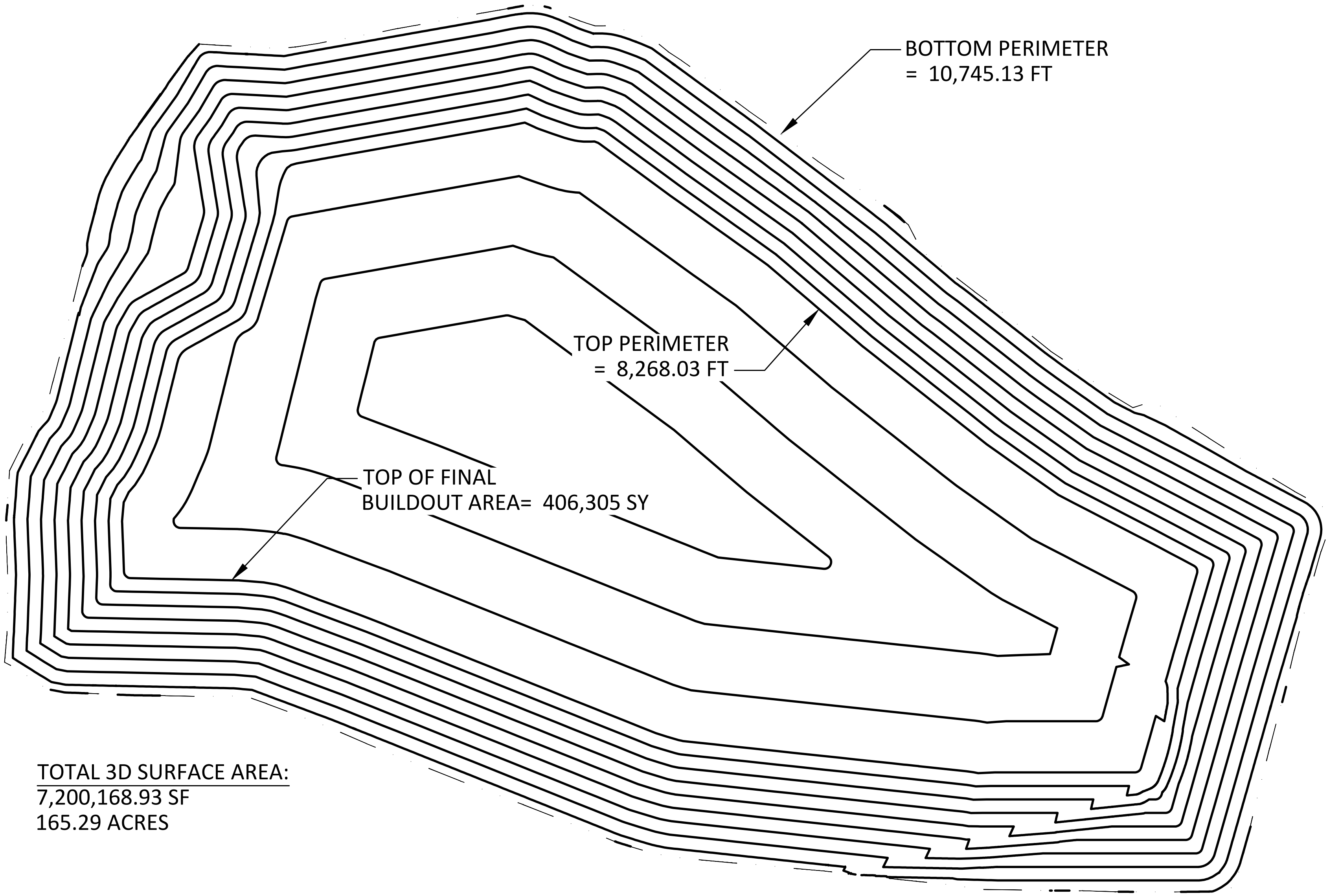
Downhole Video Camera System	Daily	200.00
Vacuum Air Pump	Daily	100.00
Vacuum Air Pump	Weekly	300.00
Vacuum Air Pump	Monthly	1,500.00
Oiless Compressor and Control Box (Groundwater)	Daily	75.00
Oiless Compressor and Control Box (Groundwater)	Weekly	225.00
Oiless Compressor and Control Box (Groundwater)	Monthly	1,125.00
Earth/Resistance Tester	Daily	100.00
Earth/Resistance Tester	Weekly	300.00
Earth/Resistance Tester	Monthly	1,500.00
Pitot Tube and Gauges	Daily	10.00
Pitot Tube and Gauges	Weekly	30.00
Pitot Tube and Gauges	Monthly	150.00
Pipe Laser	Daily	50.00
Pipe Laser	Weekly	150.00
Pipe Laser	Monthly	750.00
No. 14 P.E. Fusion Machine (1"-4")	Daily	110.00
No. 14 P.E. Fusion Machine (1"-4")	Weekly	330.00
No. 14 P.E. Fusion Machine (1"-4")	Monthly	1,650.00
No. 26 P.E. Fusion Machine (2"-6")	Daily	135.00
No. 26 P.E. Fusion Machine (2"-6")	Weekly	405.00
No. 26 P.E. Fusion Machine (2"-6")	Monthly	2,025.00
No. 28 P.E. Fusion Machine (2"-8")	Daily	180.00
No. 28 P.E. Fusion Machine (2"-8")	Weekly	540.00
No. 28 P.E. Fusion Machine (2"-8")	Monthly	2,700.00
No. 412 P.E. Fusion Machine (4"-12")	Daily	275.00
No. 412 P.E. Fusion Machine (4"-12")	Weekly	825.00
No. 412 P.E. Fusion Machine (4"-12")	Monthly	4,125.00
No. 618 P.E. Fusion Machine (6"-18")	Daily	475.00
No. 618 P.E. Fusion Machine (6"-18")	Weekly	1,425.00
No. 618 P.E. Fusion Machine (6"-18")	Monthly	7,125.00
No. 824 P.E. Fusion Machine (8"-24")	Daily	950.00
No. 824 P.E. Fusion Machine (8"-24")	Weekly	2,850.00
No. 824 P.E. Fusion Machine (8"-24")	Monthly	14,250.00
Trackstar 500 Fusion Machine	Daily	425.00
Trackstar 500 Fusion Machine	Weekly	1,275.00
Trackstar 500 Fusion Machine	Monthly	6,375.00
Sidewinder Fusion Machine	Daily	150.00
Sidewinder Fusion Machine	Weekly	450.00
Sidewinder Fusion Machine	Monthly	2,250.00

Electrofusion Processor Machine	Daily	175.00
Electrofusion Processor Machine	Weekly	525.00
Electrofusion Processor Machine	Monthly	2,625.00
Leister Extrusion Welding Gun	Daily	150.00
Air Compressor	Daily	60.00
Arc Welder	Daily	75.00
Generator (3,500-Watt)	Daily	60.00
Generator (5,000-Watt)	Daily	75.00
Generator (6,000-Watt)	Daily	80.00
Generator (8,000-Watt)	Daily	85.00
Isolation Pinch-off Tool (1”-4”)	Daily	40.00
Isolation Pinch-off Tool (1”-4”)	Weekly	120.00
Isolation Pinch-off Tool (1”-4”)	Monthly	600.00
Isolation Pinch-off Tool (2”-8”)	Daily	60.00
Isolation Pinch-off Tool (2”-8”)	Weekly	180.00
Isolation Pinch-off Tool (2”-8”)	Monthly	900.00
Isolation Pinch-off Tool (8”-12”)	Daily	100.00
Isolation Pinch-off Tool (8”-12”)	Weekly	300.00
Isolation Pinch-off Tool (8”-12”)	Monthly	1,500.00
4-Wheeler (ATV/UTV)	Daily	50.00
4-Wheeler (ATV/UTV)	Weekly	150.00
4-Wheeler (ATV/UTV)	Monthly	750.00
Infrared Thermometer	Daily	10.00
Infrared Thermometer	Weekly	30.00
Infrared Thermometer	Monthly	150.00
Tyvek Suit	Each	15.00
Polyethylene suit	Each	20.00
Organic Vapor Cartridges (per pair)	Each	20.00
Organic Vapor/Acid Cartridges (per pair)	Each	25.00
Cartridges pre-filters (per pair)	Each	15.00
Half face respirator (each)	Daily	20.00
Full face respirator (each)	Daily	25.00
Ventilator/manhole blowers	Daily	25.00
Parachute harness	Daily	10.00
Rescue Tripod	Daily	75.00
Rescue Tripod	Weekly	225.00
Rescue Tripod	Monthly	1,125.00

Meals and Incidental Expenses (M&IE) Total will be per the current U.S. General Services Administration rate for Hillsborough County, Florida.

PART 5

MATERIALS QUANTITY REFERENCES

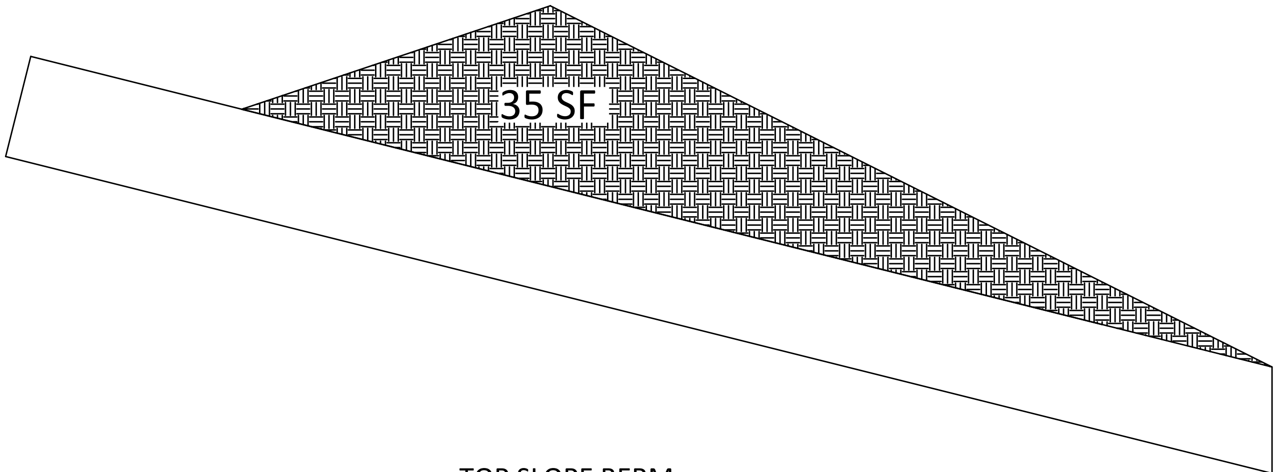


TOTAL 3D SURFACE AREA:
7,200,168.93 SF
165.29 ACRES

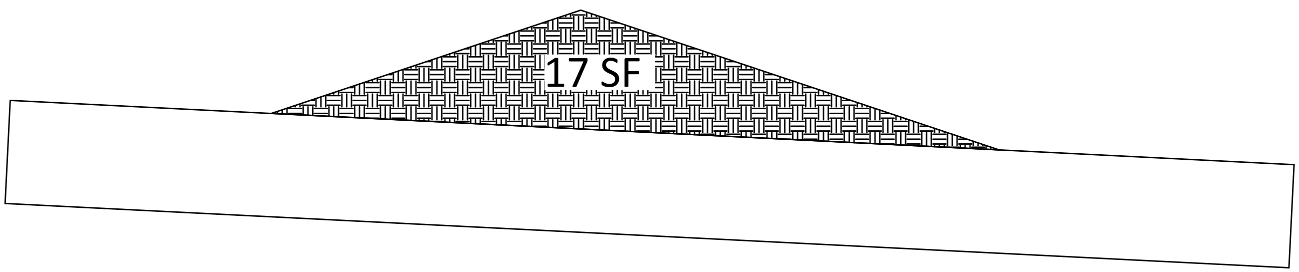
SCS ENGINEERS

PHASE I-VI FINAL COVER
SOUTHEAST COUNTY LANDFILL
FEBRUARY 2022 FINANCIAL ASSURANCE
COST ESTIMATE

SIDE SLOPE BERM

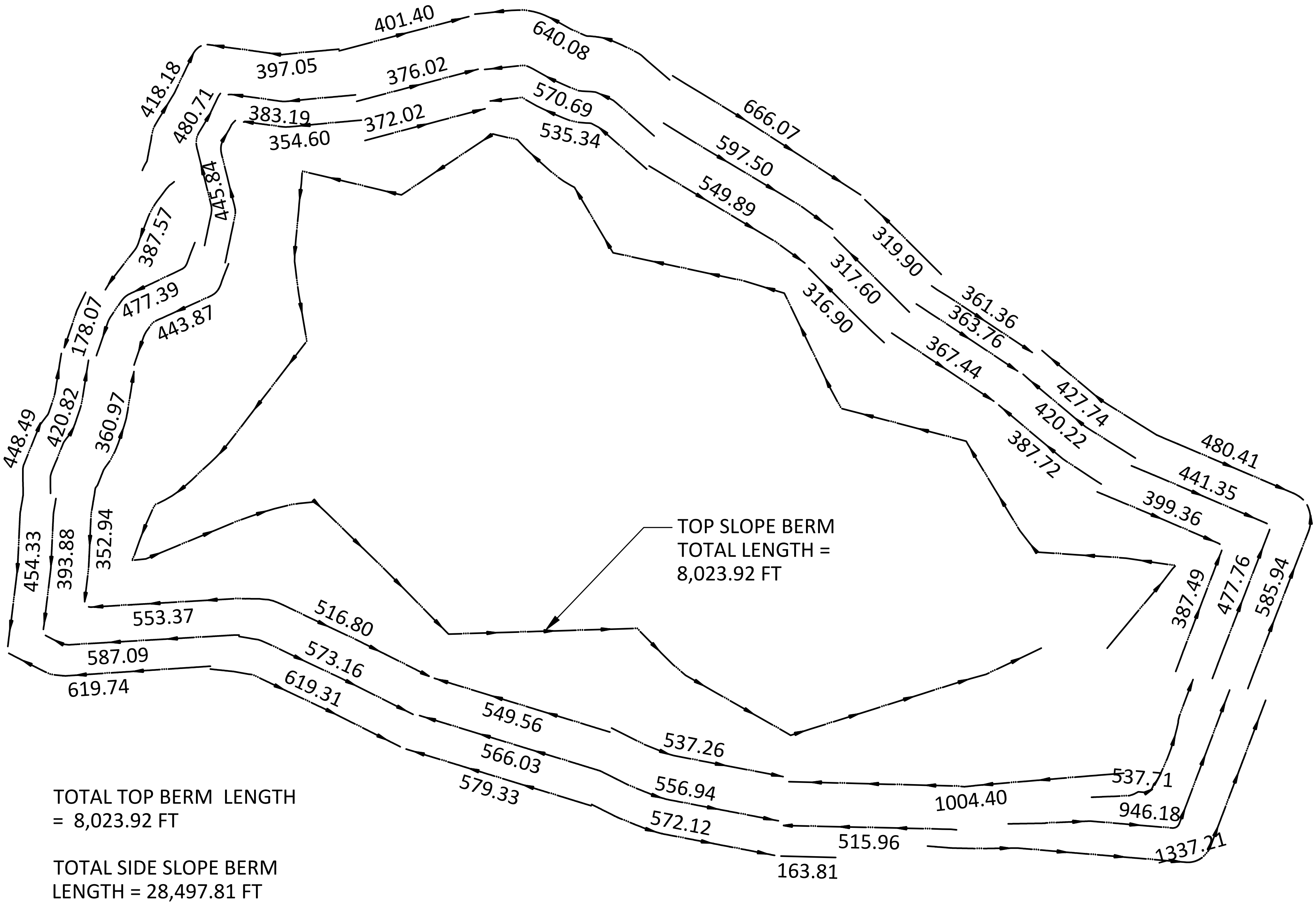


TOP SLOPE BERM



SCS ENGINEERS

STORMWATER BERM 2D AREA
SOUTHEAST COUNTY LANDFILL
FEBRUARY 2022 FINANCIAL ASSURANCE
COST ESTIMATE



SCS ENGINEERS

STORMWATER BERM LENGTHS
SOUTHEAST COUNTY LANDFILL
FEBRUARY 2022 FINANCIAL ASSURANCE
COST ESTIMATE

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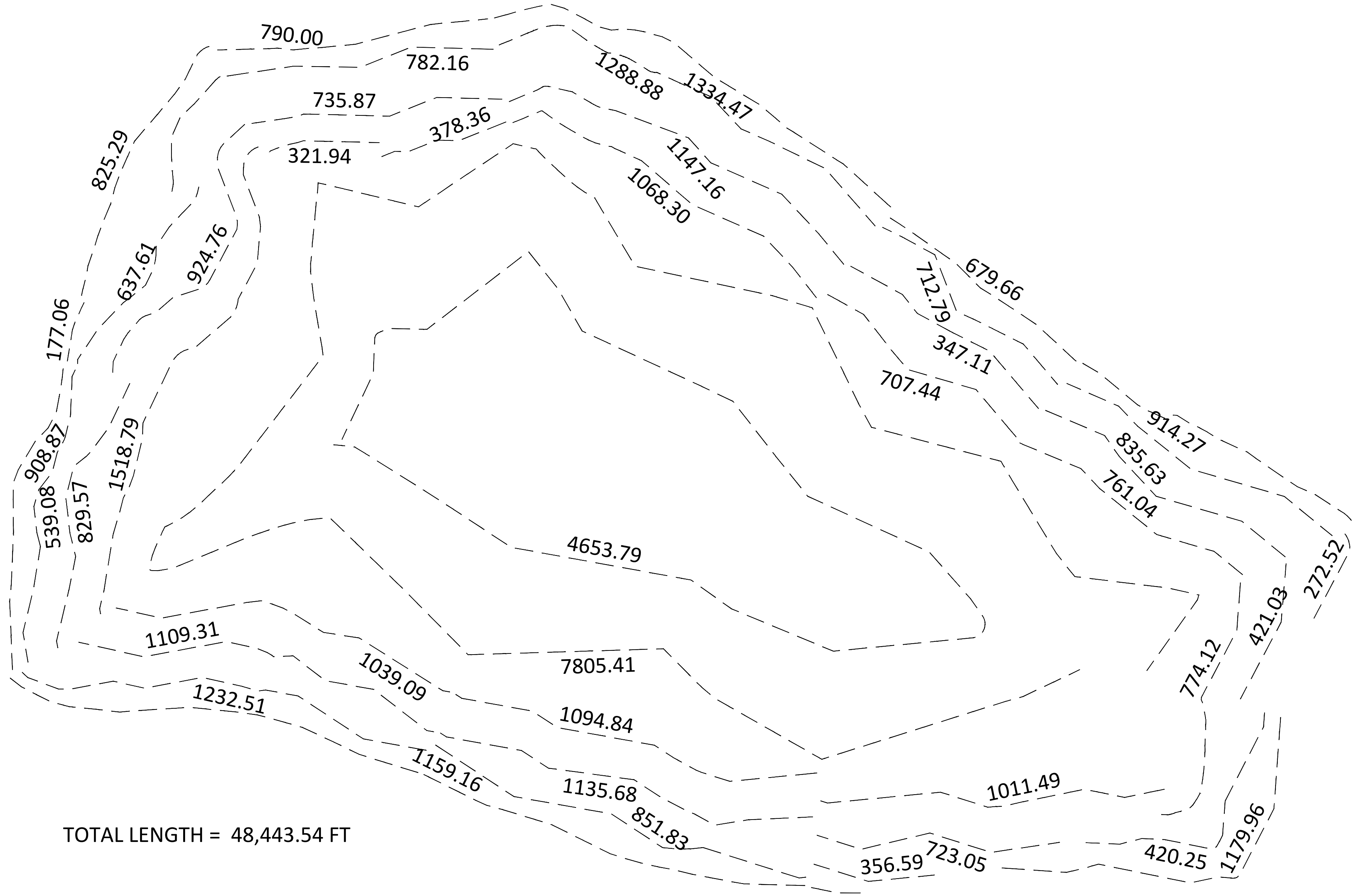
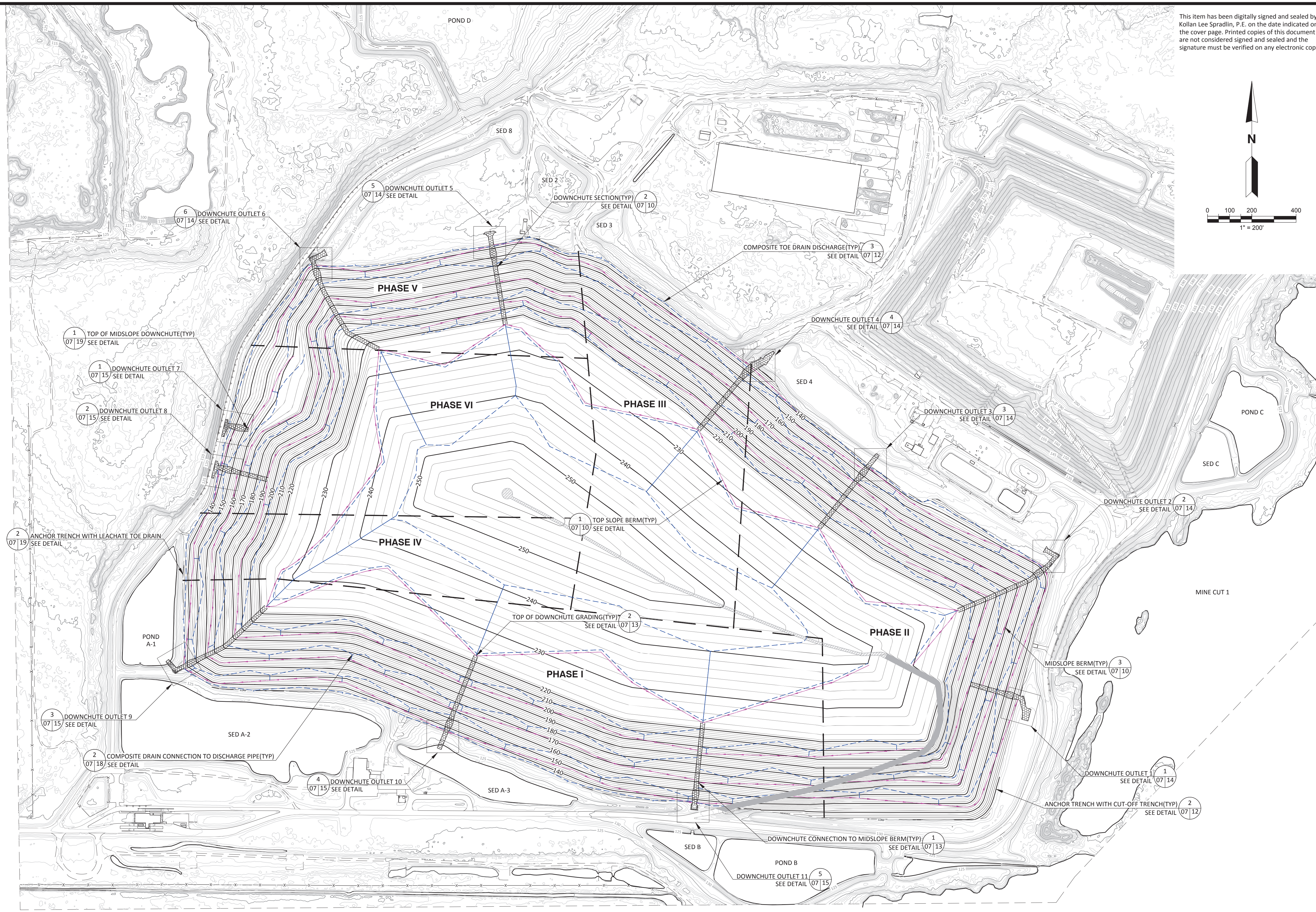


SCS ENGINEERS

STORMWATER COMPOSITE DRAIN LENGTHS
SOUTHEAST COUNTY LANDFILL
FEBRUARY 2022 FINANCIAL ASSURANCE
COST ESTIMATE



REV	DATE	DESCRIPTION	CHK. BY

SHEET TITLE
FINAL COVER STORMWATER DESIGN

PROJECT TITLE
PHASE I-VI CLOSURE DESIGN

CLIENT
HILLSBOROUGH COUNTY SOLID WASTE DEPARTMENT TAMPA, FL 33619

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS
3922 COCONUT PALM DRIVE, SUITE 102, TAMPA, FL 33619
PH (813) 621-0080 FAX NO. (813) 623-6757
FLORIDA FIRM REGISTRATION RY-4892

PROJ. NO. 09215600.13	DWN. BY: ALD	Q/A RVW BY: RBC
DSN. BY: KLS	CHK. BY: SRF	APP. BY: KLS

CADD FILE: FINAL COVER

DATE: FEBRUARY 2022

DRAWING NO. **07**

SHEET 07 of 22

F:\PROJECT\Hillsborough\09215600.00\Task 1100 -- General Services\20.0 Phase I-VI Closure\20.1 Phase I-VI Closure Permit\Engineering Drawings\FINAL COVER.dwg Jan 28, 2022 - 6:52pm Layout Name: FINAL COVER STORMWATER DESIGN By: 4745sld

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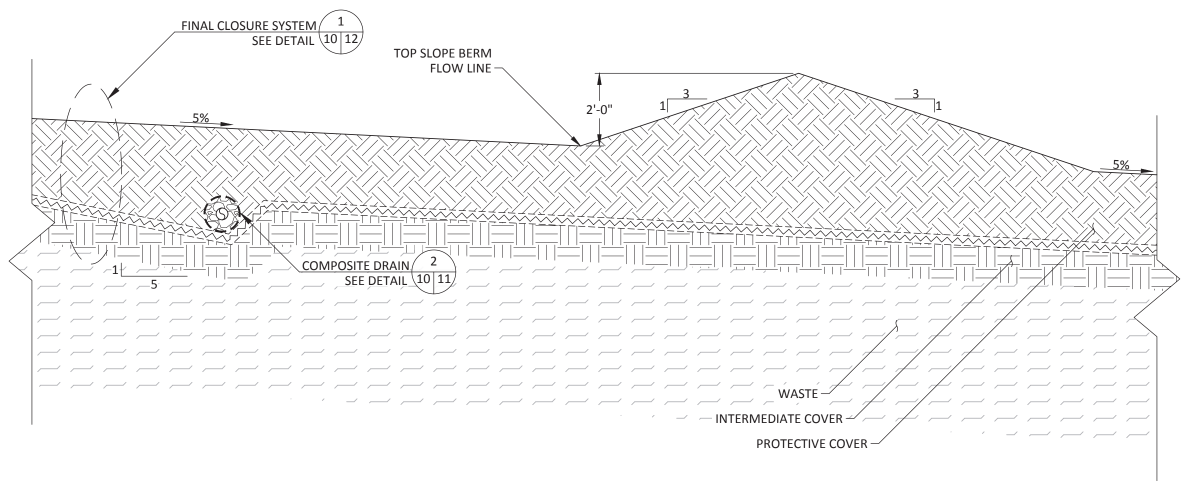

TOP SLOPE BERM DETAIL
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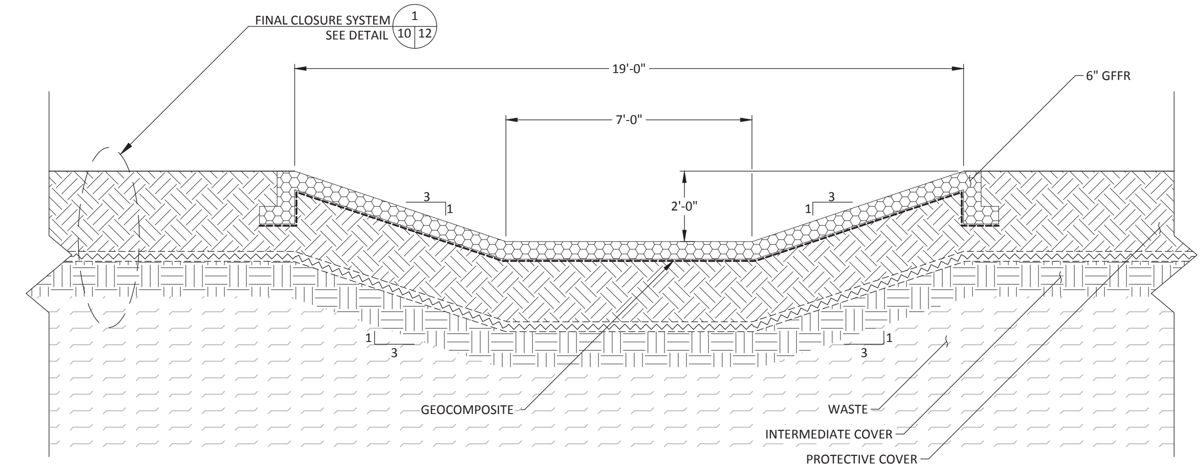
1 07 10



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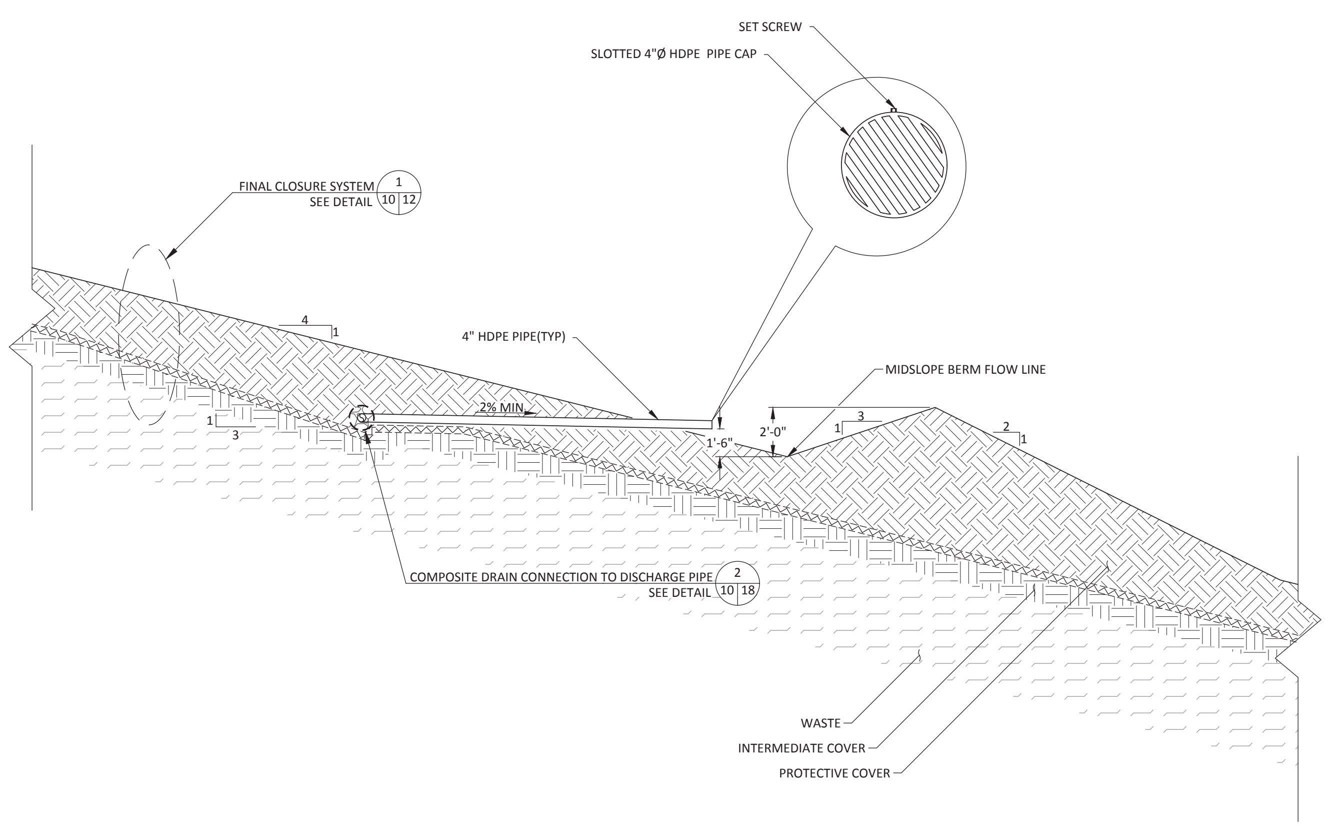

MIDSLOPE BERM DETAIL
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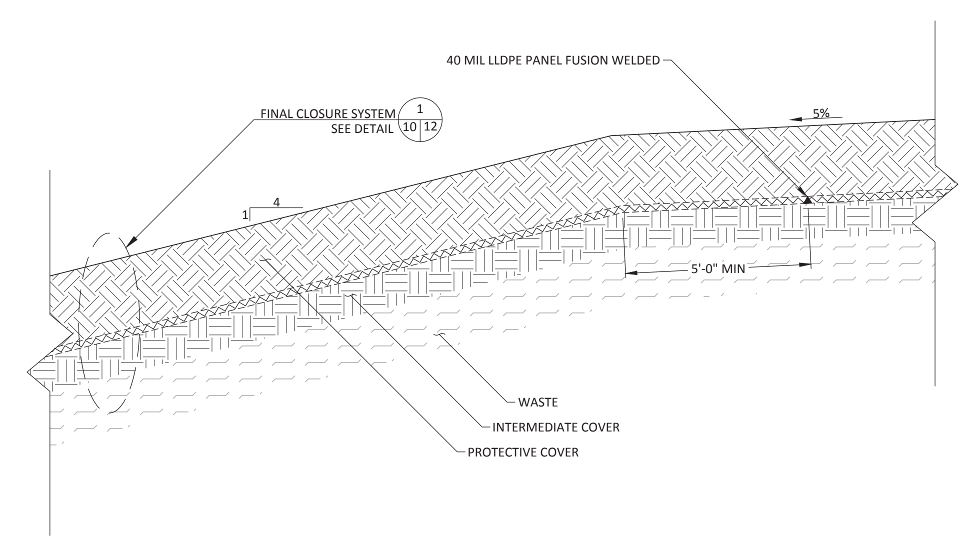

TOP SLOPE TO SIDE SLOPE LINER DETAIL
NOT TO SCALE
4 06 10

KOLLAN LEE SPRADLIN LICENSE No. 82852 STATE OF FLORIDA PROFESSIONAL ENGINEER

REV	DATE	DESCRIPTION	CHK. BY

SHEET TITLE: DETAILS-1

PROJECT TITLE: PHASE I-VI CLOSURE DESIGN

CLIENT: HILLSBOROUGH COUNTY SOLID WASTE DEPARTMENT TAMPA, FL 33619

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS
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FLORIDA FIRM REGISTRATION RY-4892

PROJ. NO. 09215600.13 | DWN. BY: ALD | Q/A RVW BY: RBC
DSN. BY: KLS | CHK. BY: SRF | APP. BY: KLS

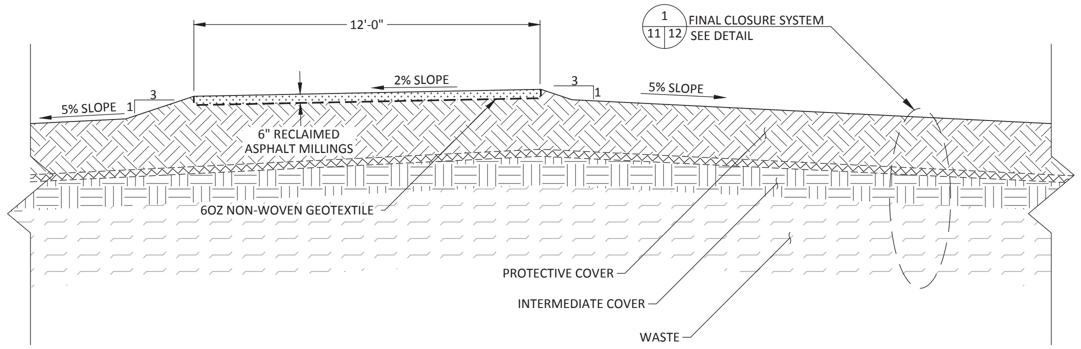
CADD FILE: DETAILS-1

DATE: FEBRUARY 2022

DRAWING NO. 10

SHEET 10 of 22

F:\PROJECT\Hillsborough\09215600.00\Task 1100 – General Services\20.0 Phase I-VI Closure\20.1 Phase I-VI Closure Permit\Engineering Drawings\DETAILS-1.dwg Jan 28, 2022 – 6:59pm Layout Name: DETAILS-1 By: 4745old



SERVICE ROAD DETAIL 1 (06 | 11)
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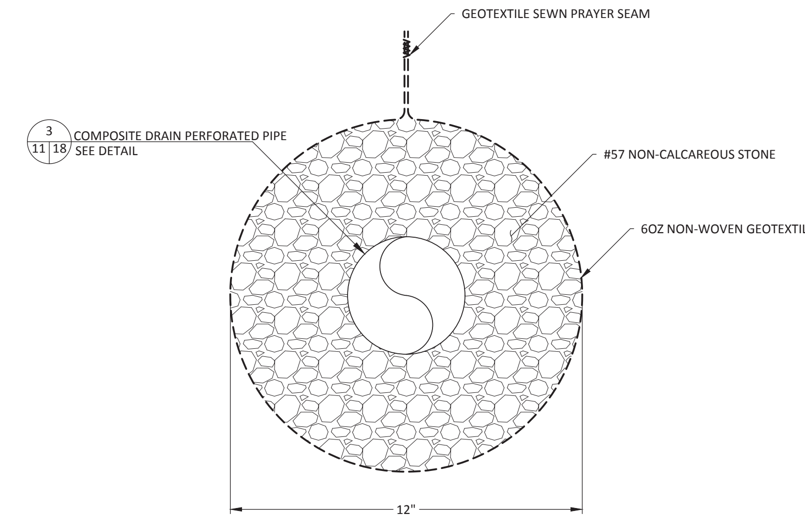

COMPOSITE DRAIN DETAIL 2 (10, 11, 12 | 11)
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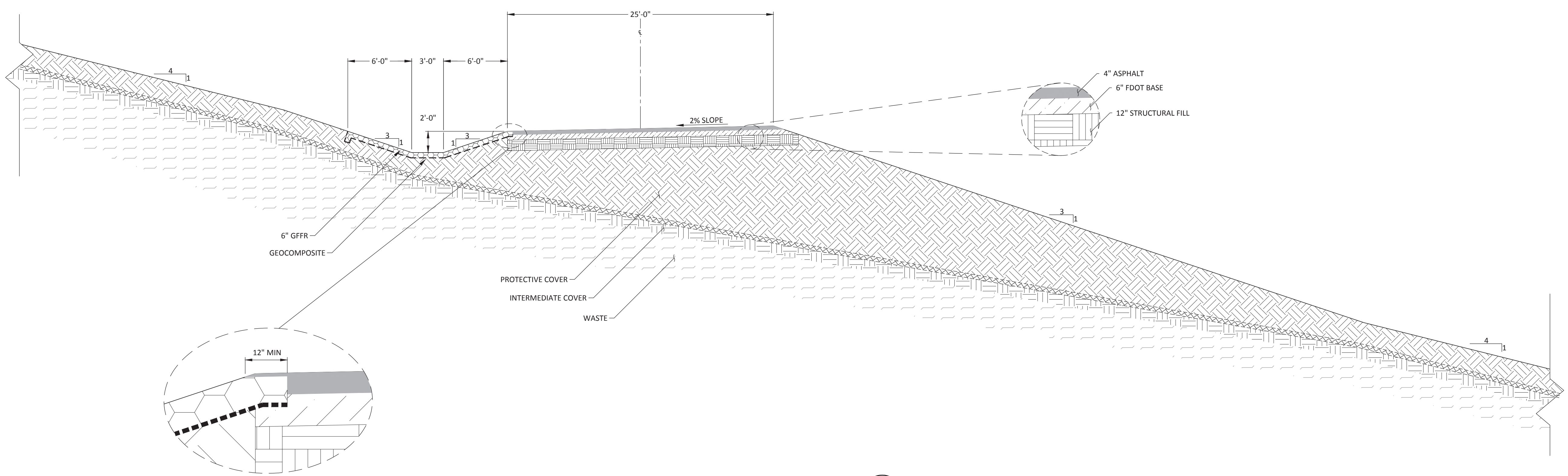

MAIN HAUL ROAD DETAIL 3 (06 | 11)
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KOLLAN LEE SPRADLIN LICENSE No. 82852 STATE OF FLORIDA PROFESSIONAL ENGINEER

REV	DATE	DESCRIPTION	CHK. BY

SHEET TITLE: DETAILS-2

PROJECT TITLE: PHASE I-VI CLOSURE DESIGN

CLIENT: HILLSBOROUGH COUNTY SOLID WASTE DEPARTMENT TAMPA, FL 33619

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS
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PH (813) 621-0080 FAX NO. (813) 623-6757
FLORIDA FIRM REGISTRATION RY-4892

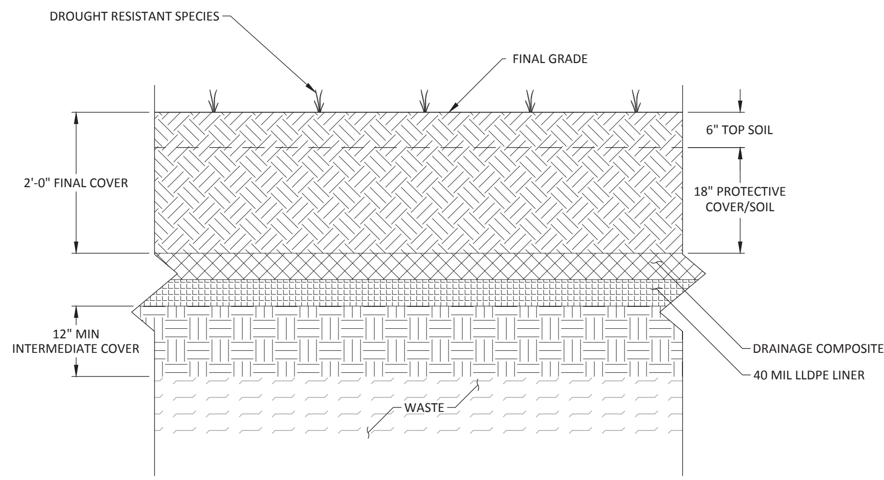
PROJ. NO. 09215600.13 | DWN. BY: ALD | Q/A RVW BY: RBC
DSN. BY: KLS | CHK. BY: SRF | APP. BY: KLS

CADD FILE: DETAILS-2

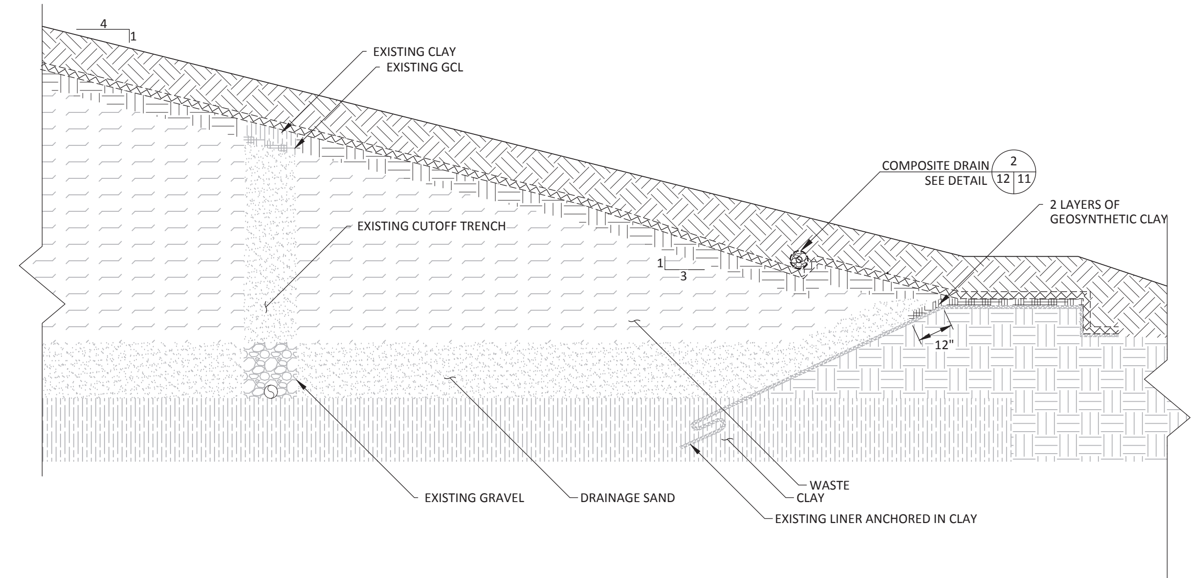
DATE: FEBRUARY 2022

DRAWING NO. 11

SHEET 11 of 22



FINAL CLOSURE SYSTEM DETAIL 1 / 12
NOT TO SCALE
10, 11, 12



ANCHOR TRENCH WITH CUT-OFF TRENCH DETAIL 2 / 07 12
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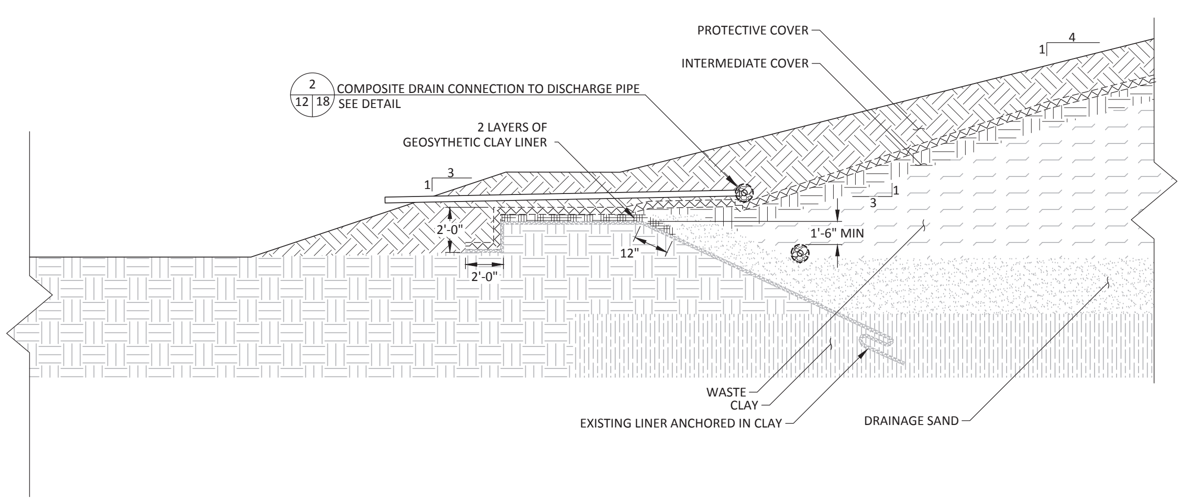

COMPOSITE TOE DRAIN DISCHARGE DETAIL 3 / 07 12
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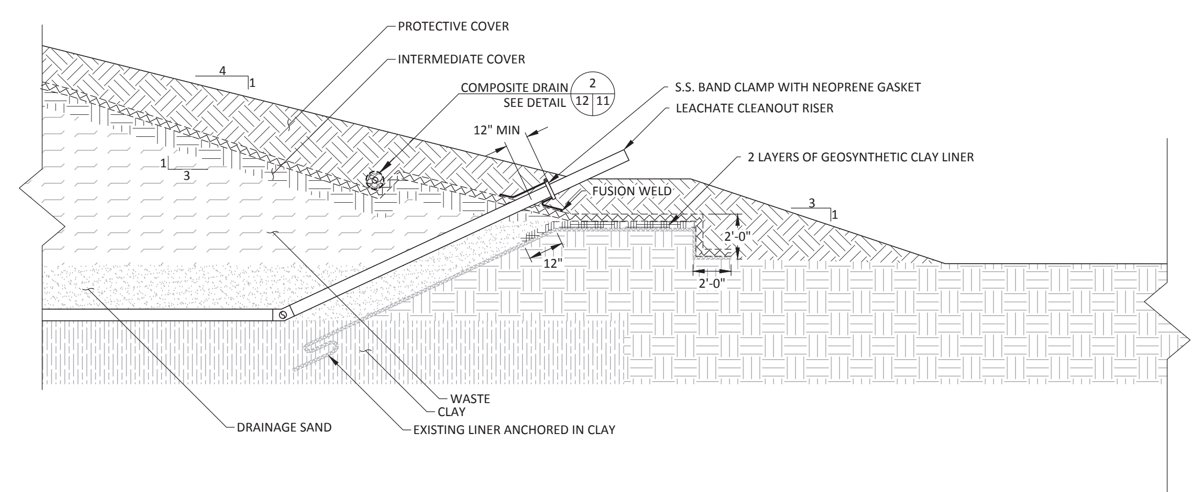

CLEANOUT ACCESS BOOT DETAIL 4 / 06 12
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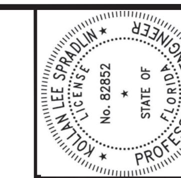

REV	DATE	DESCRIPTION	CHK. BY

SHEET TITLE
DETAILS-3

PROJECT TITLE
PHASE I-VI CLOSURE DESIGN

CLIENT
HILLSBOROUGH COUNTY
SOLID WASTE DEPARTMENT
TAMPA, FL 33619

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
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FLORIDA FIRM REGISTRATION RY-4892

PROJ. NO. 09215600.13 | DWN. BY: ALD | Q/A RVW BY: RBC
DSN. BY: KLS | CHK. BY: SRF | APP. BY: KLS

CADD FILE: DETAILS-3

DATE: FEBRUARY 2022

DRAWING NO. **12**

SHEET 12 of 22

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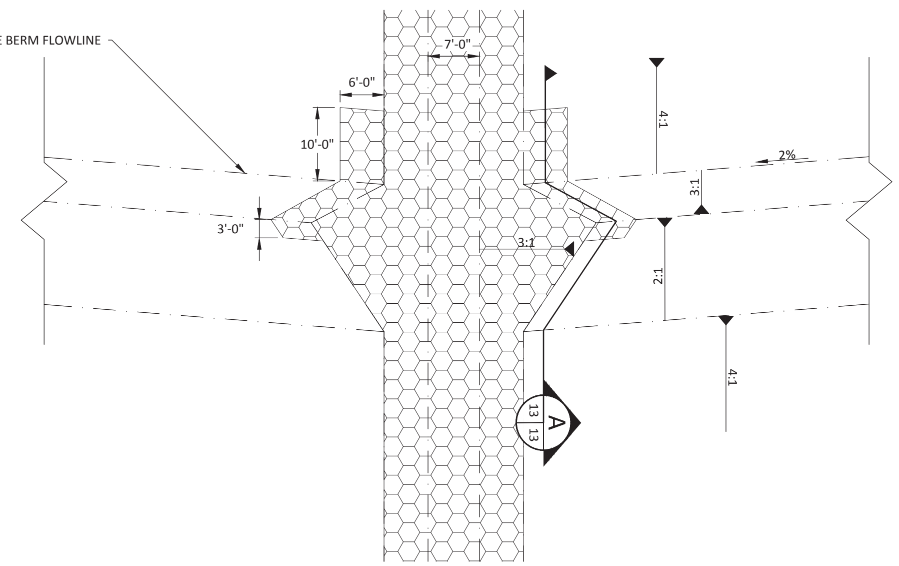

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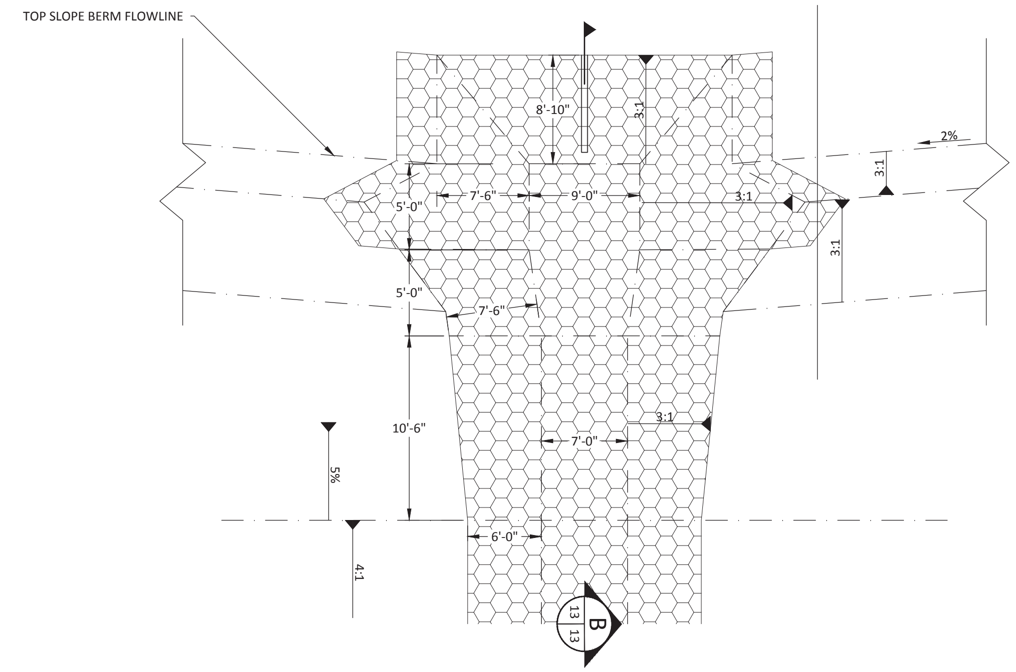

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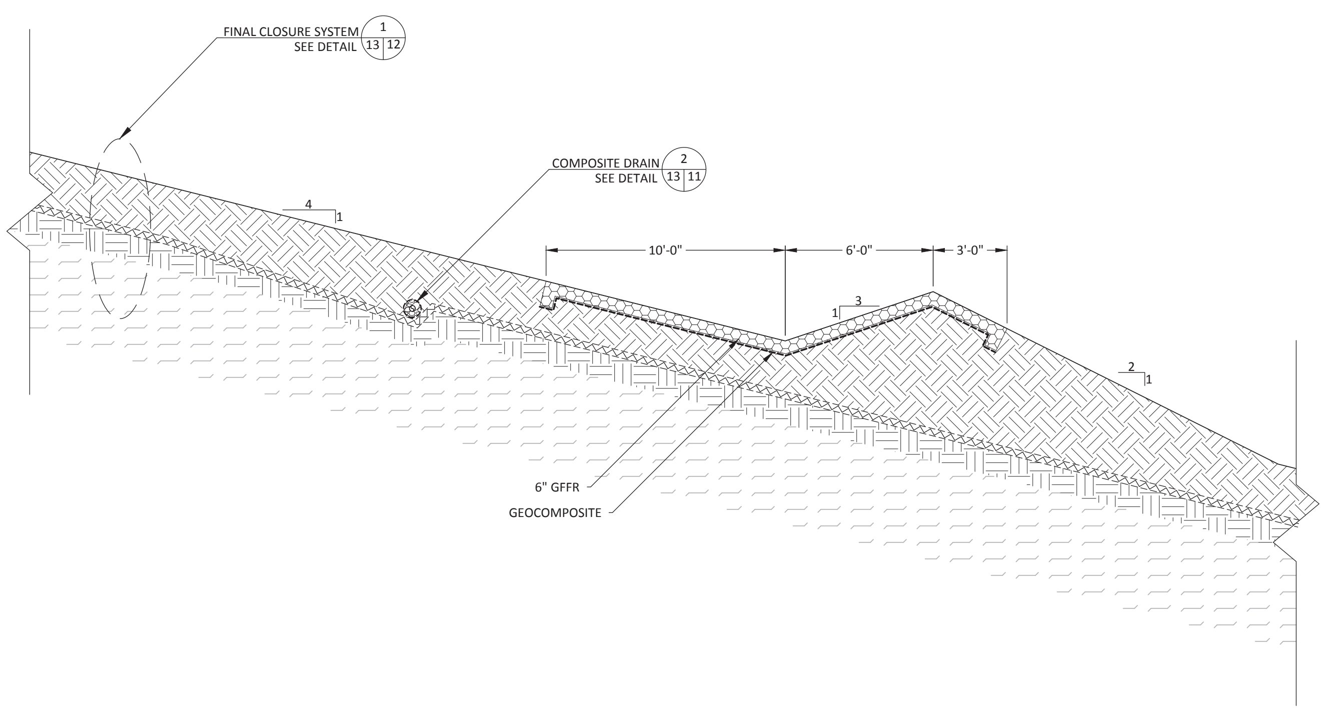

SECTION A (13 | 13)
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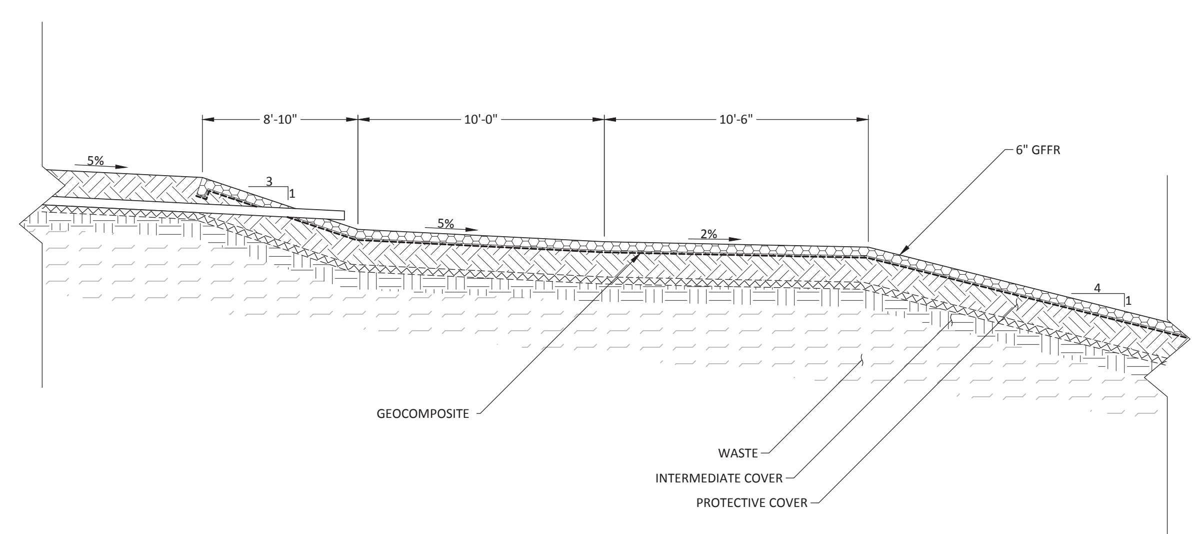

SECTION B (13 | 13)
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REV	DATE	DESCRIPTION	CHK. BY

SHEET TITLE: DETAILS-4

PROJECT TITLE: PHASE I-VI CLOSURE DESIGN

CLIENT: HILLSBOROUGH COUNTY SOLID WASTE DEPARTMENT TAMPA, FL 33619

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS
3922 COCONUT PALM DRIVE, SUITE 102, TAMPA, FL 33619
PH. (813) 621-0080 FAX NO. (813) 623-6757
FLORIDA FIRM REGISTRATION RY-4892

PROJ. NO. 09215600.13 | DWN. BY: ALD | Q/A RVW BY: RBC
DSN. BY: KLS | CHK. BY: SRF | APP. BY: KLS

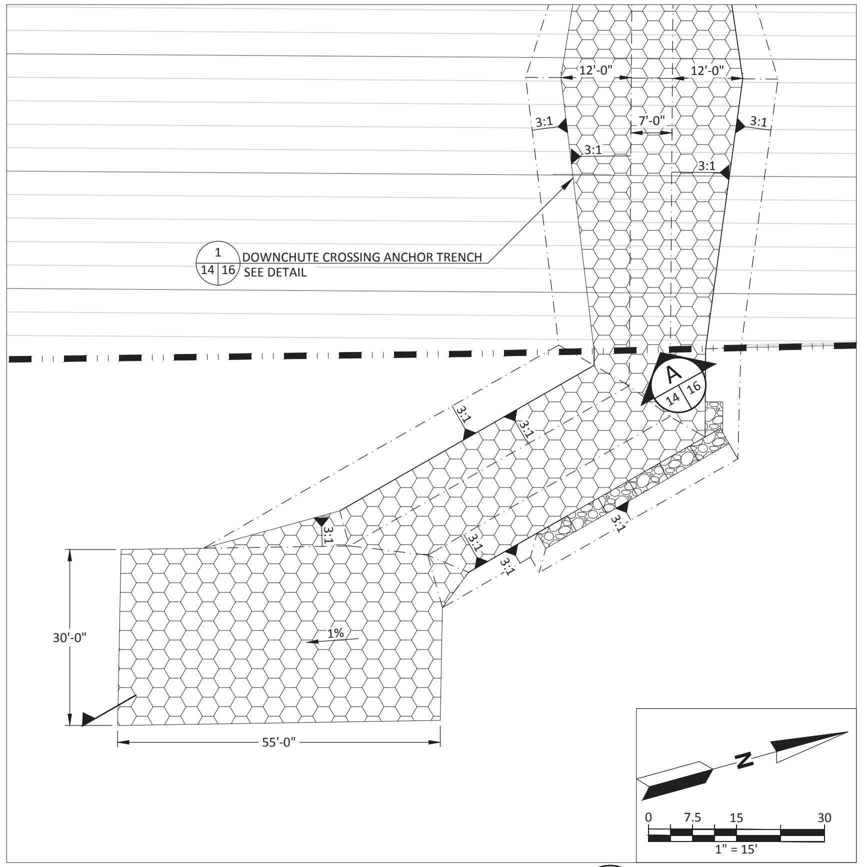
CADD FILE: DETAILS-4

DATE: FEBRUARY 2022

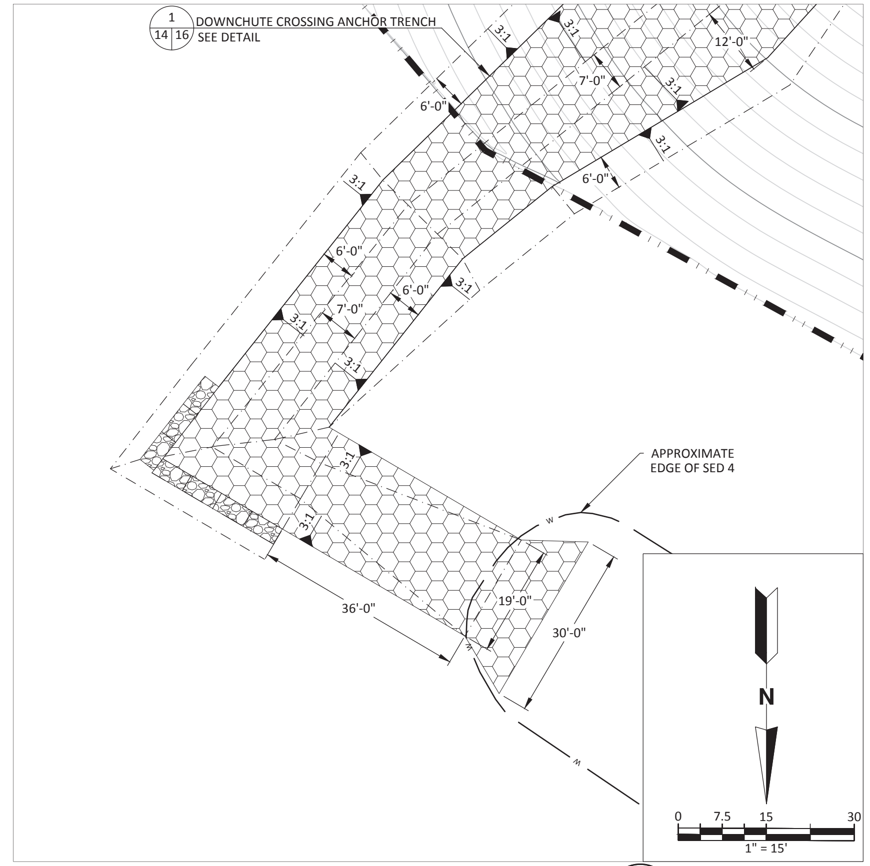
DRAWING NO. 13

SHEET 13 of 22

F:\PROJECT\Hillsborough\09215600.00\Task 1100 – General Services\20.0 Phase I-VI Closure\20.1 Phase I-VI Closure Permit\Engineering Drawings\DETAILS-4.dwg Jan 28, 2022 – 6:59pm Layout Name: DETAILS-4 By: 4745pld



DOWNCHUTE OUTLET 1 DETAIL 1 / 07 14
1" = 15'



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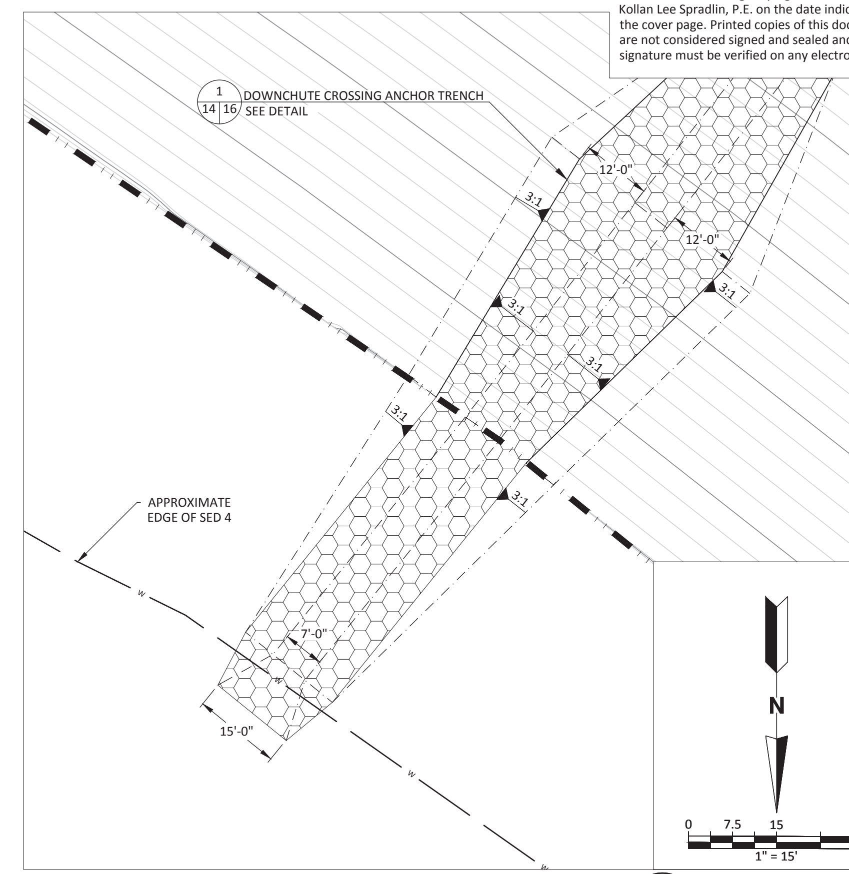

DOWNCHUTE OUTLET 3 DETAIL 3 / 07 14
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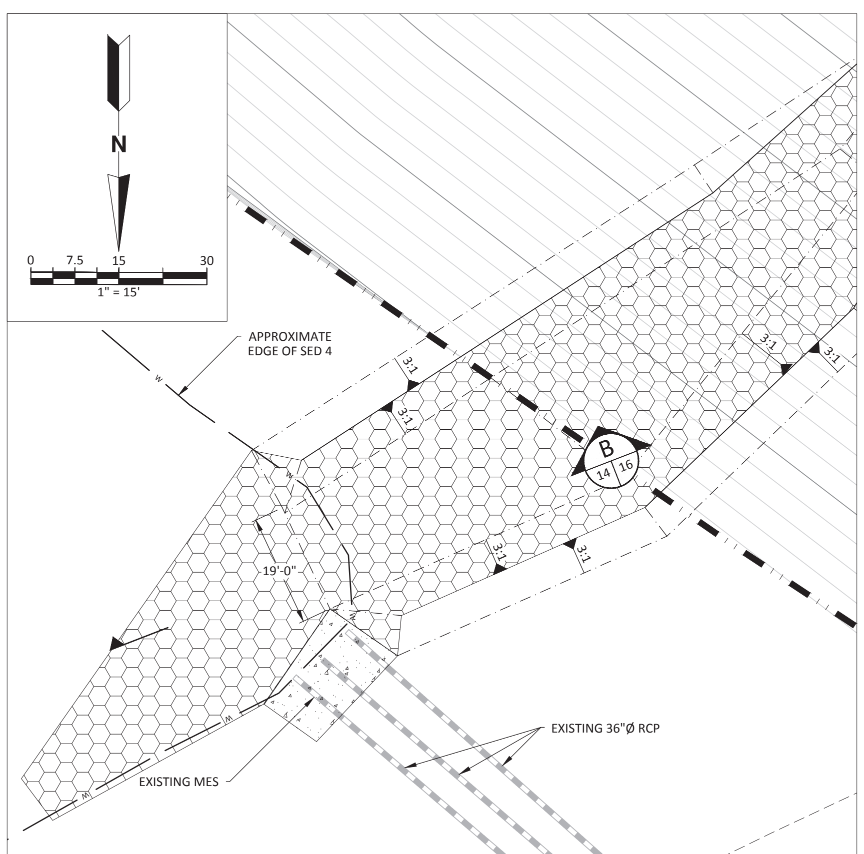

DOWNCHUTE OUTLET 4 DETAIL 4 / 07 14
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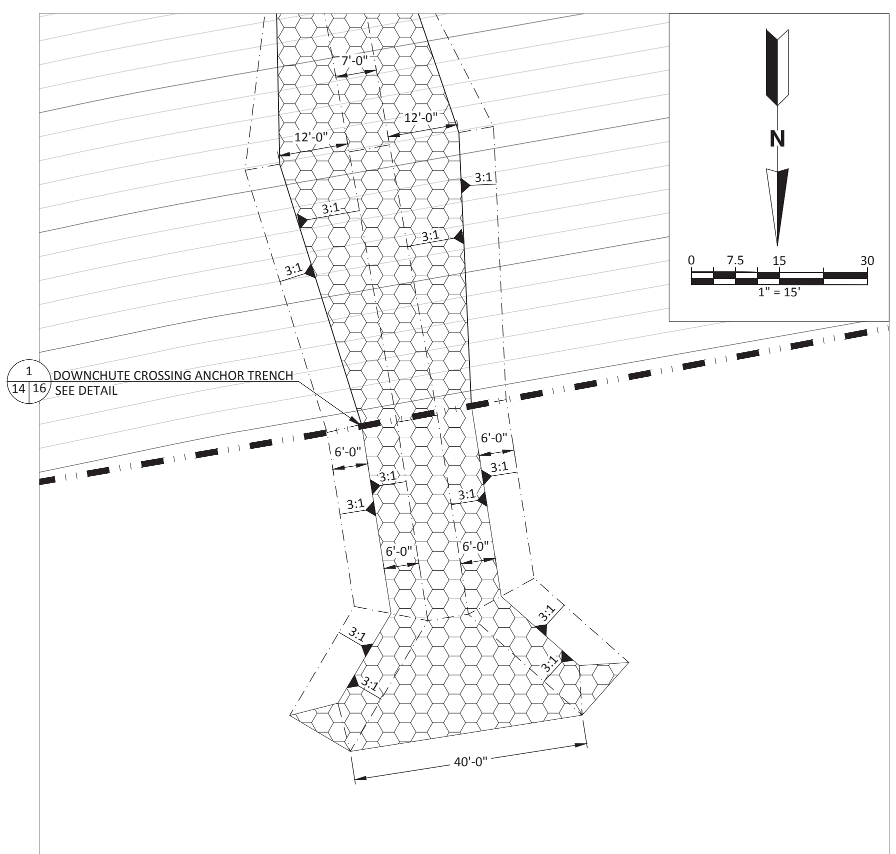

DOWNCHUTE OUTLET 5 DETAIL 5 / 07 14
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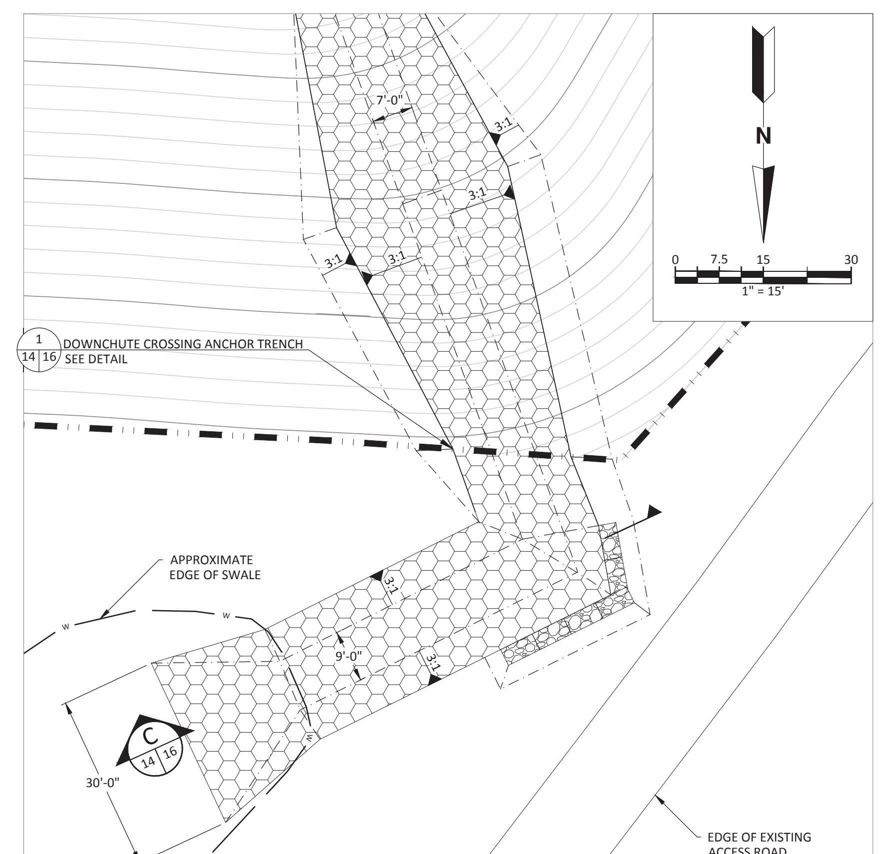

DOWNCHUTE OUTLET 6 DETAIL 6 / 07 14
1" = 15'

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KOLLAN LEE SPRADLIN ★ LICENSE No. 82852 ★ STATE OF FLORIDA ★ PROFESSIONAL ENGINEER

REV	DATE	DESCRIPTION	CHK. BY

SHEET TITLE: DETAILS-5

PROJECT TITLE: PHASE I-VI CLOSURE DESIGN

CLIENT: HILLSBOROUGH COUNTY SOLID WASTE DEPARTMENT TAMPA, FL 33619

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS
3922 COCONUT PALM DRIVE, SUITE 102, TAMPA, FL 33619
PH (813) 621-0080 FAX NO. (813) 623-6757
FLORIDA FIRM REGISTRATION RY-4892

PROJ. NO. 09215600.13	DWN. BY: ALD	Q/A RVW BY: RBC
DSN. BY: KLS	CHK. BY: SRF	APP. BY: KLS

CADD FILE: DETAILS-DOWNCHUTE

DATE: FEBRUARY 2022

DRAWING NO. 14

SHEET 14 of 22

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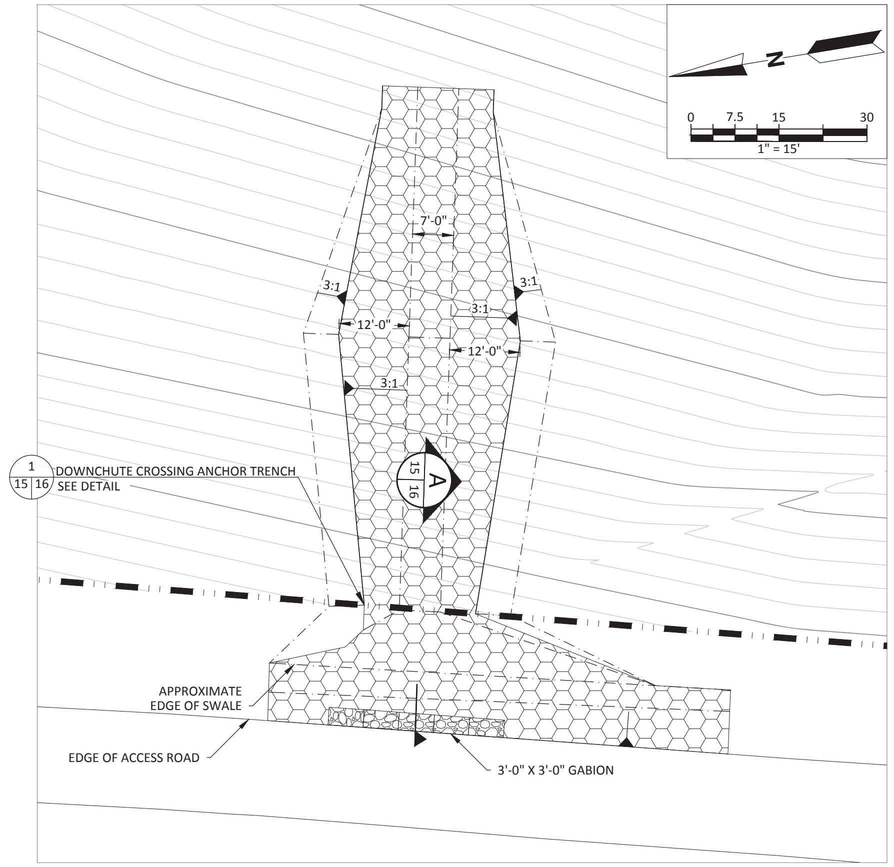

DOWNCHUTE OUTLET 7 DETAIL 1 (07 | 15)
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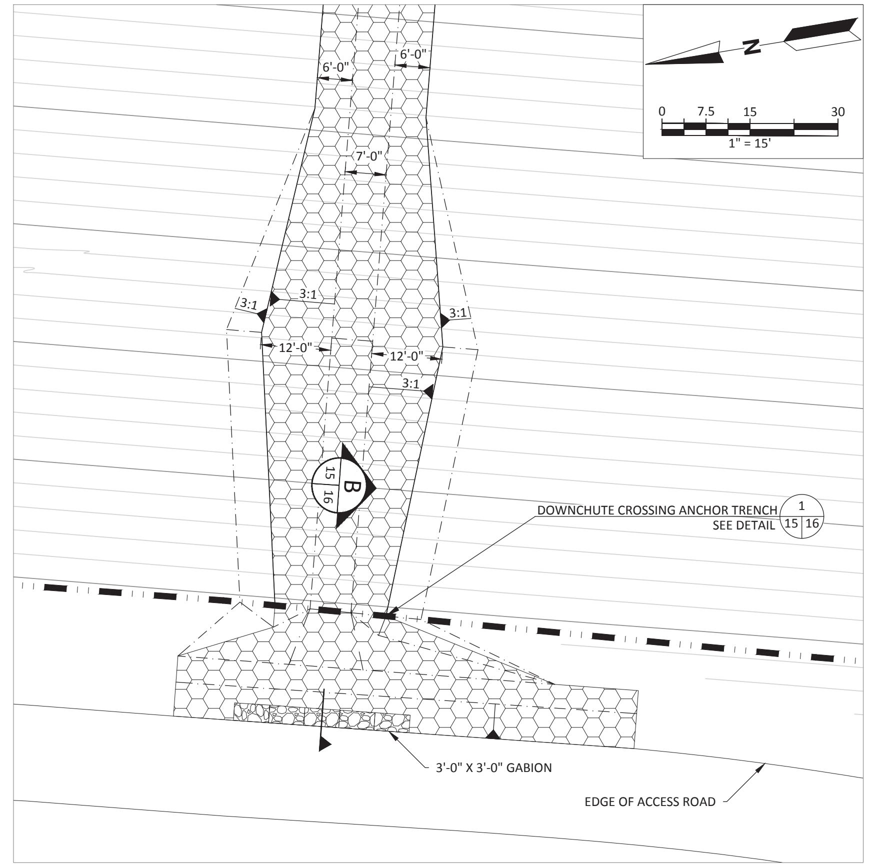

DOWNCHUTE OUTLET 8 DETAIL 2 (07 | 15)
1" = 15'

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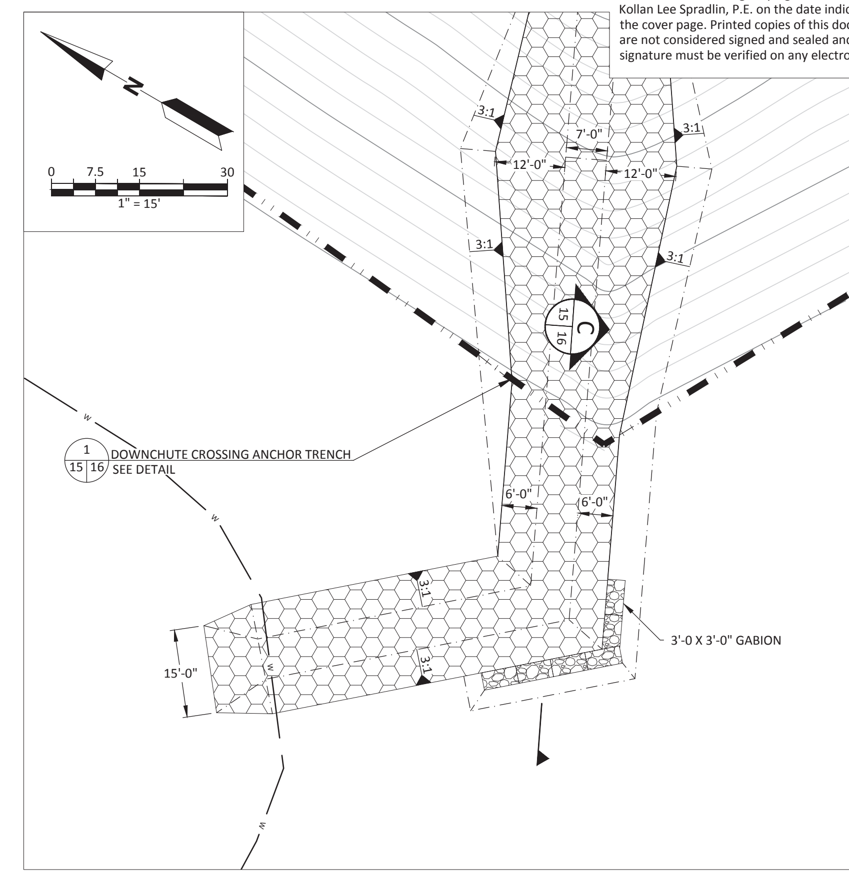

DOWNCHUTE OUTLET 9 DETAIL 3 (07 | 15)
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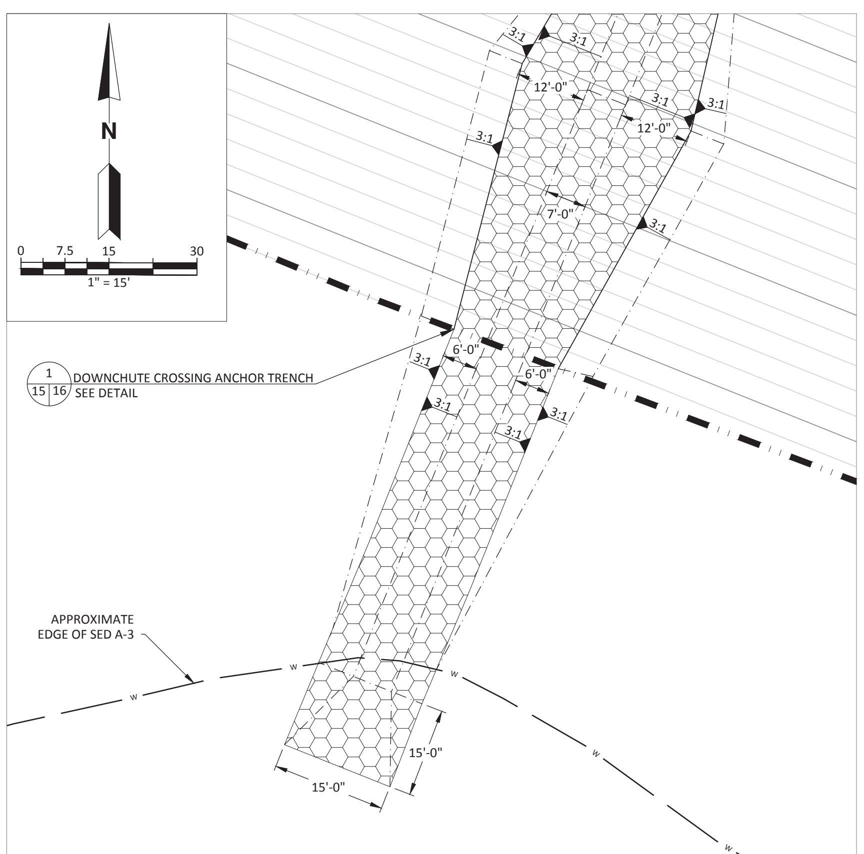

DOWNCHUTE OUTLET 10 DETAIL 4 (07 | 15)
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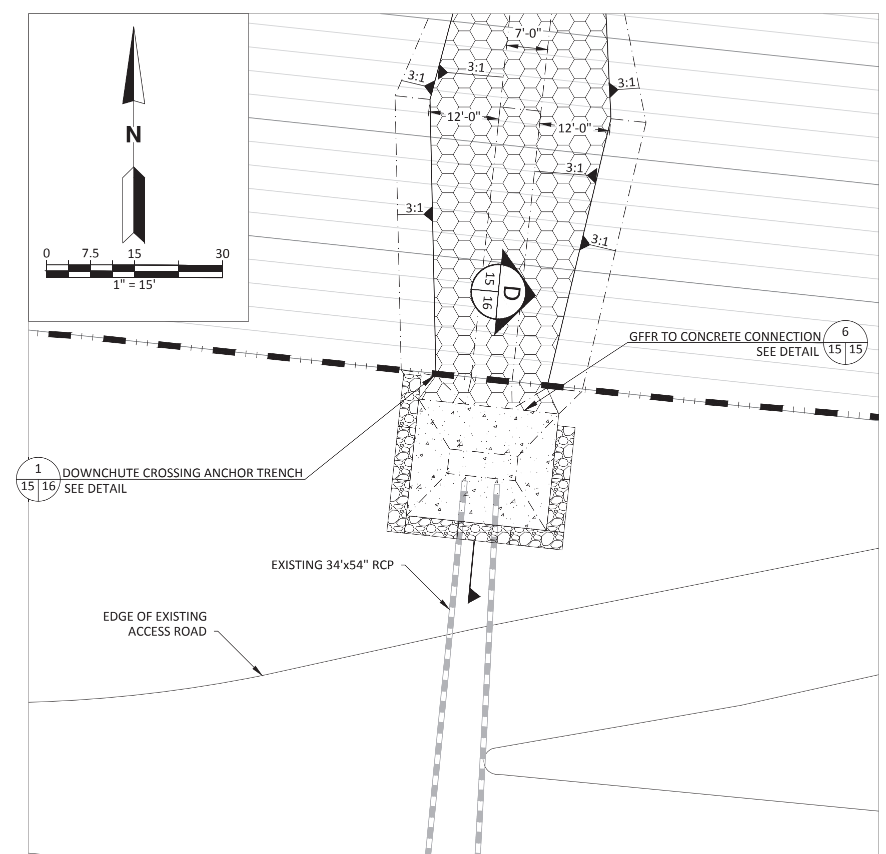

DOWNCHUTE OUTLET 11 DETAIL 5 (07 | 15)
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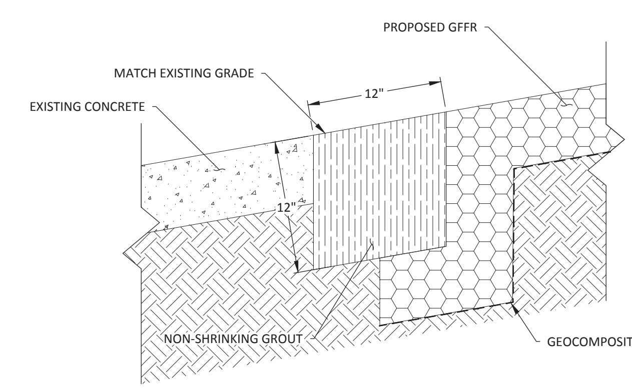


GFFR TO CONCRETE CONNECTION DETAIL 6 (15 | 15)
NOT TO SCALE

KOLLAN LEE SPRADLIN LICENSE No. 82852 STATE OF FLORIDA PROFESSIONAL ENGINEER

REV	DATE	DESCRIPTION	CHK. BY

SHEET TITLE: DETAILS-6

PROJECT TITLE: PHASE I-VI CLOSURE DESIGN

CLIENT: HILLSBOROUGH COUNTY SOLID WASTE DEPARTMENT TAMPA, FL 33619

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS
3922 COCONUT PALM DRIVE, SUITE 102, TAMPA, FL 33619
PH (813) 621-0080 FAX NO. (813) 623-6757
FLORIDA FIRM REGISTRATION RY-4892

PROJ. NO. 09215600.13 | DWN. BY: ALD | Q/A RVW BY: RBC
DSN. BY: KLS | CHK. BY: SRF | APP. BY: KLS

CADD FILE: DETAILS-DOWNCHUTE

DATE: FEBRUARY 2022

DRAWING NO. 15

SHEET 15 of 22

F:\PROJECT\Hillsborough\09215600.00\Task 1100 – General Services\20.0 Phase I-VI Closure\20.1 Phase I-VI Closure Permit\Engineering Drawings\DETAILS-DOWNCHUTE.dwg Jan 28, 2022 – 6:59pm Layout Name: DETAILS-6 By: 4745old

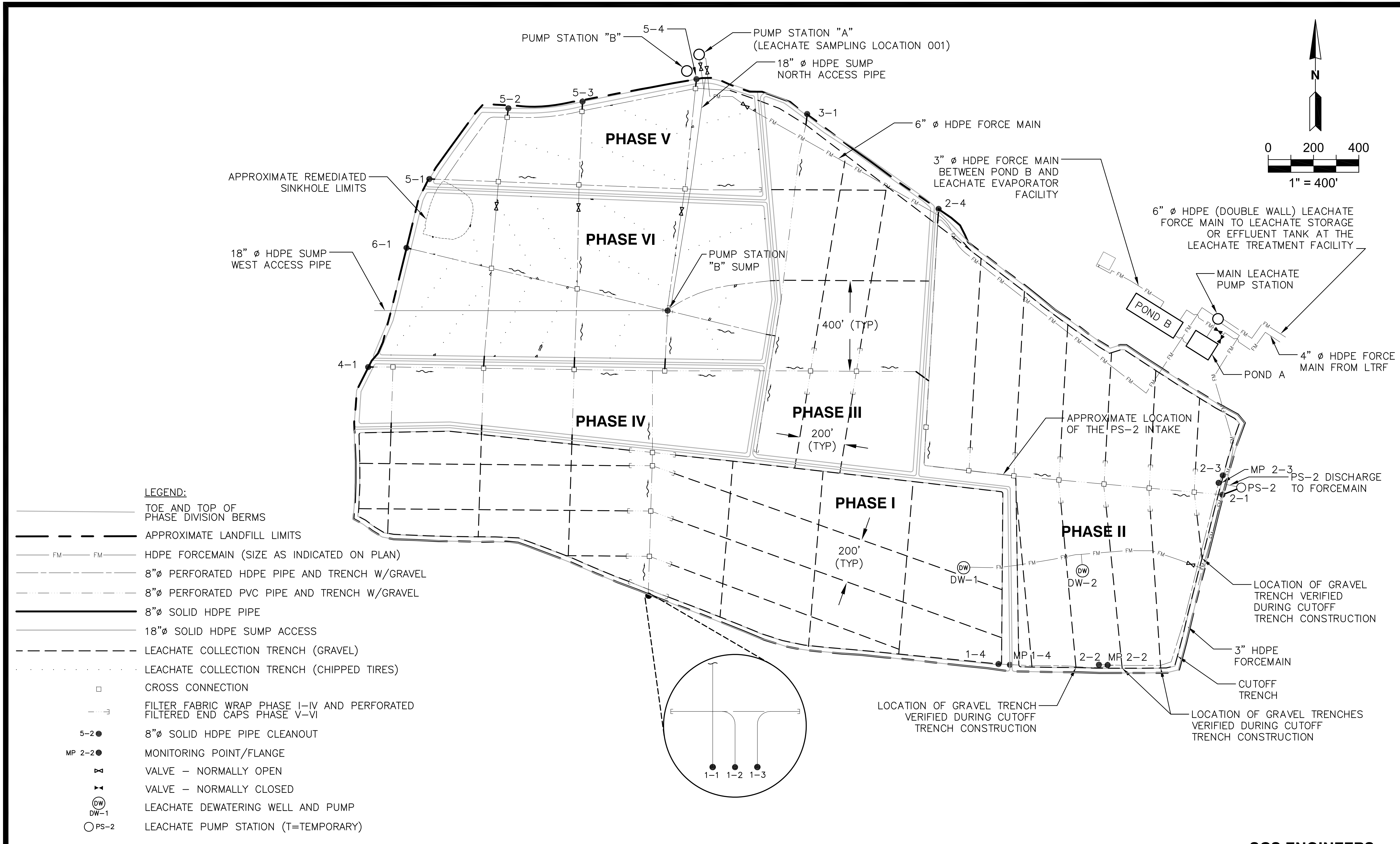


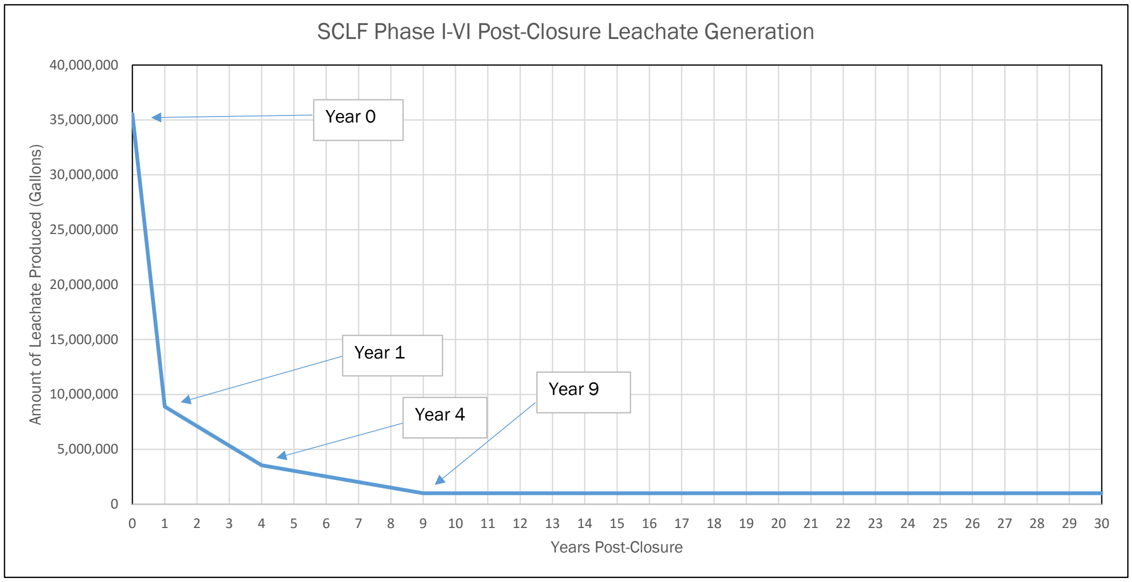
FIGURE 3-1. PHASES I-VI LEACHATE COLLECTION AND REMOVAL SYSTEM
HILLSBOROUGH COUNTY
MAY 2021

SCS ENGINEERS

SHEET 1 OF 1

CLIENT Hillsborough County	PROJECT Southeast County Landfill	JOB NO. 09215600.13

SUBJECT Post-Closure Leachate Generation Calculations	BY FCH	DATE 1/26/2022
	CHECKED KLS	DATE 1/26/2022



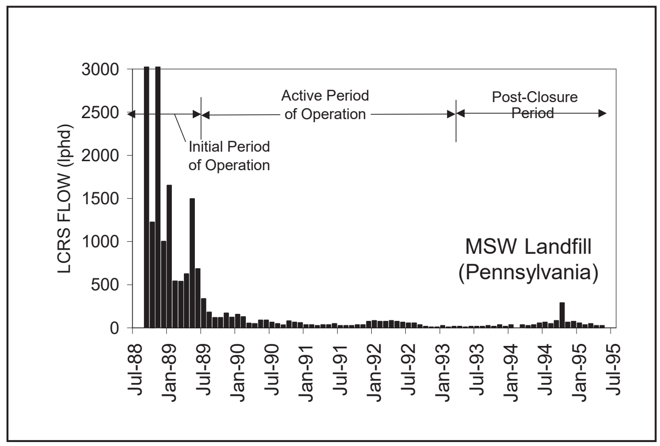
Year 0 Leachate Generation	35,532,645	gallons
Year 1 Leachate Generation	8,883,161	gallons
Year 4 Leachate Generation	3,553,265	gallons
Year 9 Leachate Generation	1,000,000	gallons
Total Leachate Generation Post-Closure	73,245,703	gallons
Average Annual Post-Closure Leachate Generation	2,441,523	gallons

NOTES:

1. Year 0 leachate generation is based on the Southeast County Landfill - Leachate Data Quarterly Reports for 2021. Phase I-VI leachate generation for 2021 was reported as 35,532,645 gallons.
2. Leachate generation is assumed to decrease by a factor of 4 between years 0 and 1 following closure. The Year 1 total leachate generation value was calculated is 35,532,645 gallons / 4 = 8,883,161 gallons This assumption is based on *Assessment and Recommendations for Improving the Performance of Waste Containment Systems* EPA/600/R-02/099.
3. Leachate generation is assumed to have decreased by an order of magnitude between years 2 and 4 following closure. Year 4 was used for calculations to provide a conservative value for total leachate generated following closure. The Year 4 total leachate generation value was calculated is 35,532,645 gallons X 0.1 = 3,553,265 gallons This assumption is based on *Assessment and Recommendations for Improving the Performance of Waste Containment Systems* EPA/600/R-02/099.
4. According to the reference document, *Assessment and Recommendations for Improving the Performanceof Waste Containment Systems EPA/600/R-02/099* leachate generation will likely be negligable by year 9; however, we have made theconservative assumption that leachate generation will not be less than 1,000,000 per year through post-closure (years 9 - 30).

EPA/600/R-02/099
December 2002

Assessment and Recommendations for Improving the Performance of Waste Containment Systems



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FOREWORD

The United States Environmental Protection Agency (EPA) is charged by Congress with protecting the Nation's land, air, and water resources. Under a mandate of national environmental laws, the Agency strives to formulate and implement actions leading to a compatible balance between human activities and the ability of natural systems to support and nurture life. To meet this mandate, EPA's research program is providing data and technical support for solving environmental problems today and building a science knowledge base necessary to manage our ecological resources wisely, understand how pollutants affect our health, and prevent or reduce environmental risks in the future.

The National Risk Management Research Laboratory is the Agency's center for investigation of technological and management approaches for preventing and reducing risks from pollution that threatens human health and the environment. The focus of the Laboratory's research program is on methods and their cost-effectiveness for prevention and control of pollution to air, land, water, and subsurface resources; protection of water quality in public water systems; remediation of contaminated sites, sediments and ground water; prevention and control of indoor air pollution; and restoration of ecosystems. NRMRL collaborates with both public and private sector partners to foster technologies that reduce the cost of compliance and to anticipate emerging problems. NRMRL's research provides solutions to environmental problems by: developing and promoting technologies that protect and improve the environment; advancing scientific and engineering information to support regulatory and policy decisions; and providing the technical support and information transfer to ensure implementation of environmental regulations and strategies at the national, state, and community levels.

This publication has been produced as part of the Laboratory's strategic long-term research plan. It is published and made available by EPA's Office of Research and Development to assist the user community and to link researchers with their clients.

E. Timothy Oppelt, Director
National Risk Management Research Laboratory

ABSTRACT

This broad-based study addressed three categories of issues related to the design, construction, and performance of waste containment systems used at landfills, surface impoundments, and waste piles, and in the remediation of contaminated sites. The categories of issues, the locations in this report where each category is addressed, and the principal investigator for the study of each category are as follows:

- geosynthetic tasks are described in Chapter 2 and Appendices A and B; the principal investigator for these tasks was Professor Robert M. Koerner, P.E.;
- natural soil tasks are described in Chapters 3 and 4 and Appendices C and D; the principal investigator for these tasks was Professor David E. Daniel, P.E.; and
- field performance tasks are described in Chapter 5 and Appendices E and F; the principal investigator for these tasks was Dr. Rudolph Bonaparte, P.E.

Each portion of the report was authored by the identified principal investigator, and individuals working with the principal investigator. However, each principal investigator provided input and recommendations to the entire study and peer-reviewed and contributed to the entire report.

Geosynthetic materials (e.g., geomembranes (GMs), geotextiles (GTs), geonets (GNs), and plastic pipe) have been used as essential components of waste containment systems since at least the early 1980's. Five separate laboratory and/or analytical tasks were undertaken to address technical issues related to the use of these materials in waste containment systems. The technical issues related to geosynthetics are: (1) protection of GMs from puncture using needlepunched nonwoven GTs; (2) behavior of waves in high density polyethylene (HDPE) GMs when subjected to overburden stress; (3) plastic pipe stress-deformation behavior under high overburden stress; and (4) service life prediction of GTs and GMs. Conclusions are: (1) needlepunched nonwoven GTs can provide adequate protection of GMs against puncture by adjacent granular soils; a design methodology for GM puncture protection was developed from the results of laboratory tests and is presented; (2) temperature-induced waves (wrinkles) in GMs do not disappear when the GM is subjected to overburden stress (i.e., when the GM is covered with soil), rather the wave height decreases somewhat, the width of the wave decreases even more, and the void space beneath the wave becomes smaller; (3) waves may induce significant residual stresses in GMs, which may reduce the GM's service life; residual stresses induced in HDPE GMs by waves may be on the order of 1 to 22% of the GM's short-term yield strength; (4) if GM waves after backfilling are to be avoided, light-colored GMs can be used, GMs can be deployed and seamed without intentional slack, GMs can be covered with an overlying light colored temporary GT until backfilling occurs, and backfilling can be performed only in the coolest part of the day or even at night; (5) based on finite element modeling results, use of the Iowa State

formula for predicting plastic pipe deflection under high overburden stress is reasonable; (6) polypropylene GTs are slightly more susceptible to ultraviolet (UV) light degradation than polyester GTs, and lighter weight GTs degrade faster than heavier GTs; (7) GTs that are partially degraded by UV light do not continue to degrade when covered with soil, i.e., the degradation process is not auto-catalytic; (8) buried HDPE GMs have an estimated service life that is measured in terms of at least hundreds of years; the three stages of degradation and approximate associated durations for each as obtained from the laboratory testing program described in this report are: (i) antioxidant depletion (≈ 200 years), (ii) induction (≈ 20 years), and (iii) half-life (50% degradation) of an engineering property (≈ 750 years); these durations were obtained from the extrapolation of a number of laboratory tests performed under a limited range of conditions; it is recommended that additional testing be performed under a broader range of conditions to develop additional insight into the ultimate service life of HDPE GMs, and other types of GMs as well.

Geosynthetic clay liners (GCLs) are a relatively new type of liner material, having first been used in a landfill in 1986. One of the key issues with respect to field performance of GCLs is their stability on permanent slopes, such as found on landfill final cover systems. Fourteen test plots, designed to replicate typical final cover systems for solid waste landfills, were constructed to evaluate the internal and interface shear strength of GCLs under full-scale field conditions on 2H:1V and 3H:1V slopes. Five different types of GCLs were evaluated, and performance was observed for over four years. All test plots were initially stable, but over time, as the bentonite in the GCLs became hydrated, three slides (all on 2H:1V slopes) that involved the GCLs have occurred. One slide involved an unreinforced GCL in which bentonite that was encased between two GMs unexpectedly became hydrated. The other two slides occurred at the interface between the woven GTs of the GCLs and the overlying textured HDPE GM. Conclusions are: (1) at the low normal stresses associated with landfill final cover systems, the interface shear strength is generally lower than the internal shear strength of internally-reinforced GCLs; (2) interfaces between a woven GT component of the GCL and the adjacent material should always be evaluated for stability; these interfaces may often be critical; (3) significantly higher interface shear strengths were observed when the GT component of a GCL in contact with a textured HDPE GM was a nonwoven GT, rather than a woven GT; (4) if bentonite sandwiched between two GMs has access to water (e.g., via penetrations or at exposed edges), water may spread laterally through waves or wrinkles in the GM and hydrate the bentonite over a large area; (5) if the bentonite sandwiched between two GMs does not have access to water, it was found that the bentonite did not hydrate over a large area; (6) current engineering procedures for evaluating the stability of GCLs on slopes (based on laboratory direct shear tests and limit-equilibrium methods of slope stability analysis) correctly predicted which test plots would remain stable and which would undergo sliding, thus validating current design practices; and (7) based on the experiences of this study, landfill final cover systems with 2H:1V sideslopes may be too steep to be stable with the desired factor of safety due to limitations with respect to the interface shear strengths of the currently available geosynthetic products.

To evaluate the field performance of compacted clay liners (CCLs), a database of 89 large-scale field hydraulic conductivity tests was assembled and analyzed. A separate database for 12 soil-bentonite admixed CCLs was also assembled and analyzed. In addition, case histories on the field performance of CCLs in final cover test sections were collected and evaluated. Conclusions are: (1) 25% of the 89 natural soil CCLs failed to achieve the desired large-scale hydraulic conductivity of 1×10^{-7} cm/s or less; (2) all of the 12 soil-bentonite admixed CCLs achieved a large-scale hydraulic conductivity of less than 1×10^{-7} cm/s; however, all of these CCLs contained a relatively large amount (more than 6%) of bentonite; soil-bentonite admixed CCLs will not be discussed further; (3) the single most common problem in achieving the desired low level of hydraulic conductivity in CCLs was failure to compact the soil in the zone of moisture and dry density that will yield low hydraulic conductivity; (4) the most significant control parameter of CCLs was found to be a parameter denoted "P_o", which represents the percentage of field-measured water content-density points that lie on or above the line of optimums; when P_o was high (80% to 100%) nearly all the CCLs achieved the desired field hydraulic conductivity, but when P_o was low (0 to 40%), fewer than half the CCLs achieved the desired field hydraulic conductivity; (5) practically no correlation was found between field hydraulic conductivity and frequently measured soil characterization parameters, such as plasticity index and percentage of clay, indicating that CCLs can be successfully constructed with a relatively broad range of soil materials; (6) hydraulic conductivity decreased with increasing CCL thickness, up to a thickness of about 1 m; and (7) analysis of CCLs constructed in the final cover test sections generally showed that CCLs placed without a GM overlain by soil tended to desiccate and lose their low hydraulic conductivity within a few years.

Liquids management data were evaluated for 187 double-lined cells at 54 landfills to better understand the field performance of landfill primary liners, leachate generation rates, and leachate chemistry. Conclusions are: (1) average monthly active-period leak detection system (LDS) flow rates for cells with HDPE GM primary liners constructed with construction quality assurance (CQA) (but without ponding tests or electrical leak location surveys) will often be less than 50 lphd, but occasionally in excess of 200 lphd; these flows are attributable primarily to liner leakage and, for cells with sand LDSs, possibly construction water; (2) average monthly active-period LDS flow rates attributable to leakage through GM/GCL primary liners constructed with CQA will often be less than 2 lphd, but occasionally in excess of 10 lphd; (3) available data suggest that average monthly active-period LDS flow rates attributable to leakage through GM/CCL and GM/GCL/CCL primary liners constructed with CQA are probably similar to those for GM/GCL primary liners constructed with CQA; (4) GM liners can achieve true hydraulic efficiencies in the 90 to 99% range, with higher efficiencies occasionally being achievable; (5) GM/GCL, GM/CCL, and GM/GCL/CCL composite liners can achieve true hydraulic efficiencies of 99% to more than 99.9%; (6) GMs should not be used alone in applications where a hydraulic efficiency above 90% must be reliably achieved, even if a thorough CQA program is employed, except perhaps in situations where electrical leak location surveys or ponding tests are used to identify GM defects and the defects are repaired; (7) GM/CCL and GM/GCL/CCL composite liners are capable of substantially preventing leachate migration over the entire period of significant leachate generation for typical landfill operations scenarios without leachate recirculation or disposal or liquid wastes of sludges; (8) leachate collection and removal system (LCRS) flow rates were highest at the beginning of cell operations and decreased as waste thickness increased and daily and intermediate covers were applied to the waste; leachate generation rates decreased on average by a factor of four within one year after closure and by one order of magnitude two to four years after closure; within nine years of closure, leachate generation rates were negligible for the landfill cells evaluated in this study; (9) municipal solid waste (MSW) cells produced, on average, less leachate than industrial solid waste (ISW) and hazardous waste (HW) cells; for cells of a given waste type, rainfall fractions were highest in the northeast and lowest in the west; the differences in leachate generation rates are a function of type of waste, geographic location, and operational practices; (10) in general, HW landfills produced the strongest leachates and coal ash landfills produced the weakest leachates; MSW ash leachate was more mineralized than MSW leachate and the other ISW leachates; (11) the solid waste regulations of the 1980s and 1990s have resulted in the improved quality of MSW and HW landfill leachates; and (12) the EPA Hydrologic Evaluation of Landfill Performance (HELP) computer model, when applied using an appropriate simulation methodology and an appropriate level of conservatism, provides a reasonable basis for designing LCRSs and sizing leachate management system components; due to the complexity and variability of landfill systems, however, the model will generally not be adequate for use in a predictive or simulation mode, unless calibration is performed using site-specific measured (not default) material properties and actual leachate generation data.

Waste containment system problems were identified at 74 modern landfill and surface impoundment facilities located throughout the U.S. The purpose of this aspect of the project was to better understand the identified problems and to develop recommendations to reduce the future occurrence of problems. Conclusions are: (1) the number of facilities with identified problems is relatively small in comparison to the total number of modern facilities nationwide; however, the search for problems was by no means exhaustive; (2) the investigation focused on landfill facilities: 94% of the identified problems described herein occurred at landfills; (3) among the landfill problems, 70% were liner system related and 30% were cover system related; however, the ratio of liner system problems to cover system problems is probably exaggerated by the fact that a number of the facilities surveyed were active and did not have a cover system; (4) based on a waste containment system component or attribute criterion, the identified problems can be grouped into the following general categories: (i) slope instability of liner systems or cover systems or excessive deformation of these systems (44%); (ii) defectively constructed liners, leachate collection and removal systems (LCRSs) or LDSs, or cover systems (29%); (iii) degraded liners, LCRSs or LDSs, or cover systems (18%); and (iv) malfunction of LCRSs or LDSs or operational problems with these systems (9%); (5) considering a principal human factor contributing to the problem criterion, the identified problems are classified as follows: (i) design (48%); (ii) construction (38%); and (iii) operation (14%); (6) the main impacts of the problems were: (i) interruption of facility construction and operation; (ii) increased maintenance; and (iii) increased costs; (7) problems detected at facilities were typically remedied before adverse environmental impacts occurred; (8) impact to groundwater or surface water was only identified at one facility, where landfill gas migrated beyond the edge of the liner system and to groundwater; (9) all of the identified problems can be prevented using available design approaches, construction materials and procedures, and operation practices; (10) although the environmental impact of problems has generally been negligible thus far, the landfill industry should do more to avoid future problems in order to: (i) reduce the potential risk of future environmental impact; (ii) reduce the potential health and safety risk to facility workers, visitors, and neighbors; (iii) increase public confidence in the performance of waste containment systems; (iv) decrease potential impacts to construction, operation, and maintenance; and (v) reduce costs associated with the investigation and repair of problems.

during the active period of operation. About 69% of these cells exhibited average LCRS flow rates greater than 10,000 lphd during the initial period of operation and 21% exhibited average LCRS flow rates greater than 5,000 lphd during the active period of operation. Average LCRS flow rates from HW cells during the active period of operation were 50 to 70% higher than flow rates from MSW cells. The reason for the higher leachate generation rates at the HW cells in this study is unclear, but may, in part, be due to differences in waste characteristics (e.g., initial moisture content, porosity, and permeability) and operational practices (e.g., waste placement and covering procedures). The ten HW cells located in the W had low average flow rates, ranging from about 1 to 4,000 lphd during operations.

- RF values calculated for the HW cells in the NE (means of 46% and 21% for the initial and active periods of operation, respectively) were higher than RF values for the SE cells (means of 33% and 11% for the initial and active periods of operation, respectively). Similar to the MSW cells, the HW cells in the SE had lower RF values than cells in the NE. For most of the HW cells in the W, RF values were less than 10% during operations.
- Average flow rates during operations ranged from 1,000 to 35,000 lphd for ash cells (1,000 to 25,000 lphd for the seven MSW ash cells and 35,000 lphd for the coal ash cell) and from 4,000 to 20,000 lphd for the C&DW cells. The limited number of MSW ash, coal ash, and C&DW cells considered in this study exhibited average LCRS flow rates during the active period of operation that were 300 to 600% higher than average LCRS flow rates from MSW cells during the same period. It is possible that the higher leachate generation rates at the MSW ash, coal ash, and C&D waste landfills may, in part, be due to differences in waste characteristics and operational practices.
- Mean RF values were 53% for ash cells and 43% for C&DW cells.
- Peak monthly LCRS flow rates were typically two to three times the average monthly flow rates for all types of waste and regions of the U.S.
- Landfill geographic region has a major impact on LCRS flow rates. For landfill sites with historical average annual rainfall less than 500 mm, average LCRS flow rates were low, typically less than 2,000 lphd. LCRS flow rates increased with increasing rainfall up to a point. In general, for landfills with historical average annual rainfall greater than 1,100 to 1,200 lphd, an increase in rainfall did not appear to cause a corresponding increase in leachate generation rate.
- LCRS flow rates were typically two to three times smaller during the active period of operation than during the initial period of operation.
- Leachate generation rates for the closed landfills in this study typically decreased by a factor of four within one year after closure and by one order of magnitude within two to four years after closure, as shown in Figure 5-5. Six years after closure, LCRS flow rates were between 5 and 1,200 lphd (mean of 180 lphd). Nine years after closure, LCRS flow rates were negligible. These data show that well designed and constructed cover systems can be very effective in minimizing infiltration of rainfall into the waste, thus reducing leachate generation rates to near-zero values.

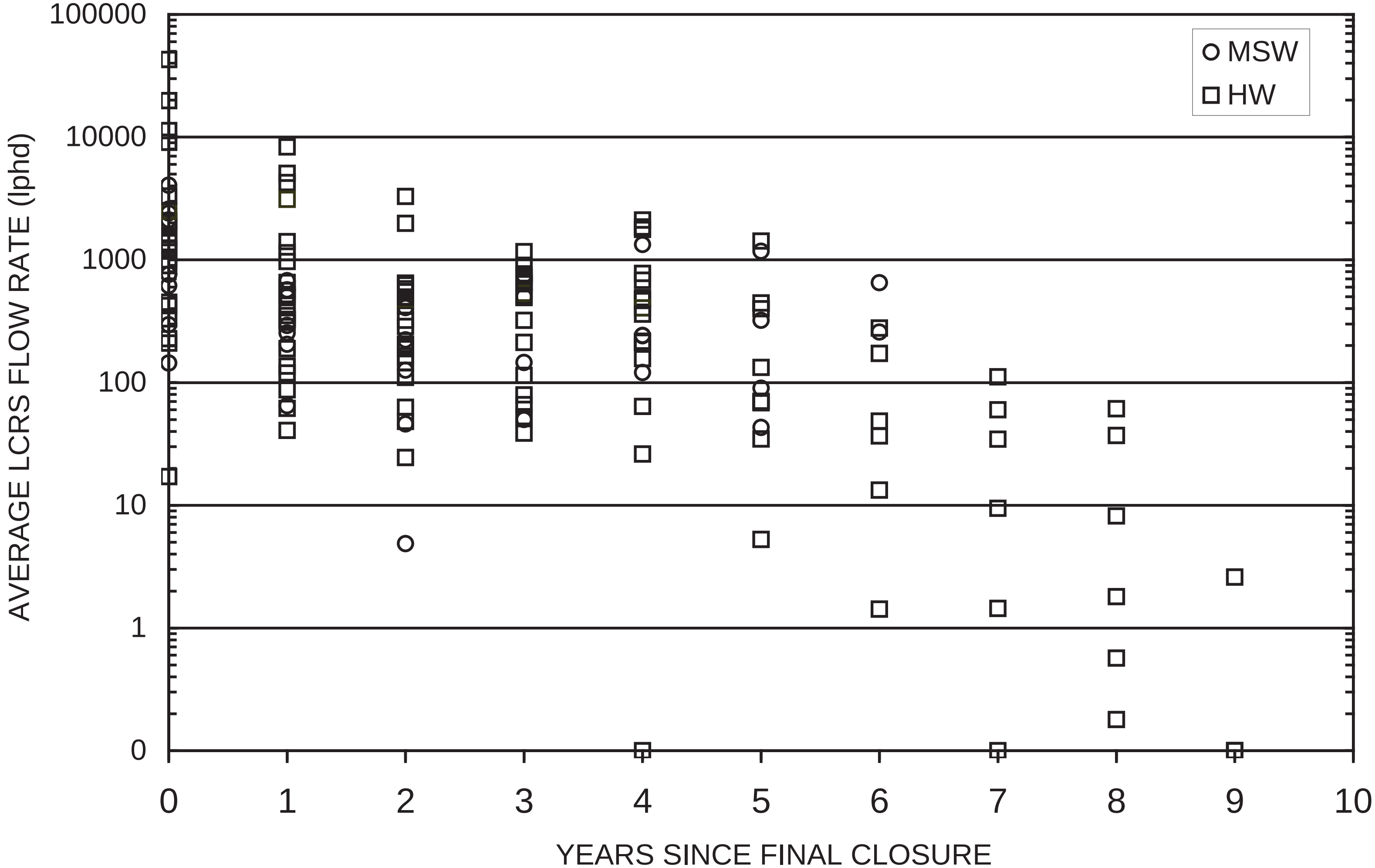


Figure 5-5. Average LCRS flow rates after closure for eleven MSW cells and 22 HW cells.

PART 6

USLE CALCULATIONS

Hillsborough County Southeast County Landfill
May 2013

Soil Erosion using the Universal Soil Loss Equation (USLE)

The Universal Soil Loss Equation A (tons/AC/year) = R * K * LS * C * P

Name	Value	Reference*
Rainfall Factor		
R =	425	Figure 1 of USDA "Predicting Rainfall Loss Handbook"
Soil Erodibility Factor		
K =	0.08	Figure 3 of USDA "Predicting Rainfall Loss Handbook"; assuming 10% silt and very fine sand (.15 to .075 mm), 90% sand (0.1 to 2 mm), 2% organic matter, fine granular structure, and moderate permeability
Topographic Factor		
LS =	11.57	Table 3 USDA "Predicting Rainfall Loss Handbook"; 150 ft slope, 33% slope
Cover and Management Factor		
C =	0.042	Assuming 60% of the ground is covered by vegetation.
Support Practice Factor		
P =	1	support practice factor (ranges 0 to 1), assumed worst case, up & down slope practice

Assumptions:

density	95	lb/ft^3	dry density for silty sand
acreage	162.4	acres	Phases I to VI
acreage	34.5	acres	Sections 7 to 9

e of Soil Loss

	C	A (tons/AC/year)	tons/ year	CF/ year	CY/ year
Phases I to VI	0.042	16.52	2,683	56,488	2,092
Sections 7 to 9	0.042	16.52	570	12,000	444

**reference* United States Department of Agriculture. "Predicting Rainfall Erosion Losses." Agriculture Handbook No. 537, December 1978.

PREDICTING RAINFALL EROSION LOSSES

A GUIDE TO CONSERVATION PLANNING

UNITED STATES
DEPARTMENT OF
AGRICULTURE

AGRICULTURE
HANDBOOK
NUMBER 537

PREPARED BY
SCIENCE AND
EDUCATION
ADMINISTRATION

site as the product of six major factors whose most likely values at a particular location can be expressed numerically. Erosion variables reflected by these factors vary considerably about their means from storm to storm, but effects of the random fluctuations tend to average out over extended periods. Because of the unpredictable short-time fluctuations in the levels of influential variables, however, present soil loss equations are substantially less accurate for prediction of specific events than for prediction of longtime averages.

The soil loss equation is

$$\mathbf{A} = \mathbf{R\,K\,L\,S\,C\,P} \qquad (1)$$

where

A is the computed soil loss per unit area, expressed in the units selected for **K** and for the period selected for **R**. In practice, these are usually so selected that they compute **A** in tons per acre per year, but other units can be selected.

R, the rainfall and runoff factor, is the number of rainfall erosion index units, plus a factor for runoff from snowmelt or applied water where such runoff is significant.

K, the soil erodibility factor, is the soil loss rate per erosion index unit for a specified soil as measured on a unit plot, which is defined as a 72.6-ft length of uniform 9-percent slope continuously in clean-tilled fallow.

L, the slope-length factor, is the ratio of soil loss from the field slope length to that from a 72.6-ft length under identical conditions.

S, the slope-steepness factor, is the ratio of soil loss from the field slope gradient to that from a 9-percent slope under otherwise identical conditions.

C, the cover and management factor, is the ratio of soil loss from an area with specified cover and management to that from an identical area in tilled continuous fallow.

P, the support practice factor, is the ratio of soil loss with a support practice like contouring, stripcropping, or terracing to that with straight-row farming up and down the slope.

The soil loss equation and factor evaluation charts were initially developed in terms of the English units commonly used in the United States. The factor definitions are interdependent, and direct conversion of acres, tons, inches, and feet to metric units would not produce the kind of integers that would be desirable for an expression of the equation in that system. Therefore, only the English units are used in the initial presentation of the equation and factor evaluation materials, and their counterparts in metric units are given in the Appendix under **Conversion to Metric System.**

Numerical values for each of the six factors were derived from analyses of the assembled research data and from National Weather Service precipitation records. For most conditions in the United States, the approximate values of the factors for any particular site may be obtained from charts and tables in this handbook. Localities or countries where the rainfall characteristics, soil types, topographic features, or farm practices are substantially beyond the range of present U.S. data will find these charts and tables incomplete and perhaps inaccurate for their conditions. However, they will provide guidelines that can reduce the amount of local research needed to develop comparable charts and tables for their conditions.

The subsection on **Predicting Cropland Soil Losses**, page 40 illustrates how to select factor values from the tables and charts. Readers who have had no experience with the soil loss equation may wish to read that section first. After they have referred to the tables and figures and located the values used in the sample, they may move readily to the intervening detailed discussions of the equation's factors.

The soil loss prediction procedure is more valuable as a guide for selection of practices if the user has a general knowledge of the principles and factor interrelations on which the equation is based. Therefore, the significance of each factor is discussed before presenting the reference table or chart from which local values may be obtained. Limitations of the data available for evaluation of some of the factors are also pointed out.

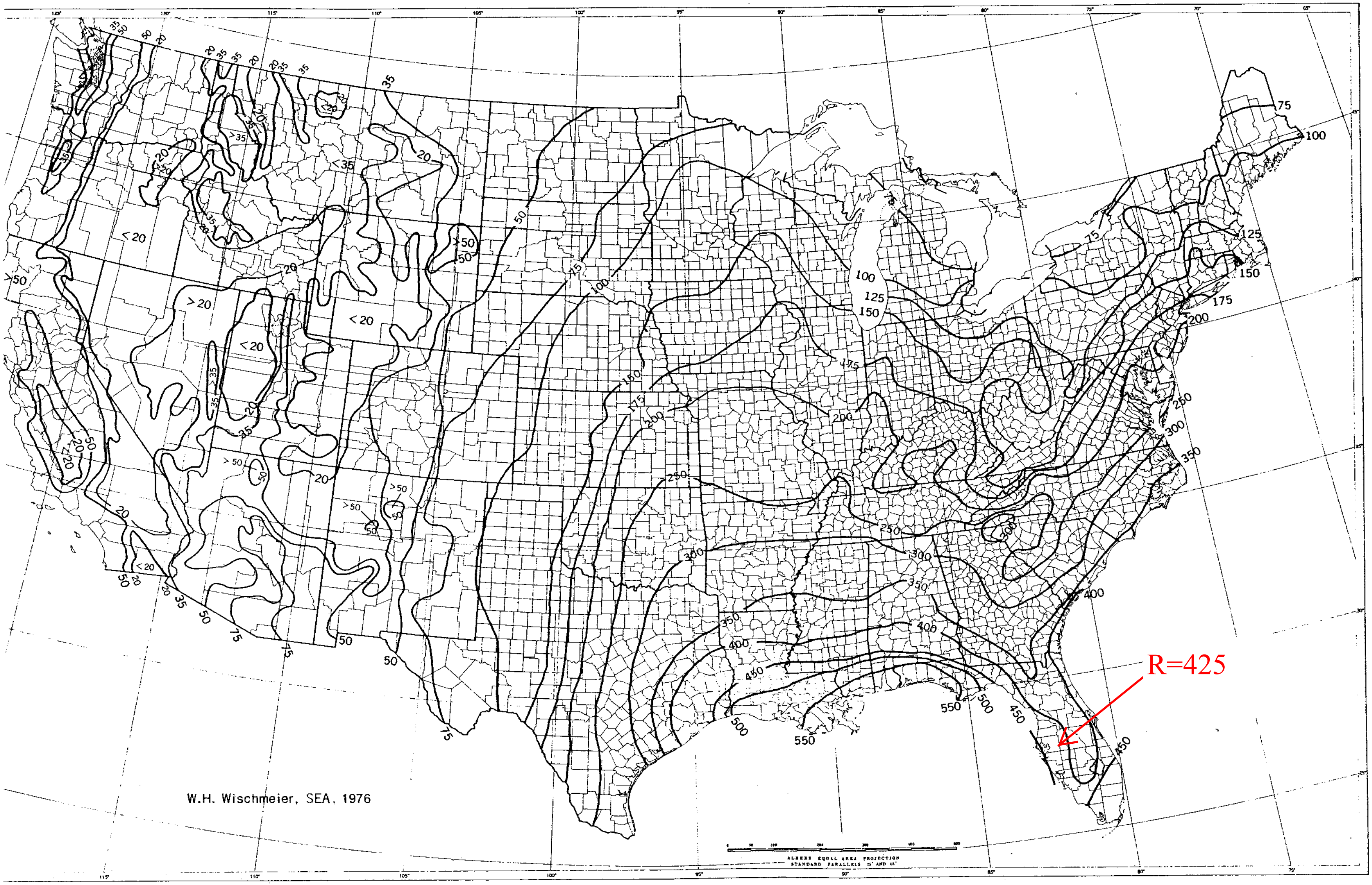


FIGURE 1.—Average annual values of the rainfall erosion index.

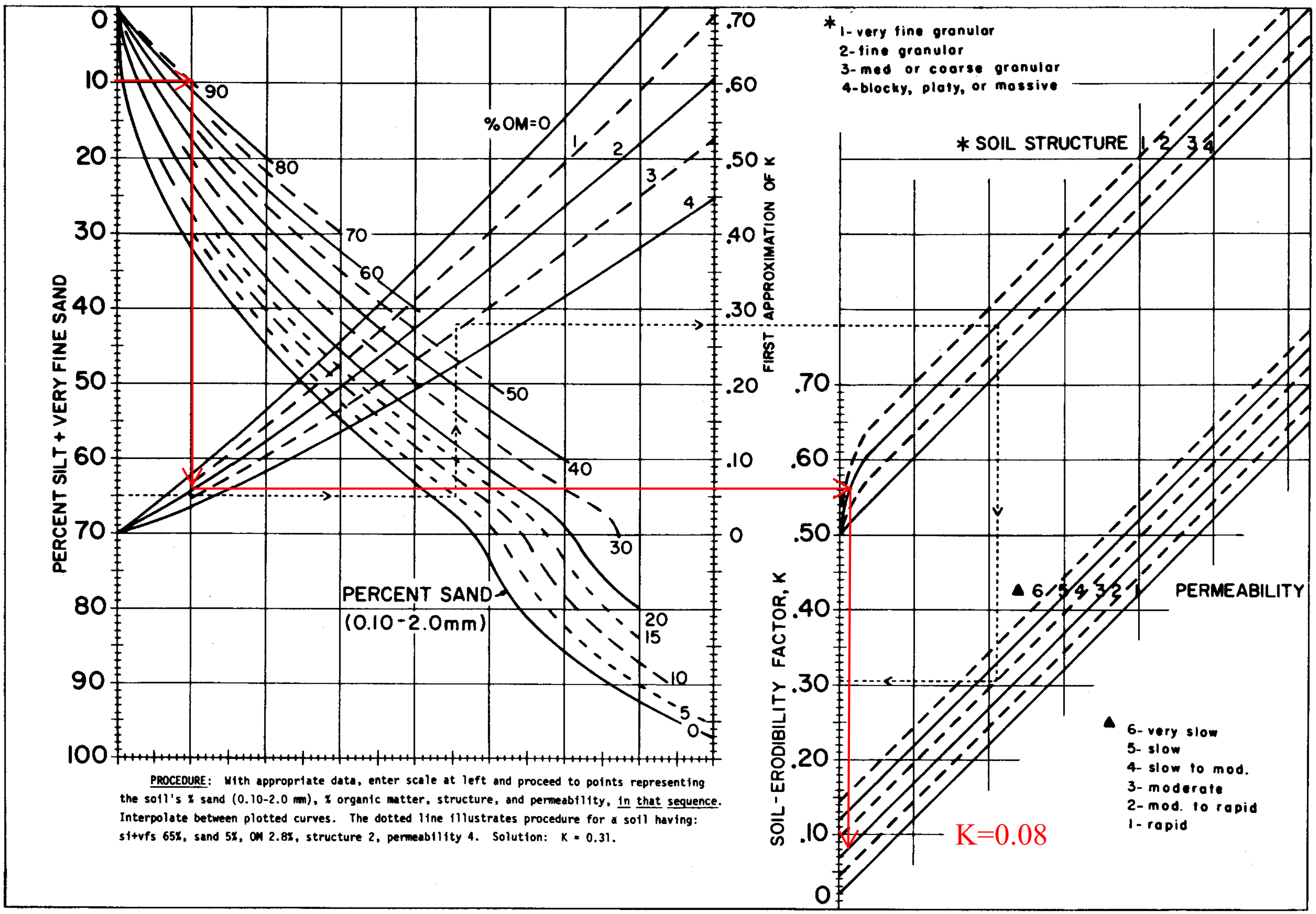


FIGURE 3.—The soil-erodibility nomograph. Where the silt fraction does not exceed 70 percent, the equation is $100\,K = 2.1\,M^{1.14}\,(10^{-4})\,(12 - a) + 3.25\,(b - 2) + 2.5\,(c - 3)$ where M = (percent si + vfs) (100 — percent c), a = percent organic matter, b = structure code, and c = profile permeability class.

TOPOGRAPHIC FACTOR (LS)

Both the length and the steepness of the land slope substantially affect the rate of soil erosion by water. The two effects have been evaluated separately in research and are represented in the soil loss equation by **L** and **S**, respectively. In field applications, however, considering the two as a single topographic factor, **LS**, is more convenient.

Slope-Effect Chart

LS is the expected ratio of soil loss per unit area from a field slope to that from a 72.6-ft length of uniform 9-percent slope under otherwise identical conditions. This ratio for specified combinations of field slope length and uniform gradient may be obtained directly from the slope-effect chart (fig. 4). Enter on the horizontal axis with the field slope length, move vertically to the appropriate percent-slope curve, and read **LS** on the scale at the left. For example, the **LS** factor for a 300-ft length of 10-percent slope is 2.4. Those who prefer a table may use table 3 and interpolate between listed values.

To compute soil loss from slopes that are appreciably convex, concave, or complex, the chart **LS** values need to be adjusted as indicated in the section **LS Values for Irregular Slopes.** Figure 4 and table 3 assume slopes that have essentially uniform gradient. The chart and table were derived by the equation

$$\mathbf{LS} = (\lambda/72.6)^{m}\ (65.41\ \sin^2\theta + 4.56\ \sin\theta + 0.065) \qquad (4)$$

where λ = slope length in feet;
θ = angle of slope; and
m = 0.5 if the percent slope is 5 or more, 0.4 on slopes of 3.5 to 4.5 percent, 0.3 on slopes of 1 to 3 percent, and 0.2 on uniform gradients of less than 1 percent.

The basis for this equation is given in the subsection discussing the individual effects of slope length and steepness. However, the relationships expressed by the equation were derived from data obtained on cropland, under natural rainfall, on slopes ranging from 3 to 18 percent in steepness and about 30 to 300 ft in length. How far beyond these ranges in slope characteristics the relationships derived from the data continue to be accurate has not been determined by direct soil loss measurements.

The Palouse Region of the Northwest represents

TABLE 3.—*Values of the topographic factor, **LS**, for specific combinations of slope length and steepness*[1]

Percent slope	Slope length (feet)											
	25	50	75	100	150	200	300	400	500	600	800	1,000
0.2	0.060	0.069	0.075	0.080	0.086	0.092	0.099	0.105	0.110	0.114	0.121	0.126
0.5	.073	.083	.090	.096	.104	.110	.119	.126	.132	.137	.145	.152
0.8	.086	.098	.107	.113	.123	.130	.141	.149	.156	.162	.171	.179
2	.133	.163	.185	.201	.227	.248	.280	.305	.326	.344	.376	.402
3	.190	.233	.264	.287	.325	.354	.400	.437	.466	.492	.536	.573
4	.230	.303	.357	.400	.471	.528	.621	.697	.762	.820	.920	1.01
5	.268	.379	.464	.536	.656	.758	.928	1.07	1.20	1.31	1.52	1.69
6	.336	.476	.583	.673	.824	.952	1.17	1.35	1.50	1.65	1.90	2.13
8	.496	.701	.859	.992	1.21	1.41	1.72	1.98	2.22	2.43	2.81	3.14
10	.685	.968	1.19	1.37	1.68	1.94	2.37	2.74	3.06	3.36	3.87	4.33
12	.903	1.28	1.56	1.80	2.21	2.55	3.13	3.61	4.04	4.42	5.11	5.71
14	1.15	1.62	1.99	2.30	2.81	3.25	3.98	4.59	5.13	5.62	6.49	7.26
16	1.42	2.01	2.46	2.84	3.48	4.01	4.92	5.68	6.35	6.95	8.03	8.98
18	1.72	2.43	2.97	3.43	4.21	3.86	5.95	6.87	7.68	8.41	9.71	10.9
20	2.04	2.88	3.53	4.08	5.00	5.77	7.07	8.16	9.12	10.0	11.5	12.9

[1] $\mathbf{LS} = (\lambda/72.6)^{m}\ (65.41\ \sin^2\theta + 4.56\ \sin\theta + 0.065)$ where λ = slope length in feet; **m** = 0.2 for gradients < 1 percent, 0.3 for 1 to 3 percent slopes, 0.4 for 3.5 to 4.5 percent slopes, 0.5 for 5 percent slopes and steeper; and θ = angle of slope. (For other combinations of length and gradient, interpolate between adjacent values or see fig. 4.)

LS

tion and developmental areas can be obtained from table 5 if good judgment is exercised in comparing the surface conditions with those of agricultural conditions specified in lines of the table. Time intervals analogous to cropstage periods will be defined to begin and end with successive construction or management activities that appreciably change the surface conditions. The procedure is then similar to that described for cropland.

Establishing vegetation on the denuded areas as quickly as possible is highly important. A good sod has a **C** value of 0.01 or less (table 5-B), but such a low **C** value can be obtained quickly only by laying sod on the area, at a substantial cost. When grass or small grain is started from seed, the probable soil loss for the period while cover is developing can be computed by the procedure outlined for estimating cropstage-period soil losses. If the seeding is on topsoil, without a mulch, the soil loss ratios given in line 141 of table 5 are appropriate for cropstage **C** values. If the seeding is on a desurfaced area, where residual effects of prior vegetation are no longer significant, the ratios for periods SB, 1 and 2 are 1.0, 0.75 and 0.50, respectively, and line 141 applies for cropstage 3. When the seedbed is protected by a mulch, the pertinent mulch factor from the upper curve of figure 6 or table 9 is applicable until good canopy cover is attained. The combined effects of vegetative mulch and low-growing canopy are given in figure 7. When grass is established in small grain, it can usually be evaluated as established meadow about 2 mo after the grain is cut.

C Values for Pasture, Range, and Idle Land

Factor **C** for a specific combination of cover conditions on these types of land may be obtained from table 10 (57). The cover characteristics that must be appraised before consulting this table are defined in the table and its footnotes. Cropstage periods and **EI** monthly distribution data are generally not necessary where perennial vegetation has become established and there is no mechanical disturbance of the soil.

Available soil loss data from undisturbed land were not sufficient to derive table 10 by direct comparison of measured soil loss rates, as was done for development of table 5. However, analyses of the assembled erosion data showed that the research information on values of **C** can be extended to completely different situations by combining subfactors that evaluate three separate and distinct, but interrelated, zones of influence: (a) vegetative cover in direct contact with the soil surface, (b) canopy cover, and (c) residual and tillage effects.

Subfactors for various percentages of surface cover by mulch are given by the upper curve of

TABLE 10.—*Factor **C** for permanent pasture, range, and idle land*[1]

Vegetative canopy		Cover that contacts the soil surface						
Type and height[2]	Percent cover[3]	Type[4]	Percent ground cover					
			0	20	40	60	80	95+
No appreciable canopy		G	0.45	0.20	0.10	0.042	0.013	0.003
		W	.45	.24	.15	.091	.043	.011
Tall weeds or short brush with average drop fall height of 20 in	25	G	.36	.17	.09	.038	.013	.003
		W	.36	.20	.13	.083	.041	.011
	50	G	.26	.13	.07	.035	.012	.003
		W	.26	.16	.11	.076	.039	.011
	75	G	.17	.10	.06	.032	.011	.003
		W	.17	.12	.09	.068	.038	.011
Appreciable brush or bushes, with average drop fall height of 6½ ft	25	G	.40	.18	.09	.040	.013	.003
		W	.40	.22	.14	.087	.042	.011
	50	G	.34	.16	.08	.038	.012	.003
		W	.34	.19	.13	.082	.041	.011
	75	G	.28	.14	.08	.036	.012	.003
		W	.28	.17	.12	.078	.040	.011
Trees, but no appreciable low brush. Average drop fall height of 13 ft	25	G	.42	.19	.10	.041	.013	.003
		W	.42	.23	.14	.089	.042	.011
	50	G	.39	.18	.09	.040	.013	.003
		W	.39	.21	.14	.087	.042	.011
	75	G	.36	.17	.09	.039	.012	.003
		W	.36	.20	.13	.084	.041	.011

[1] The listed **C** values assume that the vegetation and mulch are randomly distributed over the entire area.

[2] Canopy height is measured as the average fall height of water drops falling from the canopy to the ground. Canopy effect is inversely proportional to drop fall height and is negligible if fall height exceeds 33 ft.

[3] Portion of total-area surface that would be hidden from view by canopy in a vertical projection (a bird's-eye view).

[4] G: cover at surface is grass, grasslike plants, decaying compacted duff, or litter at least 2 in deep.

W: cover at surface is mostly broadleaf herbaceous plants (as weeds with little lateral-root network near the surface) or undecayed residues or both.

TABLE 12.—*Factor* **C** *for mechanically prepared woodland sites*

Site preparation	Mulch cover[1]	Soil condition[2] and weed cover[3]							
		Excellent		Good		Fair		Poor	
		NC	WC	NC	WC	NC	WC	NC	WC
	Percent								
Disked, raked, or bedded[4]	None	0.52	0.20	0.72	0.27	0.85	0.32	0.94	0.36
	10	.33	.15	.46	.20	.54	.24	.60	.26
	20	.24	.12	.34	.17	.40	.20	.44	.22
	40	.17	.11	.23	.14	.27	.17	.30	.19
	60	.11	.08	.15	.11	.18	.14	.20	.15
	80	.05	.04	.07	.06	.09	.08	.10	.09
Burned[5]	None	.25	.10	.26	.10	.31	.12	.45	.17
	10	.23	.10	.24	.10	.26	.11	.36	.16
	20	.19	.10	.19	.10	.21	.11	.27	.14
	40	.14	.09	.14	.09	.15	.09	.17	.11
	60	.08	.06	.09	.07	.10	.08	.11	.08
	80	.04	.04	.05	.04	.05	.04	.06	.05
Drum chopped[5]	None	.16	.07	.17	.07	.20	.08	.29	.11
	10	.15	.07	.16	.07	.17	.08	.23	.10
	20	.12	.06	.12	.06	.14	.07	.18	.09
	40	.09	.06	.09	.06	.10	.06	.11	.07
	60	.06	.05	.06	.05	.07	.05	.07	.05
	80	.03	.03	.03	.03	.03	.03	.04	.04

[1] Percentage of surface covered by residue in contact with the soil.

[2] *Excellent* soil condition—Highly stable soil aggregates in topsoil with fine tree roots and litter mixed in.

Good—Moderately stable soil aggregates in topsoil or highly stable aggregates in subsoil (topsoil removed during raking), only traces of litter mixed in.

Fair—Highly unstable soil aggregates in topsoil or moderately stable aggregates in subsoil, no litter mixed in.

Poor—No topsoil, highly erodible soil aggregates in subsoil, no litter mixed in.

[3] NC—No live vegetation.

WC—75 percent cover of grass and weeds having an average drop fall height of 20 in. For intermediate percentages of cover, interpolate between columns.

[4] Modify the listed **C** values as follows to account for effects of surface roughness and aging:

First year after treatment: multiply listed **C** values by 0.40 for rough surface (depressions >6 in); by 0.65 for moderately rough; and by 0.90 for smooth (depressions <2 in).

For 1 to 4 years after treatment: multiply listed factors by 0.7.

For 4+ to 8 years: use table 6.

More than 8 years: use table 7.

[5] For first 3 years: use **C** values as listed.

For 3+ to 8 years after treatment: use table 6.

More than 8 years after treatment: use table 7.

meadow, the selected seedbed soil loss ratio is multiplied by a factor from table 5-D. If mulch is applied, a subfactor read from the upper curve of figure 6 is multiplied by the residual subfactor to obtain **C**. When canopy develops, a canopy subfactor from figure 5 is also included.

SUPPORT PRACTICE FACTOR (P)

In general, whenever sloping soil is to be cultivated and exposed to erosive rains, the protection offered by sod or close-growing crops in the system needs to be supported by practices that will slow the runoff water and thus reduce the amount of soil it can carry. The most important of these supporting cropland practices are contour tillage, stripcropping on the contour, and terrace systems. Stabilized waterways for the disposal of excess rainfall are a necessary part of each of these practices.

By definition, factor **P** in the USLE is the ratio of soil loss with a specific support practice to the corresponding loss with up-and-down-slope culture. Improved tillage practices, sod-based rotations, fertility treatments, and greater quantities of crop residues left on the field contribute materially to erosion control and frequently provide the major control in a farmer's field. However, these are considered conservation cropping and management practices, and the benefits derived from them are included in **C**.

Contouring

The practice of tillage and planting on the contour, in general, has been effective in reducing erosion. In limited field studies, the practice provided almost complete protection against erosion from storms of moderate to low intensity, but it provided little or no protection against the occasional severe storms that caused extensive breakovers of the contoured rows. Contouring appears to be the most effective on slopes in the 3- to 8-percent range. As land slope decreases, it approaches equality with contour row slope, and the soil loss ratio approaches 1.0. As slope increases, contour row capacity decreases and the soil loss ratio again approaches 1.0.

PART 7

ON-SITE SOIL CALCULATIONS

ON-SITE SOIL CALCULATIONS

Based on the estimated required on-site soils for closure and long-term care of Phases I-VI and the Capacity Expansion Area (Sections 7, 8, and 9), the total on-site soil volume needed is the following:

Phases I-VI: 674,101 CY

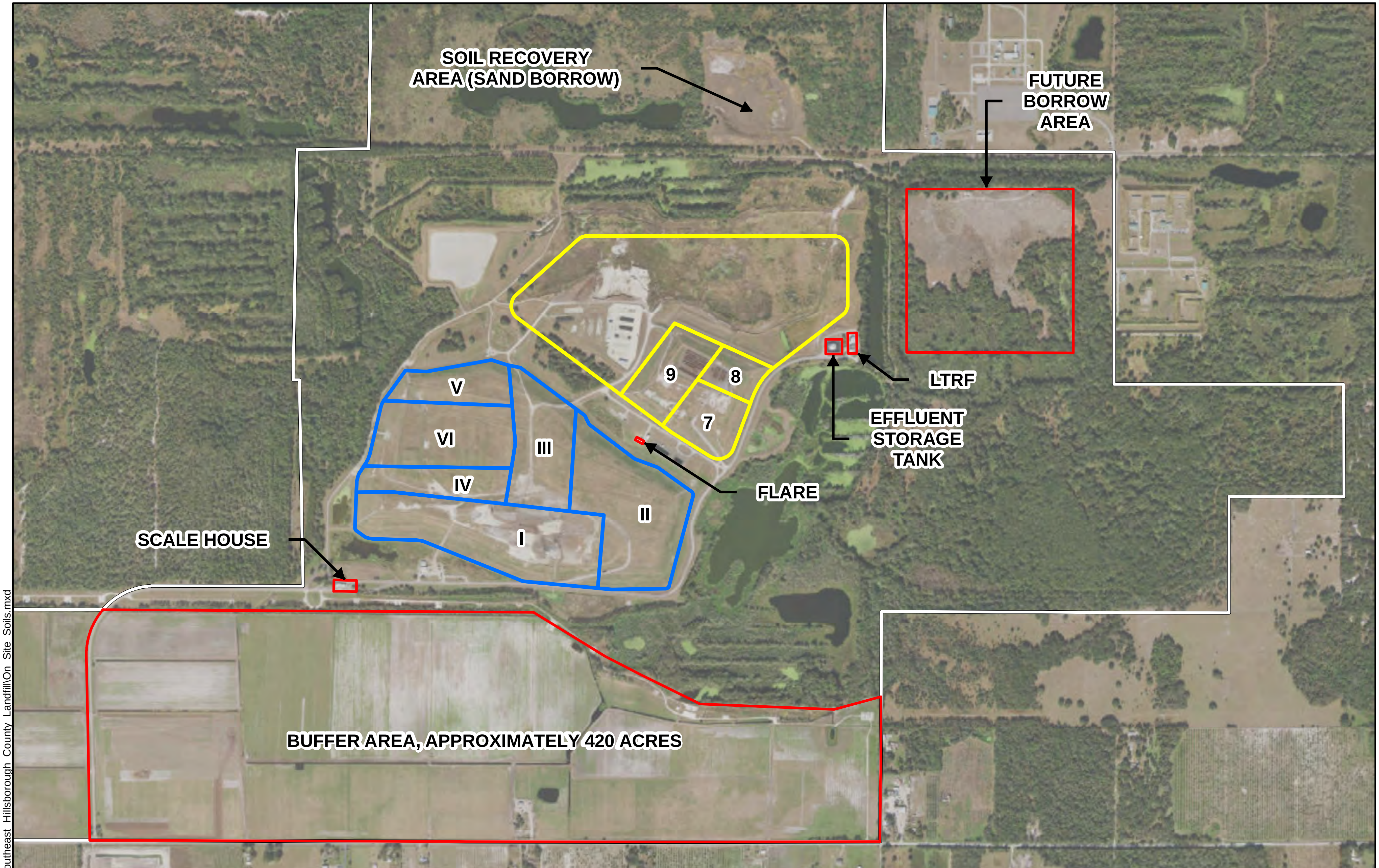
Capacity Expansion Area (Sections 7, 8, and 9): 176,337 CY

Total on-site soil for closure and long-term care: 850,438 CY

Figure 7-1 shows the buffer area owned by the SWMD. With approximately 420 AC available for use and an estimated 5 feet of excavation, the SWMD has available for use 3,388,000 CY of soil.

420 AC=18,295,200 SF
18,295,200 SF x 5 FT (excavation) = 91,476,000 CF = 3,388,000 CY

Additionally to the buffer area, the SWMD can use remaining soils in the Capacity Expansion Area, Soil Recovery Area (Sand Borrow), and the Future Borrow Area.



Legend

- APPROXIMATE PROPERTY BOUNDARY
- EXPANSION AREA (SECTIONS 7, 8, 9)
- LANDFILL PHASES I-VI
- OTHER AREAS

HILLSBOROUGH SOUTHEAST COUNTY LANDFILL
ON SITE SOILS MAP
HILLSBOROUGH COUNTY, FL

SCS ENGINEERS

Tampa, FL | November 2018

0 750 1,500 Feet

N

Hillsborough County Florida

Document Path: G:\GIS\PROJECTS\Southeast Hillsborough County Landfill\On Site Soils.mxd