

July 7, 2003

Bernardin • Lochmueller & Associates, Inc.
6200 Vogel Road
Evansville, Indiana 47715-4006

Attention: Mr. James R. Gulick, P.E., S.E.
Mr. Carl D. Camacho, P.E.

Reference: Environmental Impact Statement & Engineer's Report
The US 31 Project
Plymouth to South Bend
Marshall/St. Joseph Counties, Indiana
CTL Project No. 03-050026

Gentlemen:

CTL Engineering of Indiana, Inc. has completed Task 1 as stated in CTL Proposal No.: 01-5036-P dated July 26, 2001.

WORK DESCRIPTION

The following items were performed.

- Review of GIS maps and soil survey by Bernardin • Lochmueller.
- Review of approximately 400 water wells; 123 water well records were analyzed along the alternative routes. Refer to the attached Summary of Water Well Records in Appendix A and Attachment I.
- Review of geotechnical reports provided by INDOT-Materials & Tests Division. Refer to the attached summary in Appendix B and Attachment I.
- Review of geological maps.
- Review of Soils published by Joint Highway Research Project (JHRP) – Purdue University. Refer to Attachments II & III.

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ASSUMPTIONS

The following assumptions were made.

- The width of excavations was based on two 12' lanes + 8' outside shoulder + 4' inside shoulder and 50' of excavation beyond roadway limits. Estimated width = 46' in each direction, estimated total width = 92'.
- Depth of peat & muck estimated from JHRP publications.
- Estimated Unit Cost based on 2003 – 2004 prices. This cost may need to be revised depending upon year of construction.

Cost analyses are provided in Appendix C.

Thank you for the opportunity to be of service to you on this project. If you have any questions, please contact our office.

Sincerely,

CTL ENGINEERING OF INDIANA, INC.



Ali Karaki, P.E.
Principal Engineer



APPENDIX A
SUMMARY OF WATER WELL RECORDS



SUMMARY OF WATER WELL RECORDS

Records of Water Wells were reviewed at the Indiana Department of Natural Resources (IDNR) Division of Water – Groundwater Section’s website (www.in.gov/dnr/water/ground_water/well_database/searchfield.html) to gain a better understanding of geologic conditions previously encountered along the potential corridors for the new U.S. 31 alignment. Because of the immense amount of information on the Division of Water’s website, not every record in the study area could be reviewed; however, an attempt was made to locate those water wells located closest to the Alternate Routes “A” to “K”. Random selection was used in choosing the records to review in the many locations where numerous wells were located. The water wells were grouped into three areas: Western most Alternative “A”, Central Alternatives “B” to “F” and “J”, and Eastern Alternatives “G” to “K”. A summary of the findings for the three areas is presented below. More detailed information can be obtained by reviewing the Records of Water Wells in Attachments A, B, and C or from the IDNR Division of Water – Groundwater Section’s website.

Western most Alternative “A”

The Water wells for this area are included in Appendix A and highlighted in blue with numbers (1-22) on Attachment A. The wells were drilled to depths ranging from 30 to 170 feet below the ground surface. Bedrock was not encountered in any of the 22 wells researched in this area. Wells designated #1-20 encountered clayey soils and/or sand and gravel. Wells designated #21 and #22 at the northern extend of Alternative “A” encountered 4.0 to 6.0 feet of muck and/or morrow at the ground surface.

Central Alternatives “B” to “F” and “J”

The Water wells for this area are included in Appendix B and highlighted in orange with numbers (1-56) on Attachment A. The wells were drilled to depths ranging from 40 to 192 feet below the ground surface. Bedrock was not encountered in any of the 56 wells researched in this area. The wells primarily encountered clayey soils and/or sand and gravel. Well designated #13, located approximately one-half mile east of Alternatives “B” to “F” near the northwest corner of Riddle Lake, encountered clay and peat. Well #14 located south of Leeper Road and west of the Old Railroad Grade encountered soft clay from 1.0 to 70.0 feet. Well # 43 located southeast of the intersection of Kern and Locust Roads encountered soft clay from 5.0 to 18.0 feet.



Eastern Alternatives "G" to "K"

The Water wells for this area are included in Appendix C and highlighted in pink with numbers (1-45) on Attachment A. The wells were drilled to depths ranging from 40 to 164 feet below the ground surface. Bedrock was not encountered in any of the 45 wells researched in this area. The wells primarily encountered clayey soils and/or sand and gravel. Well designated #19, located on Osborne Road approximately one-mile east of Miami Highway, encountered soft clay from 1.0 to 85.0 feet. Well #21 located northwest of the intersection of Osborne Road and Miami Highway encountered quicksand and clay from 60.0 to 130.0 feet. Well # 29 located on Layton Road approximately one-half mile east of Elm Road, encountered soft clay from 1.0 to 60.0 feet.

APPENDIX B
SUMMARY OF GEOTECHNICAL PROJECTS



Summary of Geotechnical Projects Provided by INDOT – Materials & Tests Division

1. LaPaz Unit Salt Contamination Investigation
@ Old U.S. 31 and New U.S. 31 Intersection
Marshal County, IN
No peat encountered
2. Old U.S. 31 from Plymouth Corp. Line to New U.S. 31
Project No. RS-8150 (1)
DES. No. 00525
Marshall County, IN
Occasional peat and marl to depths of 9.5' to 17.5'
3. Oak Road from Lake Avenue (S.R.17) to U.S. 30
Project No. STP-H045 ()
DES. No. 9384030
Marshall County, IN
Possible peat to depth of 7' – isolated locations
4. Proposed U.S. 31 Temporary By-Pass, Lakeville
Project No. LAKVILL (001) CONSTR.
DES. No. 9682300
St. Joseph County, IN
Isolated peat from 7' to 13' and 17' to 36'
5. U.S. 31 at Roosevelt Road
Project No. ST-153-8
DES. No. 9804990
St. Joseph County, IN
No peat encountered
6. Sight Distance Correction of Old U.S. 31 @ Marshall County Road 3B
Project No. F-153-7 (9)
DES. No. 62150
Marshall County, IN
No peat encountered
7. Intersection Improvement U.S. 31 and S.R. 4
Project No. ST-153-7 (L)
DES. No. 8571890
St. Joseph County, IN
No peat encountered



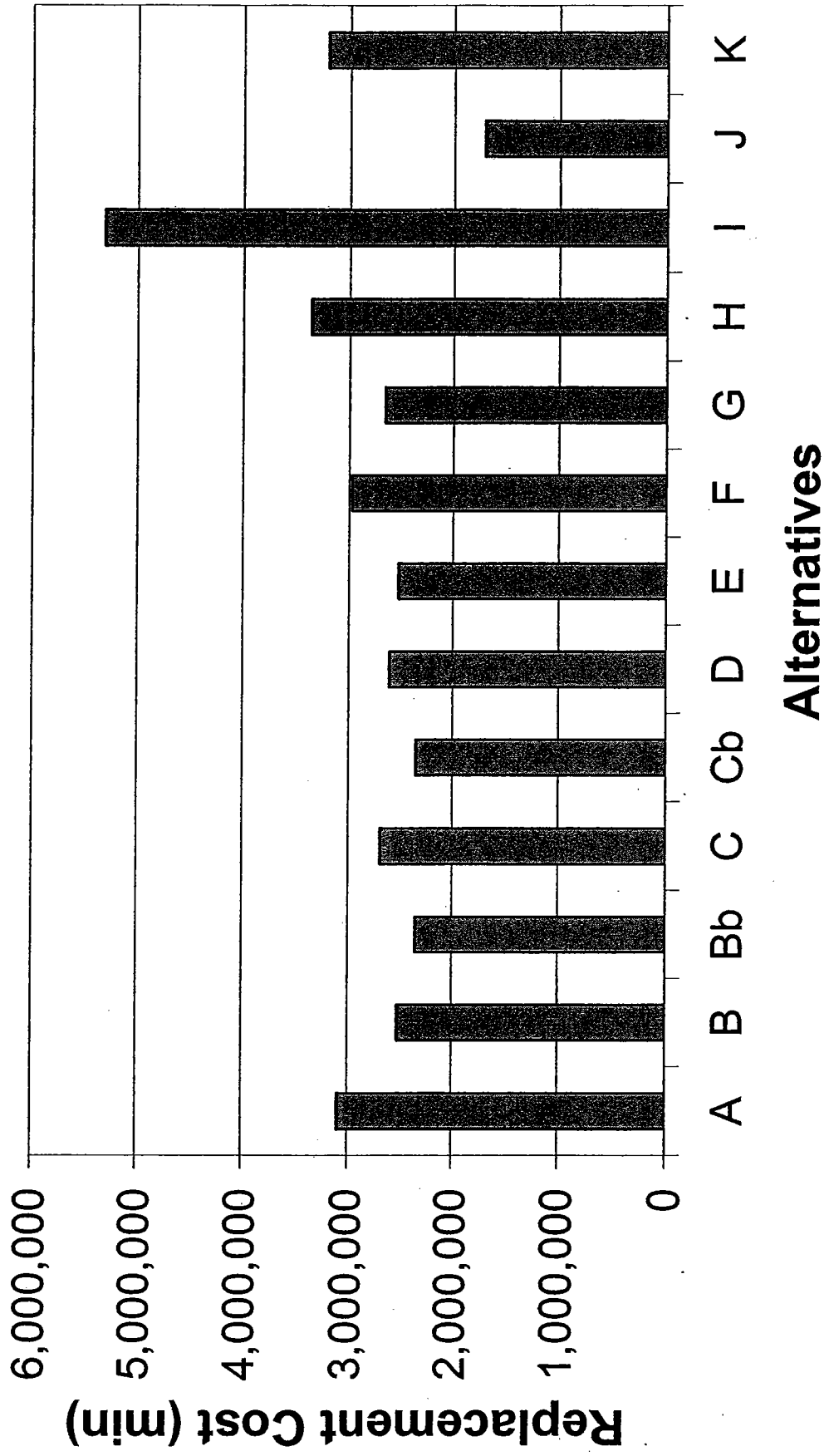
8. U.S. 31 from Madison Rd. to Kern Road.
Project No. ST-153-8
DES. No. 9804990
St. Joseph County, IN
No peat encountered
9. Intersection Improvement @ New Road
Project No. NH/153-7 (019)
DES. No. 8571900
St. Joseph County, IN
No peat encountered
10. U.S. 31 from Kern Road to U.S. 31 Bypass in South Bend
Project No. 153-8 (H)
DES. No. 61500
St. Joseph County, IN
No peat encountered
11. Miami Road Reconstruction between Kern Road and Jackson Road
Project No. STP-5106 ()
DES. No. 9381900
St. Joseph County, IN
No peat encountered, sandy loam and sand to 10'

APPENDIX C
COST ANALYSES

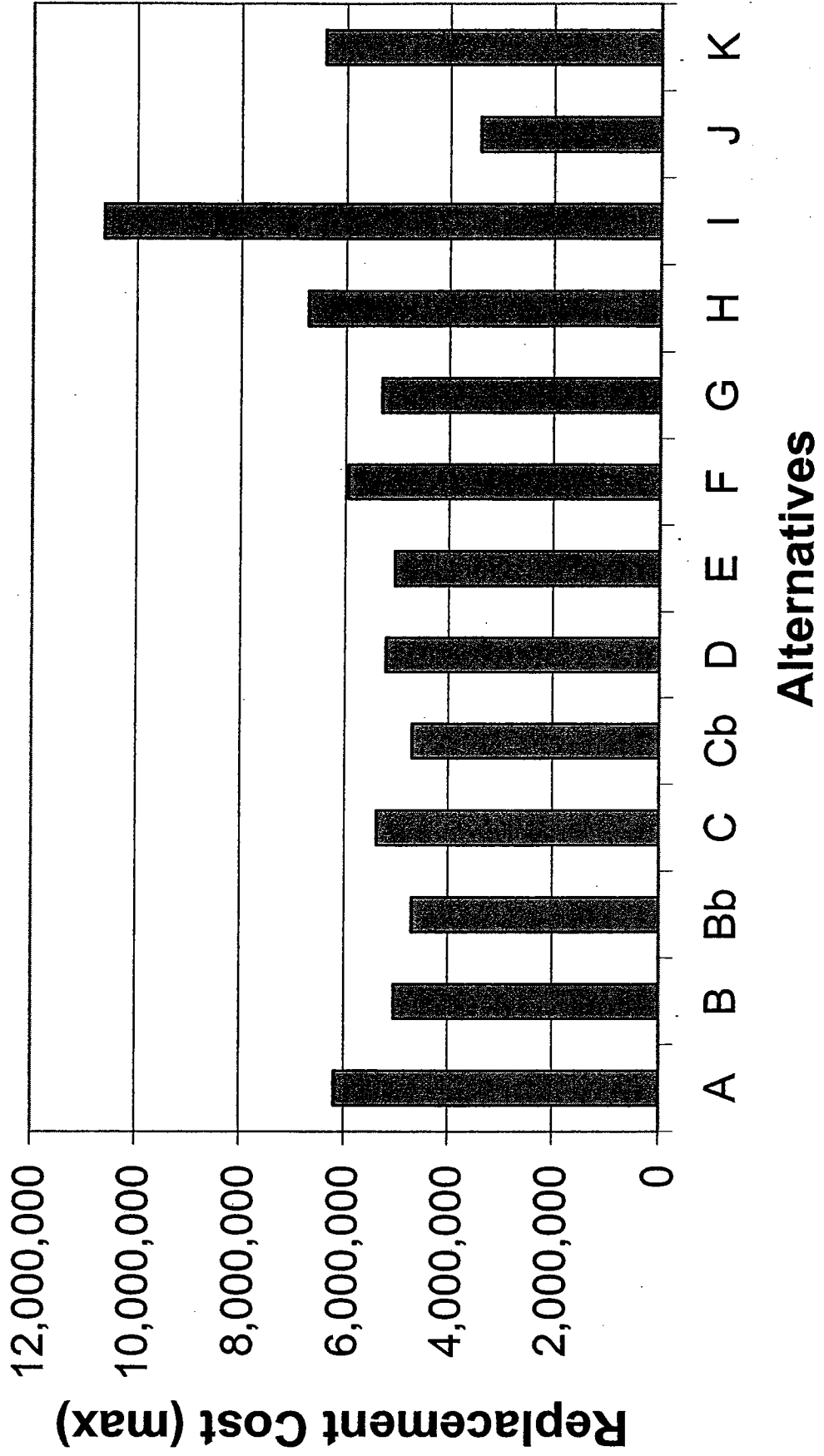
**The US 31 Project
Plymouth to South Bend**

Alternative	Cost of Peat/Muck Removal & Replacement (\$)	
	Minimum	Maximum
A	3,100,000	6,180,000
B1	2,520,000	5,040,000
B2	2,350,000	4,700,000
C1	2,690,000	5,380,000
C2	2,350,000	4,700,000
D1	2,610,000	5,210,000
D2	2,440,000	4,870,000
E1	2,520,000	5,040,000
E2	2,350,000	4,700,000
F1	2,970,000	5,950,000
F2	2,350,000	4,700,000
G	2,650,000	5,300,000
H	3,360,000	6,710,000
I	5,310,000	10,630,000
J	1,710,000	3,410,000
K	3,200,000	6,410,000

US 31 Peat/Muck Replacement



US 31 Peat/Muck Replacement



Alternative	Location	Material Type	Peat/Muck Replacement										Unit Cost		Total Cost (\$)	
			Length (feet)	Width (feet)	Depth (feet)		Volume (CuYd)		Min.	Max.	Min.	Max.	(\$)	Min	Max	
					Min	Max	Min.	Max.								
A	A1	Peat & Muck	1250	92	5	10	21296	42593	20.00	425,926	851,852	20.00	425,926	851,852		
	A2	Peat & Muck	250	92	5	10	4259	8519	20.00	85,185	170,370	20.00	85,185	170,370		
	A3	Peat & Muck	375	92	5	10	6389	12778	20.00	127,778	255,556	20.00	127,778	255,556		
	A4	Peat & Muck	375	92	5	10	6389	12778	20.00	127,778	255,556	20.00	127,778	255,556		
	A5	Peat & Muck	625	92	5	10	10648	21296	20.00	212,963	425,926	20.00	212,963	425,926		
	A6	Peat & Muck	250	92	5	10	4259	8519	20.00	85,185	170,370	20.00	85,185	170,370		
	A7	Peat & Muck	750	92	5	10	12778	25556	20.00	255,556	511,111	20.00	255,556	511,111		
	A8	Peat & Muck	5200	92	5	10	86593	177185	20.00	1,771,852	3,543,704	20.00	1,771,852	3,543,704		
Estimated Total for Peat & Muck Replacement (Alternative A)							154,611	309,222	20.00	3,100,000	-6,180,000	20.00	3,100,000	-6,180,000		
B1	B1-1	Peat & Muck	1250	92	5	10	21296	42593	20.00	425,926	851,852	20.00	425,926	851,852		
	B1-2	Peat & Muck	880	92	5	10	14993	29985	20.00	299,852	599,704	20.00	299,852	599,704		
	B1-3	Peat & Muck	625	92	5	10	10648	21296	20.00	212,963	425,926	20.00	212,963	425,926		
	B1-4	Peat & Muck	750	92	5	10	12778	25556	20.00	255,556	511,111	20.00	255,556	511,111		
	B1-5	Peat & Muck	2890	92	5	10	49237	98474	20.00	984,741	1,969,481	20.00	984,741	1,969,481		
	B1-6	Peat & Muck	625	92	5	10	10648	21296	20.00	212,963	425,926	20.00	212,963	425,926		
	B1-7	Peat & Muck	375	92	5	10	6389	12778	20.00	127,778	255,556	20.00	127,778	255,556		
Estimated Total for Peat & Muck Replacement (Alternative B1)							125,989	251,978	20.00	2,520,000	-5,040,000	20.00	2,520,000	-5,040,000		
B2	B2-1	Peat & Muck	1250	92	5	10	21296	42593	20.00	425,926	851,852	20.00	425,926	851,852		
	B2-2	Peat & Muck	880	92	5	10	14993	29985	20.00	299,852	599,704	20.00	299,852	599,704		
	B2-3	Peat & Muck	625	92	5	10	10648	21296	20.00	212,963	425,926	20.00	212,963	425,926		
	B2-4	Peat & Muck	250	92	5	10	4259	8519	20.00	85,185	170,370	20.00	85,185	170,370		
	B2-5	Peat & Muck	2890	92	5	10	49237	98474	20.00	984,741	1,969,481	20.00	984,741	1,969,481		
	B2-6	Peat & Muck	625	92	5	10	10648	21296	20.00	212,963	425,926	20.00	212,963	425,926		
	B2-7	Peat & Muck	375	92	5	10	6389	12778	20.00	127,778	255,556	20.00	127,778	255,556		
Estimated Total for Peat & Muck Replacement (Alternative B2)							117,470	234,941	20.00	2,350,000	-4,700,000	20.00	2,350,000	-4,700,000		

Alternative	Location	Material Type	Peat/Muck Replacement						Unit Cost		Total Cost (\$)	
			Length (feet)	Width (feet)	Depth (feet)		Volume (CuYd)		(\$)	Min	Max	
					Min	Max	Min.	Max.				
C1	C1-1	Peat & Muck	1250	92	5	10	21296	42593	20.00	425,926	851,852	
	C1-2	Peat & Muck	880	92	5	10	14993	29985	20.00	299,852	599,704	
	C1-3	Peat & Muck	625	92	5	10	10648	21296	20.00	212,963	425,926	
	C1-4	Peat & Muck	750	92	5	10	12778	25556	20.00	255,556	511,111	
	C1-5	Peat & Muck	2890	92	5	10	49237	98474	20.00	984,741	1,969,481	
	C1-6	Peat & Muck	625	92	5	10	10648	21296	20.00	212,963	425,926	
	C1-7	Peat & Muck	375	92	5	10	6389	12778	20.00	127,778	255,556	
	C1-8	Peat & Muck	500	92	5	10	8519	17037	20.00	170,370	340,741	
Estimated Total for Peat & Muck Replacement (Alternative C1)									20.00	2,690,000	5,380,000	
C2	C2-1	Peat & Muck	1250	92	5	10	21296	42593	20.00	425,926	851,852	
	C2-2	Peat & Muck	880	92	5	10	14993	29985	20.00	299,852	599,704	
	C2-3	Peat & Muck	625	92	5	10	10648	21296	20.00	212,963	425,926	
	C2-4	Peat & Muck	250	92	5	10	4259	8519	20.00	85,185	170,370	
	C2-5	Peat & Muck	2890	92	5	10	49237	98474	20.00	984,741	1,969,481	
	C2-6	Peat & Muck	625	92	5	10	10648	21296	20.00	212,963	425,926	
	C2-7	Peat & Muck	375	92	5	10	6389	12778	20.00	127,778	255,556	
	C2-8	Peat & Muck	500	92	5	10	8519	17037	20.00	170,370	340,741	
Estimated Total for Peat & Muck Replacement (Alternative C2)						117,470	234,941		20.00	2,350,000	4,700,000	
D1	D1-1	Peat & Muck	1250	92	5	10	21296	42593	20.00	425,926	851,852	
	D1-2	Peat & Muck	880	92	5	10	14993	29985	20.00	299,852	599,704	
	D1-3	Peat & Muck	625	92	5	10	10648	21296	20.00	212,963	425,926	
	D1-4	Peat & Muck	750	92	5	10	12778	25556	20.00	255,556	511,111	
	D1-5	Peat & Muck	2890	92	5	10	49237	98474	20.00	984,741	1,969,481	
	D1-6	Peat & Muck	625	92	5	10	10648	21296	20.00	212,963	425,926	
	D1-7	Peat & Muck	375	92	5	10	6389	12778	20.00	127,778	255,556	
	D1-8	Peat & Muck	250	92	5	10	4259	8519	20.00	85,185	170,370	
Estimated Total for Peat & Muck Replacement (Alternative D1)						130,248	260,496		20.00	2,610,000	5,210,000	
D2	D2-1	Peat & Muck	1250	92	5	10	21296	42593	20.00	425,926	851,852	
	D2-2	Peat & Muck	880	92	5	10	14993	29985	20.00	299,852	599,704	
	D2-3	Peat & Muck	625	92	5	10	10648	21296	20.00	212,963	425,926	
	D2-4	Peat & Muck	250	92	5	10	4259	8519	20.00	85,185	170,370	
	D2-5	Peat & Muck	2890	92	5	10	49237	98474	20.00	984,741	1,969,481	
	D2-6	Peat & Muck	625	92	5	10	10648	21296	20.00	212,963	425,926	
	D2-7	Peat & Muck	375	92	5	10	6389	12778	20.00	127,778	255,556	
	D2-8	Peat & Muck	250	92	5	10	4259	8519	20.00	85,185	170,370	
Estimated Total for Peat & Muck Replacement (Alternative D2)						121,730	243,459		20.00	2,440,000	4,870,000	

Alternative	Location	Material Type	Peat/Muck Replacement						Unit Cost (\$)	Total Cost (\$)	
			Length (feet)	Width (feet)	Depth (feet)		Volume (CuYd)			Min	Max
					Min	Max	Min.	Max.			
E1	E1-1	Peat & Muck	1250	92	5	10	21296	42593	20.00	425,926	851,852
	E1-2	Peat & Muck	880	92	5	10	14993	29985	20.00	299,852	599,704
	E1-3	Peat & Muck	625	92	5	10	10648	21296	20.00	212,963	425,926
	E1-4	Peat & Muck	750	92	5	10	12778	25556	20.00	255,556	511,111
	E1-5	Peat & Muck	2890	92	5	10	49237	98474	20.00	984,741	1,969,481
	E1-6	Peat & Muck	625	92	5	10	10648	21296	20.00	212,963	425,926
	E1-7	Peat & Muck	375	92	5	10	6389	12778	20.00	127,778	255,556
Estimated Total for Peat & Muck Replacement (Alternative E1)							125,989	251,978	20.00	2,520,000	5,040,000
E2	E2-1	Peat & Muck	1250	92	5	10	21296	42593	20.00	425,926	851,852
	E2-2	Peat & Muck	880	92	5	10	14993	29985	20.00	299,852	599,704
	E2-3	Peat & Muck	625	92	5	10	10648	21296	20.00	212,963	425,926
	E2-4	Peat & Muck	250	92	5	10	4259	8519	20.00	85,185	170,370
	E2-5	Peat & Muck	2890	92	5	10	49237	98474	20.00	984,741	1,969,481
	E2-6	Peat & Muck	625	92	5	10	10648	21296	20.00	212,963	425,926
	E2-7	Peat & Muck	375	92	5	10	6389	12778	20.00	127,778	255,556
Estimated Total for Peat & Muck Replacement (Alternative E2)							117,470	234,941	20.00	2,350,000	4,700,000
F1	F1-1	Peat & Muck	1250	92	5	10	21296	42593	20.00	425,926	851,852
	F1-2	Peat & Muck	880	92	5	10	14993	29985	20.00	299,852	599,704
	F1-3	Peat & Muck	625	92	5	10	10648	21296	20.00	212,963	425,926
	F1-4	Peat & Muck	750	92	5	10	12778	25556	20.00	255,556	511,111
	F1-5	Peat & Muck	2890	92	5	10	49237	98474	20.00	984,741	1,969,481
	F1-6	Peat & Muck	625	92	5	10	10648	21296	20.00	212,963	425,926
	F1-7	Peat & Muck	375	92	5	10	6389	12778	20.00	127,778	255,556
F1-8	Peat & Muck	1330	92	5	10	22659	45319	20.00	453,185	906,370	
Estimated Total for Peat & Muck Replacement (Alternative F1)							148,648	297,296	20.00	2,970,000	5,950,000
F2	F2-1	Peat & Muck	1250	92	5	10	21296	42593	20.00	425,926	851,852
	F2-2	Peat & Muck	880	92	5	10	14993	29985	20.00	299,852	599,704
	F2-3	Peat & Muck	625	92	5	10	10648	21296	20.00	212,963	425,926
	F2-4	Peat & Muck	250	92	5	10	4259	8519	20.00	85,185	170,370
	F2-5	Peat & Muck	2890	92	5	10	49237	98474	20.00	984,741	1,969,481
	F2-6	Peat & Muck	625	92	5	10	10648	21296	20.00	212,963	425,926
	F2-7	Peat & Muck	375	92	5	10	6389	12778	20.00	127,778	255,556
F2-8	Peat & Muck	1330	92	5	10	22659	45319	20.00	453,185	906,370	
Estimated Total for Peat & Muck Replacement (Alternative F2)							117,470	234,941	20.00	2,350,000	4,700,000

Alternative	Location	Material Type	Peat/Muck Replacement										Unit Cost		Total Cost (\$)	
			Length (feet)	Width (feet)	Depth (feet)		Volume (CuYd)		Min.	Max.	(\$)	Min	Max			
					Min	Max	Min.	Max.								
G	G1	Peat & Muck	1250	92	5	10	21296	42593	20.00	425,926	851,852					
	G2	Peat & Muck	880	92	5	10	14993	29985	20.00	299,852	599,704					
	G3	Peat & Muck	625	92	5	10	10648	21296	20.00	212,963	425,926					
	G4	Peat & Muck	750	92	5	10	12778	25556	20.00	255,556	511,111					
	G5	Peat & Muck	250	92	5	10	4259	8519	20.00	85,185	170,370					
	G6	Peat & Muck	3775	92	5	10	64315	128630	20.00	1,286,296	2,572,593					
	G7	Peat & Muck	250	92	5	10	4259	8519	20.00	85,185	170,370					
Estimated Total for Peat & Muck Replacement (Alternative G)							132,548	265,096	20.00	2,650,000	5,300,000					
H	H1	Peat & Muck	1250	92	5	10	21296	42593	20.00	425,926	851,852					
	H2	Peat & Muck	880	92	5	10	14993	29985	20.00	299,852	599,704					
	H3	Peat & Muck	625	92	5	10	10648	21296	20.00	212,963	425,926					
	H4	Peat & Muck	750	92	5	10	12778	25556	20.00	255,556	511,111					
	H5	Peat & Muck	250	92	5	10	4259	8519	20.00	85,185	170,370					
	H6	Peat & Muck	3775	92	5	10	64315	128630	20.00	1,286,296	2,572,593					
	H7	Peat & Muck	200	92	5	10	3407	6815	20.00	68,148	136,296					
	H8	Peat & Muck	125	92	5	10	2130	4259	20.00	42,593	85,185					
	H9	Peat & Muck	125	92	5	10	2130	4259	20.00	42,593	85,185					
	H10	Peat & Muck	1500	92	5	10	25556	51111	20.00	511,111	1,022,222					
	H11	Peat & Muck	370	92	5	10	6304	12607	20.00	126,074	252,148					
Estimated Total for Peat & Muck Replacement (Alternative H)							167,815	335,630	20.00	3,360,000	6,710,000					
I	I1	Peat & Muck	1250	92	5	10	21296	42593	20.00	425,926	851,852					
	I2	Peat & Muck	880	92	5	10	14993	29985	20.00	299,852	599,704					
	I3	Peat & Muck	675	92	5	10	11500	23000	20.00	230,000	460,000					
	I4	Peat & Muck	750	92	5	10	12778	25556	20.00	255,556	511,111					
	I5	Peat & Muck	250	92	5	10	4259	8519	20.00	85,185	170,370					
	I6	Peat & Muck	3775	92	5	10	64315	128630	20.00	1,286,296	2,572,593					
	I7	Peat & Muck	125	92	5	10	2130	4259	20.00	42,593	85,185					
	I8	Peat & Muck	1250	92	5	10	21296	42593	20.00	425,926	851,852					
	I9	Peat & Muck	4140	92	5	10	70533	141067	20.00	1,410,667	2,821,333					
	I10	Peat & Muck	625	92	5	10	10648	21296	20.00	212,963	425,926					
	I11	Peat & Muck	625	92	5	10	10648	21296	20.00	212,963	425,926					
	I12	Peat & Muck	1250	92	5	10	21296	42593	20.00	425,926	851,852					
Estimated Total for Peat & Muck Replacement (Alternative I)							265,693	531,385	20.00	5,310,000	10,630,000					

Alternative	Location	Material Type	Peat/Muck Replacement										Total Cost (\$)	
			Length (feet)	Width (feet)	Depth (feet)		Volume (CuYd)		Unit Cost (\$)	Min	Max			
					Min	Max	Min.	Max.						
J	J1	Peat & Muck	1500	92	5	10	25556	51111	20.00	511,111	-	1,022,222		
	J2	Peat & Muck	125	92	5	10	2130	4259	20.00	42,593	-	85,185		
	J3	Peat & Muck	1130	92	5	10	19252	38504	20.00	385,037	-	770,074		
	J4	Peat & Muck	1625	92	5	10	27685	55370	20.00	553,704	-	1,107,407		
	J5	Peat & Muck	375	92	5	10	6389	12778	20.00	127,778	-	255,556		
	J6	Peat & Muck	125	92	5	10	2130	4259	20.00	42,593	-	85,185		
	J7	Peat & Muck	125	92	5	10	2130	4259	20.00	42,593	-	85,185		
Estimated Total for Peat & Muck Replacement (Alternative J)							85,270	170,541	20.00	1,710,000	-	3,410,000		
K	K1	Peat & Muck	1250	92	5	10	21296	42593	20.00	425,926	-	851,852		
	K2	Peat & Muck	880	92	5	10	14993	29985	20.00	299,852	-	599,704		
	K3	Peat & Muck	625	92	5	10	10648	21296	20.00	212,963	-	425,926		
	K4	Peat & Muck	750	92	5	10	12778	25556	20.00	255,556	-	511,111		
	K5	Peat & Muck	250	92	5	10	4259	8519	20.00	85,185	-	170,370		
	K6	Peat & Muck	3775	92	5	10	64315	128630	20.00	1,286,296	-	2,572,593		
	K7	Peat & Muck	1000	92	5	10	17037	34074	20.00	340,741	-	681,481		
	K8	Peat & Muck	250	92	5	10	4259	8519	20.00	85,185	-	170,370		
	K9	Peat & Muck	625	92	5	10	10648	21296	20.00	212,963	-	425,926		
Estimated Total for Peat & Muck Replacement (Alternative K)							160,233	320,467	20.00	3,200,000	-	6,410,000		