HAR 2&3 RFI-158 Attachment A

Item Description: Site grading, Parking, Drainage and Access road

1. Clearing site (Item # 1 of Attachment A-1, Civil Quantities)

Clearing and grubbing site to prepare the site suitable for construction activity; includes the removal of top 1' soil and disposal of the same as directed, removing the existing trees from the area and to make site suitable for construction. It includes maintaining the exiting utilities lines if any and preserving the important monuments existing in the area.

Design Approach:
Area measured from GA and topographic survey map using AutoCAD software.

Design Inputs: Harris Site GA (DWG HAR-M-001)
Site topographic Survey Map (BARTON AIR TECHNOLOGIES)

Assumptions:
-Clearing and grubbing will be within top 1' soil.
-Tree removal is anticipated in about 20% of the area.
-Acreage bases and the rates will be different for area having significant tree removal and then without significant tree removal.

Attachments: see Attachment A-1 (Civil Quantities – Harris Site)

1. Sketches : Refer Figure-1
2. Calculation(s) : None
3. References : None

HAR 2&3 RFI-158 Attachment B

Item Description: Railroad modifications

Railroad Spurs in plant area to Existing Track (Item # 10 of Attachment A-1, Civil Quantities)

Supply and installation of railroad tracks in proper grade and elevation as shown in drawing, including subgrade perpetration, installation of ballast, sub-ballast, ties, track installation etc. Includes supply and installation of turnout and switches as shown in design drawing. Includes supply and installation of railroad slings, signals etc.

Design Approach / Basis for Estimate:
- Track length is measured from GA using AutoCAD.
- Switches is counted from layout shown in Figure-5

Design Inputs: Harris Site GA (DWG HAR-M-001)

Assumptions:
-Avg. 3' of compacted fill will be provided for laying tracks

Attachments: (As necessary)

1. Sketches : Figure- 5
2. Calculation(s): Table 24.1
3. References : None

Project # 12076 **Table 24.1**

Name : Shearon Harris Nuclear Power Plant, Carolina

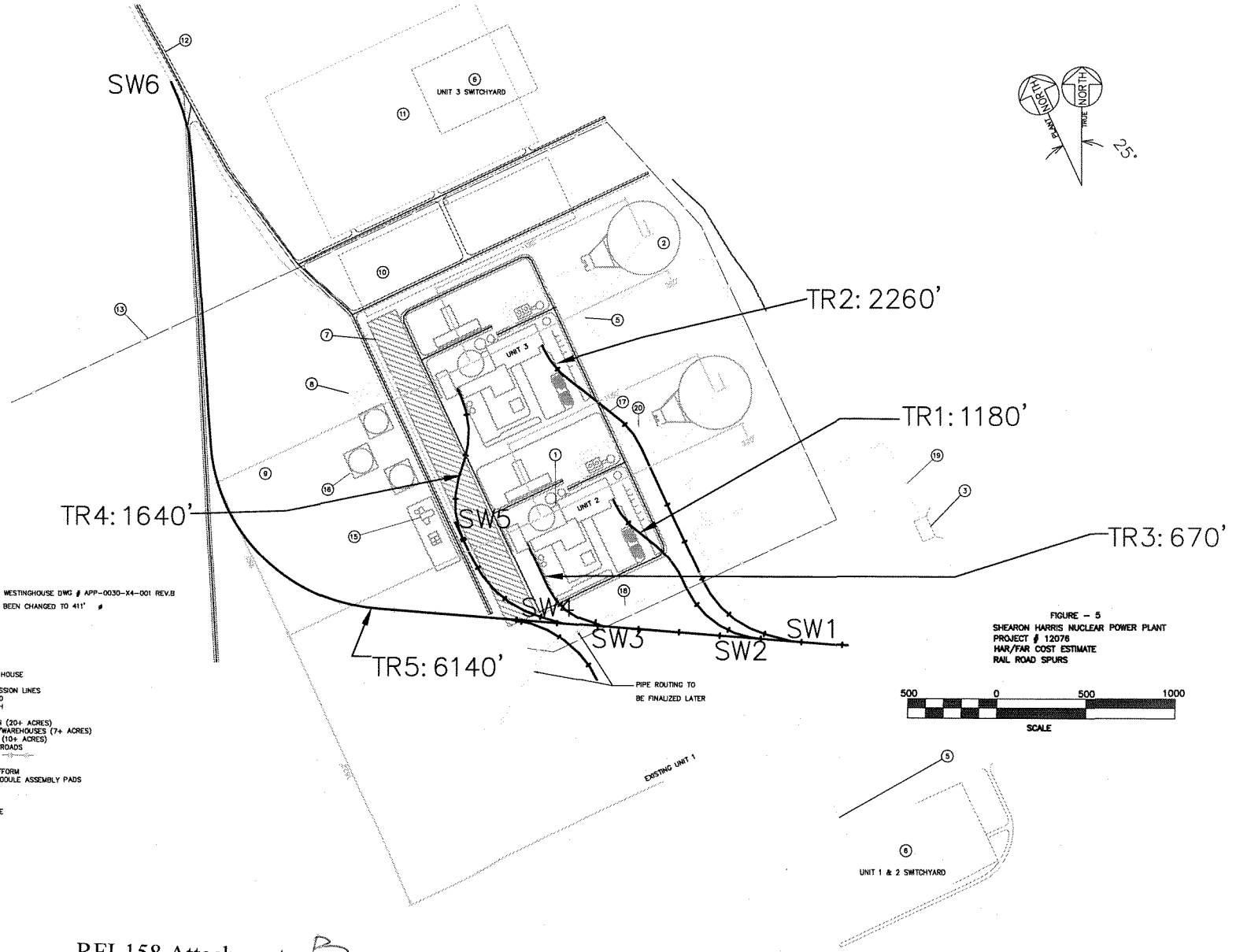
Work: Estimation of Civil Quantities for Plant Roads. for New AP-1000 units

Railroad Quantity Table			
#	Description	Length (Ft.)	Remarks
TR1	Unit-2 Turbine to New Line	1180	
TR2	Unit-3 Turbine to New line	2260	
TR3	Unit-2 Reactor side to New Line	670	
TR4	Unit-3 Reactor side to New line	1640	
TR5	New line making loop to existing line	6140	
	Total Track Length	11890	
	Say	**11900**	
	Switches & Turnout		
1	New Track to TR1		
2	New Track to TR2		
3	New Track to TR3		
4	New Track to TR4		
5	Existing Track & TR4		
6	New Loop Track to Existing Track		
	Total Switches & Turnout	**6**	Nos.

Note Ref. GA, DWG: HAR-M-001 and figure-5

Rail is assumed to be at grade level of 260

No earthwork is considered
The cost includes Earthwork, Ballast, Subballast, Slippers & Rails including supply & installation



NOTES:

1. BUILDINGS BASED ON WESTINGHOUSE DWG # APP-0030-X4-001 REV.8
2. COOLING TOWER HAS BEEN CHANGED TO 411' ø

LEGEND

1. POWER BLOCK
2. COOLING TOWER
3. MAKE UP WATER PUMP HOUSE
4. (SPARE)
5. UNIT 2 AND 3 TRANSMISSION LINES
6. UNIT 2 & 3 SWITCHYARD
7. HEAVY LIFT CRANE PATH
8. HAUL ROAD
9. CONSTRUCTION LAYDOWN (20+ ACRES)
10. CONSTRUCTION OFFICES/WAREHOUSES (7+ ACRES)
11. CONSTRUCTION PARKING (10+ ACRES)
12. CONSTRUCTION ACCESS ROADS
13. CONSTRUCTION FENCE
14. (SPARE)
15. MODULE ASSEMBLY PLATFORM
16. CONTAINMENT VESSEL MODULE ASSEMBLY PADS
17. NEW RAIL
18. BLOWDOWN WATER LINE
19. MAKEUP WATER LINE
20. CIRCULATING WATER LINE

FIGURE – 5
SHEARON HARRIS NUCLEAR POWER PLANT
PROJECT # 12076
HAR/FAR COST ESTIMATE
RAIL ROAD SPURS

RFI-158 Attachment B
Page 3 of 3

2. Excavation (Item # 2 of Attachment A-1, Civil Quantities)

Excavation in soil and in rock for the area as shown on the drawing; Includes excavation, on site disposal of excavated material as directed with all safety precaution required during the excavation like preserving monuments and maintaining required existing utility lines if any.

(a) Excavation in soil

(b) Excavation in Rock includes the excavation, on site disposal of excavated material as directed.

Design Approach:
Area measured for major contours using AutoCAD software. Average depth of excavation is computed for each area within major contours and volume of excavation is computed by multiplying area with avg. depth of cutting. For the side slopes the avg. height is computed for different segments. Cross sectional area is computed for that height and multiplied with segment length to compute the volume of excavation.

Design Inputs: (Harris Site GA (DWG HAR-M-001)
Site topographic Survey Map (BARTON AIR TECHNOLOGIES)

Assumptions:
-Entire area will be graded to EL 260' except area labeled A2 in Figure-1
- Area labeled A2 will be graded to El 268'
-Side slopes for cutting will be 2H: 1V
- Rock is anticipated about 15' below grade elevation.
(Note: Assumed on basis of preliminary information provided by CH2MHILL)

Attachments: see Attachment A-1 (Civil Quantities – Harris Site)

1. Sketches : Figure-1
2. Calculation(s) : Table 23.1 and Table-23.2
3. References : None

3. Compacted Fill for the area (Item # 3 of Attachment A-1, Civil Quantities)

Earthwork for filling the area to designed grade elevations as shown in the drawing.

Filling area with selected soil material includes borrowing the material within site limit, transporting and placing the material in layers of specified thickness, watering and compacting the layers and finishing the top layer to designed grade and slopes as specified in the design drawing. Includes obtaining necessary permits, maintaining existing plant operations, existing utility, utility lines and existing monuments, all necessary safety measures, testing and quality control expenses.

Design Approach:
Area measured for major contours using AutoCAD software. Average depth of filling is computed for each area within major contours and volume of fill is computed by multiplying area with avg. depth of filling. For the side slopes the avg. height is computed for different segments. Cross sectional area is computed for that height and multiplied with segment length to compute the volume of fill.

Design Inputs: Harris Site GA (DWG HAR-M-001)
Site topographic Survey Map (BARTON AIR TECHNOLOGIES)

Assumptions:
-Area labeled A1, & A3 will be grade to elevation 260' and A2 will be graded to elevation 268 '
-Side slopes for filling will be 3H: 1V
-15% extra material will be required due to compaction.

Attachments: see Attachment A-1 (Civil Quantities – Harris Site)

1. Sketches : Refer figure-2 of Item –2(Excavation)
2. Calculation(s) : Table 23.1 and Table 23.2
3. References : None

4. Riprap protection (Item # 3b of Attachment A-1, Civil Quantities)

Supply and installation of 3' thick riprap protection. This includes the graded stone material of specified size, transporting, placing, packing, finishing the top surface at specified slopes.

Design Approach:
Approximate length of the slopes exposed to lake-water is measured from drawing. The average sloping length for varying height along above slopes is computed from the marked up drawing. The area for riprap protection is computed by multiplying these lengths. Volume of riprap is computed by multiplying the area by the average thickness of riprap.

Design Inputs Harris Site GA (DWG HAR-M-001)
Site topographic Survey Map (BARTON AIR TECHNOLOGIES)

Assumptions:
-Slopes facing lake-water only will be provided with the riprap protection.
-Side slopes for filling will be 3H: 1V

Attachments: see Attachment A-1 (Civil Quantities – Harris Site)

1. Sketches : Refer Figure-2

2. Calculation(s) : Avg.100' sloping length for 2500' long protection work
   Volume = 2500 x 100 x 3' (Thickness)/27 = 27777 Cyd
   Say 28000 Cyd

3. References : None

5. Onsite disposal of excess material (Item 4 of Attachment A-1, Civil Quantities)

Transporting and placing the surplus material not used for filling area after the excavation during the grading operation. This includes the transporting and placing the material in the stockpile area as directed by the site in-charge/authority.

Design Approach:
Total excavation is computed; from total excavation the rock excavation and unusable volume (Stripping etc.) are deducted to compute usable material. Total required fill volume is computed; add 20% of extra to fill volume for allowance of compaction etc. This volume is deducted from usable volume of material computed from excavation to compute the surplus volume of material to be disposed.

Design Inputs: Harris Site GA (DWG HAR-M-001)
Site topographic Survey Map (BARTON AIR TECHNOLOGIES)

Assumptions:

-15% Extra fill material required due to compaction.

Attachments: see Attachment A-1 (Civil Quantities – Harris Site)

1. Sketches : Figure-2
2. Calculation(s) : Table 23.1 and Table 23.2
3. References : None

6. Excavation of stormwater ditches (Item 5a & 5b of Attachment A-1, Civil Quantities)

Excavation of stormwater ditches including excavating the stormwater ditch of specified size and side slopes with specified grade, finishing the excavated surface and disposing the excavated material onsite as directed.

Design Approach / Basis for Estimate:
Exact layout and the finish grading has not yet been decided and hence the anticipated length of the ditches are measured approximately and the length of the ditches is multiplied with cross section area of the ditch to compute the volume of ditch excavation.

Design Inputs: Harris Site GA (DWG HAR-M-001)
Site topographic Survey Map (BARTON AIR TECHNOLOGIES)

Assumptions:
-Ditch cross section is uniform with bottom width of 2' for (5a) & 4' for (5b)
-Side slope is 2H: 1V
-Side slopes will be stone surfaced

Attachments: see Attachment A-1 (Civil Quantities – Harris Site)

1. Sketches : Figure-2

2. Calculation(s) : 5(a) Cross sec. Area = (2+14)/2 x 3 = 24 Sq.ft
   Length = 16200'; Volume 16200 x 24 /27 = 14,400 Cyd.
   5(b) Cross sec. Area = (4+16)/2 x 3 = 30 Sq.ft
   Length = 3000'; Volume 3000 x 30 /27 = 3,333 Cyd.

3. References : None

7. Stone lining of stormwater ditches (Item 5c & 5d of Attachment A-1, Civil Quantities)

Supply and installation of 6" Thick stone protection on surface of stormwater ditch. This includes the graded stone material of specified size, transporting, placing, packing, finishing the top surface at specified slopes and grade.

Design Approach:
Approximate length of stormwater ditches in item 5(a) & 5(c) is multiplied with perimeter of the ditch to compute the surface area of the stormwater ditch. The computed surface area of ditches are multiplied with their respective thickness of 1' to compute volume of stone protection work.

Design Inputs: Harris Site GA (DWG HAR-M-001)
Site topographic Survey Map (BARTON AIR TECHNOLOGIES)

Assumptions:
-Ditch cross section is uniform with depth of 3' and bottom width 2'(5c) and 4' for item (5d).
-Side slopes for filling will be 2H: 1V
-Thickness of stone protection will be 6"

Attachments: see Attachment A-1 (Civil Quantities – Harris Site)

1. Sketches : None
2. Calculation(s) : Perimeter for 16200' long protection work item 5(c) = 15.4'
   Volume = 16,200 x 15.4 x 0.5' (Thickness)/27 = 4620 Cyd
   Perimeter for 3,000' long protection work item 5(d) = 17.4'
   Volume = 3,000 x 17.4 x 0.5' (Thickness)/27 = 967 Cyd
3. References : None

8. Storm Sewer CHDPE (Item 5e of Attachment A-1, Civil Quantities)

Supply and installation of different size of CHDPE storm sewer pipes. This includes supply of CHDPE storm sewer pipes, Excavation of ditches and installation of CHDPE pipes in specified grade and elevations, Filling joints, connecting the storm sewer with storm structures and backfilling the trenches with selected material of approved quality in layers.

Design Approach:
Approximate length of different size of storm-sewer from assumed storm-sewer layout. Approximate catchment area for each catch basin and storm structures is used to compute the peak discharge for each storm sewer. From that, assume allowable velocity the size of pipe is computed, the next higher available size(s) is used.

Design Inputs: Harris Site GA (DWG HAR-M-001)
Site topographic Survey Map (BARTON AIR TECHNOLOGIES)

Assumptions:
-CHDPE pipe will be used

Attachments: see Attachment A-1 (Civil Quantities – Harris Site)

1. Sketches : Figure-3
2. Calculation(s) : None
3. References : None

9. Pre cast storm manholes (Item 5f of Attachment A-1, Civil Quantities)

Supply and installation of different size of pre cast storm sewer structures. This includes supply of manholes, catch basins etc. with specified cover, including excavation of ditches and installation of structures in specified elevation, Filling joints, connecting the storm sewer with structures and backfilling the trenches with selected material of approved quality in layers.

Design Approach:
Use 2' x 2' catch basins, manhole diameter 1' greater than the maximum size of storm sewer connecting to that manhole.

Design Inputs: (Harris Site GA (DWG HAR-M-001)
Site topographic Survey Map (BARTON AIR TECHNOLOGIES)

Assumptions: None

Attachments: see Attachment A-1 (Civil Quantities – Harris Site)

1. Sketches : Refer Figure-3
2. Calculation(s) : None
3. References : None

10. 32' wide Access Road (Item 6 of Attachment A-1, Civil Quantities)

Construction of Asphalt paved new plant access road of about 15500' and 24' wide along with 4' paved shoulder on either side. The Items include

(a) excavation in all sorts of soil for the road including excavating and onsite stacking and disposal of material,
(b) compacted fill for road and access ramps in suitable layers including watering and compaction for subgrade preparation
(c) Supply and installation of aggregate base course of 10" thickness, subbase course of 6" thickness, and asphalt pavement of 5" thickness (includes binder course and surface coat), rolling compaction etc. including use of 8 oz/sy geotextile soil separator.
(d) Supply and installation of CHDPE culverts, including excavation, compacted fill, pre-cast end sections and stone protection work for the culverts.
(e) Supply and installation of traffic signboards, instruction boards, guard rails and other miscellaneous items at appropriate location along and sides of the road wherever required.

Design Approach:
- Center line of road is shown on topo and length is measured from AutoCAD
- Road elevations are assumed at different location so that it is within permissible grade and follow the general topography.
- Avg. Depth of cut or fill are computed using AutoCAD civil 3D software
- For ramps at US RT -1, cross section area of fill at both ends are averaged out to compute the fill volume
- From topography, required culverts are counted.
- Roadwork is computed by multiplying width with the length of the road.
- Cost allowance for guardrails, road signs etc. will be incorporated.

Design Inputs: Harris Site GA (DWG HAR-M-001)
Site topographic Survey Map (BARTON AIR TECHNOLOGIES)

Assumptions:
-Culverts will be of 48" CHDPE
-Road width of 24' with 4' shoulder on either side.

Attachments: see Attachment A-1 (Civil Quantities – Harris Site)

1. Sketches : Figure-4.1,4.2,4.3,4.4 (Plans), Figure 4.5&4.6 (Profile)

2. Calculation(s) : Table 23.4(AutoCAD 3D output), Table 23.5

3. References : None

11. 32' wide plant roads (Item #7 of Attachment A-1, Civil Quantities)

Construction of Asphalt paved plant roads of about 10000' and 20' wide along with 2' paved shoulder on either side. The Items include

(f) excavation in all sorts of soil for the road including excavating and onsite stacking and disposal of material,
(g) compacted fill for road and access ramps in suitable layers including watering and compaction for subgrade preparation
(h) Supply and installation of aggregate base course of 10" thickness, subbase course of 6" thickness, and asphalt pavement of 5" thickness (Includes binder course and surface coat), rolling compaction etc. including use of 8 oz/sy geotextile soil separator.
(i) Supply and installation of CHDPE culverts, including excavation, compacted fill, pre-cast end sections and stone protection work for the culverts.
(j) Supply and installation of traffic signboards, instruction boards, guard rails and other miscellaneous items at appropriate location along and sides of the road wherever required.

Design Approach:

- Length of such roads is computed from GA
- Avg. depth of cut and fill is assumed about 1'
- Numbers of culvert is approximate.
- Roadwork is computed by multiplying width with the length of the road.
- Cost allowance for guardrails, road signs etc. will be incorporated

Design Inputs: Harris Site GA (DWG HAR-M-001)
Site topographic Survey Map (BARTON AIR TECHNOLOGIES)

Assumptions:

-Avg. depth of cut & fill is 1' as the roads will be constructed on graded ground.
-Culverts will be of 24" CHDPE
-Road width of 20' with 2' shoulder on either side.

Attachments: see Attachment A-1 (Civil Quantities – Harris Site)

1. Sketches : None

2. Calculation(s) : Table 23.3

3. References : None

12. 24' wide miscellaneous plant roads (Item # 7 of Attachment A-1, Civil Quantities)

Construction of Asphalt paved plant roads of about 8700' and 20' wide along with 2' paved shoulder on either side. The Items include

(k) excavation in all sorts of soil for the road including excavating and onsite stacking and disposal of material,

(l) compacted fill for road and access ramps in suitable layers including watering and compaction for subgrade preparation

(m) Supply and installation of aggregate base course of 10" thickness, subbase course of 6" thickness, and asphalt pavement of 4" thickness (Includes binder course and 1.5" surface coat), rolling compaction etc. including use of 8 oz/sy geotextile soil separator.

(n) Supply and installation of CHDPE culverts, including excavation, compacted fill, pre-cast end sections and stone protection work for the culverts.

(o) Supply and installation of traffic signboards, instruction boards, guard rails and other miscellaneous items at appropriate location along and sides of the road wherever required.

Design Approach:

- Length of such roads is computed from GA
- Avg. depth of cut and fill is assumed about 1'
- Culvert number is approximate.
- Roadwork is computed by multiplying width with the length of the road.
- Cost allowance for guardrails, road signs etc. will be incorporated

Design Inputs: Harris Site GA (DWG HAR-M-001)
Site topographic Survey Map (BARTON AIR TECHNOLOGIES)

Assumptions:

-Avg. depth of cut & fill is 1' as the roads will be constructed on graded ground.
-Culverts will be of 24" CHDPE
-Road width of 20' with 2' shoulder on either side.

Attachments: see Attachment A-1 (Civil Quantities – Harris Site)

1. Sketches : None

2. Calculation(s) : None

3. References : None

Shearon Harris Nuclear Power Plant, Carolina

Project #

Estimate of Civil Quantities for Two New AP-1000 units

Quantities Incuded:

- Clearing & Grubbing
-Grading & Drainage of Plant area
-Access Road eartwork & Road

Table 23.1

Earthwork Computation for Area Label - A1(Figure-1)										
Contours	Avg. Level EL ft	Req. Level EL ft	Ht. Difference ft	Area Sq.ft.	Area Ac.	Volume Cu.. Yard	Rock Cut Cu. Yard	Soil Unusable Cu. Yard	Soil Available Cu. Yard	Remarks
Contour > 290	290	260	30	17750	0.41	19722	9860	657	9205	15' is considered as rock cut
280-290	285	260	25	203850	4.68	188750	75500	7550	105700	10' is considered as rock cut
270-280	275	260	15	389400	8.94	216333	0	14422	201911	-ve Volume indicates Filling
260-270 (P+Q+R)	265	260	5	1284600	29.49	237889	0	47578	190311	
260-266	263	260	3	482600	11.08	53622	0	17874	35748	
>270 (M+N)	270	260	10	139000	3.19	51481	0	5148	46333	
260-260 (Grade)	260	260	0	2240300	51.43	82974	0	82974	-99568	
260-250	255	260	-5	786472	18.05	-145643	0	29129	-209726	
250-240	245	260	-15	689950	15.84	-383306	0	25554	-490631	
240-230	235	260	-25	137630	3.16	-127435	0	5097	-159039	
<230	230	260	-30	84070	1.93	-93411	0	3114	-115830	
Excavation				4757500	109.2	850772				
Fill				1698122	39.0	-749795				

Earthwork Computation for Area Label - A2(Figure-1)										
	Avg. Level EL ft	Req. Level EL ft	Ht. Difference ft	Area Sq.ft.	Area Ac.	Volume (Cut) Cu.. Yard	Rock Cut Cu. Yard	Soil Unusable Cu. Yard	Soil Available Cu. Yard	Remarks
Contour >290	290	268	22	27000	0.62	22000	7000	1000	14000	7' is considered as rock cut
280-290	285	268	17	355500	8.16	223833	26333	13167	184333	2' is considered as rock cut
270-280	275	268	7	517100	11.87	134063	0	19152	114911	
270-260 (A+B)	265	268	-3	313600	7.20	-34844	0	11616	-46460	
260-250 (1+2+3+4)	255	268	-13	74500	1.71	-35870	0	2759	-46355	
Excavation				899600	20.65	379896				
Fill				388100	8.91	-70715				

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ATTACHMENT A-1

Shearon Harris Nuclear Power Plant, Carolina

Project #

Estimate of Civil Quantities for Two New AP-1000 units

Quantities Incuded:

- Clearing & Grubbing

-Grading & Drainage of Plant area

-Access Road eartwork & Road

Table 23.1

Earthwork Computation for Area Label - A3(Figure-1)										
	Avg. Level EL ft	Req. Level EL ft	Ht. Difference ft	Area Sq.ft.	Area Ac.	Volume Cu.. Yard	Rock Cut Cu. Yard	Soil Unusable Cu. Yard	Soil Available Cu. Yard	Remarks
Contour > 290	290	260	30	34600	0.79	38444	19222	1281	17941	15' is considered as rock cut
280-290	285	260	25	74400	1.71	68889	27556	2756	38578	10' is considered as rock cut
270-280	275	260	15	251200	5.77	139556	0	9304	130252	
260-270	265	260	5	254500	5.84	47130	0	9426	37704	
250-260 (1+2)	255	260	-5	24800	0.57	-4593	0	919	-6613	
Excavation				614700	14.11	294019				
Fill				24800	0.57	-4593				

OVER ALL SITE										
Total				8382822	192.44	699585	165471	310475	-47296	
Excavation				6271800	143.98	1524687				
Fill				2111022	48.46	-825102				
Earth to be used in side slopes									38718	
Extra earth available									-86014	

Summary

Excavation Total	1524687	Filling required	990123 includes 20% extra form compaction
Excavation from slopes	86448	Filling for sides	125168 includes 20% extra form compaction
Total Excavation	1611135	Total fill	1115288
Excavation in Rock	165471 (Item 2a)		
Excavation in Soil	1445664 (Item 2b)		
Soil Unusable	310475 (Item 1c)		
Soil Usable for filling	1135189		
Total filling	1115288 (Item 3a)		
Extra earth to be disposed	19900 (Item 4)		
Note:	All area is considered to be graded to EL 260.		
	% of Rock cut is shown in remarks column		

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ATTACHMENT A.1

Shearon Harris Nuclear Power Plant, Carolina

Table 23.2

Project # 12076-10

Estimate of Civil Quantities for Two New AP-1000 units

Table 23.2 : Earth work computation table for side slopes around graded area							
Area #	Length ft.	Area a1 in Sq.ft	Area a2 in Sq.ft	Avg. Area A in Sq.ft	Volume in Cu. Yard	Sloping Length(Avg.) in ft.	Area for Riprap A in Sq.ft
Embankment portion							
1	460	0	150	75	1278	15	6900
2	160	150	600	375	2222	45	7200
3	66	600	1350	975	2383	75	4950
4	84	1350	2400	1875	5833	105	8820
5	518	2400	1350	1875	35972	105	54390
6	125	1350	600	975	4514	75	9375
7	60	600	260	430	956	50	3000
8	31	260	150	205	235	35	1085
9	47	150	150	150	261	30	1410
10	55	150	150	150	306	30	1650
11	526	150	150	150	2922	30	15780
12	77	150	2400	1275	3636	140	10780
13	41	2400	1350	1875	2847	170	6970
14	101	1350	1350	1350	5050	90	9090
15	29	1350	600	975	1047	75	2175
16	348	600	600	600	7733	60	20880
17	219	600	1350	975	7908	75	16425
18	251	1350	1350	1350	12550	90	22590
19	89	1350	600	975	3214	75	6675
20	53	600	600	600	1178	80	3180
21	59	600	600	600	1311	60	3540
22	39	600	150	375	542	45	1755
23	146	150	0	75	406	15	2190
Toal	3584				104305		220810
				Compaction	125166		

Shearon Harris Nuclear Power Plant, Carolina

Table 23.2

Project # 12076-10

Estimate of Civil Quantities for Two New AP-1000 units

Table 23.2 : Earth work computation table for side slopes around graded area							
Area #	Length ft.	Area a1 in Sq.ft	Area a2 in Sq.ft	Avg. Area A in Sq.ft	Volume in Cu. Yard	Sloping Length(Avg.) in ft.	Area for Riprap A in Sq.ft
Cutting portion							
C1	264	0	100	50	489		
C2	523	100	100	100	1937		
C3	19	100	100	100	70		
C4	331	100	400	250	3065		
C5	55	400	900	650	1324		
C6	130	900	900	900	4333		
C7	78	900	900	900	2600		
C8	57	900	900	900	1900		
C9	144	900	900	900	4800		
C10	63	900	900	900	2100		
C11	349	900	900	900	11633		
C12	63	900	900	900	2100		
C13	296	900	400	650	7126		
C14	299	400	100	250	2769		
C15	133	100	100	100	493		
C16	34	100	100	100	126		
C17	275	100	100	100	1019		
C18	20	100	100	100	74		
C19	360	100	100	100	1333		
C20	333	100	400	250	3083		
C21	200	400	400	400	2963		
C22	38	400	400	400	563		
C23	293	400	900	650	7054		
C24	174	900	900	900	5800		
C25	246	900	400	650	5922		
C26	327	400	100	250	3028		
C27	215	100	0	50	398		
C28	132	0	100	50	244		
C29	261	100	400	250	2417		
C30	311	400	100	250	2880		
C31	19	100	100	100	70		
C32	279	100	400	250	2583		
C33	18	100	100	100	67		
C34	46	100	0	50	85		
Total	6385				86448		

Earth required from borrow area = 38718 Cu. Yard

Note: Side slope for cutting is considered as 1V:2H & the same for filling is 1V:3H

Project # 12076

Table 23.3

Name : Shearon Harris Nuclear Power Plant, Carolina

Work: Estimation of Civil Quantities for Plant Roads & Access Road for New AP-1000 units

Computation

#	Description	Length (Ft.)	Remarks
A	24' (+8' shoulder)Two lane asphalt road		
1	**Around Unit-3**	3000	Ref. GA DWG HAR-M-001
2	Around Unit-2	3000	
3	Between Const. Office and Const. Parking	2000	
4	Between Unit3 & Const. office/warehouses	1800	
	Total Road Length	9800	
	Total Say	**10000**	
B	20' wide (+6' shoulder) Asphalt road within the plant		
	Access to cooling towers and around Unit-3	1500	
	Access to Makeup water pump house	1900	
	Access to cooling tower and around Unit-2	1200	
	Other roads within unit-2 & unit-3	1000	(Approximate assumed)
	Access to intake Channel	3100	
	Total Say	**8700**	
C	Access Road (24' + 8' Shoulder) Asphalt		
1	Access road from End of crane path up to Harris road	**11400**	
2	Ramps for Interchange @ Harris Road	**4000**	
	4 Nos 1000 ft with 1V:2H slope Height 30'		
	Total say	**15500**	

Ref: DWG HAR-M-001; Rev:0

TABLE 23.4

Volume Report

Project: D:\0n5475\projects\12076-010\accessroad_forcivil3d.dwg

Alignment: Alignment - (1)
Sample Line Group: 1
Start Sta: 0+00.000
End Sta: 114+00.000

Station	Cut Area (Sq.ft.)	Cut Volume (Cu.yd.)	Reusable Volume (Cu.yd.)	Fill Area (Sq.ft.)	Fill Volume (Cu.yd.)	Cum. Cut Vol. (Cu.yd.)	Cum. Reusable Vol. (Cu.yd.)	Cum. Fill Vol. (Cu.yd.)	Cum. Net Vol. (Cu.yd.)
0+00.000	420.52	0.00	0.00	217.25	0.00	0.00	0.00	0.00	0.00
0+25.000	0.00	194.69	194.69	0.00	100.58	194.69	194.69	100.58	94.11
0+50.000	590.25	273.26	273.26	306.15	141.73	467.95	467.95	242.31	225.64
0+75.000	0.00	273.26	273.26	0.00	141.73	741.21	741.21	384.05	357.17
1+00.000	481.96	223.13	223.13	278.46	128.92	964.34	964.34	512.96	451.38
1+25.000	0.00	223.13	223.13	0.00	128.92	1187.47	1187.47	641.88	545.59
1+50.000	534.07	247.25	247.25	321.64	148.91	1434.73	1434.73	790.79	643.94
1+75.000	0.00	247.25	247.25	0.00	148.91	1681.98	1681.98	939.69	742.29
2+00.000	69.41	32.14	32.14	138.83	64.27	1714.12	1714.12	1003.97	710.15
2+25.000	0.00	32.14	32.14	0.00	64.27	1746.25	1746.25	1068.24	678.01
2+50.000	101.39	46.94	46.94	202.77	93.88	1793.19	1793.19	1162.11	631.08
2+75.000	0.00	46.94	46.94	0.00	93.88	1840.13	1840.13	1255.99	584.14
3+00.000	166.47	77.07	77.07	332.95	154.14	1917.20	1917.20	1410.13	507.07
3+25.000	0.00	77.07	77.07	0.00	154.14	1994.27	1994.27	1564.27	430.00
3+50.000	185.45	85.86	85.86	370.90	171.71	2080.13	2080.13	1735.99	344.14
3+75.000	0.00	85.86	85.86	0.00	171.71	2165.98	2165.98	1907.70	258.28
4+00.000	207.72	96.16	96.16	415.43	192.33	2262.15	2262.15	2100.03	162.12
4+25.000	0.00	96.16	96.16	0.00	192.33	2358.31	2358.31	2292.36	65.95
4+50.000	199.65	92.43	92.43	399.29	184.86	2450.74	2450.74	2477.22	-26.48
4+75.000	0.00	92.43	92.43	0.00	184.86	2543.17	2543.17	2662.08	-118.90
5+00.000	141.08	65.32	65.32	282.17	130.63	2608.49	2608.49	2792.71	-184.22
5+25.000	0.00	65.32	65.32	0.00	130.63	2673.80	2673.80	2923.34	-249.54
5+50.000	101.33	46.91	46.91	202.65	93.82	2720.72	2720.72	3017.16	-296.45
5+75.000	0.00	46.91	46.91	0.00	93.82	2767.63	2767.63	3110.99	-343.36
6+00.000	45.38	21.01	21.01	90.75	42.01	2788.63	2788.63	3153.00	-364.37
6+25.000	0.00	21.01	21.01	0.00	42.01	2809.64	2809.64	3195.01	-385.37
6+50.000	169.02	78.25	78.25	338.03	156.50	2887.89	2887.89	3351.51	-463.62
6+51.867	169.60	11.71	11.71	338.49	23.39	2899.59	2899.59	3374.90	-475.30
6+75.000	0.00	72.65	72.65	0.00	145.01	2972.25	2972.25	3519.90	-547.66
6+94.231	0.00	0.00	0.00	0.00	0.00	2972.25	2972.25	3519.90	-547.66
7+00.000	151.46	16.18	16.18	302.92	32.36	2988.43	2988.43	3552.27	-563.84
7+24.970	170.35	148.81	148.81	108.32	190.16	3137.24	3137.24	3742.43	-605.19
7+25.000	0.00	0.09	0.09	0.00	0.06	3137.33	3137.33	3742.49	-605.16

7+50.000	314.11	145.42	145.42	157.06	72.71	3282.75	3282.75	3815.20	-532.44
7+75.000	0.00	145.42	145.42	0.00	72.71	3428.18	3428.18	3887.91	-459.73
8+00.000	318.43	147.42	147.42	159.21	73.71	3575.60	3575.60	3961.62	-386.02
8+25.000	0.00	147.42	147.42	0.00	73.71	3723.02	3723.02	4035.33	-312.31
8+50.000	368.96	170.82	170.82	184.48	85.41	3893.83	3893.83	4120.74	-226.90
8+75.000	0.00	170.82	170.82	0.00	85.41	4064.65	4064.65	4206.15	-141.50
9+00.000	197.95	91.64	91.64	98.97	45.82	4156.29	4156.29	4251.97	-95.68
9+25.000	0.00	91.64	91.64	0.00	45.82	4247.93	4247.93	4297.79	-49.85
9+50.000	40.91	18.94	18.94	50.34	23.31	4266.87	4266.87	4321.10	-54.22
9+51.867	44.90	2.97	2.97	56.56	3.70	4269.84	4269.84	4324.79	-54.95
9+75.000	0.00	19.24	19.24	0.00	24.23	4289.08	4289.08	4349.02	-59.94
10+00.000	155.06	71.79	71.79	310.13	143.58	4360.86	4360.86	4492.59	-131.73
10+25.000	0.00	71.79	71.79	0.00	143.58	4432.65	4432.65	4636.17	-203.52
10+50.000	209.49	96.99	96.99	418.99	193.97	4529.64	4529.64	4830.15	-300.51
10+75.000	0.00	96.99	96.99	0.00	193.97	4626.63	4626.63	5024.12	-397.49
10+98.540	140.51	61.25	61.25	281.01	122.50	4687.88	4687.88	5146.62	-458.74
11+00.000	139.30	7.56	7.56	278.60	15.13	4695.44	4695.44	5161.75	-466.31
11+25.000	0.00	64.49	64.49	0.00	128.98	4759.93	4759.93	5290.73	-530.80
11+50.000	99.67	46.14	46.14	199.34	92.29	4806.08	4806.08	5383.02	-576.94
11+75.000	0.00	46.14	46.14	0.00	92.29	4852.22	4852.22	5475.31	-623.09
12+00.000	86.60	40.09	40.09	150.76	69.80	4892.31	4892.31	5545.10	-652.79
12+25.000	0.00	40.09	40.09	0.00	69.80	4932.40	4932.40	5614.90	-682.50
12+50.000	82.58	38.23	38.23	141.20	65.37	4970.63	4970.63	5680.27	-709.64
12+75.000	0.00	38.23	38.23	0.00	65.37	5008.87	5008.87	5745.64	-736.78
13+00.000	156.94	72.66	72.66	313.88	145.32	5081.52	5081.52	5890.96	-809.44
13+02.838	167.35	17.04	17.04	334.69	34.09	5098.57	5098.57	5925.05	-826.48
13+25.000	0.00	68.68	68.68	0.00	137.36	5167.25	5167.25	6062.41	-895.16
13+50.000	531.68	246.15	246.15	1063.37	492.30	5413.40	5413.40	6554.71	-1141.31
13+75.000	0.00	246.15	246.15	0.00	492.30	5659.55	5659.55	7047.01	-1387.46
14+00.000	848.76	392.95	392.95	1697.52	785.89	6052.50	6052.50	7832.90	-1780.40
14+25.000	0.00	392.95	392.95	0.00	785.89	6445.44	6445.44	8618.79	-2173.35
14+50.000	539.57	249.80	249.80	1079.15	499.61	6695.24	6695.24	9118.39	-2423.15
14+75.000	0.00	249.80	249.80	0.00	499.61	6945.05	6945.05	9618.00	-2672.95
15+00.000	244.85	113.35	113.35	489.69	226.71	7058.40	7058.40	9844.71	-2786.31
15+25.000	0.00	113.35	113.35	0.00	226.71	7171.76	7171.76	10071.42	-2899.66
15+48.540	96.86	42.23	42.23	193.73	84.45	7213.98	7213.98	10155.87	-2941.89
15+50.000	92.68	5.12	5.12	185.35	10.25	7219.11	7219.11	10166.12	-2947.01
15+75.000	0.00	42.91	42.91	0.00	85.81	7262.01	7262.01	10251.93	-2989.91
16+00.000	14.55	6.74	6.74	19.39	8.98	7268.75	7268.75	10260.90	-2992.15
16+25.000	0.00	6.74	6.74	0.00	8.98	7275.48	7275.48	10269.88	-2994.40
16+50.000	35.70	16.53	16.53	19.08	8.83	7292.01	7292.01	10278.71	-2986.70
16+71.212	0.00	14.02	14.02	0.00	7.49	7306.04	7306.04	10286.21	-2980.17
16+75.000	0.00	0.00	0.00	0.00	0.00	7306.04	7306.04	10286.21	-2980.17
17+00.000	21.25	9.84	9.84	41.09	19.02	7315.88	7315.88	10305.23	-2989.36
17+25.000	0.00	9.84	9.84	0.00	19.02	7325.72	7325.72	10324.25	-2998.54
17+50.000	73.56	34.05	34.05	147.11	68.11	7359.77	7359.77	10392.36	-3032.59

17+73.253	61.46	58.14	58.14	122.92	116.28	7417.91	7417.91	10508.64	-3090.73
17+75.000	0.00	1.99	1.99	0.00	3.98	7419.90	7419.90	10512.62	-3092.72
18+00.000	97.53	45.15	45.15	195.06	90.31	7465.05	7465.05	10602.93	-3137.87
18+25.000	0.00	45.15	45.15	0.00	90.31	7510.21	7510.21	10693.23	-3183.03
18+50.000	90.33	41.82	41.82	180.66	83.64	7552.02	7552.02	10776.87	-3224.85
18+75.000	0.00	41.82	41.82	0.00	83.64	7593.84	7593.84	10860.51	-3266.66
19+00.000	92.61	42.87	42.87	185.21	85.75	7636.71	7636.71	10946.25	-3309.54
19+25.000	0.00	42.87	42.87	0.00	85.75	7679.59	7679.59	11032.00	-3352.41
19+50.000	110.55	51.18	51.18	221.09	102.36	7730.77	7730.77	11134.35	-3403.59
19+75.000	0.00	51.18	51.18	0.00	102.36	7781.94	7781.94	11236.71	-3454.77
20+00.000	85.41	39.54	39.54	170.82	79.08	7821.49	7821.49	11315.79	-3494.31
20+21.744	78.35	65.94	65.94	154.34	130.93	7887.43	7887.43	11446.73	-3559.30
20+25.000	0.00	4.72	4.72	0.00	9.31	7892.15	7892.15	11456.03	-3563.88
20+50.000	91.20	42.22	42.22	175.37	81.19	7934.37	7934.37	11537.22	-3602.85
20+75.000	0.00	42.22	42.22	0.00	81.19	7976.59	7976.59	11618.41	-3641.82
21+00.000	195.15	90.35	90.35	390.29	180.69	8066.94	8066.94	11799.11	-3732.17
21+23.253	268.58	199.68	199.68	536.58	399.11	8266.62	8266.62	12198.22	-3931.60
21+25.000	0.00	8.69	8.69	0.00	17.36	8275.31	8275.31	12215.58	-3940.28
21+50.000	285.19	132.03	132.03	570.37	264.06	8407.34	8407.34	12479.64	-4072.31
21+75.000	0.00	132.03	132.03	0.00	264.06	8539.37	8539.37	12743.71	-4204.34
22+00.000	361.04	167.15	167.15	722.08	334.30	8706.52	8706.52	13078.00	-4371.49
22+25.000	0.00	167.15	167.15	0.00	334.30	8873.67	8873.67	13412.30	-4538.63
22+50.000	863.36	399.70	399.70	1726.72	799.41	9273.37	9273.37	14211.71	-4938.34
22+75.000	0.00	399.70	399.70	0.00	799.41	9673.07	9673.07	15011.12	-5338.04
23+00.000	618.05	286.13	286.13	1236.09	572.27	9959.21	9959.21	15583.38	-5624.18
23+25.000	0.00	286.13	286.13	0.00	572.27	10245.34	10245.34	16155.65	-5910.31
23+50.000	386.57	178.97	178.97	744.98	344.90	10424.31	10424.31	16500.55	-6076.24
23+75.000	0.00	178.97	178.97	0.00	344.90	10603.27	10603.27	16845.44	-6242.17
23+77.657	369.57	18.19	18.19	705.36	34.71	10621.46	10621.46	16880.15	-6258.69
24+00.000	318.17	284.56	284.56	603.30	541.46	10906.01	10906.01	17421.62	-6515.60
24+25.000	0.00	147.30	147.30	0.00	279.30	11053.31	11053.31	17700.92	-6647.61
24+50.000	336.91	155.98	155.98	665.12	307.93	11209.29	11209.29	18008.85	-6799.56
24+74.699	262.00	273.93	273.93	524.00	543.89	11483.23	11483.23	18552.74	-7069.51
24+75.000	0.00	1.46	1.46	0.00	2.92	11484.69	11484.69	18555.66	-7070.97
25+00.000	311.82	144.36	144.36	623.65	288.73	11629.05	11629.05	18844.39	-7215.34
25+25.000	0.00	144.36	144.36	0.00	288.73	11773.41	11773.41	19133.11	-7359.70
25+50.000	505.96	234.24	234.24	1011.91	468.48	12007.65	12007.65	19601.59	-7593.94
25+60.000	0.00	93.70	93.70	0.00	187.39	12101.35	12101.35	19788.98	-7687.63
25+75.000	0.00	0.00	0.00	0.00	0.00	12101.35	12101.35	19788.98	-7687.63
26+00.000	282.91	130.98	130.98	565.82	261.96	12232.32	12232.32	20050.93	-7818.61
26+25.000	0.00	130.98	130.98	0.00	261.96	12363.30	12363.30	20312.89	-7949.59
26+50.000	167.58	77.59	77.59	330.19	152.87	12440.89	12440.89	20465.76	-8024.87
26+75.000	0.00	77.59	77.59	0.00	152.87	12518.47	12518.47	20618.62	-8100.15
27+00.000	86.01	39.82	39.82	167.94	77.75	12558.29	12558.29	20696.37	-8138.08
27+25.000	0.00	39.82	39.82	0.00	77.75	12598.11	12598.11	20774.12	-8176.01
27+50.000	32.54	15.07	15.07	65.09	30.13	12613.18	12613.18	20804.25	-8191.08

27+75.000	0.00	15.07	15.07	0.00	30.13	12628.24	12628.24	20834.39	-8206.14
27+77.657	17.49	0.86	0.86	13.07	0.64	12629.10	12629.10	20835.03	-8205.93
28+00.000	115.39	54.98	54.98	57.69	29.28	12684.08	12684.08	20864.31	-8180.22
28+25.000	0.00	53.42	53.42	0.00	26.71	12737.50	12737.50	20891.02	-8153.51
28+50.000	263.92	122.18	122.18	131.96	61.09	12859.69	12859.69	20952.11	-8092.42
28+60.000	291.22	102.80	102.80	145.61	51.40	12962.49	12962.49	21003.51	-8041.02
28+75.000	0.00	80.89	80.89	0.00	40.45	13043.38	13043.38	21043.96	-8000.57
29+00.000	389.31	180.23	180.23	194.65	90.12	13223.62	13223.62	21134.08	-7910.46
29+25.000	0.00	180.23	180.23	0.00	90.12	13403.85	13403.85	21224.19	-7820.34
29+50.000	483.96	224.06	224.06	241.98	112.03	13627.91	13627.91	21336.22	-7708.31
29+75.000	0.00	224.06	224.06	0.00	112.03	13851.97	13851.97	21448.25	-7596.28
30+00.000	491.55	227.57	227.57	245.77	113.78	14079.54	14079.54	21562.03	-7482.50
30+25.000	0.00	227.57	227.57	0.00	113.78	14307.10	14307.10	21675.82	-7368.71
30+50.000	381.75	176.74	176.74	190.88	88.37	14483.84	14483.84	21764.19	-7280.35
30+75.000	0.00	176.74	176.74	0.00	88.37	14660.58	14660.58	21852.55	-7191.98
30+87.206	0.00	0.00	0.00	0.00	0.00	14660.58	14660.58	21852.55	-7191.98
31+00.000	179.03	42.42	42.42	89.52	21.21	14703.00	14703.00	21873.76	-7170.77
31+25.000	0.00	82.89	82.89	0.00	41.44	14785.88	14785.88	21915.21	-7129.33
31+44.598	36.03	13.08	13.08	72.06	26.15	14798.96	14798.96	21941.36	-7142.40
31+50.000	46.78	8.36	8.36	93.55	16.72	14807.32	14807.32	21958.08	-7150.76
31+75.000	116.24	77.05	77.05	232.47	154.09	14884.37	14884.37	22112.18	-7227.81
31+85.780	187.02	60.42	60.42	374.04	120.84	14944.79	14944.79	22233.02	-7288.23
32+00.000	202.79	57.26	57.26	405.57	114.53	15002.05	15002.05	22347.54	-7345.49
32+05.403	296.01	49.44	49.44	592.01	98.89	15051.49	15051.49	22446.43	-7394.94
32+22.728	394.07	227.05	227.05	788.13	454.10	15278.54	15278.54	22900.53	-7621.99
32+25.000	282.47	28.21	28.21	564.95	56.42	15306.76	15306.76	22956.95	-7650.20
32+50.000	543.59	395.15	395.15	1087.12	790.28	15701.90	15701.90	23747.23	-8045.33
32+60.000	678.10	259.63	259.63	1355.74	519.12	15961.53	15961.53	24266.35	-8304.82
32+63.910	744.70	127.07	127.07	1489.41	254.08	16088.60	16088.60	24520.43	-8431.83
32+75.000	444.12	277.35	277.35	888.24	554.70	16365.95	16365.95	25075.13	-8709.18
33+00.000	509.78	409.06	409.06	1019.56	818.12	16775.01	16775.01	25893.25	-9118.24
33+00.859	1218.53	31.11	31.11	2437.07	62.22	16806.12	16806.12	25955.47	-9149.35
33+25.000	1221.77	1090.97	1090.97	2443.55	2181.94	17897.09	17897.09	28137.41	-10240.32
33+50.000	903.31	983.83	983.83	1806.61	1967.67	18880.92	18880.92	30105.08	-11224.15
33+75.000	0.00	418.20	418.20	0.00	836.39	19299.12	19299.12	30941.47	-11642.35
34+00.000	578.47	267.81	267.81	1156.94	535.62	19566.93	19566.93	31477.10	-11910.16
34+25.000	0.00	267.81	267.81	0.00	535.62	19834.74	19834.74	32012.72	-12177.97
34+50.000	136.56	63.22	63.22	273.11	126.44	19897.96	19897.96	32139.16	-12241.20
34+75.000	0.00	63.22	63.22	0.00	126.44	19961.19	19961.19	32265.60	-12304.42
35+00.000	76.32	35.33	35.33	45.53	21.08	19996.52	19996.52	32286.68	-12290.16
35+25.000	0.00	35.33	35.33	0.00	21.08	20031.85	20031.85	32307.76	-12275.91
35+50.000	359.98	166.66	166.66	453.91	210.14	20198.51	20198.51	32517.91	-12319.40
35+60.000	0.00	66.66	66.66	0.00	84.06	20265.17	20265.17	32601.96	-12336.79
35+75.000	0.00	0.00	0.00	0.00	0.00	20265.17	20265.17	32601.96	-12336.79
36+00.000	288.74	133.67	133.67	144.37	66.84	20398.85	20398.85	32668.80	-12269.95
36+25.000	0.00	133.67	133.67	0.00	66.84	20532.52	20532.52	32735.64	-12203.12

ATTACHMENT A.1

36+50.000	189.06	87.53	87.53	94.53	43.76	20620.05	20620.05	32779.40	-12159.35
36+75.000	0.00	87.53	87.53	0.00	43.76	20707.58	20707.58	32823.17	-12115.59
37+00.000	89.77	41.56	41.56	44.89	20.78	20749.14	20749.14	32843.95	-12094.81
37+25.000	0.00	41.56	41.56	0.00	20.78	20790.70	20790.70	32864.73	-12074.03
37+50.000	80.62	37.32	37.32	51.41	23.80	20828.03	20828.03	32888.53	-12060.50
37+75.000	0.00	37.32	37.32	0.00	23.80	20865.35	20865.35	32912.33	-12046.98
38+00.000	32.10	14.86	14.86	57.65	26.69	20880.21	20880.21	32939.02	-12058.81
38+25.000	0.00	14.86	14.86	0.00	26.69	20895.07	20895.07	32965.71	-12070.63
38+50.000	60.34	27.93	27.93	34.47	15.96	20923.01	20923.01	32981.67	-12058.66
38+75.000	0.00	27.93	27.93	0.00	15.96	20950.94	20950.94	32997.62	-12046.68
38+82.977	103.29	15.26	15.26	51.64	7.63	20966.20	20966.20	33005.25	-12039.05
39+00.000	167.73	85.43	85.43	83.87	42.72	21051.63	21051.63	33047.97	-11996.34
39+25.000	0.00	77.65	77.65	0.00	38.83	21129.29	21129.29	33086.80	-11957.51
39+50.000	203.04	94.00	94.00	101.52	47.00	21223.29	21223.29	33133.80	-11910.51
39+75.000	0.00	94.00	94.00	0.00	47.00	21317.29	21317.29	33180.80	-11863.51
40+00.000	188.68	87.35	87.35	94.34	43.68	21404.64	21404.64	33224.47	-11819.83
40+25.000	0.00	87.35	87.35	0.00	43.68	21491.99	21491.99	33268.15	-11776.16
40+50.000	119.69	55.41	55.41	59.84	27.71	21547.40	21547.40	33295.85	-11748.45
40+65.006	0.00	33.26	33.26	0.00	16.63	21580.66	21580.66	33312.48	-11731.82
40+75.000	0.00	0.00	0.00	0.00	0.00	21580.66	21580.66	33312.48	-11731.82
41+00.000	38.79	17.96	17.96	77.59	35.92	21598.62	21598.62	33348.40	-11749.78
41+25.000	0.00	17.96	17.96	0.00	35.92	21616.58	21616.58	33384.32	-11767.74
41+50.000	139.88	64.76	64.76	279.76	129.52	21681.34	21681.34	33513.84	-11832.50
41+75.000	0.00	64.76	64.76	0.00	129.52	21746.09	21746.09	33643.36	-11897.26
42+00.000	322.48	149.30	149.30	644.96	298.59	21895.39	21895.39	33941.95	-12046.56
42+25.000	0.00	149.30	149.30	0.00	298.59	22044.69	22044.69	34240.54	-12195.85
42+50.000	379.34	175.62	175.62	758.68	351.24	22220.31	22220.31	34591.78	-12371.47
42+75.000	0.00	175.62	175.62	0.00	351.24	22395.93	22395.93	34943.02	-12547.09
43+00.000	540.45	250.21	250.21	1080.90	500.42	22646.14	22646.14	35443.44	-12797.30
43+25.000	0.00	250.21	250.21	0.00	500.42	22896.35	22896.35	35943.86	-13047.51
43+50.000	894.70	414.21	414.21	1789.40	828.43	23310.56	23310.56	36772.28	-13461.73
43+75.000	0.00	414.21	414.21	0.00	828.43	23724.77	23724.77	37600.71	-13875.94
44+00.000	1165.22	539.45	539.45	2330.44	1078.91	24264.23	24264.23	38679.62	-14415.39
44+25.000	0.00	539.45	539.45	0.00	1078.91	24803.68	24803.68	39758.53	-14954.85
44+50.000	1379.16	638.50	638.50	2758.32	1277.00	25442.18	25442.18	41035.53	-15593.35
44+61.486	1237.19	556.50	556.50	2474.38	1113.01	25998.68	25998.68	42148.53	-16149.85
44+75.000	0.00	309.62	309.62	0.00	619.24	26308.30	26308.30	42767.77	-16459.47
44+91.636	0.00	0.00	0.00	0.00	0.00	26308.30	26308.30	42767.77	-16459.47
45+00.000	995.95	154.26	154.26	1991.07	308.40	26462.57	26462.57	43076.17	-16613.60
45+25.000	0.00	461.09	461.09	0.00	921.79	26923.66	26923.66	43997.96	-17074.31
45+50.000	1165.62	539.64	539.64	2331.23	1079.27	27463.29	27463.29	45077.24	-17613.94
45+75.000	0.00	539.64	539.64	0.00	1079.27	28002.93	28002.93	46156.51	-18153.58
46+00.000	628.76	291.09	291.09	1235.11	571.81	28294.02	28294.02	46728.32	-18434.30
46+25.000	0.00	291.09	291.09	0.00	571.81	28585.11	28585.11	47300.13	-18715.02
46+50.000	406.53	188.21	188.21	789.18	365.36	28773.32	28773.32	47665.49	-18892.17
46+75.000	0.00	188.21	188.21	0.00	365.36	28961.53	28961.53	48030.85	-19069.32

47+00.000	293.67	135.96	135.96	584.32	270.52	29097.49	29097.49	48301.37	-19203.88
47+20.099	299.71	220.86	220.86	599.42	440.59	29318.35	29318.35	48741.97	-19423.61
47+25.000	0.00	27.20	27.20	0.00	54.40	29345.55	29345.55	48796.37	-19450.81
47+50.000	198.08	91.70	91.70	396.16	183.41	29437.26	29437.26	48979.78	-19542.52
47+75.000	0.00	91.70	91.70	0.00	183.41	29528.96	29528.96	49163.19	-19634.22
48+00.000	178.87	82.81	82.81	357.74	165.62	29611.77	29611.77	49328.80	-19717.03
48+25.000	0.00	82.81	82.81	0.00	165.62	29694.58	29694.58	49494.42	-19799.84
48+50.000	165.28	76.52	76.52	330.56	153.04	29771.10	29771.10	49647.46	-19876.36
48+65.006	0.00	45.93	45.93	0.00	91.86	29817.03	29817.03	49739.31	-19922.29
48+75.000	0.00	0.00	0.00	0.00	0.00	29817.03	29817.03	49739.31	-19922.29
49+00.000	137.76	63.78	63.78	274.97	127.30	29880.80	29880.80	49866.62	-19985.81
49+25.000	0.00	63.78	63.78	0.00	127.30	29944.58	29944.58	49993.92	-20049.34
49+50.000	128.84	59.65	59.65	257.56	119.24	30004.23	30004.23	50113.16	-20108.93
49+61.486	124.64	53.92	53.92	249.28	107.81	30058.14	30058.14	50220.97	-20162.82
49+75.000	0.00	31.19	31.19	0.00	62.39	30089.34	30089.34	50283.35	-20194.01
50+00.000	96.65	44.74	44.74	193.29	89.49	30134.08	30134.08	50372.84	-20238.76
50+25.000	0.00	44.74	44.74	0.00	89.49	30178.82	30178.82	50462.32	-20283.50
50+50.000	28.49	13.19	13.19	56.99	26.38	30192.01	30192.01	50488.71	-20296.69
50+75.000	0.00	13.19	13.19	0.00	26.38	30205.21	30205.21	50515.09	-20309.88
51+00.000	163.12	75.52	75.52	82.04	37.98	30280.72	30280.72	50553.07	-20272.35
51+25.000	0.00	75.52	75.52	0.00	37.98	30356.24	30356.24	50591.06	-20234.82
51+50.000	363.67	168.36	168.36	181.83	84.18	30524.60	30524.60	50675.24	-20150.64
51+70.000	0.00	134.69	134.69	0.00	67.35	30659.29	30659.29	50742.58	-20083.29
51+75.000	0.00	0.00	0.00	0.00	0.00	30659.29	30659.29	50742.58	-20083.29
52+00.000	425.12	196.81	196.81	212.56	98.41	30856.11	30856.11	50840.99	-19984.88
52+16.429	444.63	264.62	264.62	222.31	132.31	31120.73	31120.73	50973.30	-19852.57
52+22.092	445.32	94.17	94.17	222.66	47.09	31214.90	31214.90	51020.39	-19805.49
52+25.000	444.93	48.44	48.44	222.47	24.22	31263.34	31263.34	51044.61	-19781.27
52+27.752	497.96	48.69	48.69	248.98	24.34	31312.03	31312.03	51068.95	-19756.92
52+50.000	434.44	384.14	384.14	217.22	192.07	31696.17	31696.17	51261.02	-19564.85
52+75.000	0.00	201.13	201.13	0.00	100.56	31897.30	31897.30	51361.59	-19464.29
53+00.000	173.72	80.42	80.42	95.24	44.09	31977.72	31977.72	51405.68	-19427.96
53+18.013	97.36	90.42	90.42	66.40	53.92	32068.14	32068.14	51459.60	-19391.46
53+25.000	0.00	12.60	12.60	0.00	8.59	32080.74	32080.74	51468.19	-19387.45
53+50.000	55.65	25.76	25.76	110.03	50.94	32106.50	32106.50	51519.13	-19412.62
53+75.000	0.00	25.76	25.76	0.00	50.94	32132.27	32132.27	51570.06	-19437.80
53+76.216	0.00	0.00	0.00	0.00	0.00	32132.27	32132.27	51570.06	-19437.80
54+00.000	44.30	19.51	19.51	88.06	38.78	32151.78	32151.78	51608.85	-19457.07
54+25.000	0.00	20.51	20.51	0.00	40.77	32172.29	32172.29	51649.62	-19477.33
54+50.000	72.54	33.58	33.58	54.11	25.05	32205.87	32205.87	51674.67	-19468.80
54+75.000	0.00	33.58	33.58	0.00	25.05	32239.45	32239.45	51699.71	-19460.26
54+92.880	180.19	59.66	59.66	90.22	29.87	32299.11	32299.11	51729.59	-19430.47
55+00.000	203.21	50.55	50.55	101.61	25.29	32349.67	32349.67	51754.88	-19405.21
55+25.000	0.00	94.08	94.08	0.00	47.04	32443.75	32443.75	51801.92	-19358.17
55+50.000	232.86	107.80	107.80	116.43	53.90	32551.55	32551.55	51855.82	-19304.27
55+75.000	0.00	107.80	107.80	0.00	53.90	32659.36	32659.36	51909.73	-19250.37

56+00.000	209.35	96.92	96.92	104.67	48.46	32756.28	32756.28	51958.19	-19201.91
56+25.000	0.00	96.92	96.92	0.00	48.46	32853.20	32853.20	52006.65	-19153.45
56+50.000	182.33	84.41	84.41	91.16	42.21	32937.61	32937.61	52048.85	-19111.24
56+75.000	0.00	84.41	84.41	0.00	42.21	33022.02	33022.02	52091.06	-19069.04
57+00.000	50.98	23.60	23.60	32.26	14.94	33045.62	33045.62	52105.99	-19060.37
57+25.000	0.00	23.60	23.60	0.00	14.94	33069.23	33069.23	52120.93	-19051.70
57+50.000	79.35	36.74	36.74	158.68	73.46	33105.96	33105.96	52194.39	-19088.43
57+60.249	95.14	33.12	33.12	190.29	66.23	33139.08	33139.08	52260.63	-19121.54
57+75.000	0.00	25.99	25.99	0.00	51.98	33165.07	33165.07	52312.61	-19147.53
58+00.000	124.39	57.59	57.59	248.77	115.17	33222.66	33222.66	52427.78	-19205.12
58+25.000	0.00	57.59	57.59	0.00	115.17	33280.25	33280.25	52542.95	-19262.71
58+50.000	198.73	92.00	92.00	387.31	179.31	33372.25	33372.25	52722.26	-19350.01
58+70.000	0.00	73.60	73.60	0.00	143.45	33445.85	33445.85	52865.71	-19419.85
58+75.000	0.00	0.00	0.00	0.00	0.00	33445.85	33445.85	52865.71	-19419.85
59+00.000	216.07	100.03	100.03	406.50	188.19	33545.88	33545.88	53053.90	-19508.02
59+25.000	0.00	100.03	100.03	0.00	188.19	33645.92	33645.92	53242.09	-19596.18
59+50.000	324.83	150.38	150.38	599.83	277.70	33796.30	33796.30	53519.79	-19723.49
59+75.000	0.00	150.38	150.38	0.00	277.70	33946.68	33946.68	53797.49	-19850.81
59+93.711	0.00	0.00	0.00	0.00	0.00	33946.68	33946.68	53797.49	-19850.81
60+00.000	453.95	52.86	52.86	844.13	98.30	33999.55	33999.55	53895.79	-19896.25
60+25.000	0.00	210.16	210.16	0.00	390.80	34209.71	34209.71	54286.60	-20076.89
60+50.000	629.72	291.54	291.54	1212.64	561.41	34501.24	34501.24	54848.00	-20346.76
60+75.000	0.00	291.54	291.54	0.00	561.41	34792.78	34792.78	55409.41	-20616.63
60+81.560	807.26	98.06	98.06	1614.51	196.12	34890.84	34890.84	55605.53	-20714.69
61+00.000	929.54	593.10	593.10	1856.62	1185.36	35483.94	35483.94	56790.89	-21306.95
61+25.000	0.00	430.34	430.34	0.00	859.55	35914.28	35914.28	57650.44	-21736.15
61+50.000	1278.28	591.80	591.80	2552.77	1181.84	36506.08	36506.08	58832.28	-22326.20
61+75.000	0.00	591.80	591.80	0.00	1181.84	37097.87	37097.87	60014.12	-22916.24
62+00.000	1696.94	785.62	785.62	3393.89	1571.24	37883.49	37883.49	61585.36	-23701.87
62+25.000	0.00	785.62	785.62	0.00	1571.24	38669.12	38669.12	63156.60	-24487.49
62+50.000	2325.24	1076.50	1076.50	4650.48	2153.00	39745.62	39745.62	65309.60	-25563.99
62+75.000	0.00	1076.50	1076.50	0.00	2153.00	40822.11	40822.11	67462.60	-26640.49
63+00.000	1859.69	860.97	860.97	3719.38	1721.93	41683.08	41683.08	69184.54	-27501.45
63+25.000	0.00	860.97	860.97	0.00	1721.93	42544.05	42544.05	70906.47	-28362.42
63+50.000	1610.87	745.77	745.77	3220.06	1490.77	43289.82	43289.82	72397.24	-29107.42
63+75.000	0.00	745.77	745.77	0.00	1490.77	44035.60	44035.60	73888.01	-29852.41
64+00.000	1474.48	682.63	682.63	2948.97	1365.26	44718.23	44718.23	75253.28	-30535.04
64+14.720	0.00	401.93	401.93	0.00	803.86	45120.16	45120.16	76057.13	-30936.97
64+25.000	0.00	0.00	0.00	0.00	0.00	45120.16	45120.16	76057.13	-30936.97
64+50.000	1228.53	568.76	568.76	2456.25	1137.15	45688.92	45688.92	77194.28	-31505.36
64+75.000	0.00	568.76	568.76	0.00	1137.15	46257.69	46257.69	78331.44	-32073.75
64+85.929	858.04	173.66	173.66	1715.76	347.25	46431.34	46431.34	78678.68	-32247.34
65+00.000	840.59	442.62	442.62	1681.18	885.16	46873.96	46873.96	79563.85	-32689.88
65+25.000	0.00	389.16	389.16	0.00	778.32	47263.12	47263.12	80342.17	-33079.04
65+50.000	715.48	331.24	331.24	1430.97	662.48	47594.37	47594.37	81004.65	-33410.29
65+75.000	0.00	331.24	331.24	0.00	662.48	47925.61	47925.61	81667.14	-33741.53

66+00.000	433.42	200.66	200.66	866.84	401.31	48126.27	48126.27	82068.45	-33942.19
66+25.000	0.00	200.66	200.66	0.00	401.31	48326.92	48326.92	82469.77	-34142.84
66+50.000	467.68	216.52	216.52	935.35	433.03	48543.44	48543.44	82902.80	-34359.36
66+75.000	0.00	216.52	216.52	0.00	433.03	48759.96	48759.96	83335.83	-34575.88
66+93.711	0.00	0.00	0.00	0.00	0.00	48759.96	48759.96	83335.83	-34575.88
67+00.000	335.68	39.09	39.09	671.36	78.18	48799.05	48799.05	83414.02	-34614.97
67+25.000	0.00	155.41	155.41	0.00	310.81	48954.46	48954.46	83724.83	-34770.37
67+50.000	157.86	73.08	73.08	289.86	134.20	49027.54	49027.54	83859.03	-34831.49
67+75.000	0.00	73.08	73.08	0.00	134.20	49100.62	49100.62	83993.22	-34892.60
68+00.000	84.26	39.01	39.01	137.22	63.53	49139.63	49139.63	84056.75	-34917.12
68+25.000	0.00	39.01	39.01	0.00	63.53	49178.64	49178.64	84120.28	-34941.64
68+50.000	41.66	19.29	19.29	83.33	38.58	49197.93	49197.93	84158.86	-34960.93
68+75.000	0.00	19.29	19.29	0.00	38.58	49217.22	49217.22	84197.43	-34980.22
68+81.560	27.01	3.28	3.28	54.02	6.56	49220.50	49220.50	84204.00	-34983.50
69+00.000	23.05	17.09	17.09	20.54	25.46	49237.59	49237.59	84229.46	-34991.86
69+25.000	0.00	10.67	10.67	0.00	9.51	49248.26	49248.26	84238.97	-34990.71
69+50.000	231.49	107.17	107.17	115.75	53.59	49355.43	49355.43	84292.55	-34937.12
69+75.000	0.00	107.17	107.17	0.00	53.59	49462.61	49462.61	84346.14	-34883.53
70+00.000	366.86	169.84	169.84	183.43	84.92	49632.45	49632.45	84431.06	-34798.61
70+25.000	0.00	169.84	169.84	0.00	84.92	49802.29	49802.29	84515.98	-34713.69
70+50.000	498.57	230.82	230.82	249.28	115.41	50033.11	50033.11	84631.39	-34598.28
70+75.000	0.00	230.82	230.82	0.00	115.41	50263.93	50263.93	84746.80	-34482.87
71+00.000	486.75	225.35	225.35	243.38	112.67	50489.28	50489.28	84859.48	-34370.20
71+25.000	0.00	225.35	225.35	0.00	112.67	50714.63	50714.63	84972.15	-34257.52
71+50.000	355.02	164.36	164.36	177.51	82.18	50878.99	50878.99	85054.33	-34175.34
71+75.000	0.00	164.36	164.36	0.00	82.18	51043.34	51043.34	85136.51	-34093.16
71+86.602	285.54	61.35	61.35	142.77	30.68	51104.70	51104.70	85167.18	-34062.49
72+00.000	231.12	128.19	128.19	115.56	64.09	51232.88	51232.88	85231.28	-33998.40
72+21.380	0.00	91.51	91.51	0.00	45.75	51324.39	51324.39	85277.03	-33952.64
72+25.000	0.00	0.00	0.00	0.00	0.00	51324.39	51324.39	85277.03	-33952.64
72+50.000	21.49	9.95	9.95	14.40	6.67	51334.34	51334.34	85283.70	-33949.36
72+75.000	0.00	9.95	9.95	0.00	6.67	51344.29	51344.29	85290.36	-33946.07
73+00.000	171.11	79.22	79.22	342.22	158.44	51423.51	51423.51	85448.80	-34025.29
73+25.000	0.00	79.22	79.22	0.00	158.44	51502.72	51502.72	85607.24	-34104.51
73+50.000	373.57	172.95	172.95	747.15	345.90	51675.68	51675.68	85953.14	-34277.46
73+75.000	0.00	172.95	172.95	0.00	345.90	51848.63	51848.63	86299.04	-34450.41
74+00.000	977.45	452.52	452.52	499.53	231.27	52301.15	52301.15	86530.31	-34229.16
74+25.000	0.00	452.52	452.52	0.00	231.27	52753.67	52753.67	86761.57	-34007.90
74+50.000	1610.19	745.46	745.46	1318.54	610.44	53499.13	53499.13	87372.01	-33872.87
74+75.000	0.00	745.46	745.46	0.00	610.44	54244.59	54244.59	87982.44	-33737.85
75+00.000	1608.42	744.64	744.64	808.17	374.15	54989.23	54989.23	88356.60	-33367.36
75+25.000	0.00	744.64	744.64	0.00	374.15	55733.88	55733.88	88730.75	-32996.87
75+32.721	0.00	0.00	0.00	0.00	0.00	55733.88	55733.88	88730.75	-32996.87
75+34.411	1813.28	56.75	56.75	908.50	28.43	55790.63	55790.63	88759.18	-32968.56
75+50.000	1921.83	1078.27	1078.27	962.07	540.00	56868.90	56868.90	89299.19	-32430.29
75+75.000	0.00	889.74	889.74	0.00	445.40	57758.63	57758.63	89744.59	-31985.96

76+00.000	2460.10	1138.94	1138.94	1713.51	793.29	58897.57	58897.57	90537.88	-31640.31
76+25.000	0.00	1138.94	1138.94	0.00	793.29	60036.50	60036.50	91331.17	-31294.66
76+50.000	1704.47	789.10	789.10	1039.80	481.39	60825.61	60825.61	91812.55	-30986.95
76+75.000	0.00	789.10	789.10	0.00	481.39	61614.71	61614.71	92293.94	-30679.23
77+00.000	102.32	47.37	47.37	204.65	94.74	61662.09	61662.09	92388.69	-30726.60
77+25.000	0.00	47.37	47.37	0.00	94.74	61709.46	61709.46	92483.43	-30773.97
77+50.000	134.57	62.30	62.30	269.13	124.60	61771.76	61771.76	92608.03	-30836.27
77+75.000	0.00	62.30	62.30	0.00	124.60	61834.06	61834.06	92732.63	-30898.57
77+78.620	0.00	0.00	0.00	0.00	0.00	61834.06	61834.06	92732.63	-30898.57
78+00.000	91.71	36.31	36.31	183.41	72.62	61870.37	61870.37	92805.25	-30934.88
78+25.000	0.00	42.46	42.46	0.00	84.91	61912.82	61912.82	92890.16	-30977.34
78+50.000	179.25	82.99	82.99	358.51	165.98	61995.81	61995.81	93056.14	-31060.32
78+75.000	0.00	82.99	82.99	0.00	165.98	62078.80	62078.80	93222.11	-31143.31
79+00.000	257.11	119.03	119.03	514.23	238.07	62197.83	62197.83	93460.18	-31262.35
79+18.621	287.87	187.93	187.93	575.74	375.86	62385.76	62385.76	93836.04	-31450.28
79+25.000	0.00	34.01	34.01	0.00	68.01	62419.77	62419.77	93904.05	-31484.28
79+50.000	247.72	114.69	114.69	495.44	229.37	62534.45	62534.45	94133.42	-31598.97
79+75.000	0.00	114.69	114.69	0.00	229.37	62649.14	62649.14	94362.79	-31713.65
80+00.000	136.22	63.06	63.06	272.44	126.13	62712.20	62712.20	94488.92	-31776.72
80+25.000	0.00	63.06	63.06	0.00	126.13	62775.27	62775.27	94615.05	-31839.78
80+50.000	233.09	107.91	107.91	466.17	215.82	62883.18	62883.18	94830.87	-31947.69
80+75.000	0.00	107.91	107.91	0.00	215.82	62991.09	62991.09	95046.69	-32055.60
81+00.000	256.39	118.70	118.70	512.78	237.40	63109.79	63109.79	95284.09	-32174.30
81+25.000	0.00	118.70	118.70	0.00	237.40	63228.49	63228.49	95521.49	-32293.00
81+50.000	244.92	113.39	113.39	483.38	223.79	63341.87	63341.87	95745.27	-32403.40
81+75.000	0.00	113.39	113.39	0.00	223.79	63455.26	63455.26	95969.06	-32513.80
81+92.875	336.89	111.52	111.52	673.39	222.90	63566.78	63566.78	96191.96	-32625.18
82+00.000	363.83	92.46	92.46	727.66	184.86	63659.24	63659.24	96376.83	-32717.59
82+25.000	0.00	168.44	168.44	0.00	336.88	63827.68	63827.68	96713.71	-32886.03
82+50.000	371.26	171.88	171.88	742.52	343.76	63999.56	63999.56	97057.46	-33057.91
82+75.000	0.00	171.88	171.88	0.00	343.76	64171.44	64171.44	97401.22	-33229.79
83+00.000	568.14	263.03	263.03	1136.27	526.05	64434.46	64434.46	97927.27	-33492.81
83+25.000	0.00	263.03	263.03	0.00	526.05	64697.49	64697.49	98453.33	-33755.84
83+50.000	780.30	361.25	361.25	1560.60	722.50	65058.74	65058.74	99175.83	-34117.09
83+75.000	0.00	361.25	361.25	0.00	722.50	65419.99	65419.99	99898.33	-34478.34
84+00.000	1276.10	590.79	590.79	2548.83	1180.01	66010.78	66010.78	101078.34	-35067.56
84+25.000	0.00	590.79	590.79	0.00	1180.01	66601.57	66601.57	102258.36	-35656.79
84+50.000	1269.99	587.96	587.96	2511.31	1162.64	67189.53	67189.53	103421.00	-36231.47
84+75.000	0.00	587.96	587.96	0.00	1162.64	67777.48	67777.48	104583.64	-36806.16
84+76.129	1198.35	25.05	25.05	2396.64	50.11	67802.54	67802.54	104633.75	-36831.21
85+00.000	1074.18	1004.58	1004.58	2145.49	2007.87	68807.12	68807.12	106641.62	-37834.50
85+25.000	0.00	497.31	497.31	0.00	993.28	69304.43	69304.43	107634.90	-38330.47
85+50.000	675.90	312.92	312.92	1351.80	625.83	69617.35	69617.35	108260.74	-38643.39
85+75.000	0.00	312.92	312.92	0.00	625.83	69930.26	69930.26	108886.57	-38956.31
86+00.000	216.47	100.22	100.22	432.95	200.44	70030.48	70030.48	109087.01	-39056.53
86+06.936	175.21	50.31	50.31	349.89	100.55	70080.79	70080.79	109187.56	-39106.77

86+25.000	0.00	58.61	58.61	0.00	117.04	70139.40	70139.40	109304.60	-39165.20
86+50.000	129.28	59.85	59.85	102.53	47.47	70199.25	70199.25	109352.07	-39152.82
86+75.000	0.00	59.85	59.85	0.00	47.47	70259.10	70259.10	109399.54	-39140.44
87+00.000	459.93	212.93	212.93	229.97	106.47	70472.03	70472.03	109506.01	-39033.97
87+05.739	391.08	90.45	90.45	195.54	45.23	70562.48	70562.48	109551.23	-38988.75
87+25.000	0.00	139.49	139.49	0.00	69.75	70701.98	70701.98	109620.98	-38919.00
87+50.000	482.96	223.59	223.59	241.48	111.80	70925.57	70925.57	109732.77	-38807.20
87+75.000	0.00	223.59	223.59	0.00	111.80	71149.16	71149.16	109844.57	-38695.41
88+00.000	425.67	197.07	197.07	212.84	98.54	71346.23	71346.23	109943.11	-38596.87
88+25.000	0.00	197.07	197.07	0.00	98.54	71543.30	71543.30	110041.64	-38498.34
88+50.000	154.73	71.63	71.63	77.68	35.96	71614.94	71614.94	110077.60	-38462.67
88+75.000	0.00	71.63	71.63	0.00	35.96	71686.57	71686.57	110113.56	-38426.99
89+00.000	304.85	141.14	141.14	609.71	282.27	71827.71	71827.71	110395.84	-38568.13
89+15.030	244.78	152.99	152.99	489.56	305.97	71980.69	71980.69	110701.81	-38721.11
89+25.000	0.00	45.19	45.19	0.00	90.38	72025.89	72025.89	110792.19	-38766.31
89+50.000	819.34	379.32	379.32	1638.67	758.64	72405.21	72405.21	111550.84	-39145.63
89+75.000	0.00	379.32	379.32	0.00	758.64	72784.53	72784.53	112309.48	-39524.95
89+90.398	498.79	142.23	142.23	993.60	283.33	72926.76	72926.76	112592.81	-39666.05
90+00.000	447.64	168.29	168.29	887.01	334.40	73095.05	73095.05	112927.20	-39832.16
90+09.814	0.00	81.35	81.35	0.00	161.20	73176.40	73176.40	113088.41	-39912.01
90+25.000	0.00	0.00	0.00	0.00	0.00	73176.40	73176.40	113088.41	-39912.01
90+50.000	289.75	134.14	134.14	568.15	263.03	73310.54	73310.54	113351.44	-40040.89
90+75.000	0.00	134.14	134.14	0.00	263.03	73444.69	73444.69	113614.47	-40169.78
91+00.000	135.95	62.94	62.94	271.90	125.88	73507.63	73507.63	113740.35	-40232.72
91+25.000	0.00	62.94	62.94	0.00	125.88	73570.57	73570.57	113866.23	-40295.66
91+50.000	163.96	75.91	75.91	327.91	151.81	73646.47	73646.47	114018.04	-40371.57
91+75.000	0.00	75.91	75.91	0.00	151.81	73722.38	73722.38	114169.85	-40447.47
92+00.000	142.54	65.99	65.99	285.07	131.98	73788.37	73788.37	114301.82	-40513.46
92+25.000	0.00	65.99	65.99	0.00	131.98	73854.35	73854.35	114433.80	-40579.45
92+50.000	120.78	55.92	55.92	241.56	111.83	73910.27	73910.27	114545.63	-40635.36
92+75.000	0.00	55.92	55.92	0.00	111.83	73966.19	73966.19	114657.47	-40691.28
93+00.000	107.43	49.74	49.74	213.42	98.81	74015.92	74015.92	114756.27	-40740.35
93+25.000	0.00	49.74	49.74	0.00	98.81	74065.66	74065.66	114855.08	-40789.42
93+50.000	116.63	54.00	54.00	87.84	40.67	74119.65	74119.65	114895.75	-40776.09
93+75.000	0.00	54.00	54.00	0.00	40.67	74173.65	74173.65	114936.42	-40762.76
94+00.000	389.76	180.45	180.45	220.33	102.00	74354.10	74354.10	115038.42	-40684.32
94+25.000	0.00	180.45	180.45	0.00	102.00	74534.54	74534.54	115140.42	-40605.88
94+50.000	463.14	214.42	214.42	313.87	145.31	74748.96	74748.96	115285.73	-40536.77
94+75.000	0.00	214.42	214.42	0.00	145.31	74963.38	74963.38	115431.04	-40467.67
95+00.000	226.44	104.83	104.83	185.79	86.01	75068.21	75068.21	115517.06	-40448.85
95+25.000	0.00	104.83	104.83	0.00	86.01	75173.04	75173.04	115603.07	-40430.03
95+50.000	138.85	64.28	64.28	85.87	39.76	75237.33	75237.33	115642.83	-40405.50
95+56.901	228.45	46.94	46.94	127.42	27.26	75284.26	75284.26	115670.09	-40385.82
95+75.000	0.00	76.57	76.57	0.00	42.71	75360.83	75360.83	115712.80	-40351.96
96+00.000	410.47	190.03	190.03	217.62	100.75	75550.87	75550.87	115813.55	-40262.68
96+25.000	0.00	190.03	190.03	0.00	100.75	75740.90	75740.90	115914.30	-40173.39

ATTACHMENT A.1

96+25.417	373.92	2.89	2.89	239.14	1.85	75743.79	75743.79	115916.14	-40172.35
96+50.000	412.58	358.05	358.05	246.28	220.99	76101.84	76101.84	116137.13	-40035.29
96+75.000	0.00	191.01	191.01	0.00	114.02	76292.85	76292.85	116251.15	-39958.30
97+00.000	512.02	237.05	237.05	273.54	126.64	76529.90	76529.90	116377.79	-39847.89
97+25.000	0.00	237.05	237.05	0.00	126.64	76766.95	76766.95	116504.43	-39737.48
97+50.000	245.49	113.65	113.65	126.50	58.56	76880.60	76880.60	116562.99	-39682.39
97+75.000	0.00	113.65	113.65	0.00	58.56	76994.26	76994.26	116621.56	-39627.30
98+00.000	184.81	85.56	85.56	103.09	47.73	77079.81	77079.81	116669.29	-39589.47
98+10.932	148.22	67.42	67.42	87.74	38.63	77147.23	77147.23	116707.92	-39560.69
98+25.000	0.00	38.61	38.61	0.00	22.86	77185.85	77185.85	116730.78	-39544.93
98+50.000	43.69	20.23	20.23	86.79	40.18	77206.08	77206.08	116770.96	-39564.88
98+75.000	0.00	20.23	20.23	0.00	40.18	77226.31	77226.31	116811.14	-39584.83
99+00.000	98.62	45.66	45.66	197.24	91.31	77271.96	77271.96	116902.46	-39630.49
99+25.000	0.00	45.66	45.66	0.00	91.31	77317.62	77317.62	116993.77	-39676.15
99+50.000	111.80	51.76	51.76	223.60	103.52	77369.38	77369.38	117097.29	-39727.91
99+75.000	0.00	51.76	51.76	0.00	103.52	77421.14	77421.14	117200.81	-39779.67
100+00.000	86.13	39.88	39.88	172.26	79.75	77461.02	77461.02	117280.56	-39819.54
100+25.000	0.00	39.88	39.88	0.00	79.75	77500.89	77500.89	117360.31	-39859.42
100+50.000	86.22	39.92	39.92	172.43	79.83	77540.81	77540.81	117440.14	-39899.33
100+75.000	0.00	39.92	39.92	0.00	79.83	77580.72	77580.72	117519.97	-39939.25
101+00.000	74.22	34.36	34.36	148.44	68.72	77615.08	77615.08	117588.69	-39973.61
101+25.000	0.00	34.36	34.36	0.00	68.72	77649.44	77649.44	117657.42	-40007.97
101+50.000	65.84	30.48	30.48	131.68	60.96	77679.93	77679.93	117718.38	-40038.45
101+75.000	0.00	30.48	30.48	0.00	60.96	77710.41	77710.41	117779.34	-40068.93
102+00.000	204.84	94.83	94.83	102.42	47.42	77805.24	77805.24	117826.76	-40021.52
102+25.000	0.00	94.83	94.83	0.00	47.42	77900.07	77900.07	117874.17	-39974.10
102+32.083	0.00	0.00	0.00	0.00	0.00	77900.07	77900.07	117874.17	-39974.10
102+50.000	583.73	193.68	193.68	291.86	96.84	78093.75	78093.75	117971.01	-39877.26
102+75.000	0.00	270.24	270.24	0.00	135.12	78363.99	78363.99	118106.13	-39742.14
103+00.000	921.12	426.44	426.44	460.56	213.22	78790.44	78790.44	118319.36	-39528.92
103+25.000	0.00	426.44	426.44	0.00	213.22	79216.88	79216.88	118532.58	-39315.70
103+50.000	1222.89	566.15	566.15	611.45	283.08	79783.03	79783.03	118815.65	-39032.62
103+75.00	0.00	566.15	566.15	0.00	283.08	80349.19	80349.19	119098.73	-38749.54

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104+00.000	1209.95	560.16	560.16	604.97	280.08	80909.35	80909.35	119378.81	-38469.46
104+06.366	1230.90	287.77	287.77	615.45	143.88	81197.11	81197.11	119522.69	-38325.58
104+20.653	1585.02	698.09	698.09	792.51	349.04	81895.20	81895.20	119871.74	-37976.54
104+25.000	2203.87	287.21	287.21	1101.94	143.61	82182.42	82182.42	120015.35	-37832.93
104+34.750	1615.76	661.76	661.76	807.88	330.88	82844.17	82844.17	120346.22	-37502.05
104+49.040	2315.81	1041.49	1041.49	1157.92	520.75	83885.67	83885.67	120866.97	-36981.31
104+50.000	1630.58	70.22	70.22	815.30	35.11	83955.89	83955.89	120902.09	-36946.19
104+63.136	1629.72	736.58	736.58	814.86	368.29	84692.47	84692.47	121270.38	-36577.90
104+75.000	1624.53	715.40	715.40	812.27	357.70	85407.87	85407.87	121628.07	-36220.21
105+00.000	2275.87	1805.74	1805.74	1137.93	902.87	87213.61	87213.61	122530.94	-35317.34
105+25.000	0.00	1053.64	1053.64	0.00	526.82	88267.25	88267.25	123057.77	-34790.52
105+50.000	1222.79	566.11	566.11	611.39	283.05	88833.36	88833.36	123340.82	-34507.46
105+75.000	0.00	566.11	566.11	0.00	283.05	89399.46	89399.46	123623.87	-34224.41
106+00.000	1004.35	464.98	464.98	502.17	232.49	89864.44	89864.44	123856.36	-33991.92
106+25.000	0.00	464.98	464.98	0.00	232.49	90329.41	90329.41	124088.85	-33759.43
106+25.605	872.18	9.78	9.78	436.09	4.89	90339.19	90339.19	124093.74	-33754.55
106+50.000	725.03	721.54	721.54	362.52	360.77	91060.73	91060.73	124454.51	-33393.77
106+75.000	0.00	335.66	335.66	0.00	167.83	91396.40	91396.40	124622.34	-33225.94
107+00.000	337.38	156.19	156.19	168.69	78.10	91552.59	91552.59	124700.44	-33147.85
107+25.000	0.00	156.19	156.19	0.00	78.10	91708.78	91708.78	124778.53	-33069.75
107+50.000	105.60	48.89	48.89	211.20	97.78	91757.67	91757.67	124876.31	-33118.64
107+67.917	0.00	35.04	35.04	0.00	70.08	91792.71	91792.71	124946.39	-33153.68
107+75.000	0.00	0.00	0.00	0.00	0.00	91792.71	91792.71	124946.39	-33153.68
108+00.000	282.28	130.69	130.69	564.56	261.37	91923.40	91923.40	125207.76	-33284.36
108+07.907	373.93	96.08	96.08	747.86	192.17	92019.48	92019.48	125399.92	-33380.45

ATTACHMENT A.1

108+25.000	0.00	118.36	118.36	0.00	236.73	92137.84	92137.84	125636.65	-33498.81
108+50.000	396.42	183.53	183.53	791.21	366.30	92321.37	92321.37	126002.95	-33681.58
108+75.000	0.00	183.53	183.53	0.00	366.30	92504.90	92504.90	126369.25	-33864.35
109+00.000	444.23	205.66	205.66	882.86	408.73	92710.56	92710.56	126777.98	-34067.42
109+25.000	0.00	205.66	205.66	0.00	408.73	92916.22	92916.22	127186.72	-34270.49
109+50.000	474.56	219.70	219.70	949.12	439.41	93135.93	93135.93	127626.12	-34490.20
109+75.000	0.00	219.70	219.70	0.00	439.41	93355.63	93355.63	128065.53	-34709.90
110+00.000	252.84	117.05	117.05	505.67	234.11	93472.68	93472.68	128299.64	-34826.96
110+25.000	0.00	117.05	117.05	0.00	234.11	93589.74	93589.74	128533.75	-34944.01
110+50.000	238.37	110.35	110.35	476.73	220.71	93700.09	93700.09	128754.46	-35054.36
110+75.000	0.00	110.35	110.35	0.00	220.71	93810.45	93810.45	128975.17	-35164.72
111+00.000	287.63	133.16	133.16	575.27	266.33	93943.61	93943.61	129241.50	-35297.88
111+25.000	0.00	133.16	133.16	0.00	266.33	94076.78	94076.78	129507.82	-35431.05
111+50.000	243.39	112.68	112.68	486.78	225.36	94189.46	94189.46	129733.19	-35543.73
111+53.871	0.00	17.45	17.45	0.00	34.89	94206.90	94206.90	129768.08	-35561.18
111+75.000	0.00	0.00	0.00	0.00	0.00	94206.90	94206.90	129768.08	-35561.18
112+00.000	156.78	72.58	72.58	313.56	145.16	94279.49	94279.49	129913.24	-35633.76
112+25.000	0.00	72.58	72.58	0.00	145.16	94352.07	94352.07	130058.41	-35706.34
112+50.000	95.54	44.23	44.23	191.08	88.46	94396.30	94396.30	130146.87	-35750.57
112+52.435	92.24	8.47	8.47	184.48	16.93	94404.77	94404.77	130163.81	-35759.04
112+75.000	0.00	38.55	38.55	0.00	77.09	94443.31	94443.31	130240.90	-35797.58
113+00.000	18.34	8.49	8.49	34.56	16.00	94451.80	94451.80	130256.90	-35805.10
113+03.871	0.00	1.31	1.31	0.00	2.48	94453.12	94453.12	130259.38	-35806.26
113+25.000	0.00	0.00	0.00	0.00	0.00	94453.12	94453.12	130259.38	-35806.26
113+50.000	142.93	66.17	66.17	71.47	33.09	94519.29	94519.29	130292.46	-35773.17
113+52.43	144.38	12.96	12.96	72.19	6.48	94532.24	94532.24	130298.94	-35766.70

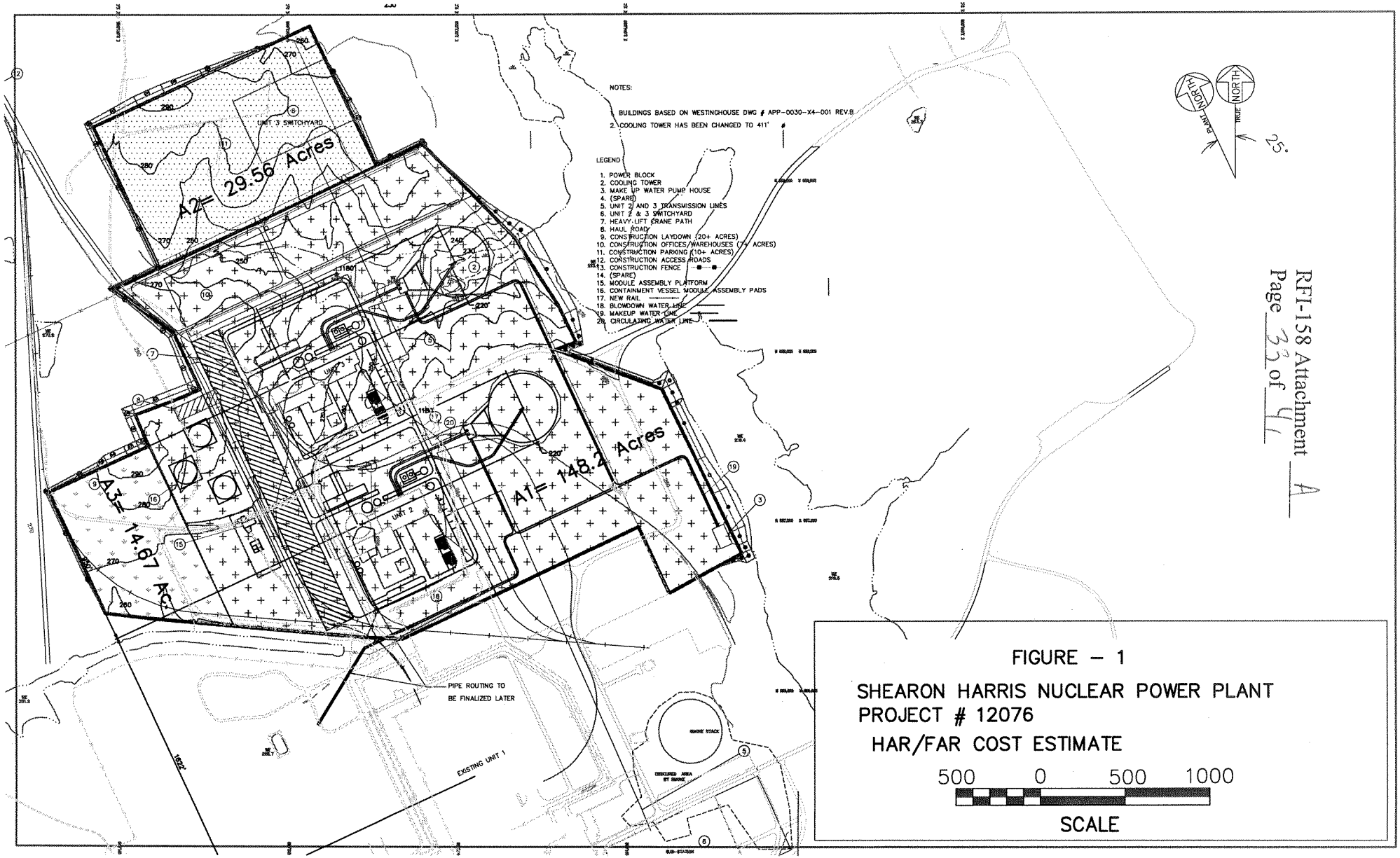
5									
113+75.000	0.00	60.33	60.33	0.00	30.17	94592.58	94592.58	130329.11	-35736.53
114+00.000	0.00	0.00	0.00	0.00	0.00	94592.58	94592.58	130329.11	-35736.53

Project # 12076 **Table 23.5**

Name : Shearon Harris Nuclear Power Plant, Carolina

Estimation of Civil Quantities for Plant Access Roads. for New AP-1000 units

Earthwork Computation For Ramps @ Harris US-1 Rout Interchange				
Description	Value	Unit		
Height of Ramp	30.00	ft		
Length of ramp	1000.00	ft		
Side slopes	2.00	1V:2H		
Width of ramp	32.00	Ft.		
Area at Bottom	0.00	Sq.ft		
Area at Max. ht	2760.00	Sq.ft		
Avg. Area	1380.00	Sq.ft		
Volume	51111	Cu. Yard		
4 Nos. of Ramp	204444	Cu. Yard		
Apply Compaction Factor	245333	Cu. Yard		
Say	**250000**	Cu. Yard		



RFI-158 Attachment A
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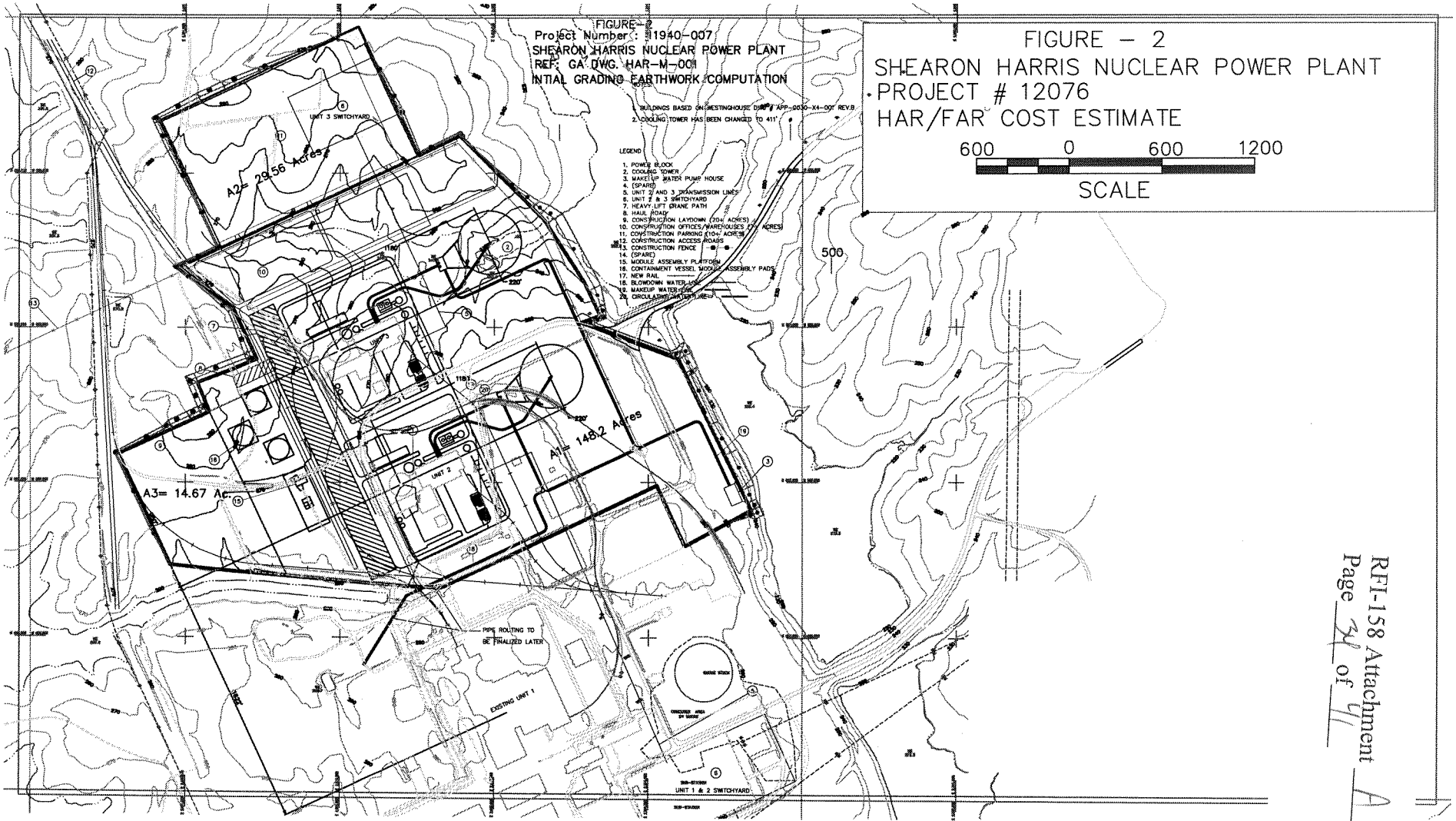
FIGURE – 1

SHEARON HARRIS NUCLEAR POWER PLANT
PROJECT # 12076
HAR/FAR COST ESTIMATE

500 0 500 1000

SCALE



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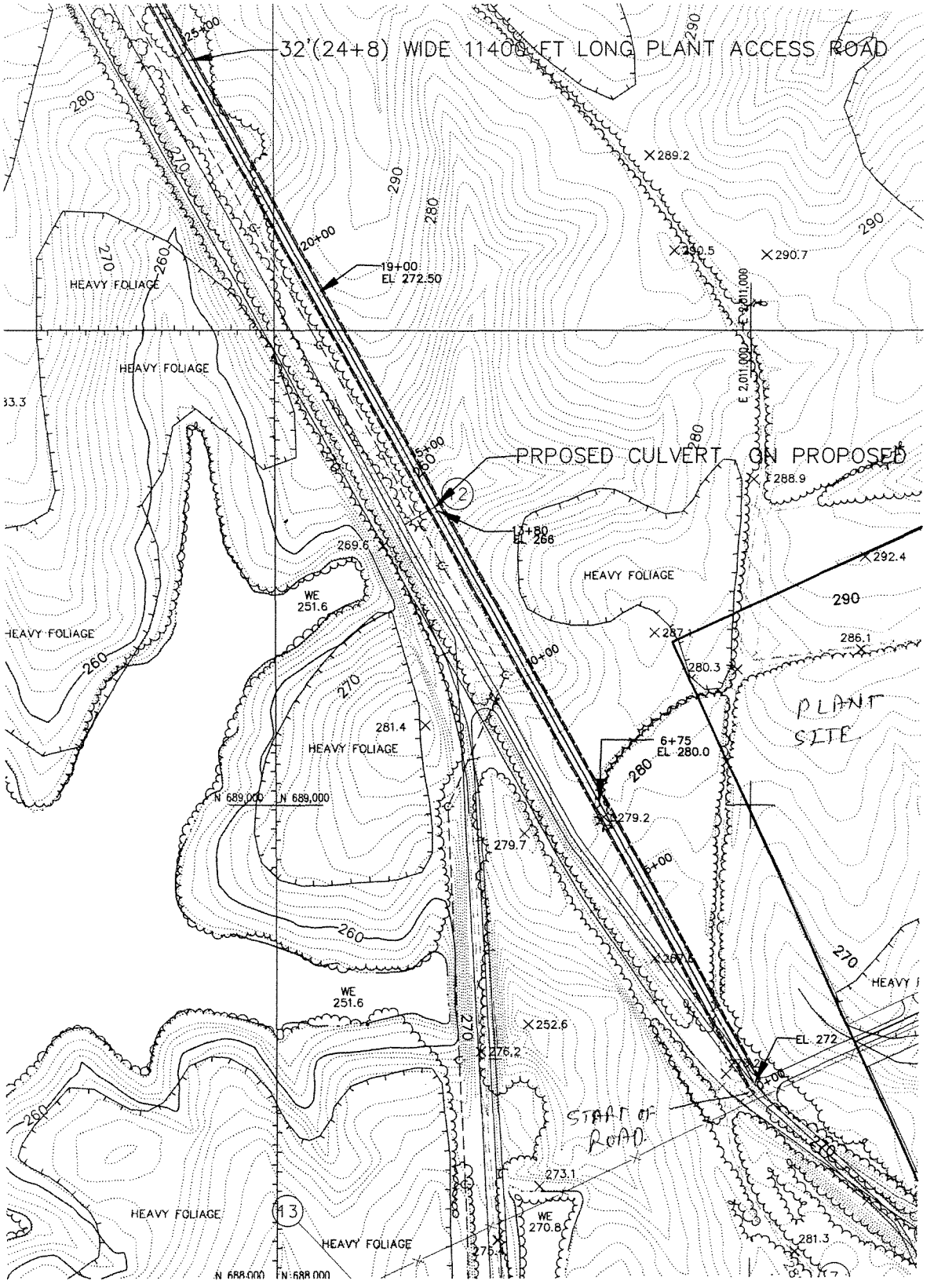

Figure 4.1
PLAN – Plant Access Road
Sheet 1 of 4
Scale 1" = 200'

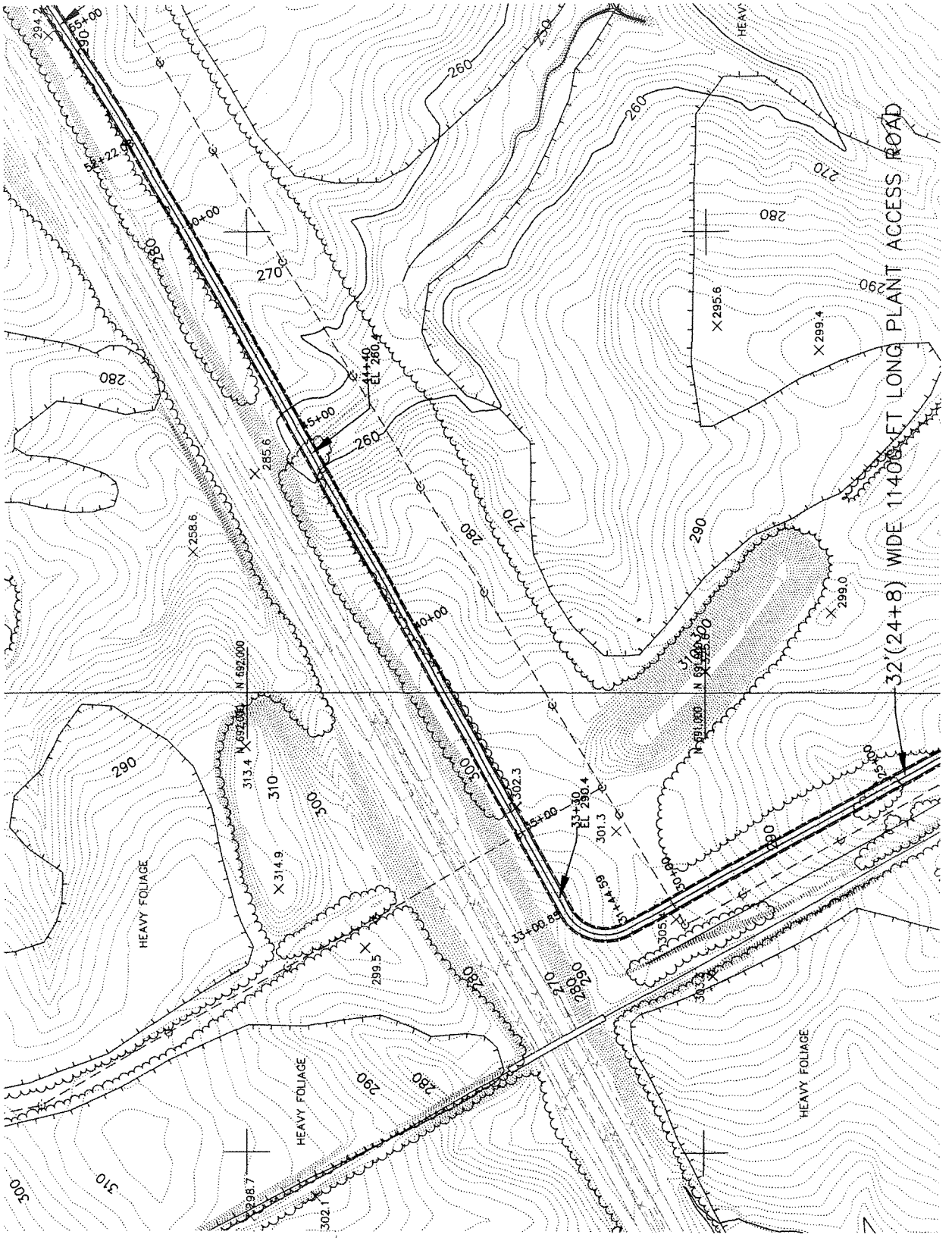

Figure 4.2
PLAN – Plant Access Road
Sheet 2 of 4
Scale 1" = 200'

RFI-158 Attachment A
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Figure 4.3
PLAN – Plant Access Road
Sheet 3 of 4
Scale 1" = 200'

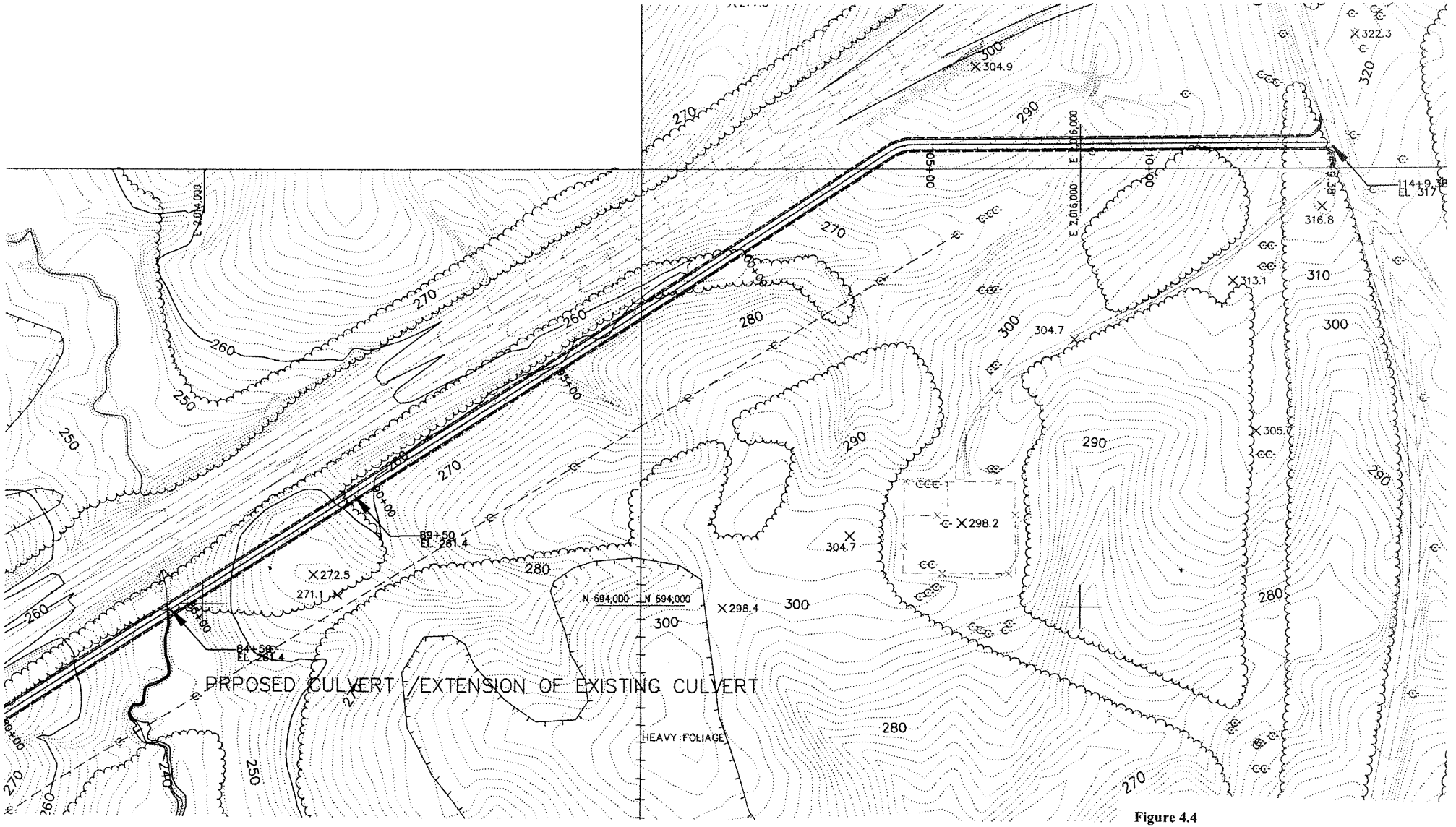

Figure 4.4
PLAN – Plant Access Road
Sheet 4 of 4
Scale 1" = 200'

RFI-158 Attachment A
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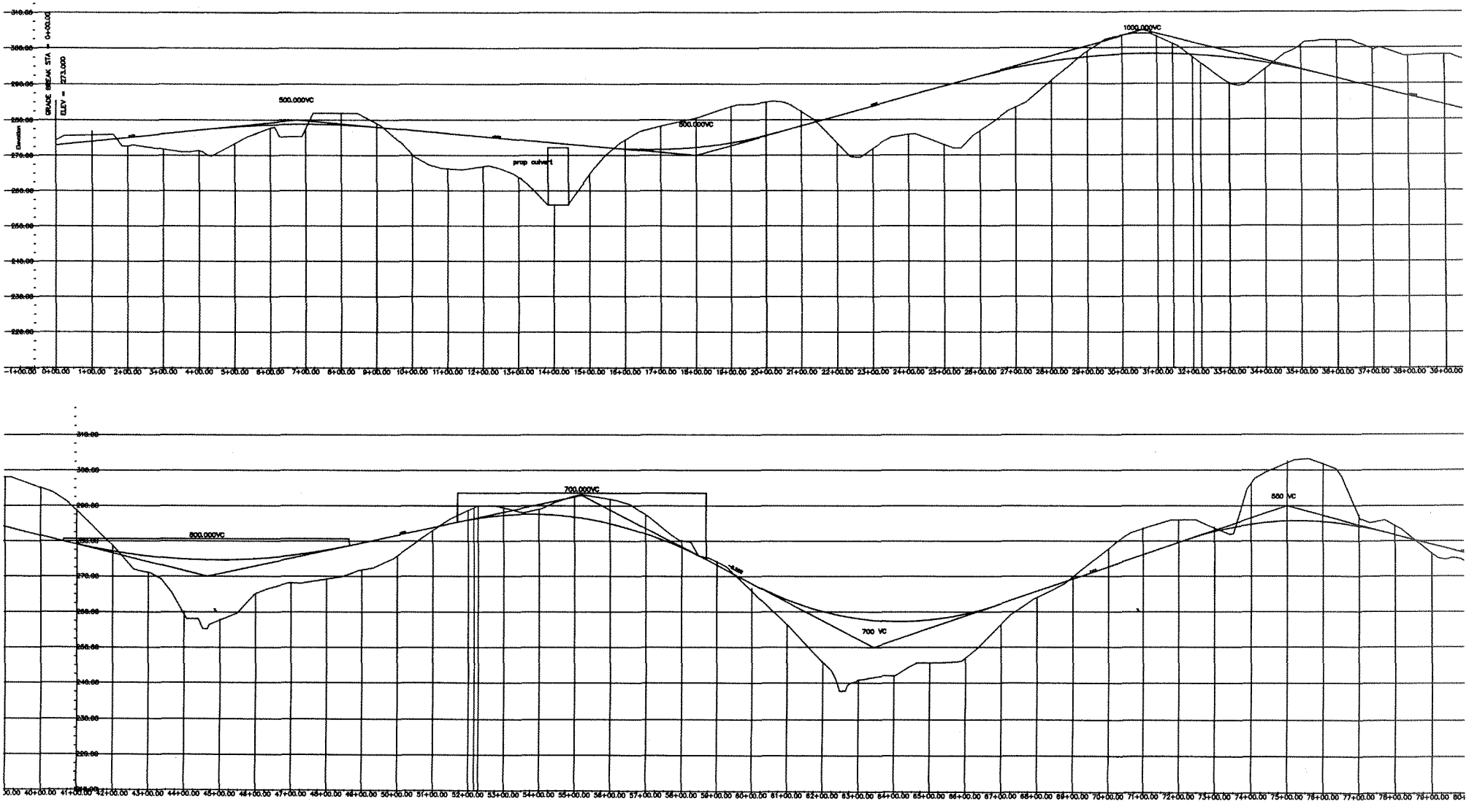
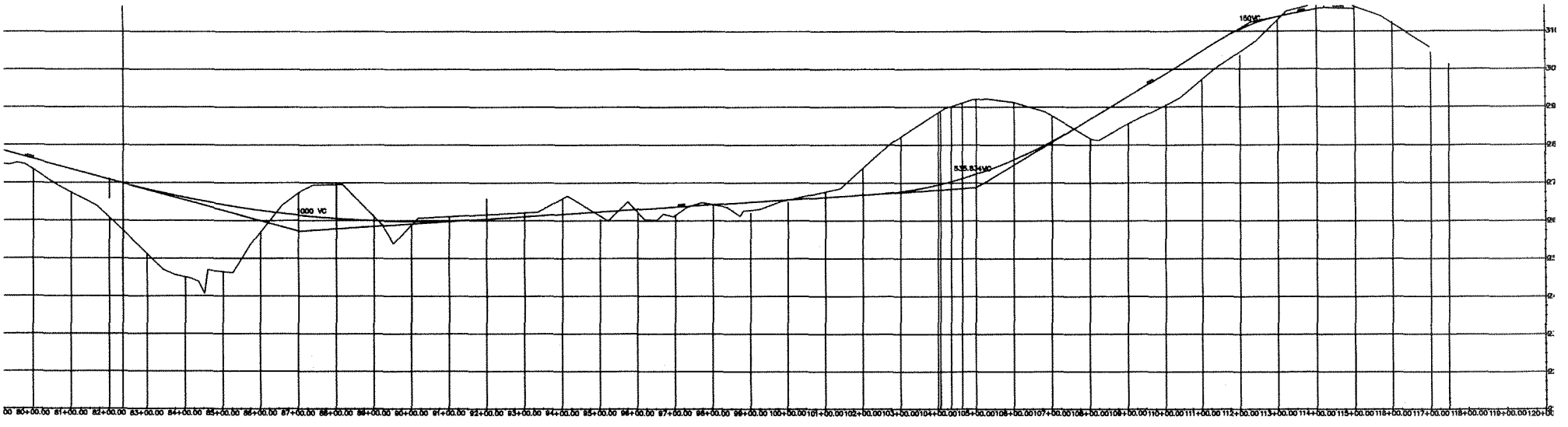


PROFILE

sta.00+00 to 80+00

Figure 4.5
PROFILE – Plant Access Road
Sheet 1 of 2

RFI-158 Attachment A
Page 40 of 41



PROFILE

sta.80+00 to 120+00

RFI-158 Attachment A
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Figure 4.6
PROFILE – Plant Access Road
Sheet 2 of 2

HAR 2&3 RFI-158 Attachment C

Item Description: Construction parking lots, Laydown areas, Roads - surfacing

Surfacing in Plant, Construction Laydown, Construction parking & Switchyard area (Item # 14 of Attachment A-1, Civil Quantities)

(a) Providing and laying 3.5" asphalt pavement in plant area and around cooling tower area over a 6" aggregate base course and 6" aggregate subbase course including supply, transporting, placing, compacting, rolling etc. as per design and drawing.
(b) Providing and laying 12" crushed stone surfacing in plant area and around cooling tower area not covered under asphalt. Item includes placing 8 oz/sy geotextile 12" crushed stone surfacing course including supply, transporting, placing, compacting, rolling etc. as per design and drawing.
(c) Providing and laying 9" crushed stone surfacing in laydown area and construction office area. Item includes placing 8 oz/sy geotextile 9" crushed stone surfacing course including supply, transporting, placing, compacting, rolling etc. as per design and drawing.
(d) Providing and laying 12" crushed stone surfacing in switchyard area for unit-3. Item includes placing 8 oz/sy geotextile 12" crushed stone surfacing course including supply, transporting, placing, compacting, rolling etc. as per design and drawing.
(e) Providing and laying 4" thick seeded top soil, including providing 4" thick top soil, seeding, mulching, etc. as per DOT approved guide lines.

Design Approach / Basis for Estimate:
Area measured from GA and topographic map using AutoCAD software for different facilities. Area of each surface type is combined to compute the total surfacing of individual type.

Design Inputs: Harris Site GA (DWG HAR-M-001)
Site topographic Survey Map (BARTON AIR TECHNOLOGIES)

Assumptions:
-Plant area and area around cooling tower will be asphalt surfaced
-West side area labeled as A3 in Figure-1 will be seeded
-Switchyard and other reaming area will be surfaced with crushed stone.

Attachments: see Attachment A-1 (Civil Quantities – Harris Site)

1. Sketches : Figure-10
2. Calculation(s) : Table 26.1
3. References : None

Shearon Harris Nuclear Power Plant, Carolina

Table 26.1

Project #

Civil Quantities for Two New AP-1000 units

Area Statement for Surfacing to Civil Quantities of the Estimate

Area Statement as Per GA				
#	Area Description	Suface Type	Area in Acres	Remarks
1	Power Blocks		5.60	(Both for Unit 2 & 3)
2	Cooling Towers		2.50	(Both)
3	Switch yard		5.50	
4	Const. Parking		24.00	Area lable 11 in GA
5	Const. Offices & Warehouse		18.00	
6	Plant Roads & Roads		12.00	
7	Heavy Lift Crane path		7.50	
8	Construction Laydown		32.00	
9	Building Area		10.00	
10	West side to Const. Laydown		14.67	
11	Other Remaing area		60.00	
	Total of Graded area		191.77	
a - Asphalt surfacing in plant unit area and Cooling tower area and parking area.				
a	Power Blocks -Cooling tower Surrounded area	Asphalt	46.00	
1	Cooling tower		2.50	
2	Power Block		5.60	
3	Building & Other area		6.00	
4	Plant roads		10.00	
	Ashphalt Paved Area		21.90	a - (1+2+3+4)
		Say	22.00	
b- Crushed stone surfacing in plant unit area and Cooling tower area and parking area.				
1	Total area		74.00	
2	Area covered in Ashphalt in (a)		-22.00	
3	Plant roads		-12.00	
4	Buildings		-6.00	
	Net Area		34.00	

Shearon Harris Nuclear Power Plant, Carolina

Table 26.1

Project #

Civil Quantities for Two New AP-1000 units

Area Statement for Surfacing to Civil Quantities of the Estimate

Area Statement as Per GA				
C-Crushed stone surfacing in Laydown area & construction office area.				
1	West side area		32.00	
3	Const. Offices		18.00	
4	Switchyard & Parking		29.5	
5	Switchyard area		-5.5	
	Total		74.00	
		Say	74.00	
Area not covered under surfacing for this estimate				
1	Plant Road		12.00	
2	Buildings		10.00	
3	Power Block		5.60	
4	Heavy Lift Crane path		7.5	
5	Cooling Towers		2.5	
	Total		37.60	
		Say	38.00	

RFI-158 Attachment C
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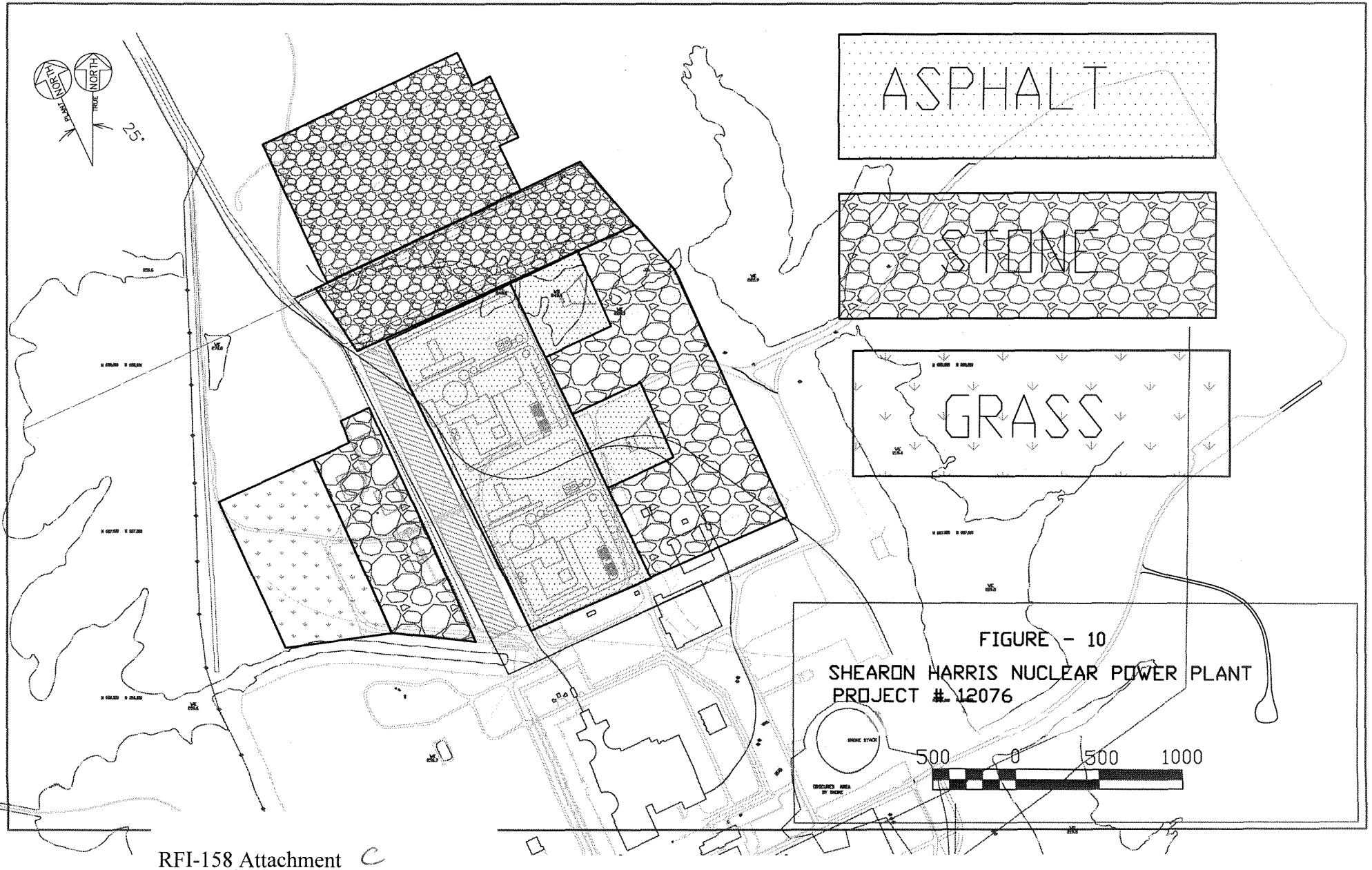

RFI-158 Attachment C
Page 4 of 4

HAR 2&3 RFI-158 Attachment D

Item Description: New Saddle Dikes west of the Plant for low areas below EL 260

Saddle dikes (4 Nos) (Dike A,B,C & D) (Item #12 of Attachment A-1, Civil Quantities)

Items include

(a) Compacted earth fill dike on low areas in the west of plant below elevation 260 to raise the same at elevation 260. It includes providing compacted layers of fill to design grade and elevations as per drawings.

(b) Supply and installation of 3' Thick riprap protection. This includes the graded stone material of specified size, transporting, placing, and packing, finishing the top surface at specified slopes.

(c) Supply and installation of 8 oz/sy geotextile fabric for the riprap protection, includes the lapping, joining, testing etc.

Design Approach:

-Approximate length of the dikes according to elevation is measured from topographic map.

-Computation table prepared to compute the volume of dike and the riprap volume

Design Inputs: (Harris Site GA (DWG HAR-M-001)
Site topographic Survey Map (BARTON AIR TECHNOLOGIES)

Assumptions:

-Top width of dikes will be 15'

-Side slopes of dike will be 3H: 1V

-15% extra material will be required due to compaction

-Top of dike elevation will be 260'

Attachments: see Attachment A-1 (Civil Quantities – Harris Site)

1. Sketches : Figure-11 (Location of dikes)
2. Calculation(s) : Table 27.1
3. References: None

Shearon Harris Nuclear Power Plant **Table 27.1**

Project # 12076-010

Estimate of Civil Quantities for Two New AP-1000 units

Saddle Dikes

Side Slopes 3 1V:3H

EARTHWORK COMPUTATIONS									
Location	Length ft	Top Width ft	Top of Dike EL ft	Existing High EL ft	Area A1 ft^2	Existing Low EL ft	Area A1 ft^2	Avg. Area ft^2	Quantity Cyd
Dike A	325	15	260	258	42	254	198	120	1444
Dike B	460	15	260	258	42	254	198	120	2044
Dike C	860	15	260	258	42	248	612	327	10416
Dike D	925	15	260	258	42	250	450	246	8428
Total	2570								22332
							Allow 15% compaction		**25682**

RIPRAP COMPUTATIONS									
Location	Length ft	Top Width ft	Top of Dike EL ft	Existing Low EL ft	Sloping Length ft	Avg. Sloping Width ft	Area A1 ft^2	Thickness ft	Quantity Cyd
Dike A	325	15	260	254	19.0	9.5	3083	3	343
Dike B	460	15	260	254	19.0	9.5	4364	3	485
Dike C	860	15	260	248	37.9	19.0	16317	3	1813
Dike D	925	15	260	250	31.6	15.8	14626	3	1625
Total							38390		4266

RFI-158 Attachment D
Page 2 of 4

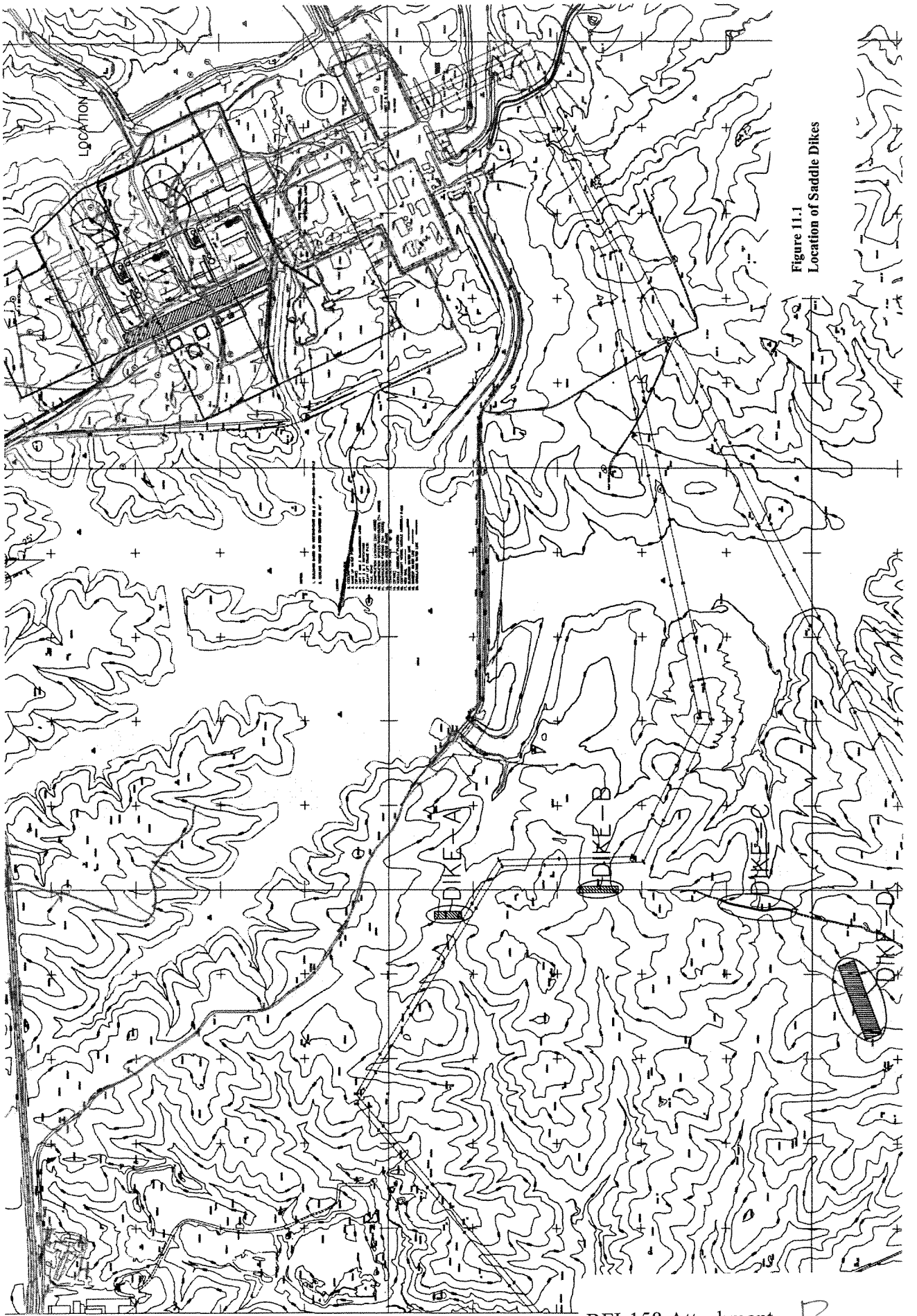

Figure 11.1
Location of Saddle Dikes

RFI-158 Attachment D
Page 3 of 4

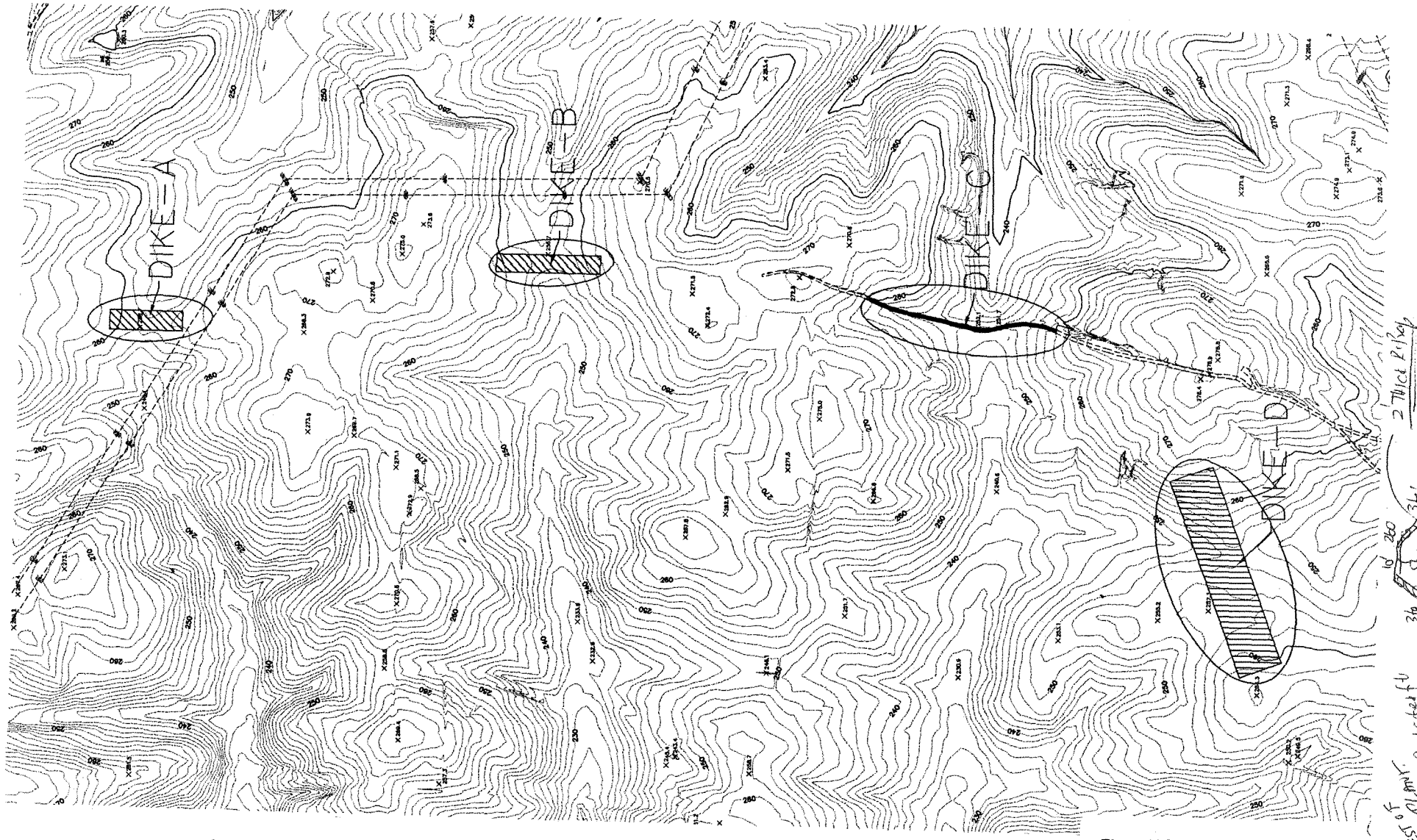

Figure 11.2
Location of Saddle Dikes

RFI-158 Attachment D
Page 4 of 4

HAR 2&3 RFI-158 Attachment E

Item Description: Sewage Treatment Plant (Expanded or New)

Sewage treatment plant (Item –9 of attachment A-1, Civil Quantities)

Supply, install and setup the sewage treatment plant of specified capacity

Design Approach:
- Information for existing sewage treatment plant for existing unit-1 from Progress Energy.
- Two treatment plant units of similar sewage flow capacity are considered one for each of these units.

Design Inputs: (1) Information from Progress Energy

Assumptions:
-Average capacity required for each unit is proportionate to existing sewage treatment plant for unit-1

Attachments: Attachment A– 1 (Civil Quantities- Harris Site)

1. Sketches : None

2. Calculation(s): Existing sewage plant is having capacity 17000 gallons per day and serving 600 people.
   Provide two new sewage treatment plant of similar 17000 gallons for new units, one for each.

3. References : Information about existing sewage plant from PGN (Copy enclosed)

"Nevill, James"
<James.Nevill@pgnmail.com>
11/06/2006 10:50 AM

To <GOPAL.KOMANDURI@sargentlundy.com>
cc
bcc
Subject Information Request for Harris

Gopal,

The sewage treatment plant providing treatment for the existing Harris Unit 1supports 600 people and has a flow of 17,000 gallons per day.

Thanks, Jim

HAR 2&3 RFI-158 Attachment F

Item Description: Lake water level affected roads including flood protection for Training Center.

1. Flood protection for Training Center area (Item # 11 of Attachment A-1 Civil Quantity)

Items include

(a) Compacted earth fill dike on the back side of the Training Center in compacted layers to design grade and elevations as shown in drawings.
(b) Supply and installation of 3' Thick riprap protection. This includes the graded stone material of specified size, transporting, placing, and packing, finishing the top surface at specified slopes.
(c) Supply and installation of 8 oz/sy geotextile for the riprap protection, includes the lapping, joining, testing etc.
(d) Supply and installation of 24" dia CHDPE culverts, including excavation, compacted fill, pre-cast end sections and stone protection work for the culverts.

Design Approach:

- Existing road and raised road is marked on CAD drawing and width, etc. are measured. Excel sheet is prepared to compute net area of revised section as shown in sketch. Net area of each segment is used to compute the volume of required fill.
- For computation of riprap, average sloping length of lake facing portion is used to compute the area of riprap. This area is multiplied by thickness to compute the volume of riprap.
- Area computed for Geotextile fabric.
- Number of culverts are according to the site layout.

Design Inputs: Harris Site GA (DWG HAR-M-001)
Site topographic Survey Map (BARTON AIR TECHNOLOGIES)

Assumptions:

-Top of dike EL 250' (1' above raised road EL provided by PNG);
- Side slopes 3H:1V,
- Thickness of riprap 3'

Attachments: see Attachment A-1 (Civil Quantities – Harris Site)

1. Sketches : Figure-6, Sketch for computing net area
   Figure-7 & 8 (Locations of roads to be raised)
   Figure 7-1 showing proposed plan for Training Center dike.

2. Calculation(s): Refer Table 22.1, Table 22.3

3. References: N/A

2 Raising lake level affected roads (Item # 13 of Attachment A-1, Civil Quantities) at Location A,B,C,J,K,L,M,N,O,P (Note: Locations D,E,F,G,H,I are not used)

Items include
(e) Compacted fill for raising lake affected road, including transporting and placing selected earth material in compacted layers to design grade and elevations as shown in drawings
(f) Supply and installation of 2' Thick riprap protection. This includes the graded stone material of specified size, transporting, placing, and packing, finishing the top surface at specified slopes.
(g) Supply and installation of 8 oz/sy geotextile for the riprap protection, includes the lapping, joining, testing etc.
(h) Supply and installation of CHDPE/CMP culverts, including excavation, compacted fill, pre-cast end sections and stone protection work for the culverts.

Design Approach:
- Existing road and raised road is marked on CAD drawing and width, etc. are measured. Excel sheet is prepared to compute net area of revised section as shown in sketch. Net area of each segment is used to compute the volume of required fill.
- For computation of riprap, Average sloping length of lake facing portion is used to compute the area of riprap. This area is multiplied by thickness to compute the volume of riprap.
- Area computed for riprap is used for Geotextile
- Number of culverts are according to the site layout.

Design Inputs: Harris Site GA (DWG HAR-M-001)
Site topographic Survey Map (BARTON AIR TECHNOLOGIES)

Assumptions:
-Top of new road EL 249';
-Side slopes 3H: 1V
-Thickness of riprap 2'
- 100' length of road on both end of affected road will be re-surfaced

Attachments: see Attachment A-1 (Civil Quantities – Harris Site)

1. Sketches : Figure-6
Figure-7 & 8(Locations of roads to be raised)
Figures 7-2 through 7-13 showing proposed plans of raised lake affected roads at locations A1,A2,B,C1,C2,J,K,L,M,N,O,P (Note: Locations D,E,F,G,H,I are not used)

2. Calculation(s):Refer Table-22.2 and Table-22.3

3. References: N/A

Shearon Harris Nuclear Power Plant

Table 22.1

Project # 12076-010

Estimate of Civil Quantities for Two New AP-1000 units

Table 22.1; Dike for Training Center

Road ID	#	Length	EL1	W1	EL2	W2	B	EL3	Area 1	Area 2	Net Area	Avg. Net Area	Qty Cu.Yard
Training Center	1	0	250	5	250.0	5	5	250	0	0	0	0	0
	2	120	249	5	235.0	5	106	234	56	833	777	389	1727
	3	95	249	5	228.0	5	126	228	0	1376	1376	1076	3787
	4	220	249	5	226.0	5	140	226	0	1668	1668	1522	12397
	5	225	249	5	232.0	5	113	222	590	1593	1003	1335	11127
	6	145	249	5	234.0	5	104	232.5	82	899	818	910	4888
	7	275	249	5	236.0	5	95	235	50	700	650	734	7473
	8	65	249	5	230.0	5	128	229.5	33	1297	1264	957	2303
	9	170	249	5	224.0	5	140	224	0	1813	1813	1538	9684
	10	460	249	5	222.0	5	168	222	0	2336	2336	2074	35335
	11	270	249	5	227.0	5	128	227	0	1463	1463	1899	18993
	12	280	249	5	230.0	5	120	230	0	1188	1188	1325	13743
		2325											121457

After allowing 15% for Compaction 139676

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Shearon Harris Nuclear Power Plant

Table: 22.2

Project # 12076-010

Estimate of Civil Quantities for Two New AP-1000 units

Lake level affected road

Table 22.2; Lake Affected Roads

Road ID	#	Length	EL1	W1	EL2	W2	B	EL3	Area 1	Area 2	Net Area	Avg. Net Area	Qty Cu.Yard
Location A1	1	0	249	22	249.0	22	22	249	0	0	0		
	2	190	249	22	247.0	22	85	239	428	535	107	53.5	376
	3	130	249	22	247.0	22	99	235	726	847	121	114	549
	4	210	249	22	249.0	22	22	249	0	0	0	60.5	471
	Total	530											1396
Location A2	1	0	249	22	249.0	22	22	249	0	0	0		
	2	160	249	22	247.0	22	48	244	105	175	70	35	207
	3	120	249	22	246.3	22	98	236	618	780	162	116	516
	4	70	249	22	246.3	22	85	238	444	589	144	153	397
	5	30	249	22	246.5	22	54	244	114	209	95	120	133
	6	350	249	22	246.0	22	22	249	-66	0	66	80.5	1044
Total A2		730											2439
Total A		1260											3835
Location B	1	0	249	22	249.0	22	22	249	0	0	0		
	2	530	249	22	232.5	22	122	232	36	1224	1188	594	11660
	3	1060	249	22	234.0	22	164	226.5	698	2093	1395	1291.5	50703
	4	370	249	22	249.0	22	22	249	0	0	0	697.5	9558
		1960											71922
Location C1	1	0	249	20	249.0	20	20	249	0	0	0		
	2	1220	249	20	234.0	20	129	232	149	1267	1118	558.75	25247
	3	140	249	20	233.0	20	195	222	1183	2903	1720	1418.75	7358
	4	970	249	20	230.0	20	195	220	1075	3118	2043	1881	67586
		2330											100189

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Shearon Harris Nuclear Power Plant

Table: 22.2

Project # 12076-010

Estimate of Civil Quantities for Two New AP-1000 units

Lake level affected road

Table 22.2; Lake Affected Roads

Road ID	#	Length	EL1	W1	EL2	W2	B	EL3	Area 1	Area 2	Net Area	Avg. Net Area	Qty Cu.Yard
Location C2	1	0	249	20	249.0	20	20	249	0	0	0		
	2	525	249	20	238.0	20	85	238	0	578	578	288.75	5615
	3	72	249	20	236.5	20	158	227.5	801	1914	1113	645	2253
	4	147	249	20	234.0	20	202	220	1554	3219	1665	1389	7581
	5	445	249	20	230.0	20	202	220	1110	3219	2109	1887	31101
		1189											46529
Total C		3519											146719
Location O	1	0	249	12	249.0	12	12	249	0	0	0		
	2	110	249	12	244.5	12	40	244	13	130	117	58.5	238
	3	525	249	12	230.0	12	153	225	413	1980	1568	842.25	16377
	4	165	249	12	230.0	12	190	220	1010	2929	1919	1743	10653
	5	465	249	12	232.0	12	163	223	788	2275	1468	1703	29334
	6	185	249	12	238.0	12	100	234	112	840	728	1108	7590
		1450											64193
Location J	1	0	249	22	249.0	22	22	249	0	0	0		
	2	175	249	22	247.0	22	82	240	364	468	104	52	337
	3	50	249	22	246.5	22	136	232	1146	1343	198	150.75	279
	4	120	249	22	246.2	22	180	225.5	2091	2374	283	240	1067
	5	237	249	22	246.1	22	196	220	2645	3161	316	299	2629
	6	390	249	22	246.1	22	135	231	1185	1413	228	272	3927
	7	270	249	22	246.5	22	59	244	101	203	101	164	1645
	8	160	249	22	247.0	22	22	246	22	66	44	73	430
		1402											10314

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Shearon Harris Nuclear Power Plant

Table: 22.2

Project # 12076-010

Estimate of Civil Quantities for Two New AP-1000 units

Lake level affected road

Table 22.2; Lake Affected Roads

Road ID	#	Length	EL1	W1	EL2	W2	B	EL3	Area 1	Area 2	Net Area	Avg. Net Area	Qty Cu.Yard
Location K	1	0	250	32	250.0	32	32	242	256	256	0		
	2	153	250	32	250.0	32	120	225	1900	1900	0	0	0
	3	163	249	32	245.0	32	275	210	5373	5987	614	307	1853
	4	190	249	32	238.0	32	260	210	4368	6084	1716	1165	8198
	5	105	249	32	235.0	32	237	224	1480	3363	1883	1800	6998
	6	100	249	32	234.0	32	140	232.5	129	1419	1290	1587	5676
	7	225	249	32	236.0	32	85	242	-351	410	761	1025	8544
	8	428	249	32	249.0	32	32	249	0	0	0	380	6028
		1364											37497
Location M	1	0	250	22	250.0	22	5	250	0	0	0	0	0
	2	400	250	22	233.0	22	106	230	192	1280	1088	544	8059
	3	305	250	22	231.0	22	126	230	74	1480	1406	1247	14086
	4	505	250	22	235.0	22	140	230	405	1620	1215	1311	24511
	5	65	250	22	236.0	22	113	234	135	1080	945	1080	2600
	6	320	250	22	246.0	22	104	241	315	567	252	599	7093
	7	80	250	22	250.0	22	95	250	0	0	0	126	373
		1675											56724
Location N	1	0	250	20	250.0	20	20	250	0	0	0	0	0
	2	105	250	20	246.0	20	60	243.5	100	280	180	80	311
	3	160	250	20	240.0	20	115	233.5	439	1114	675	418	2783
	4	55	250	20	240.0	20	135	235.5	349	1124	775	725	1477
	5	60	250	20	240.0	20	87	239	54	569	535	655	1941
	6	120	250	20	243.0	20	61	243	0	284	284	409	1819

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Shearon Harris Nuclear Power Plant **Table: 22.2**

Project # 12076-010

Estimate of Civil Quantities for Two New AP-1000 units

Lake level affected road

Table 22.2; Lake Affected Roads

Road ID	#	Length	EL1	W1	EL2	W2	B	EL3	Area 1	Area 2	Net Area	Avg. Net Area	Qty Cu.Yard
	7	237	250	20	250.0	20	20	250	0	0	0	142	1244
		777											9575
Location L	1	0	249	26	249.0	20	26	249	0	0	0	544	0
	2	187	249	20	245.0	20	80	240	250	450	200	100	693
	3	75	249	20	245.0	20	80	240	250	450	200	200	556
	4	227	249	20	247.0	20	50	245	70	140	70	135	1135
	5	165	249	20	249.0	20	20	249	0	0	0	35	214
		654											2597
Location P	1	0	249	25	249.0	25	25	249	0	0	0	0	0
	2	915	249	25	238.5	25	120	234	326	1088	761	381	12899
	3	27	249	25	239.0	25	120	234	363	1088	725	743	743
	4	35	249	25	240.0	25	110	232	540	1148	808	666	864
	5	950	249	25	249.0	25	25	249	0	0	0	304	10688
		1927											25193
All Roads		15988											428568

After allowing 15% for Compaction **492854**

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Shearon Harris Nuclear Power Plant **Table : 22.3**

Project # 12076-010

Estimate of Civil Quantities for Two New AP-1000 units

Table 22.3; Riprap for Lake Level Affacted Road						
Location	Sloping Length	Length	Area	Thickness	Volume	
Location B U/S	75	800	60000	3	6667	
Location B D/S	70	800	56000	3	6222	
Location O U/S	80	1300	104000	3	11556	
Location O D/S	70	800	56000	3	6222	
Location C (N)	180	900	162000	3	18000	Both side
Location C (s)	180	500	90000	3	10000	Both side
Location J U/S	90	1400	126000	3	14000	
Location J D/S	90	800	72000	3	8000	
Location K U/S	120	450	54000	3	6000	
Location K D/S	120	700	84000	3	9333	
Location L U/S	25	600	15000	3	1667	
Location L D/S	25	400	10000	3	1111	
Location N U/S	60	400	24000	3	2667	
Location N D/S	50	400	20000	3	2222	
Location P U/S	40	900	36000	3	4000	
Location P D/S	40	900	36000	3	4000	
Total Roads					96000	
Location Q U/S	32	150	4800	3	533	US RT-1
Location Q D/S	32	150	4800	3	533	Riprap
Location R U/S	79	700	55300	3	6144	
Location R D/S	79	700	55300	3	6144	
Location S U/S	79	500	39500	3	4389	
Location S D/S	79	500	39500	3	4389	22133
Training Campus	70	2325	162750	3	18083	

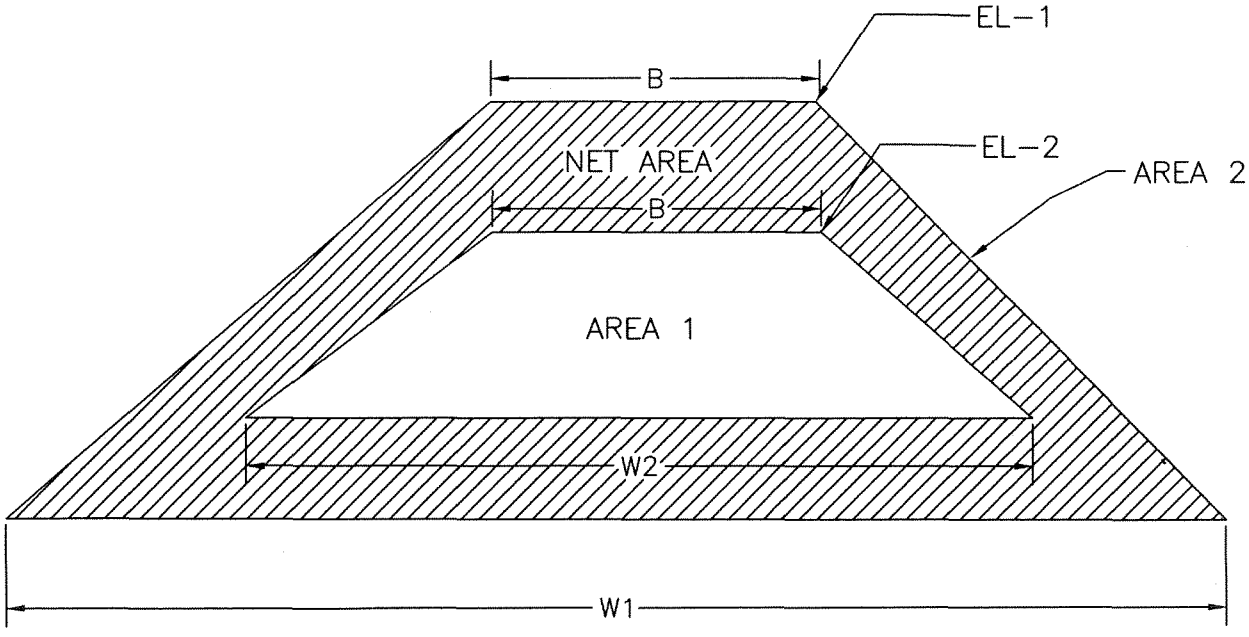

FIGURE - 6
SHEARON HARRIS NUCLEAR POWER PLANT
PROJECT # 12076
HAR/FAR COST ESTIMATE
DEFINATION SKETCH FOR AREA COMPUTATION
SCALE : NOT TO SCALE

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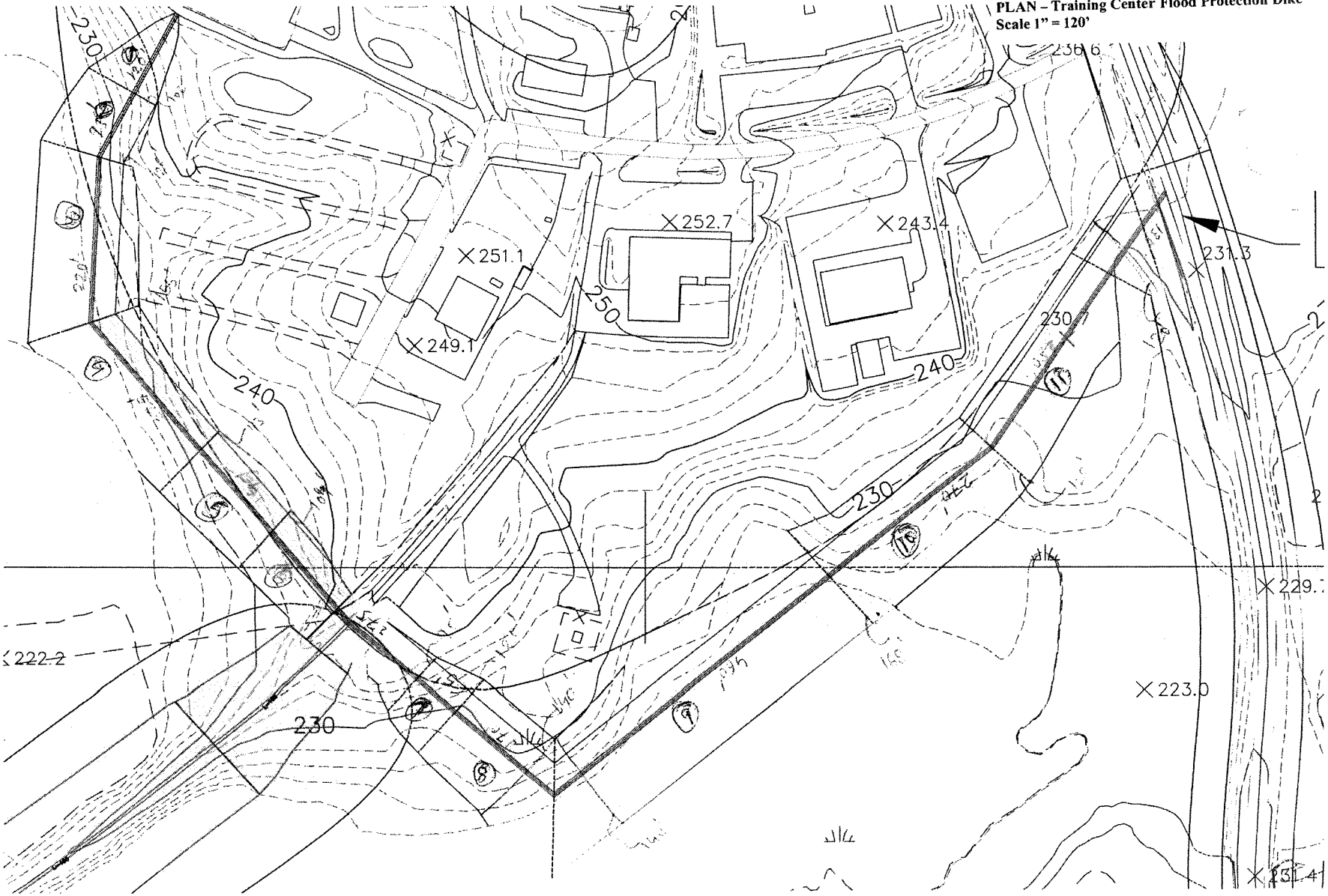
Figure 7.1
PLAN – Training Center Flood Protection Dike
Scale 1" = 120'



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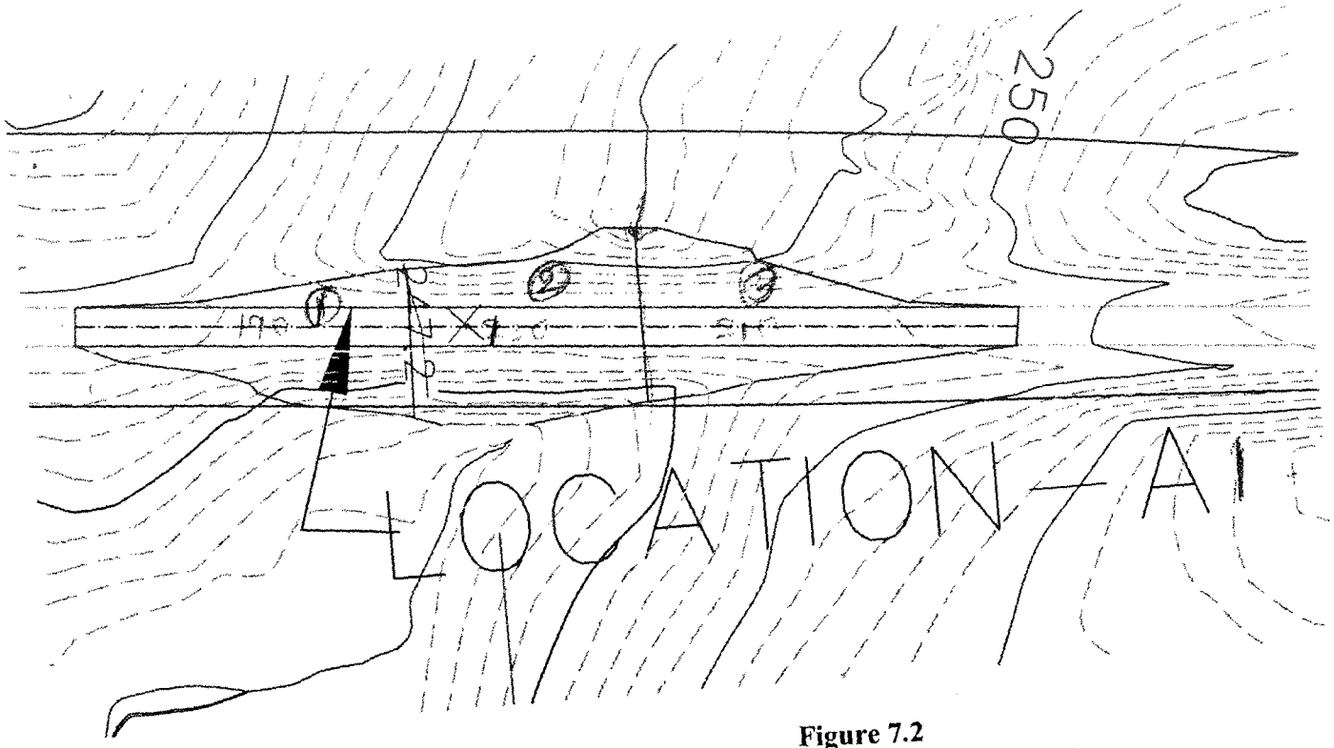

Figure 7.2
PLAN – Location A 1
Scale 1" = 100'

Figure 7.3
PLAN – Location A 2
Scale 1" = 100'

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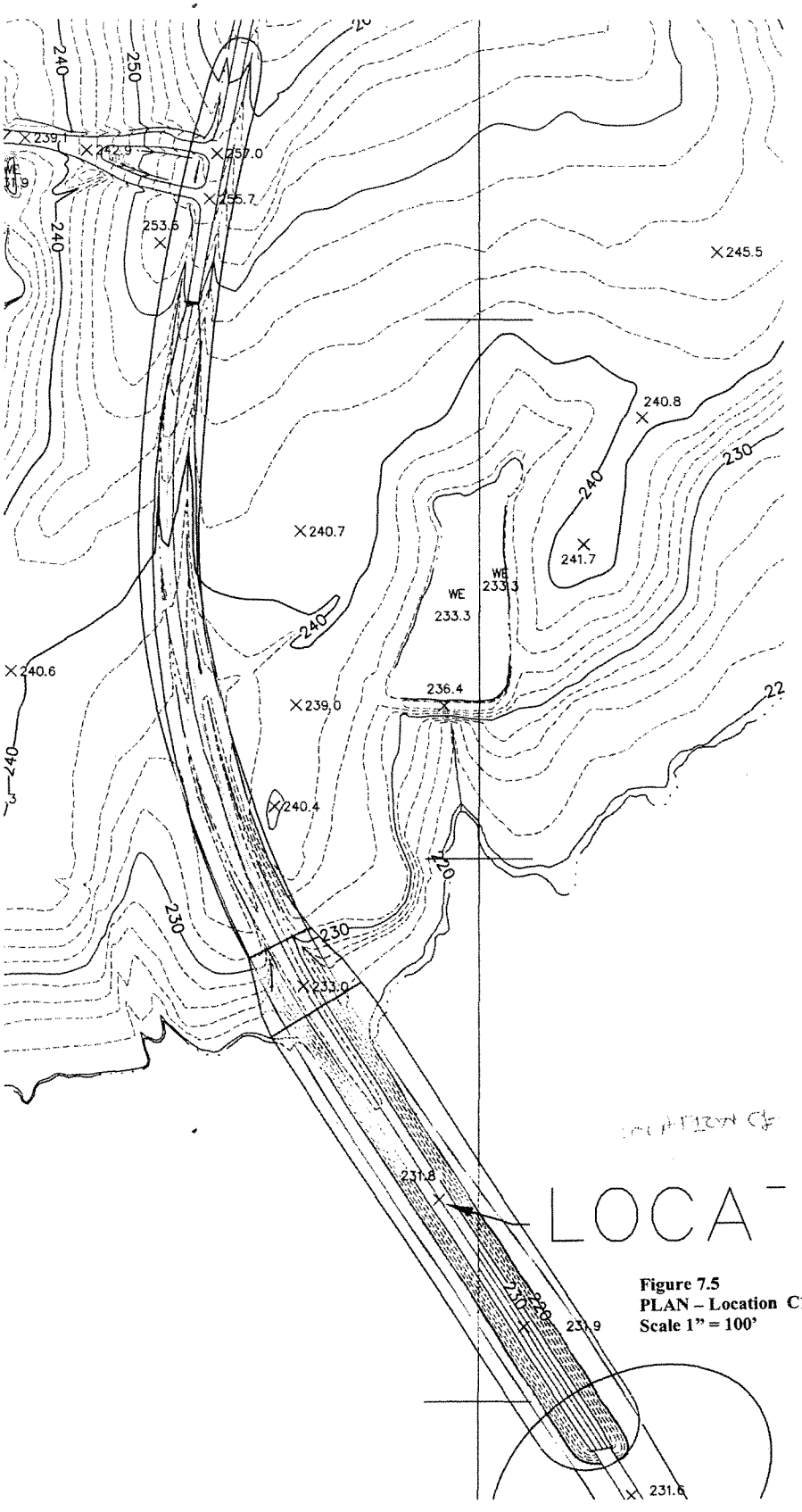

Figure 7.5
PLAN – Location C1
Scale 1" = 100'

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Figure 7.6
PLAN – Location C2
Scale 1" = 100'

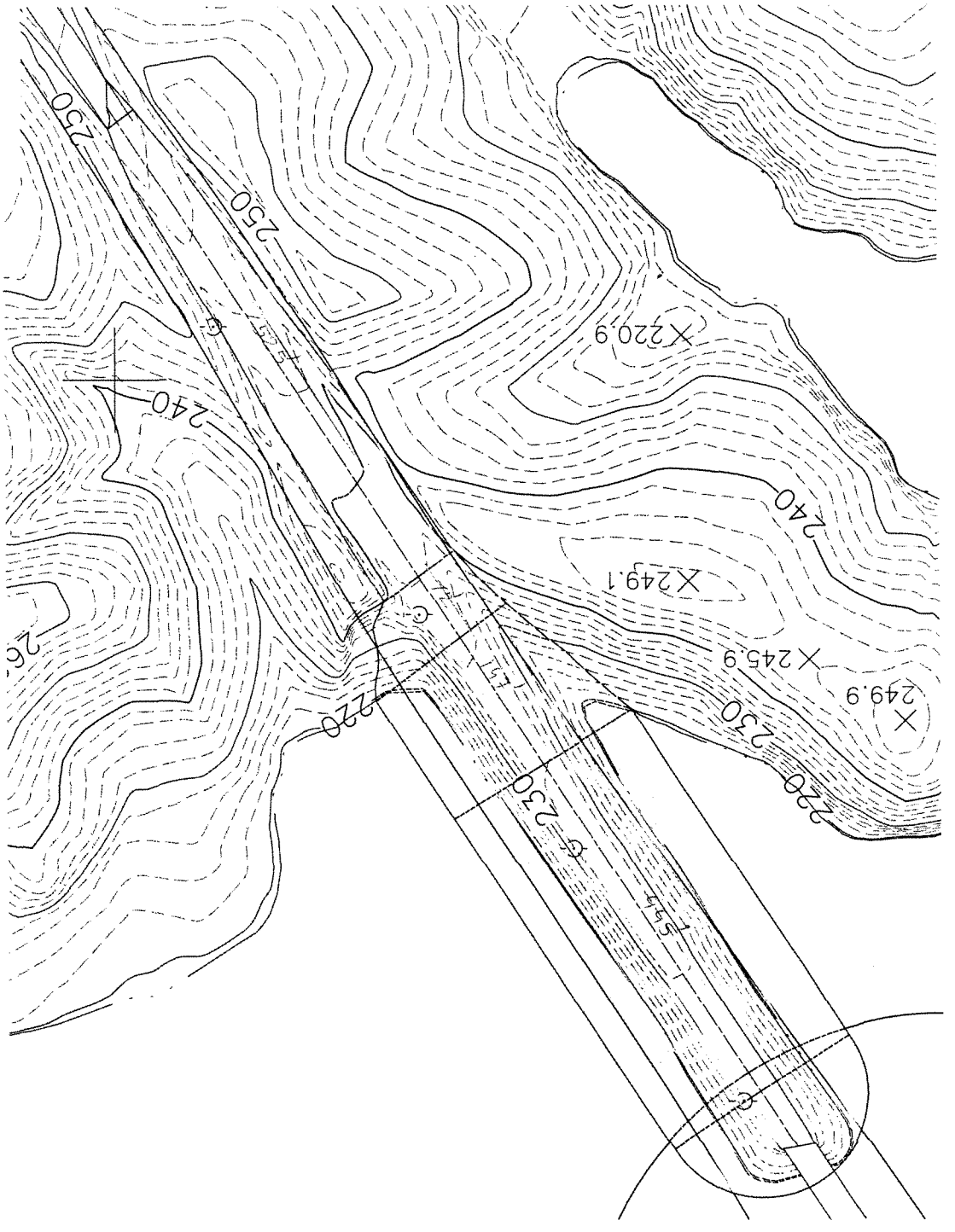

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Figure 7.7
PLAN – Location J
Scale 1" = 150'

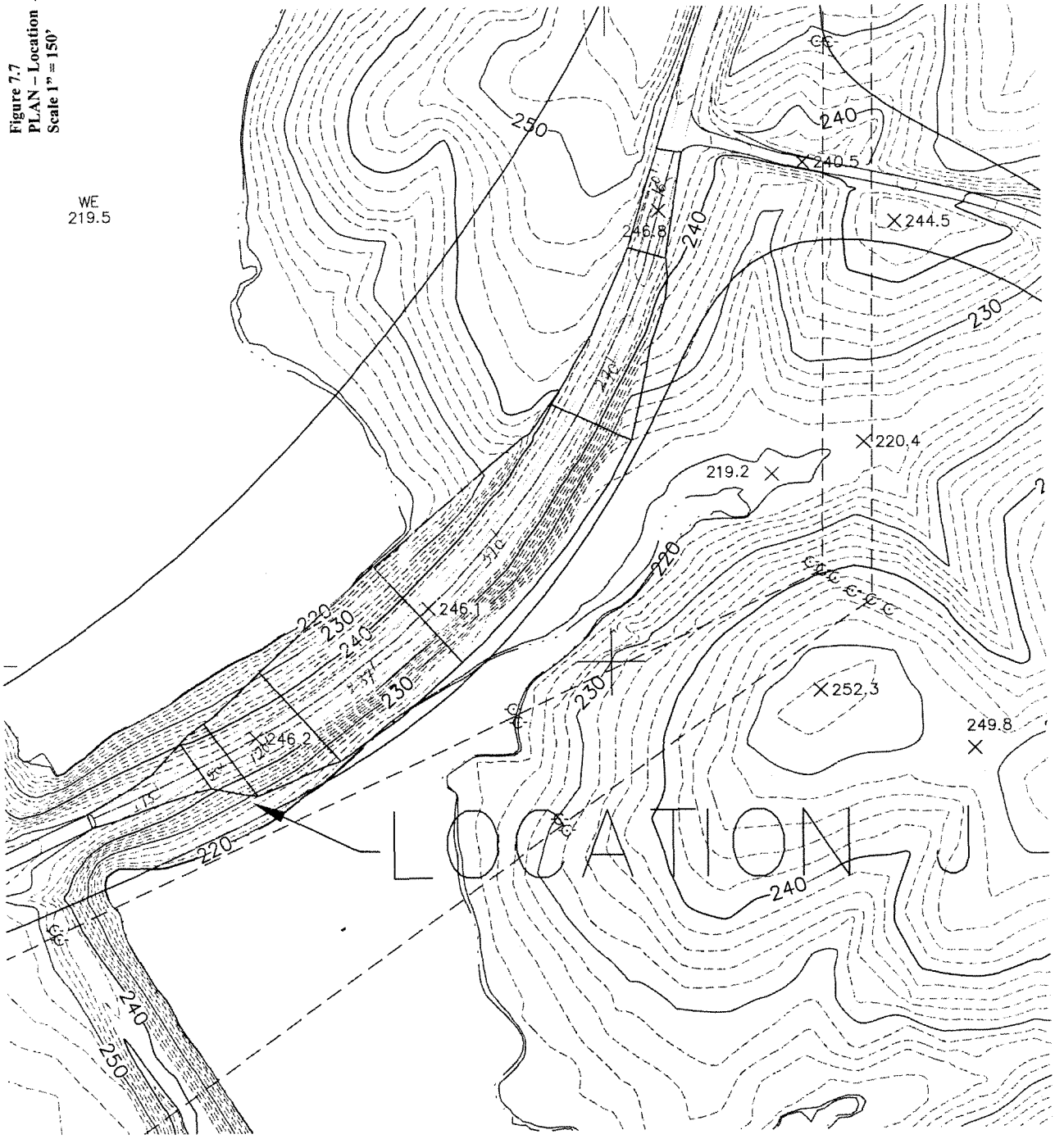

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Figure 7.8
PLAN – Location K
Scale 1" = 100'

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Figure 7.9
PLAN – Location L
Scale 1" = 100'

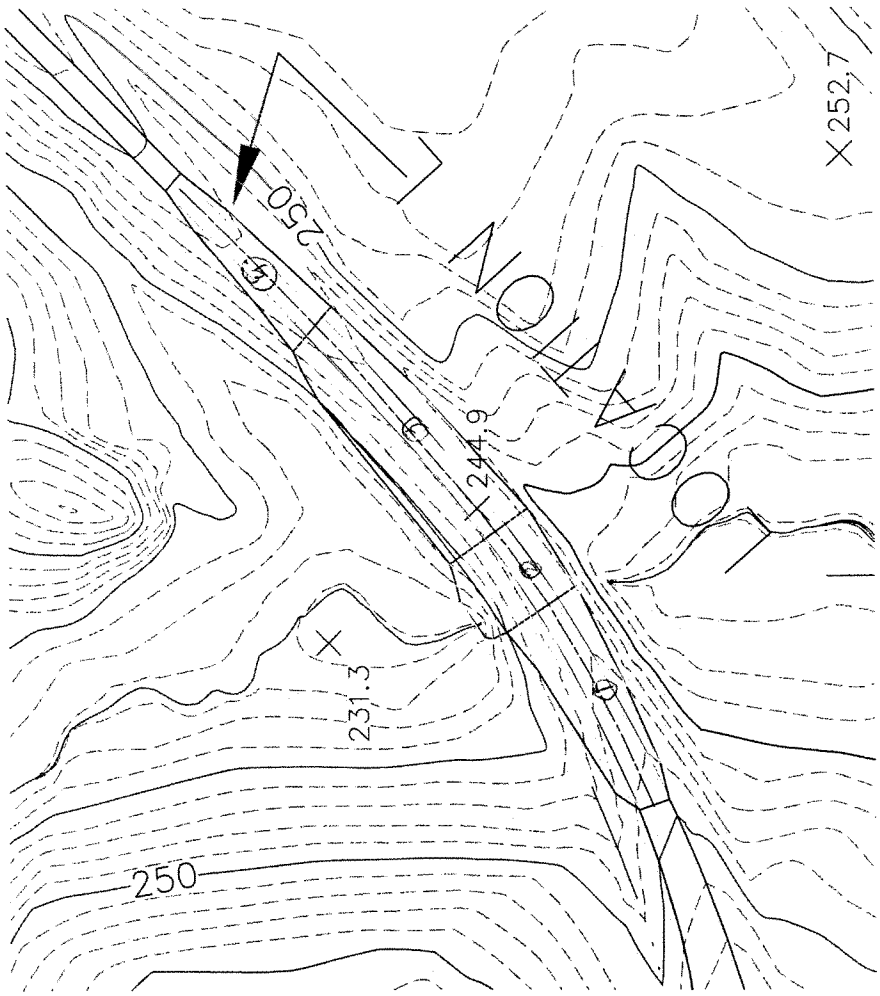

Figure 7.10
PLAN – Location M
Scale 1" = 100'

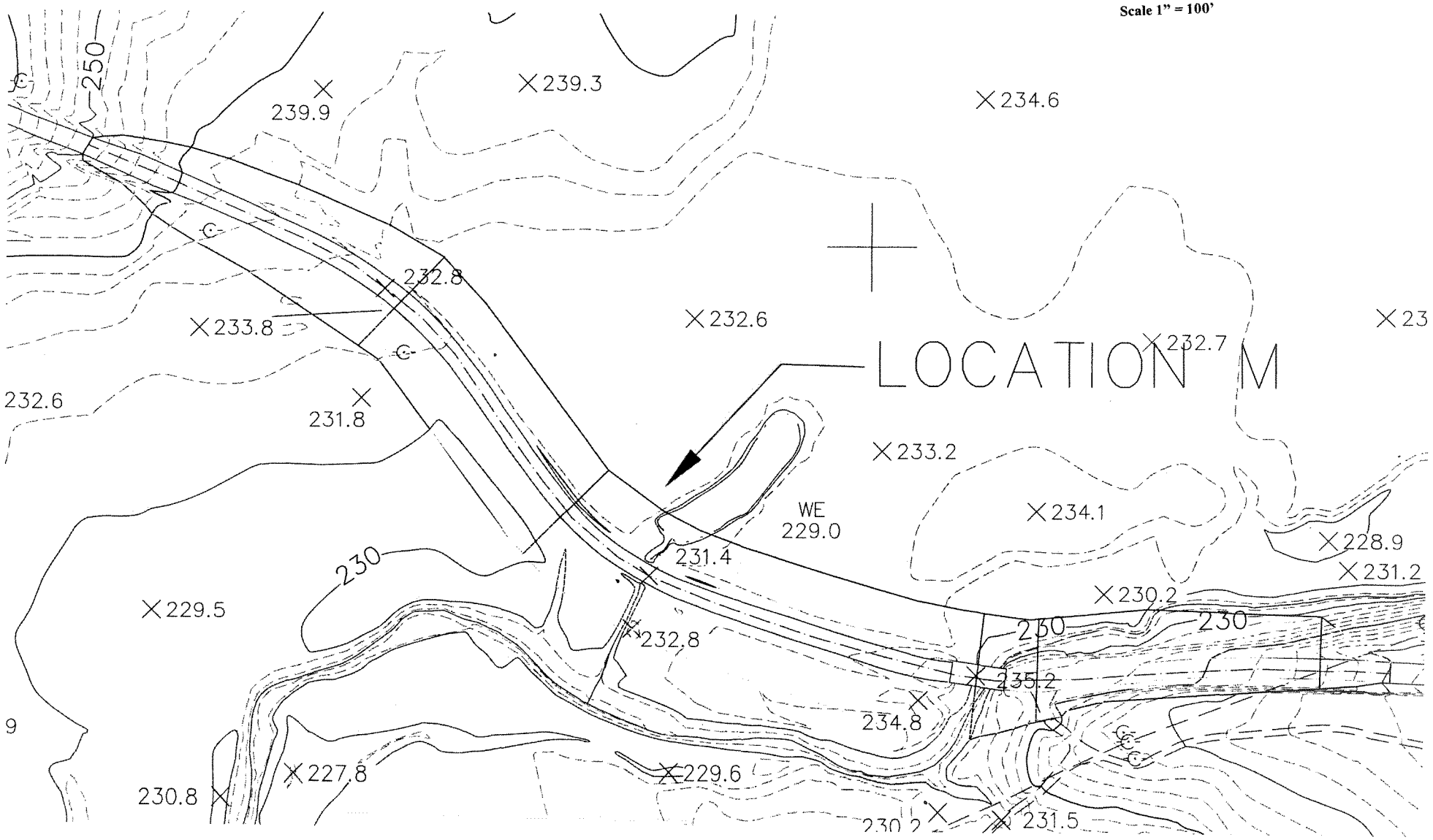

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Figure 7.11
PLAN – Location N
Scale 1" = 100'

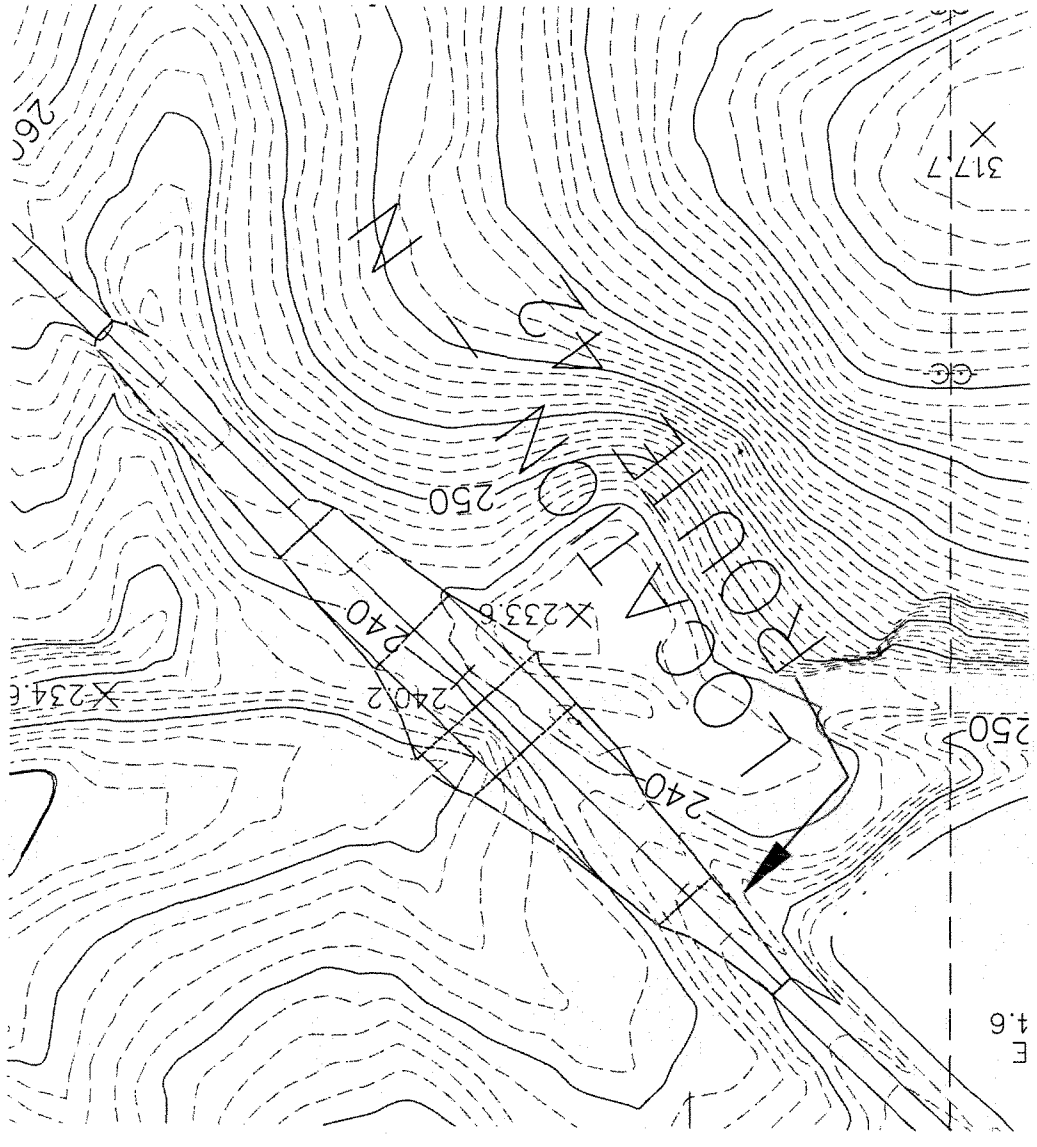
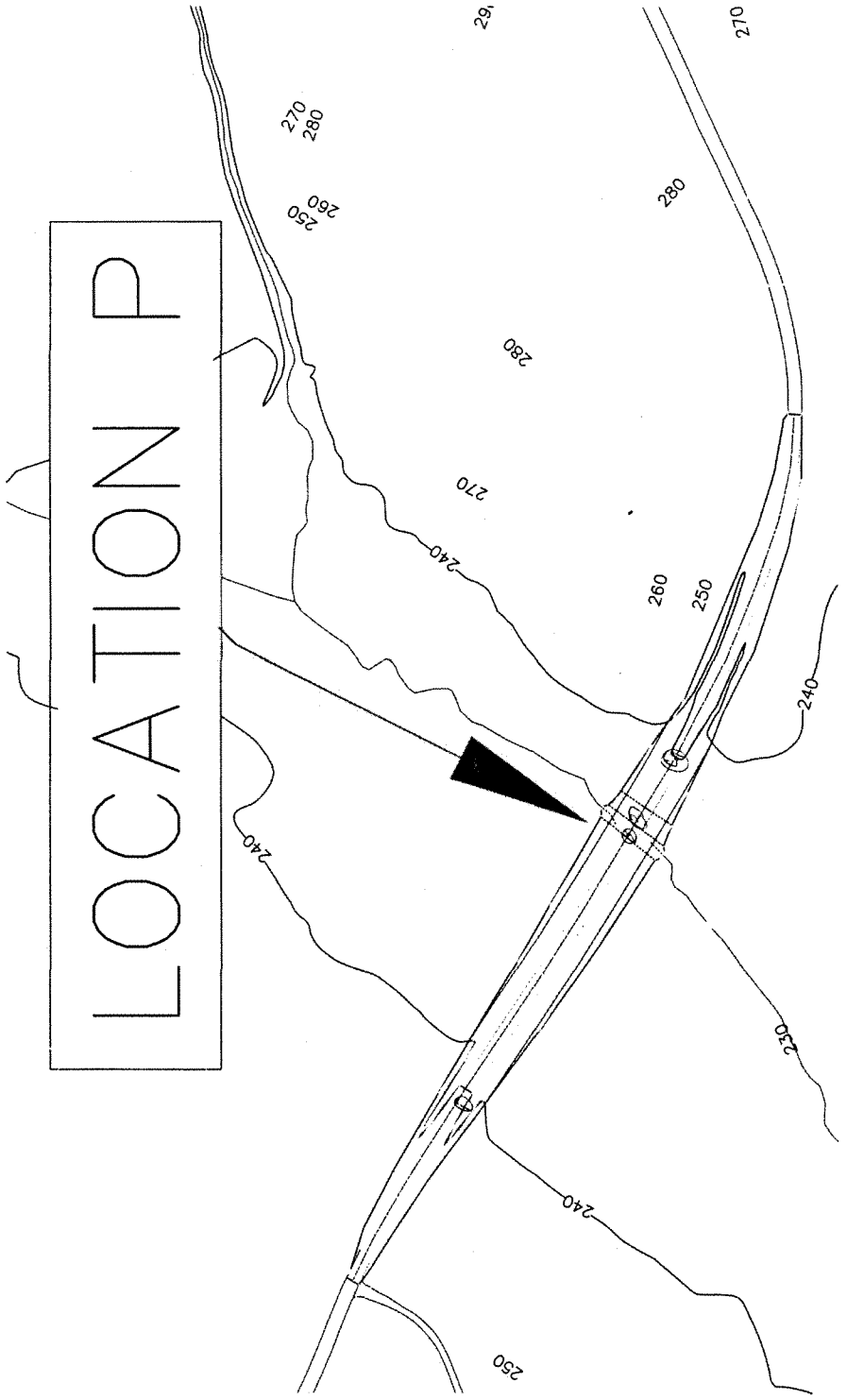


Figure 7.12
PLAN – Location O
Scale 1" = 120'

Figure 7.13
PLAN – Location P
Scale 1" = 200'



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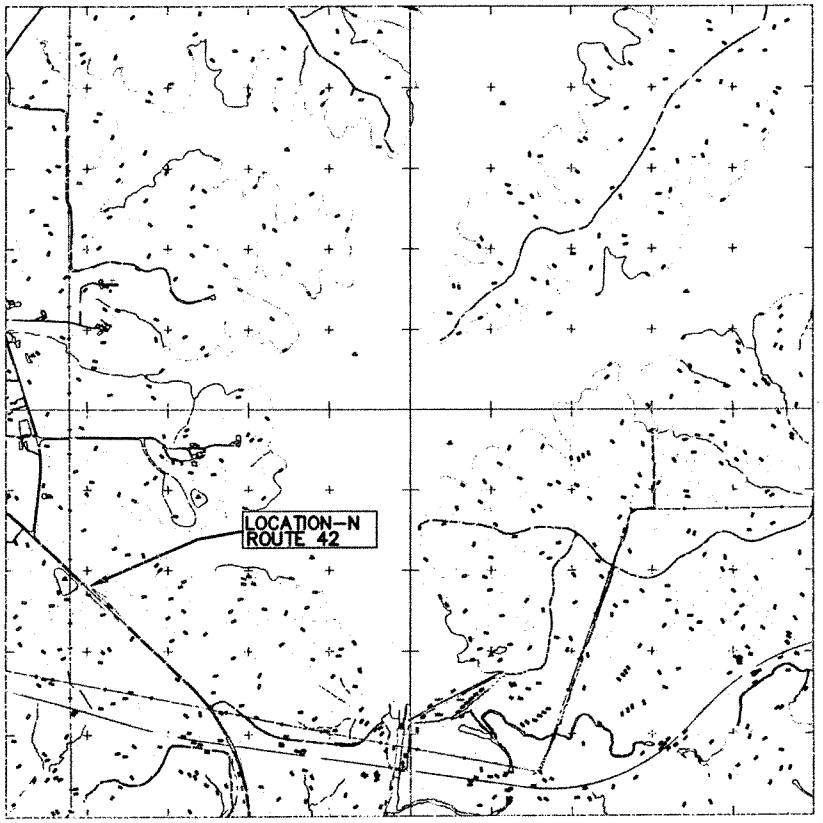

FIGUER – 8
SHEARON HARRIS NUCLEAR POWER PLANT
PROJECT # 12076-010
LOCATION MAP SHOWING LOCATIONS OF
LAKE AFFACTED ROADS & AREAS

0 2000 4000
SCALE

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HAR 2&3 RFI-158 Attachment G

Item Description:

Remedial Work for Plant Foundation

Includes excavation for the following items:

Containment, Auxiliary Bldg., Radwaste Bldg., Annex Bldg., Diesel Generator Bldg., Service Water Cooling Towers, Circ Water Lines, CW Cooling Tower, and Crane Pad

Excluded (covered by another estimate):

Transportation Pad, Circulating Water Pump House

Design Approach:

This work will entail the removal of the overburden soil and some weathered rock from the rough grade elevation down to the foundation grade level. All of the soil will be removed. The weathered rock will be examined and over-excavated as required to provide the design bearing pressure required for the specific structure. A 4" mudmat will be placed on all subgrade surfaces after inspection and approval.

Design Inputs:

Results of the CH2MHill subsurface investigation program are used to determine the thickness of soil overburden, depth to weathered rock, and depth to sound rock.

Assumptions:

- The weathered rock can support the respective design loads.
- Excavation slopes will be 2H: 1V in soil, 1H: 2V in the weathered rock, and 1H: 4V in the sound rock.
- Only minor cleaning of the subgrade (rock surface) will be required.
- No remediation of the underlying rock will be required, i.e., no grouting.
- No extensive dewatering will be required. The use of sumps and pumps will be adequate.

Enclosures:

1. Sketches

Sketches of excavation limits are provided.

2. Conceptual Calculation(s)

   Quantities based on graphic solutions.

3. References

   CH2MHill subsurface investigation report (not provided as yet).

4. Quantity Estimate

   - Placement of 4" mudmat (281,000 square feet)/ Plant Unit.
   - Excavation of 115,000 cubic yards of soil/ Plant Unit.
   - Excavation of 32,000 cubic yards of weathered rock/ Plant Unit.
   - Excavation of 64,000 cubic yards of rock/ Plant Unit.
   - Placement and compaction of 79,000 cubic yards of fill/ Plant Unit.

From EL (-)40 to (-)16
Volume: 1.05004e+006 Cubic ' 38,890 yd³ rock
Surface Area: 109158 Square '

Mass Per Volume: 1
Mass: 1.05004e+006

Centroid: (989543, 338796, -185.919)
Center Of Mass: (989543, 338796, -185.919)

Moments of Inertia: (3.4131e+009, 5.23315e+009, 8.54557e+009)
Products of Inertia IXY: -1.59982e+009 IXZ: 233227, IYZ 524683

Principal Moments: 2.48259e+009 (0.864418, -0.502774, -1.02575e-005)
Principal Moments: 6.16366e+009 (0.502774, 0.864418, 0.000239642)
Principal Moments: 8.54557e+009 (-0.000111619, -0.000212308, 1)

Radii of Gyration: (57.0126, 70.5957, 90.2126)

From EL (-)16 to (-)10
Volume: 655694 Cubic ' 24,285 yd³ rock
Surface Area: 228731 Square '

Mass Per Volume: 1
Mass: 655694

Centroid: (989693, 338862, -171.146)
Center Of Mass: (989693, 338862, -171.146)

Moments of Inertia: (4.71916e+009, 1.53506e+010, 2.00658e+010)
Products of Inertia IXY: -6.0081e+009 IXZ: 59363.2, IYZ 39506.2

Principal Moments: 2.01278e+009 (0.911766, -0.41071, 2.09936e-006)
Principal Moments: 1.8057e+010 (0.41071, 0.911766, 3.00678e-005)
Principal Moments: 2.00658e+010 (-1.42633e-005, -2.65526e-005, 1)

Radii of Gyration: (84.8363, 153.007, 174.935)

Volume: 358085 Cubic ' 13,262 weathered rock
Surface Area: 245969 Square '

Mass Per Volume: 1
Mass: 358085

Centroid: (989691, 338861, -166.651)
Center Of Mass: (989691, 338861, -166.651)

Moments of Inertia: (2.80006e+009, 8.72706e+009, 1.15266e+010)
Products of Inertia IXY: -3.39829e+009 IXZ: -128900, IYZ -10243.7

Principal Moments: 1.2546e+009 (0.910288, -0.413977, -1.10101e-005)
Principal Moments: 1.02725e+010 (0.413977, 0.910288, -4.99867e-005)
Principal Moments: 1.15266e+010 (3.07157e-005, 4.09443e-005, 1)

Radii of Gyration: (88.4282, 156.114, 179.414)

From EL (-)7 to (-)5
Volume: 296897 Cubic ' 10,996 weathered rock
Surface Area: 301111 Square '

Mass Per Volume: 1
Mass: 296897

Centroid: (989686, 338831, -164.155)
Center Of Mass: (989686, 338831, -164.155)

Moments of Inertia: (3.26378e+009, 6.47566e+009, 9.73923e+009)
Products of Inertia IXY: -2.67448e+009 IXZ: -2127.85, IYZ 3055.6

Principal Moments: 1.75012e+009 (0.870285, -0.492549, -4.2018e-007)
Principal Moments: 7.98931e+009 (0.492549, 0.870285, 9.2071e-007)
Principal Moments: 9.73923e+009 (-8.78184e-008, -1.00824e-006, 1)

Radii of Gyration: (104.847, 147.686, 181.117)

From EL (-)5 to EL 0
Volume: 889571 Cubic ' 32,947 yd^3 soil
Surface Area: 379478 Square '

Mass Per Volume: 1
Mass: 889571

Centroid: (989671, 338823, -160.608)
Center Of Mass: (989671, 338823, -160.608)

Moments of Inertia: (1.14168e+010, 2.40243e+010, 3.54374e+010)
Products of Inertia IXY: -9.86902e+009 IXZ: 458262, IYZ 382970

Principal Moments: 6.01012e+009 (0.877012, -0.480468, 7.40456e-006)
Principal Moments: 2.9431e+010 (0.480468, 0.877012, 9.2576e-005)
Principal Moments: 3.54374e+010 (-5.09737e-005, -7.76326e-005, 1)

Radii of Gyration: (113.288, 164.337, 199.591)

Cooling Tower
Volume: 33310.3 Cubic ' 1,234 yd^3 soil
Surface Area: 17136.7 Square '

Mass Per Volume: 1
Mass: 33310.3

Centroid: (989833, 339109, -160.452)
Center Of Mass: (989833, 339109, -160.452)

Moments of Inertia: (1.62133e+007, 2.32148e+007, 3.92916e+007)
Products of Inertia IXY: -4.18437e+006 IXZ: 0.00016524, IYZ -0.000804891

Principal Moments: 1.42584e+007 (0.906, -0.423277, 1.959e-011)
Principal Moments: 2.51697e+007 (0.423277, 0.906, -4.66856e-011)
Principal Moments: 3.92916e+007 (2.01244e-012, 5.05892e-011, 1)

Radii of Gyration: (22.0621, 26.3994, 34.3448)

Diesel Generator building

Volume: 29811.7 Cubic ' 1104 yd³ soil
Surface Area: 15501.5 Square '

Mass Per Volume: 1
Mass: 29811.7

Centroid: (989798, 338587, -160.442)
Center Of Mass: (989798, 338587, -160.442)

Moments of Inertia: (1.5203e+007, 1.5203e+007, 3.0284e+007)
Products of Inertia IXY: 0.00129093 IXZ: 0.000336856, IYZ -0.000198743

Principal Moments: 1.5203e+007 (0.903778, -0.428001, 2.58275e-011)
Principal Moments: 1.5203e+007 (0.428001, 0.903778, -2.35026e-012)
Principal Moments: 3.0284e+007 (-2.23365e-011, 1.31783e-011, 1)

Radii of Gyration: (22.5825, 22.5825, 31.8723)

Crane Mat

Volume: 132551 Cubic ' 4,909 yd³ soil
Surface Area: 63826 Square '

Mass Per Volume: 1
Mass: 132551

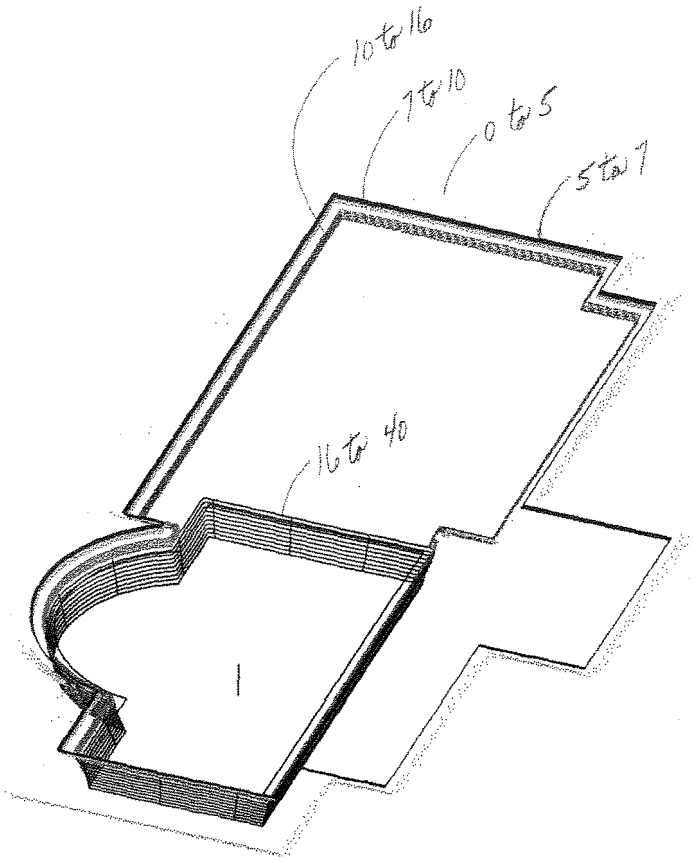
Centroid: (989448, 339016, -160.508)
Center Of Mass: (989448, 339016, -160.508)

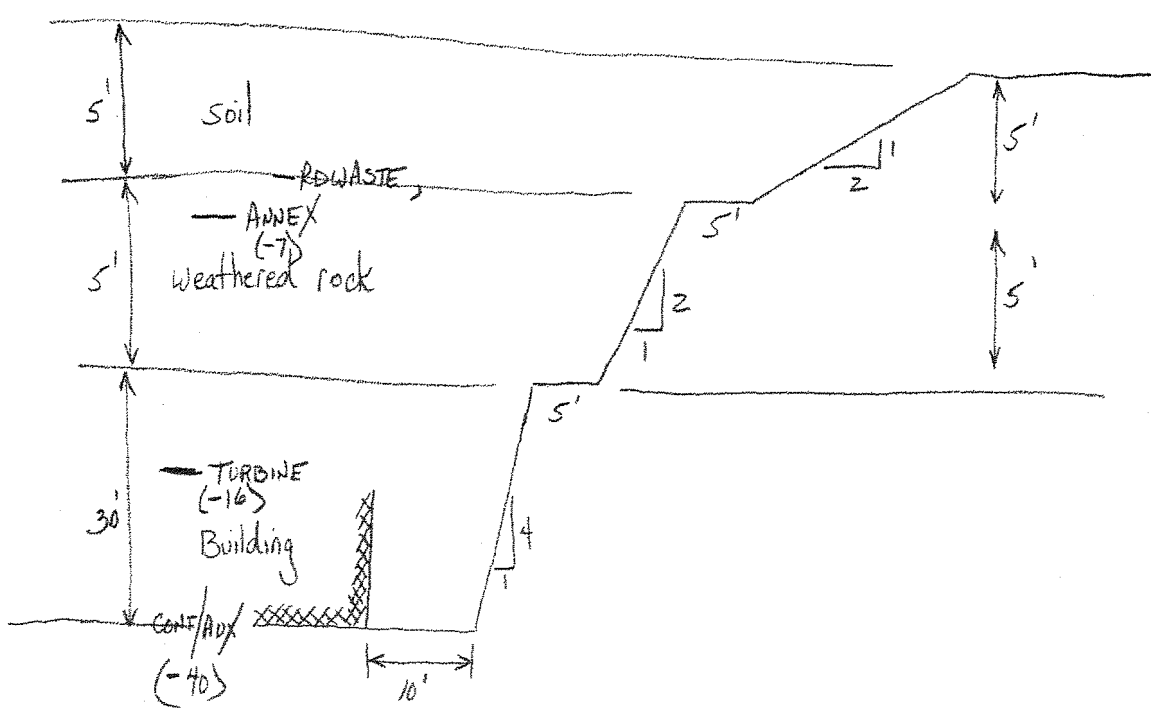
Moments of Inertia: (4.2034e+008, 5.63123e+008, 9.82916e+008)
Products of Inertia IXY: -8.63118e+007 IXZ: 38900.1, IYZ -82816.7

Principal Moments: 3.7972e+008 (0.904809, -0.425817, 0.000116814)
Principal Moments: 6.03742e+008 (0.425817, 0.904809, -0.000153937)
Principal Moments: 9.82916e+008 (-4.01456e-005, 0.000189026, 1)

Radii of Gyration: (56.3131, 65.1794, 86.1127)

Unit 2


10 to 16
7 to 10
0 to 5
5 to 7
16 to 40
1


5'
soil
RDWASTE
ANNEX
(-7)
5'
weathered rock
30'
TURBINE
(-16)
Building
CONT/AUX
(-40)
10'
4
1
5'
2
1
5'
5'
2
1
5'
5'

ROCK : 38,890 yd^3
24,285 yd^3

WEATHERED ROCK
13,262 yd^3
10,996 yd^3

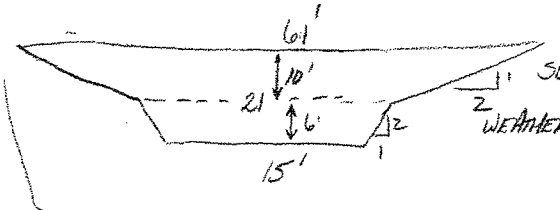
SOIL 32,947 yd^3
1,234 yd^3
1,104 yd^3
4,909 yd^3

127,627 yd^3 − 82,756 yd^3 (building, from FAR OPTION 1) = 78,641 yd^3 fill
+26,730
+ 7,040

Soil 10' deep with weathered rock below

Circ Water Lines

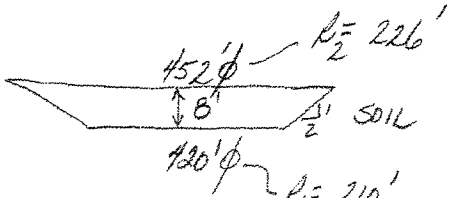
660' + 1100' = 1760 ft



SOIL $A_S = 410\ ft^2$ $V = 721{,}600\ ft^3 = 26{,}730\ yd^3$ SOIL

WEATHERED $A_W = 108\ ft^2$ $V = 190{,}080\ ft^3 = 7{,}040\ yd^3$ WEATHERED

Cooling Tower (-8ft)



$$V = \frac{\pi h}{3}\left(R_1^2 + R_1R_2 + R_2^2\right)$$

$$= \frac{\pi(8)}{3}\left[226^2 + 226(210) + 210^2\right]$$

$$= 1{,}195{,}000\ ft^3 = 44{,}257\ yd^3 \text{ SOIL}$$

Floor Area

$120{,}000\ ft^2$ (see Florida; Option 1)

Cooling Tower = $\frac{\pi(420)^2}{4} = 138{,}544\ ft^2$

Crane Pad = $7{,}228\ ft^2 + 14{,}575\ ft^2 = 21{,}803\ ft^2$

$\Sigma = 280{,}347\ ft^2$

HAR 2&3 RFI-158 Attachment H

Item Description:

Transport Pad, Haul Road, and Assembly Pads (Structural Input – Common to both Units)

Includes pads and excavation

Design Approach / Basis for Estimate:

Based on conceptual layout

Design Inputs:

Westinghouse general arrangement of AP1000 plant

Assumptions:

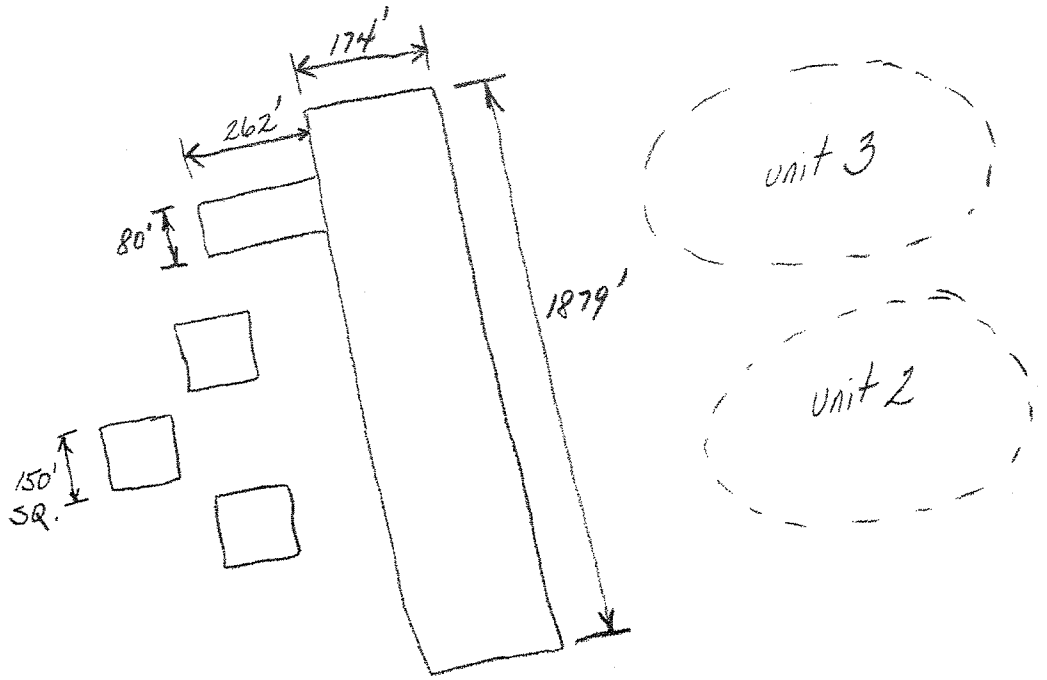
None

Enclosures:

1. Supporting sketch and calculation of cubic yards of concrete, cubic yards of granular subgrade material, and excavated material

2. Quantity Estimate

    - Excavation of 23,100 cubic yards of soil
    - Placement and compaction of 7,700 cubic yards of granular subgrade material
    - 38,500 cubic yards of concrete



1) $t = 2.5ft$ with 6" granular subgrade
2) 1 foot embedment

$$\text{AREA} = 3(150')^2 + (80')(262') + (174')(1879') = 415,406\ ft^2$$

$$\text{CONCRETE VOLUME} = \frac{(415,406\ ft^2)(2.5')}{27} = 38,464\ yd^3$$

$$\text{SUBGRADE MATERIAL} = \frac{(415,406\ ft^2)(.5')}{27} = 7,693\ yd^3$$

$$\text{EXCAVATED MATERIAL} = \frac{(415,406\ ft^2)(1.5')}{27} = 23,078\ yd^3$$

HAR 2&3 RFI-158 Attachment I

Item Description:

Lake Level Affected Transmission Towers

Design Approach / Basis for Estimate:

Replace affected Towers based on Lake level of 245ft.

Design Inputs:

Attachment.1

Assumptions:

Basis is a 100 year history of flood level of 245 ft.

Enclosures:

1. Sketches : N / A
2. Conceptual Estimate: Number of affected towers and foundations, refer to Attachment 1.
3. References : N/ A

Based on the preliminary estimate for Harris Plant #2, the following structures are affected, based on a maximum water level of 245 feet:

Line Name	# Str Affected
Cape Fear – Harris 230kV North	10
Cape Fear - Harris 230kV South	11
Harris Plant - Wake 230kV	9
Harris Plant - Siler City 230kV	13
Harris Plant - Apex US1 230kV	4
Harris - Ft. Bragg Woodruff St. 230kV	26
Harris Plant - Erwin 230kV	16
Total	**89**

*The 89 structure total does not include approximately 8 structures that will be on islands as a result of the water level increase. These structures might require relocation and/or foundations depending on soil conditions.

Of those 89 structures, 12 have existing foundations, ranging from 4 to 28 feet, with an average of 17 feet. (2 foundation depths are not indicated on P&P sheets)

Based on the 245 foot water level, 83 structures will require foundations; this includes replacing 11 existing foundations. The height of the foundations range from 3 to 48 feet with an average of 17 feet.

There are 3 OPGW splices located on structures affected by the 245 foot water level. In order for the OPGW splices to be located on dry land, splice one will need to move 2,100 feet, splice two 1,450 feet, and splice three 2,200 feet. The total of OPGW line needed to move the splices is 5,750 feet.

HAR 2&3 RFI-158 Attachment J

Item Description:

CWS Makeup and Discharge Piping.

The enclosed drawing HAR-M-001 shows both the Blowdown piping (highlighted) and the makeup piping preliminary routings. Sketch 2 shows a preliminary routing of the blowdown piping in Harris Lake.

Design Approach:

The conceptual design was performed by Worley Parsons and is shown in FSAR Figure 10.4.5-1, Revision X. The routing of the Makeup water piping and Blowdown piping was shown on drawing HAR-M-001 Revision 0.

Design Inputs:

- See Marley report CW-1. Piping and equipment commodities are identified in FSAR Figure 10.4.5-1.
- Flows are based on Marley information provided for a 365-foot diameter natural draft cooling tower. Cooling tower makeup flow is 28,000 gpm.

Assumptions:

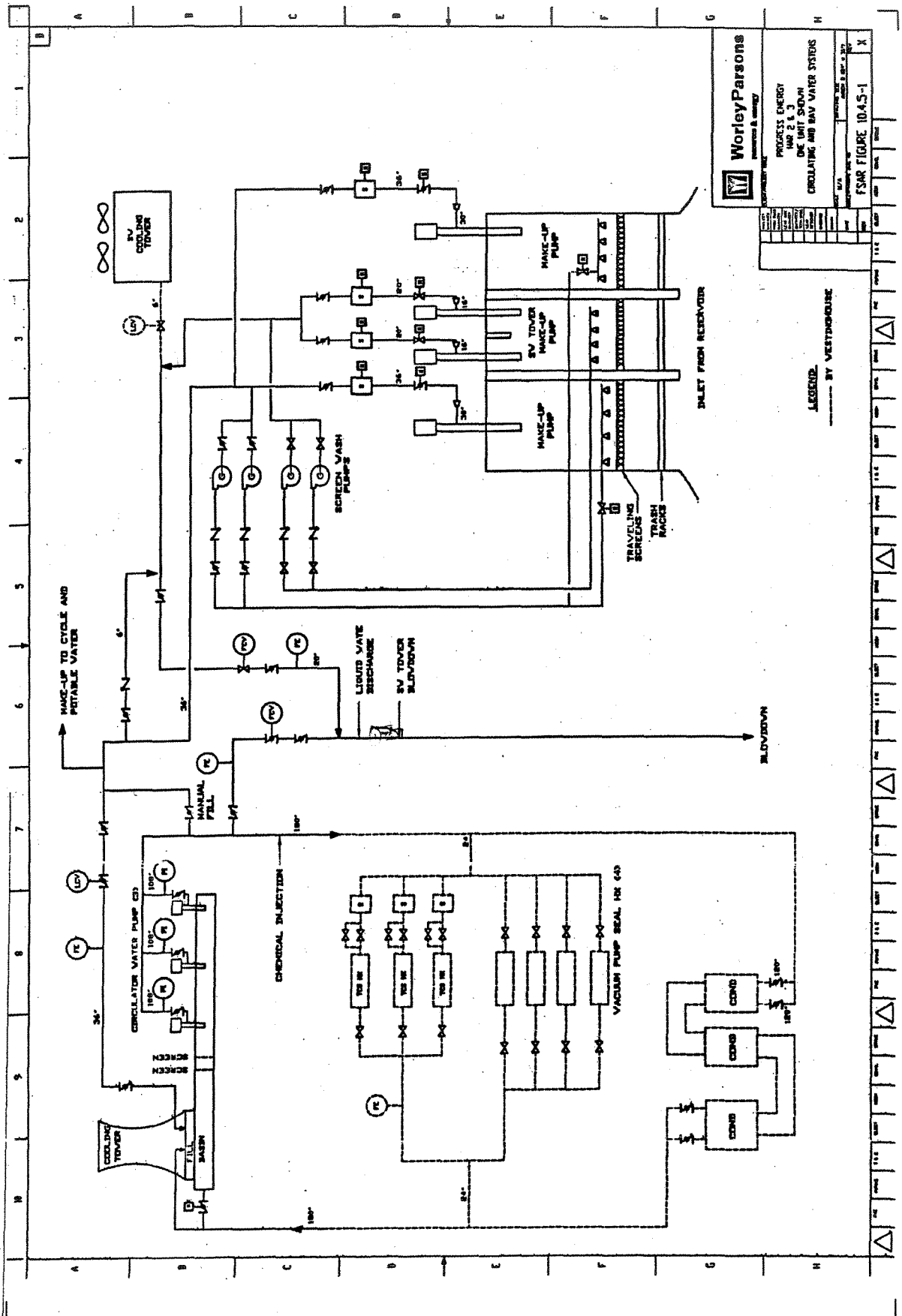
- Where not shown on the FSAR drawing, pipe sizes are estimated based from engineering experience with similar size systems in comparable applications.
- Pipe routing is estimated from engineering experience with similar plant layout.

Enclosures:

1. Sketches – HAR-M-001, HAR Units 2&3 General Arrangement; Sketch 2, Proposed Blowdown Pipe Routing in Harris Lake.

2. Conceptual Calculation(s) – WorleyParsons Design Input CW-1, Cooling Water Systems, Site Dependent

3. References – FSAR Figure 10.4.5-1, entitled Progress Energy HAR 2&3 One Unit Shown Circulating and Raw Water Systems.



RFI-158 Attachment J
Page 2 of 29

DESIGN INPUT

SUBJECT:	Cooling Water Systems, Site Dependent	IDENTIFIER:	CW-1
DISCIPLINE:	Mechanical	CLASSIFICATION:	Non-Safety
PROJECT:	Progress Energy-Shearon Harris Unit 2 & 3 COLA		
JOB NUMBER:	537828	WBS NUMBER:	30

DESIGN INPUT COVER SHEET

REVISION	0	1	2
Item(s)	N/A		
Assumptions/data requiring confirmation?	No		

Originator / Date	8/2/06		
Reviewer / Date	8/8/06		
Interface review date	N/A		
Approval by PUL / Date	8-8-06		

RFI-158 Attachment J
Page 3 of 24

DESIGN INPUT CHECKLIST

SUBJECT:	Cooling Water Systems, Site Dependent	IDENTIFIER:	CW-1
DISCIPLINE:	Mechanical	CLASSIFICATION:	Non-Safety
PROJECT:	Progress Energy-Shearon Harris Unit 2 & 3 COLA		
JOB NUMBER:	537828	WBS NUMBER:	30

APPLICABLE DESIGN INPUT REQUIREMENTS FOR NUCLEAR PROJECTS:

(Y)	(N)		(If Yes, complete explanation, including references, on DIR, Form NEP1-3. Note: items 1, 2 and 3 are applicable)
☒		1.	Scope/Basic functions of structure, system or component
☒		2.	Performance requirements such as capacity, rating, system output.
☒		3.	Codes Standards, and regulatory requirements including applicable issue and/or addenda
☒	☐	4.	Design Conditions such as temperature, pressure, fluid, chemistry and voltage
☒	☐	5.	Loads such as seismic, wind, thermal and dynamic
☒	☐	6.	Environmental conditions anticipated, such as pressure, temperature, humidity, corrosiveness, site elevation, wind direction, nuclear radiation, electromagnetic radiation, and duration of exposure including 10CFR50.49 application
☒	☐	7.	Interface requirements including definition of the functional and physical interfaces including structures, systems, and components. Functional interfaces include input services (air, electricity)
☒	☐	8.	Material requirements such items as compatibility, electrical insulation properties, protective coating, and corrosion resistance
☒	☐	9.	Mechanical requirements such as vibration, stress, shock and reaction forces
☒	☐	10.	Structural requirements covering such items as equipment foundations and pipe supports
☒	☐	11.	Hydraulic requirements such as NPSH, allowable pressure drops, and fluid velocities
☒	☐	12.	Chemistry requirements such as provisions for sampling and limitations on water chemistry
☒	☐	13.	Electrical requirements such as source of power, voltage, raceway requirements, electrical insulation, motor requirements.
☒	☐	14.	Layout and arrangement requirements
☒	☐	15.	Operational requirements under various conditions such as plant start-up, normal plant operation, plant shutdown, plant emergency operation, special or infrequent operation, and system abnormal or emergency operation
☒	☐	16.	Instrumentation and control requirements including indicating instruments, controls and alarms required for operation, testing and maintenance.
☐	☒	17.	Access and administrative control requirements required for plant security
☐	☒	18.	Redundancy, diversity, and separation requirements
☐	☒	19.	Failure effects requirements including a definition of those events and accidents which structures, systems and components must be designed to withstand
☐	☒	20.	Test requirements including pre-operational and subsequent periodic in-plant and the condition under which they must operate
☐	☒	21.	Accessibility, maintenance, repair and in-service inspection requirements
☐	☒	22.	Personnel requirements and limitations

DESIGN INPUT CHECKLIST

SUBJECT:	Cooling Water Systems, Site Dependent	IDENTIFIER:	CW-1
DISCIPLINE:	Mechanical	CLASSIFICATION:	Non-Safety
PROJECT:	Progress Energy-Shearon Harris Unit 2 & 3 COLA		
JOB NUMBER:	537828	WBS NUMBER:	30

APPLICABLE DESIGN INPUT REQUIREMENTS FOR NUCLEAR PROJECTS:

(Y)	(N)	(If Yes, complete explanation, including references, on DIR, Form NEP1-3. Note: items 1, 2 and 3 are applicable)
☐	☒	23. Transportability requirements such as size and shipping weight limitations
☒	☐	24. Fire protection or fire resistance requirements
☐	☒	25. Handling, storage, cleaning and shipping requirements
☐	☒	26. Other requirements to prevent undue risk to the health and safety of public
☐	☒	27. Materials, processes, parts, and equipment suitable for the application
☐	☒	28. Safety requirements for preventing personnel injury including such items as radiation hazards, restricting the use of dangerous materials, escape provisions for enclosures and grounding of electrical systems
☒	☐	29. OTHER requirements, as necessary
☐	☐	30.

RFI-158 Attachment J
Page 5 of 29

DESIGN INPUT RECORD

SUBJECT:	Cooling Water Systems, Site Dependent	IDENTIFIER:	CW-1
DISCIPLINE:	Mechanical	CLASSIFICATION:	Non-Safety
PROJECT:	Progress Energy-Shearon Harris COLA		
JOB NUMBER:	537828	WBS NUMBER:	30

1. Scope/Basic Function:
    a. Provide cooling water for the turbine plant and makeup water to the service water cooling tower.
2. Performance Requirements:
    a. Supply adequate water to the Condenser and Turbine Building Closed Cycle Cooling heat exchangers for cooling.
    b. Provide a nominal cooling tower blowdown flow of 6000 gpm for liquid waste discharge. (DCD section 11.2.3.3)
3. Codes/Standards:
    a. ANSI B31.1, Power Piping
    b. AWWA C207, Steel Flanges
    c. AWWA C301/302/303, Concrete pipe
    d. AWWA C504, Butterfly Valves
4. Design Conditions:
    a. Temperature: circulating water max temp = 92°F (Westinghouse 6/21/06 E Mail)
    b. Wet Bulb temperature 77°F, Relative Humidity 50% for cooling tower (Shearon Harris FSAR Table 10.4.5-1)
5. Seismic, environmental loads: Although the system is Non-Seismic, the cooling tower shall be able to withstand the maximum gradient overland wind speed of 123 mph (Ref. FSAR 2.4.5.1). There are no other environmental qualifications required for the circ water system.
6. Environmental conditions (from FSAR Table 2.4.11-2):
    a. Wet bulb temperature: Min normal average = 36.9°F, Max normal average = 70.9°F
    b. Dry bulb temperature: Min normal average = 41.6°F, Max normal average = 77.9°F
7. Interface:
    a. Functional interfaces:
        i. Input services: Electrical power will be required for pumps, valves, and sensors as necessary. Air supply will be required if air operated equipment is used for system control or monitoring
    b. Physical interfaces:
        i. A new intake structure is required for cooling tower make-up, see attached 3/1/06 memo.
        ii. The liquid waste line from the plant connects to the blowdown piping for dilution before discharge.
        iii. Route the cooling tower blowdown to the reservoir through a new blowdown line.
        iv. The make-up pump discharge must provide an alternate source of dilution flow for the plant liquid wastes. (DCD section 11.2.2.1.1)

DESIGN INPUT RECORD

SUBJECT:	Cooling Water Systems, Site Dependent	IDENTIFIER:	CW-1
DISCIPLINE:	Mechanical	CLASSIFICATION:	Non-Safety
PROJECT:	Progress Energy-Shearon Harris COLA		
JOB NUMBER:	537828	WBS NUMBER:	30

v. Connect circulating water piping to Westinghouse turbine plant 108" steel turbine plant circulating water inlet and discharge piping (Ref. FSAR 10.4.5.2).

8. Material requirements:
   a. Reinforced concrete pressure piping for the underground portions of the system.
   b. Remainder of system piping to be carbon steel with an internal corrosion-resistant coating.
9. Mechanical requirements:
   a. Vertical wet pit pumps will be used for make-up and circulating water services
   b. A natural draft cooling tower will be used for circulating water. See the attached 3/27/06 memo.
   c. Provide trash racks and traveling screens (with 3/8" screen openings, Ref. 4/20/06 email) to remove debris from the water entering the intake structure.
   d. Provide self cleaning strainers, with 1/16" openings (Ref. FSAR 10.4.5.2), on the make-up water pump discharges.
   e. Provide screens ahead of the circulating water pumps to remove any debris that may enter the cooling tower basin.
10. Structural requirements:
   a. Circulating Water Pump House and Cooling Towers (both non-seismic), DCD Table 3.2-2.
   b. Intake structure: Non-seismic structure shall be designed for two units.
11. Hydraulic requirements:
   a. NPSH:

      Adequate submergence of pumps shall provide required NPSH.
   b. Pressure drops / Fluid velocities:

      TDH of pumps shall be based on system pressure drop plus an engineering margin.

      Nominal velocity of fluid shall be 7 to 8 fps.
   c. Required flows based on two AP1000 units are tabulated below:

RFI-158 Attachment 1
Page 7 of 29

DESIGN INPUT RECORD

SUBJECT:	Cooling Water Systems, Site Dependent	IDENTIFIER:	CW-1
DISCIPLINE:	Mechanical	CLASSIFICATION:	Non-Safety
PROJECT:	Progress Energy-Shearon Harris COLA		
JOB NUMBER:	537828	WBS NUMBER:	30

Service	Quantity (1)	Reference	Notes
Cooling Tower Evaporation	28,000 gpm	Marley 4/21/06 E Mail = 5% margin and rounded up	
Cooling Tower Blowdown	13,880 gpm/49,000 gpm max	Value at 3 concentrations, Max from PPE item 2.5.4	Returned to reservoir
Service Water Tower Evaporation	264 gpm norm./ 940 gpm max.	Westinghouse 7/13/06 E Mail	
Service Water Tower Blowdown	88 gpm/312 gpm max.	~40% of evaporation	Westinghouse should confirm value
Sanitary waste Disch.	30 gpm/69 gpm max	PPE 5.1.1	S&L to confirm value
Raw water Use	69 gpm	PPE 5.2.1	S&L to confirm value
Demin Water discharge	50 gpm/140 gpm max	PPE 6.1.1	S&L to confirm value
Raw water to make-up Demin.	400 gpm/150 gpm avg.	PPE 6.2.1	S&L to confirm value
Fire Protection	625 gpm	PPE 7.1.1	S&L to confirm value

(1) Two unit flow, divide by 2 for single unit flow

12. Chemistry requirements:
    a. Sampling to verify water quality (DCD 9.2.8.2.1 & 9.3.4).
    b. Chemical injection from turbine island chemical feed system to various points in the circulating water system (DCD 10.4.5.2.2).
13. Electrical requirements:
    a. Non-Safety AC source to power circulating water pumps, make-up water pumps, screen wash pumps, traveling screens, and self cleaning strainers.
14. Layout and arrangement requirements:
    a. Maintain one (1) tower diameter between natural draft towers.
    b. Locate new intake structure to take suction from main reservoir.
    c. Maximum through-screen velocity is 0.5 fps. (EPA 316b)
15. Operational requirements:
    a. Provide two (2) 100% capacity pumps to provide make-up-water to the service water cooling tower basin during outages and startup without operating the main make-up water pumps and to provide the required dilution flow of 6000 gpm for liquid waste discharge.
    b. Two (2) 100% capacity pumps to provide make-up water to the main cooling tower basin for the circulating water system.

DESIGN INPUT RECORD

SUBJECT:	Cooling Water Systems, Site Dependent	IDENTIFIER:	CW-1
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PROJECT:	Progress Energy-Shearon Harris COLA		
JOB NUMBER:	537828	WBS NUMBER:	30

c. Three (3) individual 1/3 capacity vertical pumps to provide water from the cooling tower to the circulating water system (200,000 gpm capacity per pump for total circ water system flow of 600,000 gpm, Ref. DCD Table 10.4.1-1).

16. Instrumentation & control requirements:
    a. Indicating instruments/controls:
        i. Level indication on circ water intake structure.
        ii. Valve position indicators on circulating water pump isolation MOVs.
        iii. Pressure and temperature indications at discharge of each circulating water pump.
        iv. Flow indication for make-up and blowdown flows.
    b. Alarms: Alarm on excess level drop across traveling screen.
    c. Automatic start of screen wash pump and traveling screen from level drop across screen.
17. Access/Admin control requirements: N/A
18. Redundancy/Diversity/Separation requirements: N/A
19. Failure effects requirements: N/A
20. Test requirements: N/A
21. Accessibility/maintenance/repair/in-service requirements:
    a. No special inspection / testing / maintenance activities are required for Class E systems (DCD Table 5.2-1).
    b. Safe accessibility to equipment is to be considered during piping layout phase of the design.
22. Personnel requirements: N/A
23. Transportability requirements: N/A
24. Fire protection/fire resistance requirements:
    a. Fire protection is required for cooling tower fill if combustible.
25. Handling/storage/cleaning/shipping requirements: N/A
26. Other requirements to prevent risk to public health/safety: N/A
27. Materials/processes/parts/equipment suitable for application: N/A
28. Safety requirements: N/A
29. Other
    a. Expansion joints shall be installed on the discharge of vertical pumps to facilitate fit-up with discharge piping.

DESIGN INPUT RECORD

SUBJECT:	Cooling Water Systems, Site Dependent	IDENTIFIER:	CW-1
DISCIPLINE:	Mechanical	CLASSIFICATION:	Non-Safety
PROJECT:	Progress Energy-Shearon Harris COLA		
JOB NUMBER:	537828	WBS NUMBER:	30

Attachments

1. Memo on Intake Structure, dated 3/1/06, Ed Toll
2. Memo on Cooling Tower Type, dated 3/27/06, Ed Toll
3. Westinghouse E Mail dated 6/21/06 to A. K. Singh on impact of increased approach temperature
4. Westinghouse E Mail to A. K. Singh dated 7/13/06 on advanced response to S&L requests
5. SPX E Mail to E. B. Toll dated 4/21/06 on cooling tower capacities
6. US Filter E Mail dated 4/20/06 regarding screen sizing

RFI-158 Attachment JT
Page 10 of 29

MEMORANDUM

DATE	March 1, 2006
TO	John Ioannidi
FROM	Ed Toll
COPY	
PROJECT	000/00000
SUBJECT	Intake Structure for COLA Units
DOC NO	
FILE LOC	Attachment to Cooling Water Systems Design Input

Review of feasibility of using existing intake for 1st new unit

The original Shearon Harris ESW and CT makeup intake structure was designed for four units according to discussions with Progress Energy. The structure was to have fourteen intake bays and the seven bays on the East side were completed structurally for the construction of SHNPP unit 1. (FSAR figure 3.8.4-41)

Two of the completed bays are used for the unit 1 cooling tower makeup pumps, with a capacity of 26,000 gpm each, and two of the completed bays are used for the Emergency Service Water pumps with a capacity of 21,000 gpm each. (FSAR section 3.8.4.1.12-3) FSAR figure 9.2.1-1 indicates that the ESW pumps are installed in bays 8 and 6. This leaves two of the ESW bays available for use, but with a unit 1 ESW pump located between them, and one makeup pump bay available for use. The unit 1 ESW pump bays in the intake structure are safety related and the new units do not require any safety related cooling water systems

Recommendation for new units

A new independent intake structure for the new units is recommended for numerous reasons as noted below:

- The existing intake structure has only one spare non-safety bay for use as a cooling tower makeup source and two 100% pumps are planned for the new unit.
- Use of the spare ESW pump bays is undesirable because it requires construction of a non-safety system within the safety related areas of the operating unit.
- Piping to the new unit would have to be constructed next to the unit 1 piping and within the unit 1 fence. The same concern applies to power to the new unit pumps and controls.
- The existing bays may not be the optimum size for the new unit pumps. Pump bay dimensions are normally related to the suction bell diameter for vertical pumps.
- Installing the traveling screens and pumps for the new units would require lifting the equipment over the operating plant components including Safety related components.
- Construction of a new intake structure is still required for the second new unit and the use of the same component designs for both new units may be compromised by the need to fit components within the existing intake structure.

MEMORANDUM

- The existing makeup intake structure is located south of the operating unit and the new units are proposed for a location north of the existing unit which would require a circuitous route for piping and power feeds as well as the potential for numerous interferences with buried services associated with the operating unit
- The Cooling tower Makeup pumps for the new units have significantly different flows than those for the operating unit. The use of a new intake structure will permit the use of other makeup pump sizing, such as 3-50% pumps/unit, which may be better suited to the requirements of the new units if a wet/dry tower is a viable alternate cooling tower type.
- There are no safety related cooling water pumps for the AP1000 plant and therefore a safety related intake is not required.
- A new intake structure provides the flexibility to add other services such as fire pumps if desired for site related services.
- Provides the ability to add low load makeup water pumps for use during start-up and/or operation with other cooling tower configurations such as wet/dry that have reduced evaporation during colder weather conditions.

The following SHNPP documents were reviewed in the process of arriving at this recommendation:
Drawing CAR-2165-G-003, Site Plan
FSAR Chapters 3.8.4, 9.2.1, and 10.4.5
FSAR Figures 3.8.4-28, 3.8.4-29, 3.8.4-41, 9.2.1-1, 9.2.1-2

MEMORANDUM

DATE	March 27, 2006
TO	John Ioannidi
FROM	Ed Toll
COPY	
PROJECT	53782830
SUBJECT	Subject Cooling Tower Type
DOC NO	
FILE LOC	Attachment to Cooling System Design Input.

Review of Cooling Tower Type Selection for AP1000 COLA

The following potential cooling tower types for use at the COLA site were discussed with SPX (Marley):

- Natural Draft Tower
- Wet/Dry tower
- Natural Draft Dry Tower

Mr. Jim VanGarsse, the Northeast Regional Manager for SPX, provided the following information to the writer:

- Freezing weather is a problem with the dry tower and only one Natural Draft Dry tower has ever been built. That tower is located in South Africa.
- A natural Draft wet/dry tower has never been built. If this type of tower was selected it would be a first of the kind.
- A fan assisted wet/dry tower can be built but the cost would be 2 to 3 times that of a wet natural draft tower. The fan assisted wet dry tower could save up to 50% of the evaporation. (Based on the site weather conditions, the writer estimates that the approximate maximum reduction in evaporation is 30% without impacting the cold water temperature. Higher cold water temperatures would reduce generation output. The fan assisted tower would also reduce the available plant output by increasing the house load. The mechanical draft wet/dry tower for one unit would have a footprint of approximately 1700 ft x 750 ft and use 48-250 BHP motors.

Recommendation for new units

A conventional Natural Draft tower for the new units is recommended for the following reasons:

- Use a proven technology for plant reliability
- Significantly higher cost associated with a wet/dry tower

- Larger footprint required for a wet/dry tower with additional space between units to minimize recirculation and allow for proper orientation to prevailing wind direction.
- Additional house load for fans with a wet/dry tower

Toll, Edward B. (Reading)

From: ANAND.K.SINGH@sargentlundy.com
Sent: Thursday, June 22, 2006 10:04 AM
To: Ioannidi, John (Reading); Toll, Edward B. (Reading)
Cc: Kristie.Hedden@ch2m.com; CYNTHIA.L.MALECKI@sargentlundy.com
Subject: Fw: DCP/NUS0164 WEC Response to Progress Energy's Query Pertaining t o the Potential Impact of an Increased Approach Temperature for a Natural Draft Cooling Tower
Attachments: 7096.doc

A. K. Singh
312 269 7517
312 269 7313 Fax

---- Forwarded by ANAND K SINGH/Sargentlundy on 06/22/2006 09:03 AM ----

"Whiteman, Jesse L." <whitemjl@westinghouse.com>

05/21/2006 02:47 PM

To "ANAND.K.SINGH@sargentlundy.com" <ANAND.K.SINGH@sargentlundy.com>, "garry.miller@pgnmail.com" <garry.miller@pgnmail.com>

cc "Iller, Linda G." <IllerLG@westinghouse.com>, "McDermott, Daniel J." <mcdermdj@westinghouse.com>, "Whiteman, Jesse L." <whitemjl@westinghouse.com>, "Sterdis, Andrea" <SterdiA@westinghouse.com>, "Olesky, Cynthia L." <oleskycl@westinghouse.com>

Subject DCP/NUS0164 WEC Response to Progress Energy's Query Pertaining t o the Potential Impact of an Increased Approach Temperature for a Natural Draft Cooling Tower

AK, please find attached WEC's response to your query on behalf of Progress Energy pertaining to the potential impact of an increase in the return temperature of the AP1000 Circulating Water System (CWS) associated with a specific choice of a natural draft cooling tower proposed for Shearon Harris Units 2 & 3. Again, I apologize for the delay in getting the formal version of this response out to you.

Questions, comments, please do not hesitate to give me a call.

Regards,

Jesse Whiteman
Customer Interface Engineer
AP1000 Program Engineering
Phone : 412-374-4726
FAX: 412-374-5456

<<7096.doc>>

RESPONSE TO PROGRESS ENERGY QUERY

INCREASED APPROACH TEMPERATURE
FOR NATURAL DRAFT COOLING TOWER

Sargent & Lundy (as a representative of Progress Energy) has requested that Westinghouse comment on the potential impacts of an increase in the return temperature of the AP1000 Circulating Water System (CWS) associated with a specific choice of natural draft cooling tower design prepared for the proposed Shearon Harris Units 2 and 3.

BACKGROUND

Table 10.4.5-1 in the AP1000 Design Control Document provides parameters for the conceptual design of a natural draft cooling tower consistent with the certified AP1000 plant design. Since the design and performance of the cooling tower is strongly affected by the choice of site, the material provided in the DCD has been explicitly identified as not a part of the AP1000 Certified Design. It has always been assumed that COL applicants referencing the certified AP1000 design would choose the type, size, and performance of their CWS cooling tower on the basis of actual site characteristics and other criteria. The final cooling tower parameters will obviously further impact the design of the main turbine-generator and its auxiliaries because of the potential for variation in circulating water temperature (and therefore, achievable condenser backpressure) from the values assumed in preparing the DCD. They may also impact the performance of standard AP1000 systems that rely upon the CWS as their ultimate heat sink.

The AP1000 CWS provides cooling water to the following components (Westinghouse system designations shown in parentheses):

- Main condenser (CDS)
- Turbine Building Closed Cooling Water system (TCS)
- Condenser air removal pump heat exchangers (CMS)

The TCS in turn supplies cooling water to the following components:

- Main turbine lube oil coolers (2 per unit)
- Generator hydrogen coolers (2 per unit)
- Generator exciter air coolers (2 per unit)
- Turbine electro-hydraulic control oil coolers (2 per unit)
- Generator hydrogen side seal oil cooler (1 per unit)
- Generator air side seal oil cooler (1 per unit)
- Main feedwater pump lube oil coolers (2 per unit)
- Secondary Sample System sample coolers

Sargent & Lundy has developed with Marley a conceptual design for a cooling tower suitable for an AP1000 unit at the Shearon Harris site. This design adopts a 15°F

approach at limiting full power design conditions rather than the 10°F approach cited in the AP1000 DCD. Marley advises that this increased approach value permits the use of a single large hyperbolic tower instead of two similarly sized towers that would be required to produce a 10°F approach at the site.

DISCUSSION

Sargent & Lundy's enquiry specifically requests that Westinghouse offer comments regarding possible "design and licensing" impacts on the Westinghouse standard design, if any, of the 15°F approach and the resulting increased inlet water temperature to the plant main condenser, the Turbine Building Closed Cooling Water heat exchangers, the HVAC head exchanger [*sic*], and Service Water System blowdown to the CWS basin.

Main Condenser/Plant Electrical Power Output – AP1000 main condenser and circulating water system design parameters are derived from information developed during an optimization study performed for the earlier AP600 plant. Specific parameters for these systems retained from that study were the cooling tower type (natural draft), condenser type (multipressure – multishell), the condenser design backpressure (2.5" HgA), and the condenser design cold water temperature (87°F). Accepting the EPRI ALWR URD 1% exceedance dry/wet bulb temperature combination of 100/77°F, this choice determined the design approach value of 10°F for the cooling tower.

The cooling tower design is site-specific. For the proposed Shearon Harris natural draft tower design, the cold water design temperature of 92°F results in an approximate 6% increase in backpressure with the standard AP1000 condenser design. Assuming a standard turbine design optimized for the nominal condenser backpressure of 2.5" HgA, this backpressure increase corresponds to a reduction in enthalpy extraction of roughly 1% over the thermodynamic cycle. Thus, the instantaneous electrical power output of the plant will be reduced by an equivalent percentage if full NSSS thermal output can be maintained.

Seal Water Heat Exchangers – Three identical cooling circuits supplied from the main condenser inlet header serve the three Seal Water heat exchangers (CMS-ME-01A/B/C) for the Main Condenser liquid ring air removal pumps. A significant enough increase in seal water temperature will reduce the non-condensable gas removal efficiency of the air removal pumps. The usual design criterion is to provide at least a 7.5°F differential between the seal water temperature and condenser saturation temperature to assure air removal effectiveness.

Service Water System Blowdown to CWS – An increase in CWS cold water design temperature should have no effect on the suitability of the CWS basin as the discharge point for SWS blowdown.

Turbine Building Closed Cooling Water System Heat Exchangers – The TCS fluid temperature is controlled by passing it through heat exchangers that are supplied with cooling water from the CWS. Without any change to the size (UA) of the TCS heat

exchangers, or change in relative flow rates, the TCS heat exchanger outlet temperature would be expected to increase essentially on a degree for degree basis with an increase in the CWS supply temperature. To obtain the same cooling performance with a 92°F CWS supply temperature as is currently obtainable with the standard TCS heat exchanger design with a 90°F supply temperature would require an increase in overall UA of approximately 70% per heat exchanger for each of the 3 TCS heat exchangers.

However, there will be times during the year when the CWS supply temperature would be expected to increase to 95°F. Although the full power design CWS return temperature assumed for the standard AP1000 plant is 87° (77° wet bulb plus 10° approach), the current TCS heat exchanger design is based upon supplying cooling water at 95°F at the standard AP1000 1% wet bulb exceedance temperature of 80°F. Hence, the CWS inlet temperature to the TCS heat exchanger is assumed to be 90°F for heat exchanger sizing purposes. With an increase in CWS tower approach of 5°F as proposed by Marley, the circulating water temperature would be approximately 95°F (80° wet bulb plus 15° approach), leaving no margin between the TCS heat sink temperature and the desired TCS heat exchanger outlet temperature. In this case, TCS supply temperature would be expected to increase to approximately 100°F. The Shearon Harris site is located within the 0% exceedance = 80°F zone as indicated by an earlier Westinghouse wet bulb study; this is the absolute limiting site wet bulb condition, and the TCS temperature would not be expected to exceed 100°F.

There are 3 distinct categories of cooling loads serviced by the TCS: 1) the main feedwater pump lube oil coolers; 2) the Secondary Sample System roughing coolers; and 3) the turbine-generator associated cooling systems. Assuming no change to the TCS heat exchanger size or increased flow to the equipment cooled by the TCS, the impact of raising CWS supply temperature would be to reduce the differential between the TCS supply temperature and the required process fluid outlet temperatures for each of the various coolers.

The design of lube oil coolers, hydrogen coolers, exciter air coolers, and other turbine-generator auxiliary coolers is generally performed by the turbine and generator suppliers. These units are therefore sized appropriately to cope with the increased cooling water supply temperature during the final design of the prime mover and generating equipment for each site. The design of the "standard" AP1000 turbine-generator unit is not yet complete and the cooling requirements for the T-G auxiliaries have not yet been determined. However, lube oil is generally supplied in the temperature range between 110 and 120°F for bearing and sealing purposes, giving a minimum delta T of 10° between the anticipated upper bound cooling water temperature of 100°F at the Shearon Harris site and the required process fluid outlet temperature for these oil coolers. This temperature differential should be sufficient to allow for the design of coolers that satisfy the turbine-generator manufacturers' requirements. A similar logic applies to the design of coolers for the remaining turbine-generator auxiliaries. Hydrogen coolers would usually be the load most affected by an increase in cooling water temperature, since they are typically the user with the highest heat duty. Discussions with turbine-generator vendors indicate that a 5°F

increase in TCS supply temperature could be accepted without causing a significant increase in the "footprint" of TG auxiliary coolers.

The Secondary Sampling System roughing coolers are intended to reduce sample temperature to approximately 120°F; a further reduction to approximately 77°F is provided by cooling the flowing samples with chilled water from the Central Chilled Water System (VWS). Therefore, an increase in TCS supply temperature would not be expected to significantly impact the design of the SSS roughing coolers; the required cooling capability could be obtained by minor increases in the cooling water flow through the shell side of each roughing unit and final cooler.

SUMMARY

Westinghouse does not anticipate any licensing impact from Progress Energy's adoption of a 5° higher cooling tower design approach value from that referenced in the AP1000 DCD.

There may be design impacts of a minor nature on the turbine-generator auxiliary coolers and Secondary Sample System roughing cooler parameters due to increased TCS supply temperature.

The most significant impact expected would be the potential decrease in plant electrical energy output associated with increased turbine backpressure caused by cold water temperature increase and by reduction in non-condensable removal efficiency when wet bulb temperature approaches the maximum value for this site. The amount of loss anticipated can be reduced by optimizing the total energy output of the turbine for the anticipated annual variation in backpressure caused by changes in site ambient conditions, rather than by designing the turbine for maximum electrical output at only the design condenser backpressure point of 2.5" HgA.

Toll, Edward B. (Reading)

From: ANAND.K.SINGH@sargentlundy.com
Sent: Friday, July 14, 2006 9:49 AM
To: Toll, Edward B. (Reading)
Cc: Ioannidi, John (Reading); GOPAL.KOMANDURI@sargentlundy.com; DON.K.SCHOPFER@sargentlundy.com
Subject: Fw: An Advance Copy of the WEC Responses to S&L Requests CWO#12 and t he Two Parts of CWO#10
Attachments: RESPONSE TO SL CWOs.doc

Ed:

Please verify that you ahve all the information that was requested. Once I hear from you, I will inform Westinghouse accordingly.

thanks

A. K. Singh
312 269 7517
312 269 7313 Fax

---- Forwarded by ANAND K SINGH/Sargentlundy on 07/14/2006 08:47 AM ----

"Whiteman, Jesse L." <whitemjl@westinghouse.com>

07/13/2006 11:27 PM

To "ANAND.K.SINGH@sargentlundy.com" <ANAND.K.SINGH@sargentlundy.com>

cc "garry miller@pgnmail.com" <garry miller@pgnmail.com>, "Iller, Linda G." <IllerLG@westinghouse.com>, "Whiteman, Jesse L." <whitemjl@westinghouse.com>, "McDermott, Daniel J." <mcdermdj@westinghouse.com>, "Stella, Mark E." <StellaME@westinghouse.com>, "Corletti, Michael M." <corlettmm@westinghouse.com>

Subject An Advance Copy of the WEC Responses to S&L Requests CWO#12 and t he Two Parts of CWO#10

AK, I truly apologize for the delay in getting these to you, but in this particular case this was the best date we could make. Please find attached an advance copy of our responses to CWO # 10 and #12. I will formalize when I return to the office on July 24th.

Regards,

Jesse Whiteman
Customer Interface Engineer
AP1000 Program Engineering
Phone - 412-374-4726
FAX: 412-374-5456
<<RESPONSE TO SL CWOs.doc>>

RESPONSE TO SARGENT & LUNDY QUESTIONS on SHEARON HARRIS 2 & 3 PLANT SWS, CWS, and Main Condenser DESIGN INPUTS

The following responses refer to the numbered CWOs in the referenced S&L RFI documents that request information from Westinghouse to support the conceptual design of the CWS.

CWO #12 **Service Water System - Water Usage Information**

		Normal (full power)	Maximum (cooldown @ 4 hr)
a.	SWS tower evaporation rate	132 gpm	470 gpm
b.	SWS tower drift rate	< 1 gpm	1 gpm
c.	SWS tower blowdown rate	44 gpm (2 COC)	156 gpm (4 COC)

Makeup should be sized to provide the total of evaporation + blowdown + drift loss in the maximum heat duty condition. Note that this data is based on preliminary SWS tower sizing and performance calculations and is subject to change when the tower vendor is selected and provides final design parameters.

CWO #10/1 **Condenser circulating water side pressure drop**

This information is dependent upon the final design of the main condenser and its supply and discharge piping. The condenser design has not yet been finalized. For initial CWS pump sizing and performance analyses it is recommended that a design condenser tube head loss of approximately 25 to 30 feet be used at 600,000 gpm.

CWO #10/2 **Circulating water system line sizes: Turbine Building Closed Cooling Water System line size, and SWS cooling tower makeup / blowdown line size**

The nominal diameter of the combined CWS supply and return headers is estimated to be 180 inches to maintain a fluid velocity of approximately 8.0 ft/s with a combined header flow rate of 600,000 gpm.

All steel piping in the CWS is AP1000 Class JCE piping. The JCD/JCE piping class definition sheets are attached for information.

The nominal size of the individual CWS supply lines to the main condenser sections is estimated to be 96 inches, but their size is subject to change depending upon the final design of the main condenser.

The CWS lines to the TCS HX supply and return headers are 24 inches in diameter.

The SWS makeup lines from the CWS are 6 inches in diameter.

The individual train SWS blowdown lines are nominally 2 inches and the combined blowdown line to the CWS cooling tower basin is 3 inches in size.

Russell, Tammy (Reading)

From: Corey.Baker@ct.spx.com
Sent: Friday, April 21, 2006 11:49 AM
To: Toll, Edward B. (Reading)
Cc: JIM.VANGARSSE@ct.spx.com
Subject: Re: Fw: Progress Energy Shearon Harris

Ed,

The issue is really a combination of all factors (flow, range, approach). These items must be chosen such that a feasible design, both thermally and structurally, is achieved. The flow of 600,000 gpm alone makes this tower very large--both height and diameter. The height component is more of a structural limitation, while diameter limitation is to promote air flow into the center of the tower. Every dimension/aspect is closely tied to performance, so these are merely generalities.

Notice the existing tower, which is also large with similar range, has an approach temperature of 18.2 F while the requested approach on the new tower is 10.0 F. The larger approach provides more advantageous driving temperatures, so the water loading (gpm/ft^2) can increase. Therefore, we can compromise on a reasonable design somewhere between these two values. Following is a summary of the selection.

8600262-6.6-404
600000gpm at 117.2-92.0-77.0°F (15°F approach)
6.6 ft DF254 fill
600 ft shell height
411 ft base diameter
13210 gpm evaporation

Please let me know if you have questions.

Corey Baker P.E.
Thermal Performance & Ratings
SPX Cooling Technologies
7401 W 129 Street
Overland Park, KS 66213 USA
Tel: +1 913 664 7718
Fax: +1 913 664 7642

JIM VANGARSSE/MarleyCT/SPX

04/20/2006 07:03 AM

To Corey Baker/CT/SPX@SPX

cc

Subject Fw: Progress Energy Shearon Harris

Corey,

the Owner still wants find a way to get this into one ND tower. see the additional questions below.

will you respond directly to Ed Toll? I'm going to be out for a few days for some minor surgery. thanks

Jim Van Garsse
SPX Cooling Technologies
914-697-5030 x 20

---- Forwarded by JIM VANGARSSE/MarleyCT/SPX on 04/20/2006 07:58 AM ----

"Toll, Edward B. \(Reading\)" <Edward.B.Toll@worleyparsons.com>

04/19/2006 08:00 AM

To <JIM.VANGARSSE@ct.spx.com>

cc "Ioannidi, John \(Reading\)" <John.Ioannidi@worleyparsons.com>

Subject RE: Progress Energy Shearon Harris

Is the flow the controlling variable or is it possible to use a single tower with a larger approach. The existing natural draft tower for Harris unit 1 has a flow of 538,000 gpm and an approach of 18.2 F with inlet water of 121F and outlet of 95.2. While the new unit water flow is about 11% more I don't know if this is the most significant factor at work here. I hate to keep bothering you but the client has clearly stated that he does not want a "cooling tower farm" which is the reason I have to make certain a single tower will not work.

From: JIM.VANGARSSE@ct.spx.com [mailto:JIM.VANGARSSE@ct.spx.com]
Sent: Tuesday, April 18, 2006 2:00 PM
To: Toll, Edward B. (Reading)
Subject: Fw: Progress Energy Shearon Harris

Ed,

here's our response to the question about using a single ND tower.

Jim Van Garsse

SPX Cooling Technologies
914-697-5030 x 20

----- Forwarded by JIM VANGARSSE/MarleyCT/SPX on 04/18/2006 01:58 PM -----

Corey Baker/CT/SPX

04/18/2006 01:47 PM

To JIM VANGARSSE/MarleyCT/SPX@SPX
cc
Subject Re: Progress Energy Shearon Harris Link

Jim,

We tried to make a single tower selection for these conditions, but the flow exceeds reasonable tower limits. Even relaxing the approach is not sufficient to squeeze into one tower. For the sake of giving you some alternative, we selected a tower with reduced flowrate (increased range accordingly) and increased approach. The selection summary is as follows.

8600252-6.6-390
500000gpm at 120.24-90.0-77.0°F
6.6 ft DF254 fill
600 ft shell height
396 ft base diameter
13190 gpm evaporation

Hopefully this helps. Let me know if you have questions.

Corey Baker P.E.
Thermal Performance & Ratings
SPX Cooling Technologies
7401 W 129 Street
Overland Park, KS 66213 USA
Tel: +1 913 664 7718
Fax: +1 913 664 7642

JIM VANGARSSE/MarleyCT/SPX

04/11/2006 11:39 AM

To Corey Baker/CT/SPX@SPX
cc
Subject Progress Energy Shearon Harris

Hi Corey,

pls refer to your 3/24 email to me on this.

customer wants to try to get this into one ND tower instead of 2. we're looking at the DF254 fill option only.

can you solve for approach with the largest single tower?

flow is 600,000 gpm
77F wet bulb / 93 dry bulb
range 25.2F

thanks

Jim Van Garsse

4/20/06 email regarding screen sizing:

From:	Coniglio, Richard J (WT) [Richard.Coniglio@siemens.com]
Sent:	Thursday, April 20, 2006 8:40 AM
To:	Russell, Tammy (Reading)
Subject:	RE: USFilter.com Contact Form - Through Flow Traveling Water Screen

Tammy,

Given the following revised conditions:
Through Flow Traveling Screen Model 45A
Flow Rate = 30,000 GPM per screen
Low water depth = 20'
Screen cloth = 3/8" square openings with 14 gage (.080") diameter wire

An 8 ft wide screen (9'-2" wide channel) will result in a through cloth velocity of 0.73 fps.
A 10 ft wide screen (11'-2" wide channel) will result in a through cloth velocity of 0.58 fps.
A 12 ft wide screen (13'-2" wide channel) will result in a through cloth velocity of 0.48 fps.

Please let me know if I can be of further assistance.

PLEASE NOTE: My Email address has changed to richard.coniglio@siemens.com. Please update your files to reflect this new information. The old address will be forwarded only for a short time.

Regards,
Rich Coniglio
Intake Sales & Marketing Manager
USFilter's Envirex Products
A Siemens Business
100 Highpoint Drive, Suite 101
Chalfont, PA 18914
Phone (USA): 215-712-7063
Mobile (USA): 215-275-5258
Fax (USA): 215-996-1156
e-mail: richard.coniglio@siemens.com
Website: www.usfilter.com

-----Original Message-----
From: Russell, Tammy (Reading) [mailto:Tammy.Russell@worleyparsons.com]
Sent: Wednesday, April 19, 2006 7:28 AM
To: Coniglio, Richard J (WT)
Subject: RE: USFilter.com Contact Form - Through Flow Traveling Water Screen

Thank you so much for your help. Could you get us velocities with the same given information, but with a low water depth of 20 ft instead of 25?

Thanks,

Tammy Russell
WorleyParsons
610-855-2580
tammy.russell@worleyparsons.com

-----Original Message-----

From: Coniglio, Richard J (WT) [mailto:Richard.Coniglio@siemens.com]
Sent: Monday, April 17, 2006 10:11 AM
To: Russell, Tammy (Reading)
Subject: RE: USFilter.com Contact Form - Through Flow Traveling Water Screen

Tammy,

Given the following:
Through Flow Traveling Screen Model 45A
Flow Rate = 30,000 GPM per screen
Low water depth = 25'
Screen cloth = 3/8" square openings with 14 gage (.080") diameter wire

An 8 ft wide screen (9'-2" wide channel) will result in a through cloth velocity of 0.58 fps.
A 10 ft wide screen (11'-2" wide channel) will result in a through cloth velocity of 0.46 fps.
A 12 ft wide screen (13'-2" wide channel) will result in a through cloth velocity of 0.38 fps.

Please let me know if I can be of further assistance.

PLEASE NOTE: My Email address has changed to richard.coniglio@siemens.com. Please update your files to reflect this new information. The old address will be forwarded only for a short time.

Regards,
Rich Coniglio
Intake Sales & Marketing Manager
USFilter's Envirex Products
A Siemens Business
100 Highpoint Drive, Suite 101
Chalfont, PA 18914
Phone (USA): 215-712-7063
Mobile (USA): 215-275-5258
Fax (USA): 215-996-1156
e-mail: richard.coniglio@siemens.com
Website: www.usfilter.com

-----Original Message-----
From: tammy.russell@worleyparsons.com
[mailto:tammy.russell@worleyparsons.com]
Sent: Monday, April 17, 2006 7:42 AM
To: Coniglio, Richard J (WT)
Subject: USFilter.com Contact Form - Through Flow Traveling Water Screen

First Name: Tammy
Last Name: Russell
Company: WorleyParsons
Phone:
Mailing Address:
City:
Email: tammy.russell@worleyparsons.com
State: --Select One--
Zip: 19607
Fax:

Country Region: --Select One--
Subject: Through Flow Traveling Water Screen
Message: We are sizing some intake bays for a project and need the effective areas of a

through-flow traveling screen with 3/8 inch openings, in 8 ft, 10 ft, and 12 ft widths. I appreciate your help with this.

Thanks,

Tammy Russell
WorleyParsons
610-855-2580

COOLING TOWER BLOWDOWN

PLANT NORTH

TRUE NORTH

25°

UNIT 3 SWITCHYARD

UNIT 3

UNIT 2

PIPE ROUTING TO BE FINALIZED LATER

EXISTING UNIT 1

COOLING TOWER

OBSCURED AREA BY STEAM

SUB-STATION

UNIT 1 & 2 SWITCHYARD

SILOS

HEAVY FOLIAGE

220'

NOTES:

1. BUILDINGS BASED ON WESTINGHOUSE DWG # APP-0030-X4-001 REV.B
2. COOLING TOWER HAS BEEN CHANGED TO 411'Ø

LEGEND

1. POWER BLOCK
2. COOLING TOWER
3. MAKE UP WATER PUMP HOUSE
4. (SPARE)
5. UNIT 2 AND 3 TRANSMISSION LINES
6. UNIT 2 & 3 SWITCHYARD
7. HEAVY LIFT CRANE PATH
8. HAUL ROAD
9. CONSTRUCTION LAYDOWN (20+ ACRES)
10. CONSTRUCTION OFFICES/WAREHOUSES (7+ ACRES)
11. CONSTRUCTION PARKING (10+ ACRES)
12. CONSTRUCTION ACCESS ROADS
13. CONSTRUCTION FENCE
14. (SPARE)
15. MODULE ASSEMBLY PLATFORM
16. CONTAINMENT VESSEL MODULE ASSEMBLY PADS
17. NEW RAIL
18. BLOWDOWN WATER LINE
19. MAKEUP WATER LINE
20. CIRCULATING WATER LINE

RFI-158 Attachment J
Page 28 of 29

0 100' 200' 400' 600'

FILENAME:HAR-M-001.DGN

CONTRACTOR/INSTALLER SHALL TAKE ALL APPROPRIATE PRECAUTIONS TO ENSURE THE SAFETY OF ALL PEOPLE LOCATED ON THE WORK SITE, INCLUDING CONTRACTOR'S/INSTALLER'S PERSONNEL (OR THAT OF ITS SUBCONTRACTOR(S)) PERFORMING THE WORK.

DRAWING RELEASE RECORD

REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE

DRAWING RELEASE RECORD

REV.	DATE REL'D.	PREPARED	REVIEWED	APPROVED	PURPOSE
0	08-01-2006	J.L.HENRY	W.J.WALSH	---------	INITIAL ISSUE

SCALE 1"=200'

PROJECT NUMBER 11940-007

GENERAL ARRANGEMENT

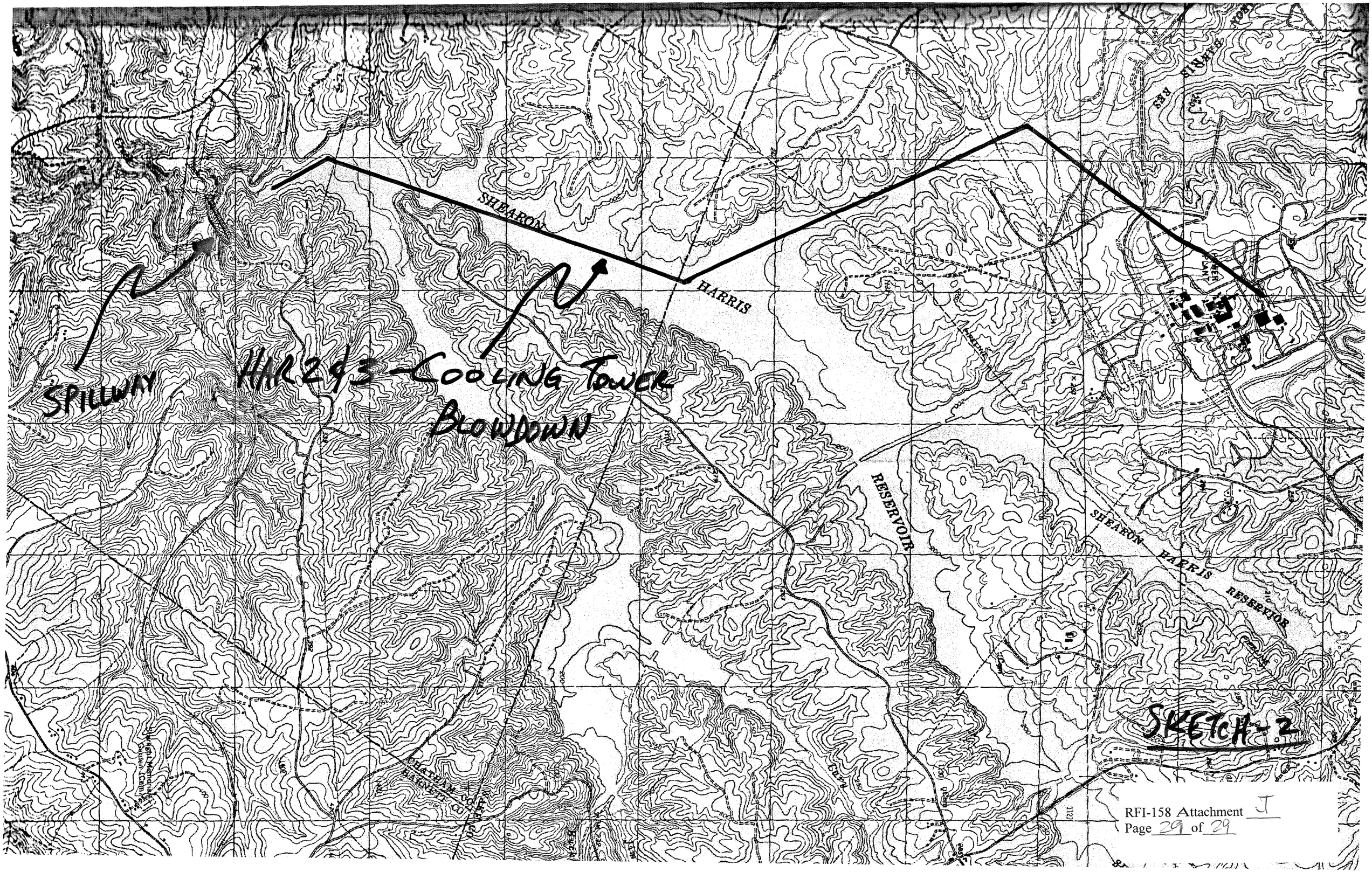
SHEARON HARRIS NUCLEAR POWER PLANT UNITS 2 & 3 CAROLINA POWER & LIGHT COMPANY

Sargent & Lundy

DRAWING NO. HAR-M-001 REV. 0

SHEET OF

L2445/01310/DMS/01310mlorr1SHEAR-M-001.dgn
7/12/06 3:00:27 PM



RFI-158 Attachment J
Page 29 of 29

HAR 2&3 RFI-158 Attachment K

Item Description: Auxiliary spillway (Note: This work may not be installed)

Auxiliary Spillway (Item # 15 of attachment A-1, Civil Quantities)

Items include

(a) Excavation in hard soil or weathered rock, including excavating, disposing excavated rock material, site cleaning and finishing surface to required grade and elevation. May require blasting after permission.
(b) Stone filling of selected graded size in the bottom and side portion of spill way in the area below required grade elevation, including graded size stone to required grade and elevation as directed or shown in drawing.
(c) Construction of a railroad bridge including a 50' long and 75' wide concrete channel both upstream and downstream of the bridge. The bridge shall be similar to the existing Railroad Bridge over spillway channel.
(d) Supply and placing of approved concrete mix for Reinforced concrete cap in the side and bottom of spillway channel as shown in the design and drawing.
(e) Supply and installation of 3' thick riprap for the spillway channel as shown in design drawing. This includes graded stone material in bottom and sides of 300' wide spillway channel of about 500' length.

Design Approach:

- Spillway channel is marked on topographic map using AutoCAD. Excavation and fill is computed from AutoCAD civil 3D software.
- Reinforced concrete is computed by computing by length, width and thickness of concrete.
- Riprap is computed by perimeter of channel up to 3' height and the length of riprap.
- A railroad bridge similar to the existing one on spillway channel is assumed

Design Inputs: Harris Site GA (DWG HAR-M-001)
Site topographic Survey Map (BARTON AIR TECHNOLOGIES)

Assumptions:

-Spill way channel will be 300' wide with side slopes 3H:1V
-Reinforced concrete cap will be 1' thick, 300' wide and 125' long.
-Riprap will be 3' Thick and 500' length along with the side slopes up to 3' height

Attachments:

1. Sketches : Figure 9.1(Plan), 9.2 (Profile) & 9.3(Typical section)
2. Calculation(s) : Table 25.1
3. References : None

Shearon Harris Nuclear Power Plant **Table 25.1**

Project # 12076-010

Estimate of Civil Quantities for Two New AP-1000 units

Auxiliary Spill Way				
Item	Description	Qty	Unit	Remark
(a)	Excavation in rock/soil	235000	Cyd	From AotoCAD 3D
(b)	Stone filling in pockets	20000	Cyd	From AotoCAD 3D
(c)	New Railroad Bridge		Lumpsum	Railroad bridge ove 75' vide channel 40' high
(d)	Reinforced concrete cap	1400	Cyd	125' long, 300' wide and 1' thick
	125 x 300 x 1 /27			
(e)	Riprap protaction	18000	Cyd	300' bottom and 1V;3H side slopes
	$(300 + 3 \times 2 \times 10^{1/2}) \times 500 \times 3/27$			Riprap upto 3' height and 500' long

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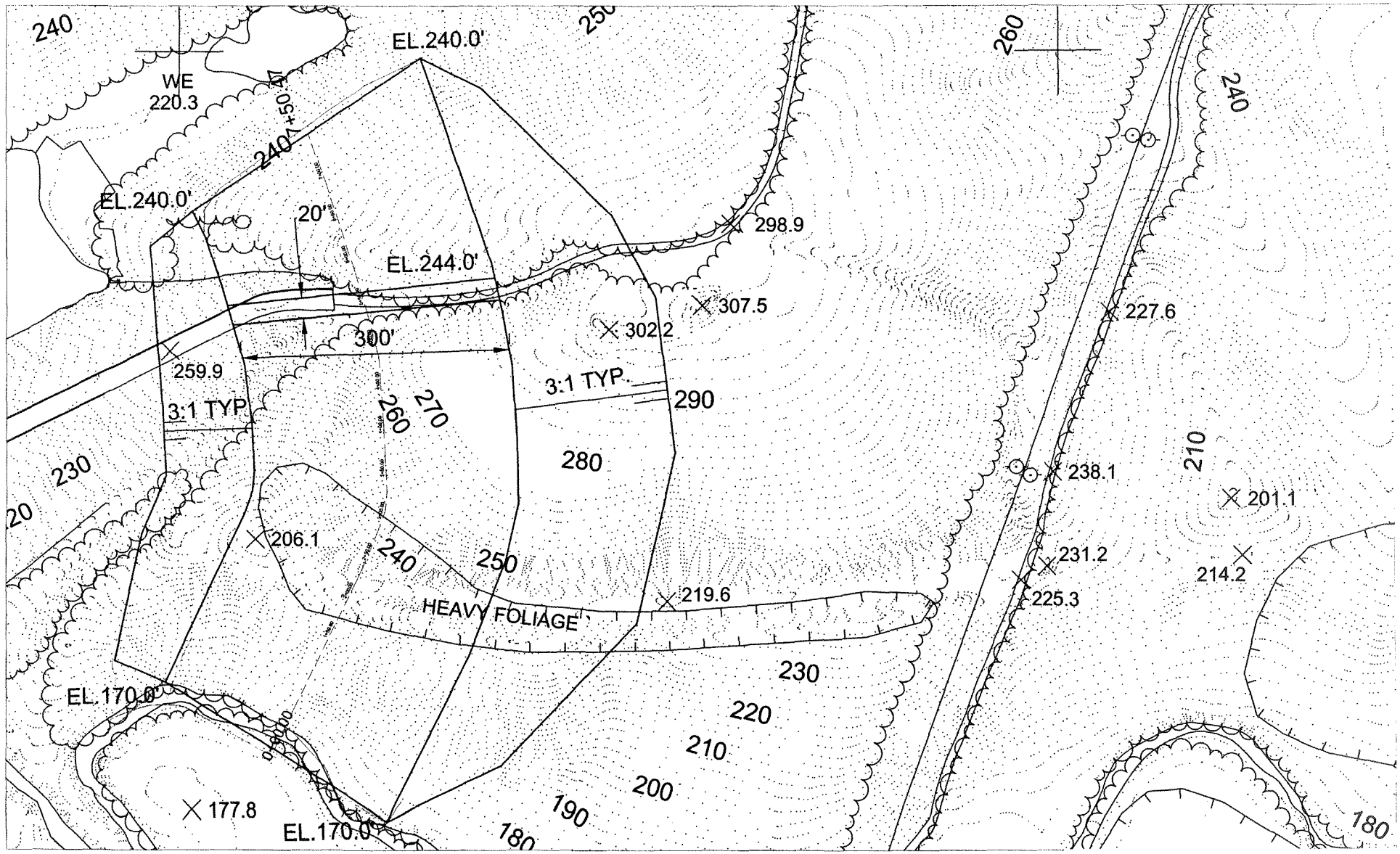
Civil_qty_11-29-06_revised.xls-Auxilary spillway



PROPOSED PLAN
SCALE : 1:100

Figure 9.1
Auxiliary Spillway
PLAN

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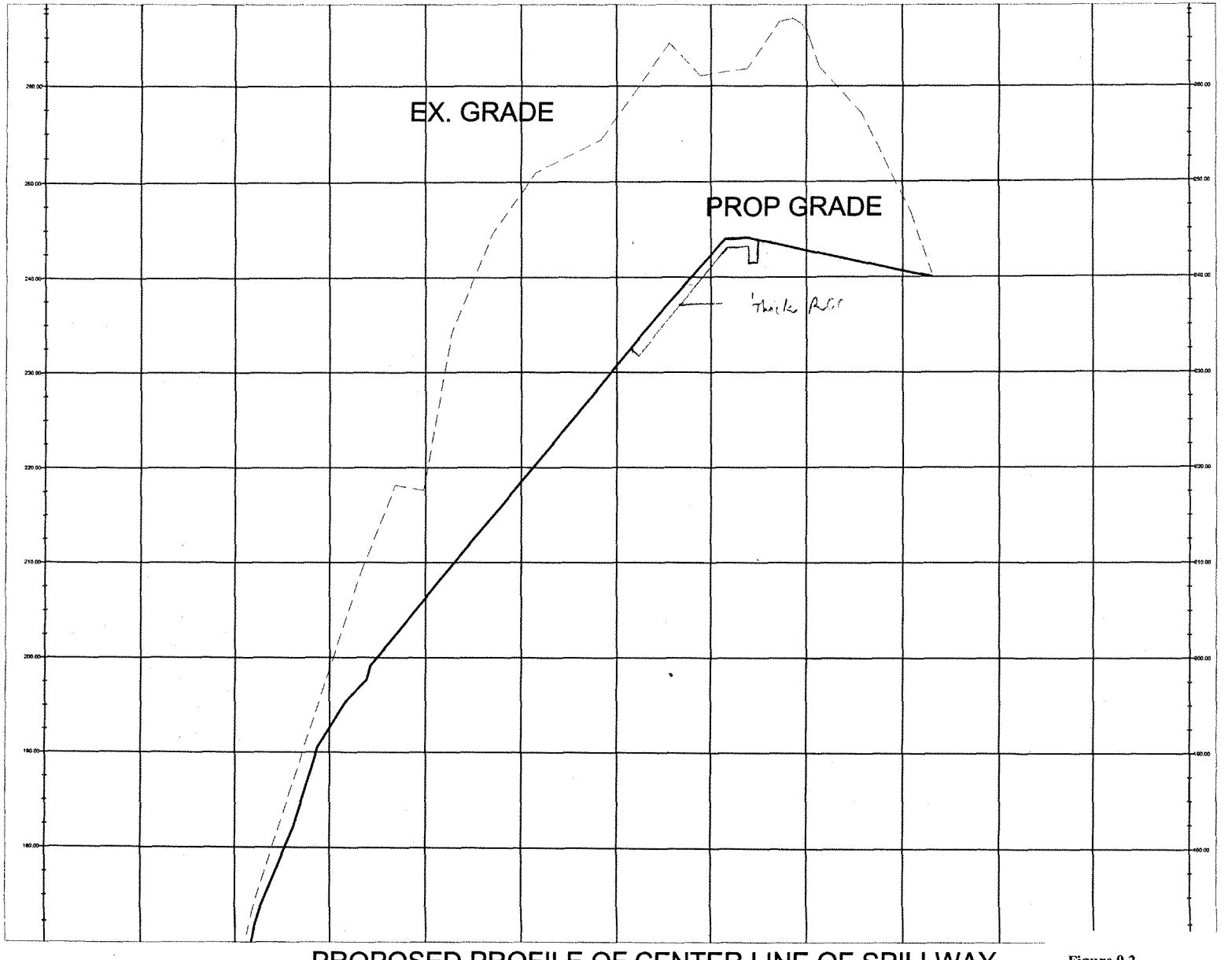

PROPOSED PROFILE OF CENTER LINE OF SPILLWAY
SCALE : 1:100

Figure 9.2
Auxiliary Spillway
PROFILE

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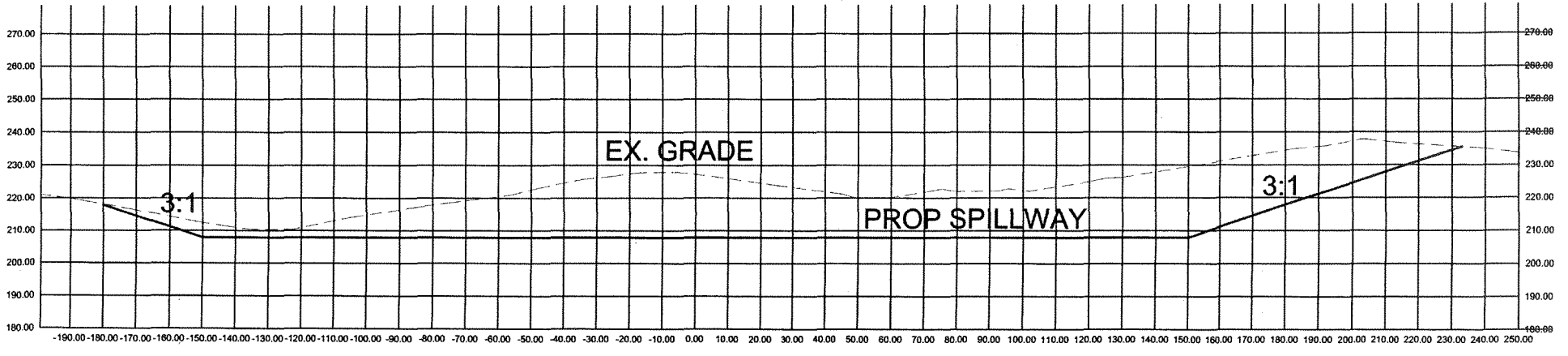

TYPICAL SECTION

SCALE : 1:30

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Figure 9.3
Auxiliary Spillway
TYPICAL CROSS SECTION