

**FINAL**

**CONSTRUCTION COMPLETION REPORT  
INTERIM REMEDIAL ACTION  
LANDFILLS 12 AND 16 CAP CONSTRUCTION  
LONGHORN ARMY AMMUNITION PLANT (LHAAP)  
KARNACK, TEXAS**



*Glen R. Turney 12/2/98*

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**Texas No. 82782**

**December 1998**



**OHM Remediation  
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**ACRONYMS AND ABBREVIATIONS**

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
EPA	Environmental Protection Agency (US)
FML	Flexible Membrane Liner
GCL	Geocomposite Clay Liner
LF	Landfill
LHAAP	Longhorn Army Ammunition Plant
LLDPE	Linear Low-Density Polyethylene
NCP	National [Oil and Hazardous Substances Pollution] Contingency Plan
OHM	OHM Remediation Services Corporation
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SCP	Stormwater Control Plan
TERC	Total Environmental Restoration Contract
USACE	United States Army Corps of Engineers

**CONSTRUCTION COMPLETION REPORT**  
**INTERIM REMEDIAL ACTION LANDFILLS 12 AND 16 CAP CONSTRUCTION**  
**LONGHORN ARMY AMMUNITION PLANT (LHAAP)**  
**KARNACK, TEXAS**

## 1.0 INTRODUCTION

The United States Army Corps of Engineers (USACE) contracted OHM Remediation Services Corp. (OHM) to cap existing Landfills 12 and 16 at Longhorn Army Ammunition Plant (LHAAP), Karnack, Texas. The project included construction of access roads, preparation of temporary stockpiles for waste treated by others, stormwater controls, and construction of geocomposite landfill caps.

## 2.0 SITE INFORMATION

LHAAP is located in central east Texas in the northeast corner of Harrison County 40 miles west of Shreveport, Louisiana, and approximately 14 miles northeast of Marshall, Texas, as shown on **Drawing C-01 in Appendix H of the Work Plan**. The installation occupies 8,493 acres between State Highways 43 and 134 (western and northern boundaries, respectively) and the western shore of Caddo Lake.

The LHAAP 12 and 16 Landfills are in a remote location of the plant. LHAAP 12 Landfill is an open area, encompassing approximately seven acres of grass bounded by heavy timber. A tributary of Central Creek flows along the eastern, northeastern, and northern edges of the landfill.

LHAAP 16 landfill is a sloped, open area encompassing approximately 16 acres of grass bounded along the west and north by a gravel road and along the east and south by heavy timber. Harrison Bayou borders the landfill along the east and southeast. The southeastern edge of the landfill is in the 100-year flood plain.

### 3.0 PROJECT SCOPE

#### 3.1 Regulatory Requirements

This project was required by the Record of Decision (ROD) made in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This ROD is documented in the Administrative Record for this site.

The ROD for LHAAP 12 and 16 Landfills addressed an Early Interim Remedial Action which is necessary to mitigate potential risks posed by buried source material at the landfills. The source material includes industrial solid wastes, possibly containing hazardous constituents, generated at LHAAP. The potential risks, in general, include the infiltration of water into the landfills and contaminant transport. The selected remedy includes a multi-layer cap and cover system over each landfill to minimize both water infiltration and contaminant transport.

The cap and cover system for each landfill consists of the following components:

- A grading layer placed on the landfills to provide proper grading for drainage.
- A low permeability sodium bentonite geocomposite, geosynthetic membrane liner.
- A final soil cover with adequate slopes and vegetation.
- Perimeter berms and drainage swales to control surface runoff.

#### 3.2 Landfill Cap Design Features

The grading layer primarily consisted of treated contaminated soil material from the Burning Ground No. 3 remediation project adjacent to the landfills. This material was spread and compacted in lifts

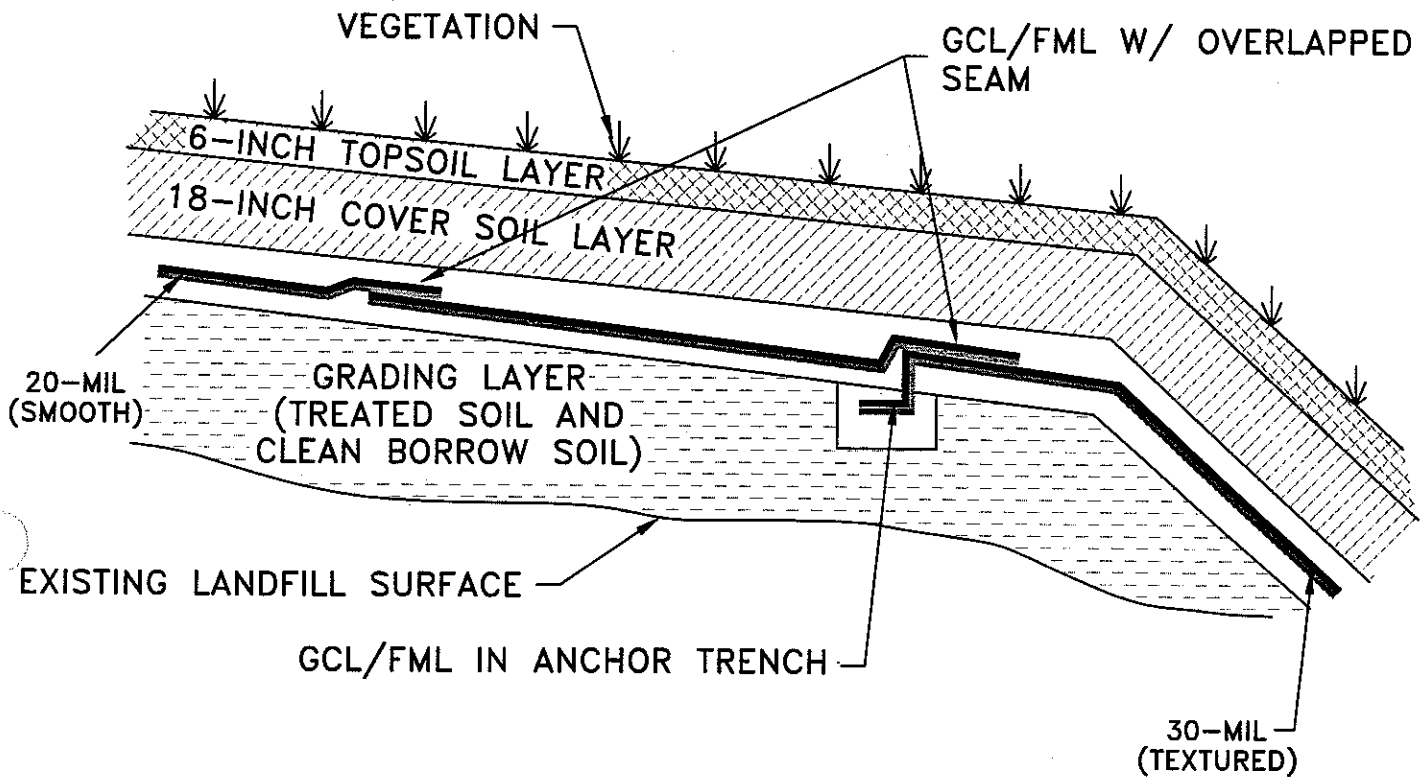
to make a firm foundation for the cap liner layers. Additional subgrade material consisting of impermeable clay was also placed and compacted along with the treated soil to make up the required grade. The approximate quantity of treated soils used in the subgrade was 37,840 cubic yards. The total design volume capacity of the two landfills was maximized to the extent practical. The two landfills were designed with a reasonable overage of the volume to accommodate treated soil materials plus a buffer volume of clean fill soil which was taken from the LHAAP borrow source. Demolition debris, consisting of stormwater culverts, pavement, concrete, signage and power/light poles found in the vicinity of Landfills 12 and 16 were placed in the lower lifts of the grading layer and covered with compacted soil material. Debris were placed at a minimum of 18 inches beneath the subgrade soil surface. Section 4.11 includes a list of items demolished and placed in the subgrade.

A combination of low-permeability sodium bentonite geocomposite liner (GCL) and a 20-mil flexible membrane liner (FML) was used as a composite layer over the subgrade as shown on **Figure 3-1**. A 30-mil textured FML layer was used on all 4:1 slopes. The GCL and FML are bonded together at the manufacturer's plant before delivery to the site in rolls. The composite GCL/FML were deployed with the GCL side of the composite facing downward and the FML facing upward. Seams were overlapped and anchored according to the design specification except where noted otherwise in **Table 5-1** or on as-built drawings. FML welding was not necessary since there was GCL between the two pieces of FML at the overlap. The GCL acts as a seal between the two pieces of FML.

The final soil cover consisted of an 18-inch layer of cover soil and a 6-inch layer of topsoil. The cover soil was placed on the FML liner and compacted carefully to prevent damage to the GCL and FML liners. Material for the cover soil layer was taken from the LHAAP borrow source. Topsoil (which met the design specifications) came from either the borrow source or the LHAAP magazine area. The topsoil was placed, spread, and lightly compacted to receive vegetation. The landfill areas' disturbed ground surface and the topsoil layer were revegetated to protect the cap from erosion by wind and water.

Perimeter drainage features, such as berms and swales, were constructed around each landfill to control long-term erosion and sedimentation.





**COMPOSITE GCL/FML LAYER**  
(TYPICAL) FOR BOTH LANDFILLS

OHM Remediation Services Corp. Houston, Texas A Subsidiary of OHM Corp.		
DRAWN BY:	MHE	11/25/98
CHECKED BY:	GRT	11/30/98
FILE	917852-A1	
REV	SHEET	PROJECT
1	1	917852

U.S. ARMY CORPS OF ENGINEERS  <b>TULSA DISTRICT</b>	
TERC CONTRACT DACA 56-94-D-0020  LANDFILL 12 AND LANDFILL 16 CAPS	DELIVERY ORDER NO. 0012  LHAAP, KARNACK, TEXAS

FIGURE 3-1  LANDFILL CAP LINER CONFIGURATION
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#### **4.0 CONSTRUCTION WORK TASKS**

The construction work included the following tasks.

##### **4.1 Task 1 - Mobilization**

OHM mobilized key personnel and equipment from the Houston, Texas office in July 1996 and constructed a temporary support facility east of the entrance to Landfill 16.

##### **4.2 Task 2 - Construction of Access Roads**

OHM constructed temporary access roads at the borrow pit and at both landfills.

##### **4.3 Task 3 - Preparation of Borrow Source**

An area of approximately 8.5 acres was selected as the borrow source. Approximately one foot of the topsoil at the borrow source was stripped prior to using underlying soil for the cap. The brush and grubbed material was stockpiled and burned. The borrow source was cleared and grubbed in increments as material was required in order to minimize the area exposed to wind and rain.

##### **4.4 Task 4 - Installation of Stormwater Controls**

A silt fence was erected around the borrow source and each landfill to control silt migration caused by stormwater. Silt fencing was also used in the ditches along the borrow source access road to minimize sedimentation.

#### **4.5 Task 5 - Preliminary Site Survey**

A land surveyor licensed in the State of Texas performed the following work:

- Set up control points
- Set grade stakes at the landfills
- Prepared drawings showing the locations and elevations of the control points

OHM personnel used the control points to replace grade stakes as the work progressed.

#### **4.6 Task 6 - Construction and Operation of LF 12 & LF 16 Stockpiles**

##### **4.6.1 Sub-task 6.1 - Clear Stockpile Area**

OHM cleared areas at Landfill 12 and Landfill 16 to receive treated soil. The tree stumps and brush were stockpiled and burned as discussed previously regarding the borrow source.

##### **4.6.2 Sub-task 6.2 - Construction of Stormwater Diversion Berms At Stockpile**

OHM installed berms at the stockpiles to divert stormwater run-on around the treated contaminated materials. A silt fence was constructed at each stockpile to control sediments from the disturbed area. Plastic sheets were used to cover the stockpiles. Soil was excavated at the borrow pit using an excavator and hauled to the stockpiles by dump truck.

##### **4.6.3 Sub-task 6.3 - Handling the Treated Contaminated Soil Stockpile**

Radian International stockpiled treated contaminated soil delivered to each landfill. OHM decontaminated equipment on a temporary decon pad before leaving the stockpile. A bulldozer was utilized to build a stockpile of treated material with sloping sides.

#### 4.7 Task 7 - Air Monitoring

OHM performed perimeter air monitoring to ensure employees were properly protected when handling the treated stockpiles.

#### 4.8 Task 8 – Construction of LF 12 and LF 16 Cap

##### 4.8.1 Sub-task 8.1 - Clear and Proofroll

OHM cleared and proofrolled the landfill cap areas as required in the **Work Plan** Specification Section 02110 - Clearing and Grubbing. The tree stumps and brush were removed and stockpiled outside the landfill boundary and burned. A water truck was used to proofroll the surface. The landfill surface was cleared and grubbed in increments as the work progressed, in order to minimize the disturbed area exposed to wind and rain.

##### 4.8.2 Sub-task 8.2 - Place Grading Layer

The grading layer consisted of treated soils, supplemented by clean fill soils (clay) from the borrow source as required to achieve the lines and grades in the final landfill design drawings and Specification Section 02444 - Subgrade Layer.

OHM placed and compacted treated soils from the stockpile. Treated soils from the stockpile were spread over the landfill area to the lines and grades shown on the as-built drawings (**Appendix A**). The first 8-inch loose lift was compacted by 5 passes of the compactor. Subsequent lifts were placed in 8-inch loose lifts at a moisture content within 3 percent of optimum and compacted to 90 percent Standard Proctor density by ASTM D 698. Field density tests were performed on each of the compacted layers to verify the degree of compaction. The tests were performed at a rate of 1 per 10,000 square feet per lift (at a minimum). The in-place density tests were confirmed by ASTM D 2922. Compacted lifts were scarified at least 6 inches prior to placing the next lift. Debris from demolition of existing pavement and other features were spread in the lower lifts. Debris were

not placed in the top 18 inches of the grading layer. Large debris were placed at least 3 feet below the top of the grading layer.

In **LF 12**, approximately 2,000 cubic yards of treated soil and 34,496 cubic yards of borrow source clay were placed in the grading layer (subgrade). The finished subgrade is shown on **Drawing LF-12-1 in Appendix A**.

In **LF 16**, approximately 35,840 cubic yards of treated soil and 10,581 cubic yards of imported clay were placed in the grading layer. The finished subgrade is shown on **Drawing LF-12913-16 in Appendix A**.

The final surface was smooth-rolled, inspected, and approved by USACE representatives prior to placing GCL liner.

#### **4.8.3 Sub-task 8.3 – Installation of GCL/FML**

The GCL and FML liners were installed to the limits shown on the design drawings and as required in Specification Sections 02271 and 02442. Storage of materials on-site, placement, overlaps, placement in anchor trenches, ballasting to prevent uplift by wind, and repairs were inspected by USACE representative. Special care was taken when the surface conditions were wet to avoid damage to the GCL.

The panel layouts of the liners for **LF-12** and **LF-16** are shown on drawings in **Appendix A**.

#### **4.8.4 Sub-task 8.4 – Placement of Cover Layer**

Soils at the borrow pit were mixed as necessary during excavation and loading to reduce the likelihood of using high-plasticity clays in the cover soil. This procedure was rarely necessary. An excavator loaded dump trucks at the borrow pit. The trucks dumped the soil on the working surface of the landfill cap. A motor grader, bulldozer, compactor, and water truck spread and compacted

the soil over the landfill cap to the lines and grades shown on the design drawings. The cover layer material was placed in 12-inch loose lifts at a moisture content within 3 percent of optimum and compacted to 90 percent Standard Proctor density as required in Specification Section 02221-Coversoil and Topsoil. Field density tests were performed on each of the compacted layers at the specified frequency to verify the degree of compaction. The first lift was walked in using the bulldozer (not the compactor) to avoid damaging the underlying GCL/FML .

In **LF 12**, approximately 19,080 cubic yards of soil were placed in the cover layer. The finished cover layer is shown on **Drawing "Cover" in Appendix A**.

In **LF 16**, approximately 36,972 cubic yards of soil were placed in the cover layer. The finished cover layer is shown on **Drawing 12913-16 in Appendix A**.

#### **4.8.5 Sub-task 8.5 – Placement of Topsoil**

The topsoil was placed and lightly compact in one lift over the cover layers to the lines and grades shown on the design drawings and as required in Specification Section 02221-Coversoil and Topsoil.

In **LF 12**, approximately 7,632 cubic yards of soil were placed in the topsoil. The finished cap is shown on **Drawing FINIS2 in Appendix A**.

In **LF 16**, approximately 14,292 cubic yards of soil were placed in the topsoil. The finished cap is shown on **Drawing FINIS2 in Appendix A**.

#### **4.8.6 Sub-task 8.6 – Construction of Landfill Drainage**

Drainage swales were constructed around the landfills to the lines and grades shown on the design drawings with some exceptions noted on the drawings. Soil excavated to construct the swales was spread over disturbed areas in the immediate vicinity of the work.

#### **4.8.7 Sub-task 8.7 - Vegetation of the Landfill Cap Surface**

Both landfill caps were revegetated as described in Specification Section 02930 - Establishment of Turf. The grass seed mix used was appropriate to the region and planting season. Turf establishment is complete at LF 12, while summer seeding will take place at LF 16 next spring.

#### **4.9 Task 9 - Demobilization**

All equipment including trailers were demobilized in October 1998. Housekeeping was performed to leave the Site(s) free of debris.

#### **4.10 Task 10 - Plugging and Abandonment of Groundwater Wells**

A well driller licensed in the State of Texas plugged and abandoned the existing monitoring wells within the limits of the new landfill caps as required in Specification Section 02671 - Ground-Water Monitoring Wells. Debris were disposed of in accordance with the **Waste Management Plan**. Well locations are shown in the construction drawings included as **Appendix A (Drawing C)**. All abandonment documentation was submitted to the Texas Department of Water Resources as per their requirements.

#### **4.11 Task 11 - Demolition of Existing Features**

OHM demolished existing stormwater culverts, pavement, signage and power/light poles in the vicinity of Landfills 12 and 16 as required in Specification Section 02050 - Demolition.

Debris disposed of in the landfills included:

- Metal fence and gate
- Corrugated metal pipe culverts
- Concrete debris stacked on Landfill 12

- Concrete, bentonite and PVC pipe from abandoned monitoring wells
- Lighting / power poles
- Electric Cable
- Asphalt paving from Landfill 16
- Road signs and posts
- Gravel from on-site roads.

Debris were disposed of in the landfill in accordance with the **Waste Management Plan**. This is shown on **Drawings C07 and C14**.

## **5.0 PROJECT VARIANCES AND AMENDMENTS**

During the construction of the landfills, the design and construction details were subjected to variances and amendments to adapt to the changing field conditions in accordance with good engineering practices. The variances and amendments made are listed in **Table 5-1**. The original design drawings were revised to include these changes and are included under separate cover "Variances and Amendments" in **Appendix A**.



TABLE 5-1

Sheet Reference Numbers	Discrepancies
C-07	Piezometer Well #PZ 12-01 does not appear on drawings to be demolished. LF-12.
C-08	There is no definite toe grades set for sub-grade at Station 1+50 nor 14+00. Had to field fit sub-grade toes. LF-12
C-08	AL-1 points to a monument that does not exist, should point to PI #1, elevation should be 202.62 instead of 199.60. LF-12
C-08	2-95 points to a monument that does not exist. Should point to Station 0+00 elevation 199.04. LF-12
C-08	Curve Data, Delta is wrong, should be 46 degrees, 33 minutes, 17 seconds instead of 48 degrees, 00 minutes, 28 seconds. LF-12
C-08	Vertical alignment, finished elevation is wrong. Add .5 (tenths) to finish elevation because of Drawing C-11 stating only 12 inch total coversoil and 6 inch topsoil originally. LF-12
C-08	The major discrepancies occur between the plan view drawing (C-8) of the landfill and the various cross sections of the landfill at various stations along the baseline. The discrepancies occurs between the scaled distance from the baseline to the toe at sub-grade on the plan view as compared to this distance as shown at the various cross sections. LF-12
C-11	Incorrect amount of coversoil (18" coversoil) LF-12 & LF-16.
C-11	Anchor Trench detail #2 does not reflect trench to be excavated at true toe as detail #1 does. LF-12 & LF-16. Anchor Trench was excavated using detail #2.
C-08	Treated soil placed from Station 8+00 to Station 12+50 east side of baseline approximately 100 feet. LF-12
C-09	Concrete from north end of LF-12 (existing) moved to low area of LF-12 Station 4+50 - 5+00, approximately 175 feet east of baseline. LF-12
C-09	Bridge lift of approximately 3 feet of borrow clay placed west side of baseline LF-12 approximately 75 feet West from Station 12+50 to 14+00. LF-12
C-08	No information was given on the cross sections for elevations for radius at Station 1+43 and Radius at Station 14+05, both radius elevations were placed by contour elevations & percent fall of known elevations adjacent to radius. LF-12
C-09	Elevations from Station 7+00, 100 feet East of Baseline to Station 8+00, 100 feet East of Baseline changed, also elevations from Station 7+00 to Station 8+00 on Crown (East Side) changed. These changes were made due to elevation errors on the cross sections. LF-12
C-09	Piezometer well PZ.12-01 removed at Station 6+50,

TABLE 5-1

Sheet Reference Numbers	Discrepancies
	approximately 75 feet East of the Baseline. LF-12
C-09	PPE placed at Station 13+50, 50 feet West of the Baseline, PPE consists of sarans & tyvex used from sump concrete sampling phase. LF-12
C-08	Modifications to anchor trench from Station 4+30, West toe to Station 4+82, West toe. Modifications were made to insure complete coverage of Landfill 12. LF-12
C-09	Cover material placed from Station 1+43, 150 feet to 250 feet East of the Baseline to Station 6+50, 150 feet to 250 feet East of the Baseline. This area of placement is flood prone low area. LF-12
C-09	Berm placed from Station 6+50, 150 feet East of the Baseline to 175 feet East of the Baseline to Station 11+50, 50 feet East of the Baseline. LF-12
C-14	Iron ore road placed on Landfill 16 – West to East.
C-14	Monitor Wells #16-7, 16-8, 16-9, 16-10, 16-11, 122, 16-1, 16-2, 16-3, and 16-4 were abandoned and removed. LF-16
C-14	Concrete from sump demolition & monitor well abandonment was placed at Station 5+50, 150 feet North to 250 feet North of the Baseline to Station 7+00, 150 feet North to 250 feet North of the Baseline. LF-16
C-16	Treated material placed from Station 3+50, 100 feet North to 165 feet North of the Baseline to Station 8+00, 200 feet North to 265 feet North of the Baseline. Also treated material placed from Station 4+00 Baseline to 60 feet North of the Baseline to Station 7+00, 100 feet North to 160 feet North of the Baseline. LF-16
C-16	Concrete placement from Radian was placed from Station 6+50, 50 feet North of the Baseline to 150 feet South of Baseline to station 8+50, 50' feet North of Baseline to 250 feet South of Baseline. LF-16
C-18	Detail #1 40 mil geomembrane liner is changed to 20 mil geomembrane liner. Also cover soil on Detail #1 shows 12 inches of coversoil – changed to 18 inches of cover soil.
C-16	Asphalt placed from Station 3+00 to Station 5+00, 100' to 200' South of Baseline. Asphalt was from asphalt pad at station 1+00, 100' South of Baseline. LF-16
C-16	Bricks from Radian International placed at Station 6+50, 100' North of Baseline, Station 7+50, 150' South of Baseline, Station 5+50, 100' South of Baseline, and Station 7+00, 100' North of Baseline 16.
C-17	Liner material from Radian International was placed at Station 5+25, 150' South of the Baseline in Grid #35. LF-16

TABLE 5-1

Sheet Reference Numbers	Discrepancies
C-17	55-gallon drums filled with grout from Radian International were placed at Station 4+75, 175' South of Baseline in Grid #27. LF-16
C-16	Berm placed from Station 6+25, from South toe to 250' North on East side of LF-16 (See detail on Sheet C-16)
C-17	Placement of 30 mil liner, to be used as 20 mil – Panels P-252, P-263
C-10	Perimeter fence placement LF-12
C-17	Perimeter fence placement F-16
C-20	Perimeter ditches at LF-12 & LF-16 were excavated with a minimum excavation to best meet the existing topography.
C-17	Subgrade at stations 3+00, 100' North to Station 5+00 approximately 200' North was raised 3 to 4 tenths because of existing evidence of contamination.
C-15 & C-16	MW 16-8 not shown on drawing raised 8' to accept fill in the area.
C-16	New toe and crown, office fence left in place.
C-16	Baseline used for LF construction.
C-16, C-17	EZY Bag and woven fabric placed.
C-17	Silt fencing placed to reduce water flow to swale area.

**APPENDIX A**

**CONSTRUCTION AS-BUILT DRAWINGS**

**LIST OF DRAWINGS****LANDFILL 12 AS-BUILTS**

PLAN VIEW CONTOURS  
TOP SOIL  
PLAN VIEW CONTOURS  
COVER SOIL  
PLAN VIEW CONTOURS  
SUBGRADE  
LINER PANEL  
LAYOUT

**REVISED CONSTRUCTION DRAWINGS LF-12**

DEMOLITION PLAN  
  
CONTROL PLAN  
  
SUBGRADE GRADING PLAN  
  
FINAL GRADING PLAN  
  
TYPICAL SECTION  
  
CROSS SECTION I  
  
CROSS SECTION II

**LANDFILL 16 AS-BUILTS**

PLAN VIEW CONTOURS  
TOP SOIL  
POINT NOS. AND  
ELEVATIONS  
PLAN VIEW CONTOURS  
COVER SOIL  
PLAN VIEW CONTOURS  
SUBGRADE  
PLAN VIEW ELEVATIONS  
FINISHED GRADE  
PLAN VIEW ELEVATIONS  
COVER GRADE  
PLAN VIEW ELEVATIONS  
SUBGRADE  
LINER PANEL LAYOUT

**REVISED CONSTRUCTION DRAWINGS LF-16**

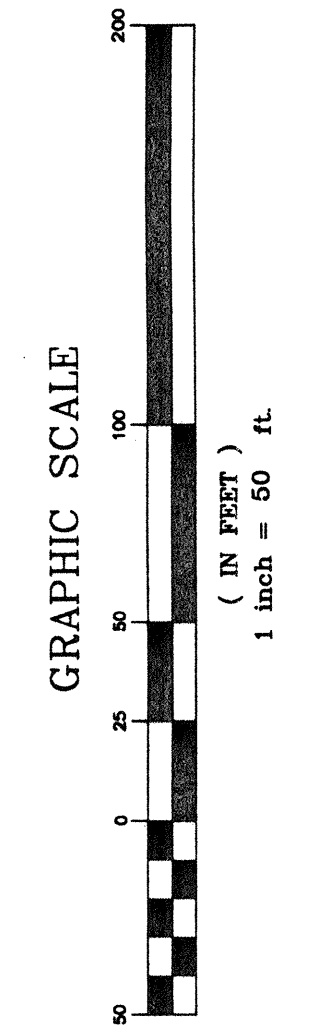
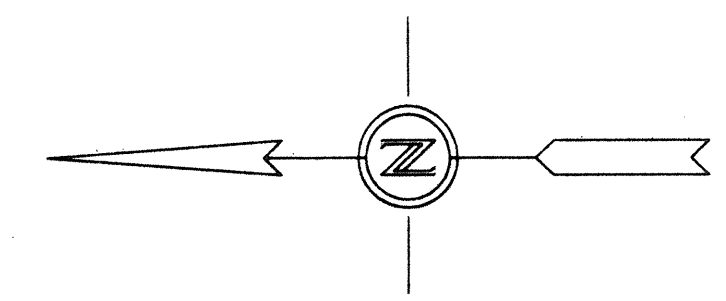
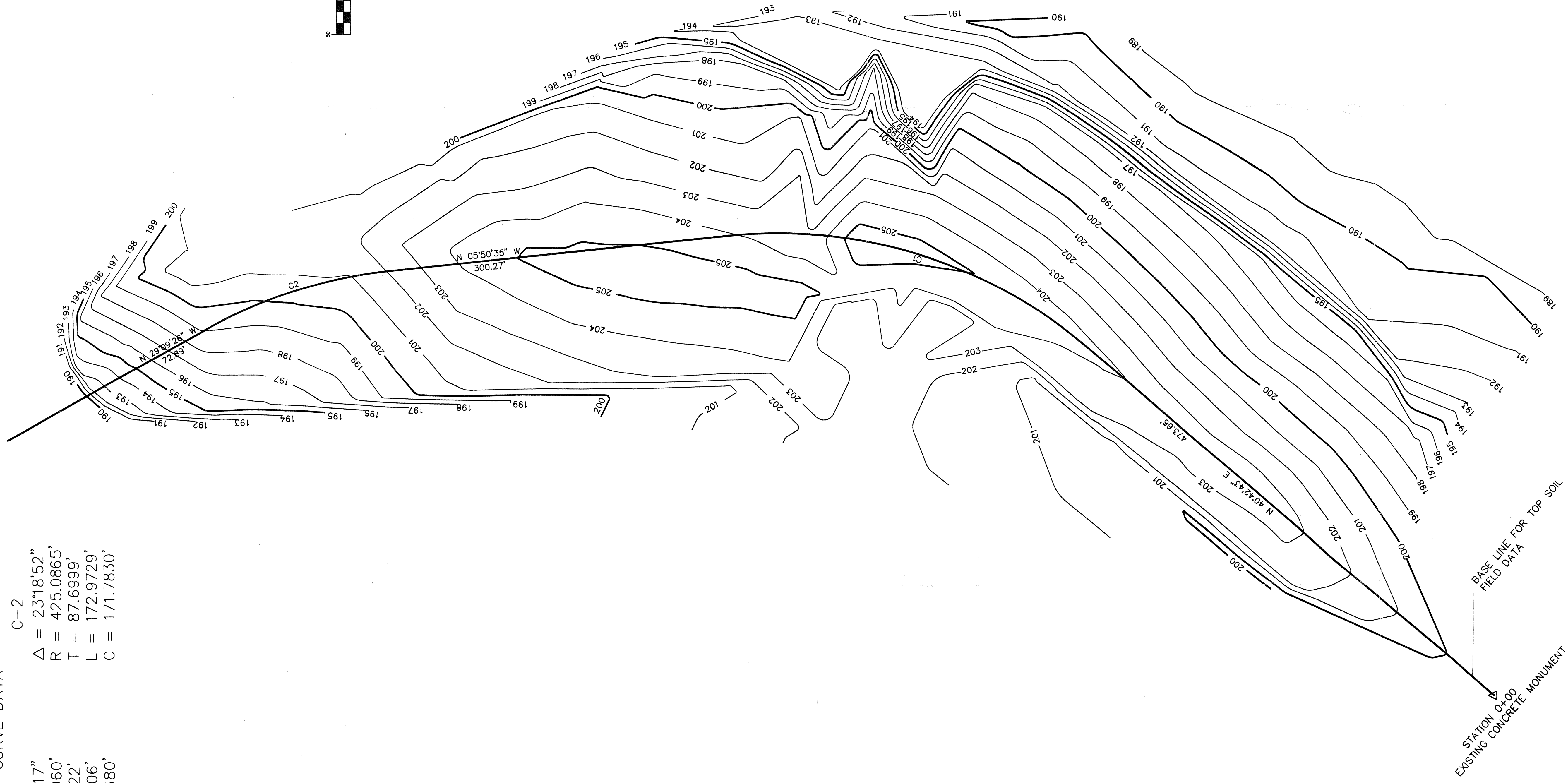
EXISTING SITE PLAN  
  
DEMOLITION PLAN  
  
SUBGRADE PLAN  
  
FINAL GRADING PLAN  
  
TYPICAL SECTION  
  
CROSS SECTIONS  
  
TYPICAL SECTION AND DETAIL

<b>LANDFILL 12 AS-BUILTS</b>	
<b>DRAWING DESCRIPTION</b>	<b>DRAWING NAME/NUMBER</b>
1. Plan View Contours Top Soil	TOP SOIL
2. Plan View Contours Cover Soil	COVER
3. Plan View Contours Subgrade	LF-12-1
4. Liner Panel Layout	12PNL

CURVE DATA

C-1  
 $\Delta = 46^{\circ}33'17''$   
 $R = 422.2960'$   
 $T = 181.6722'$   
 $L = 343.1306'$   
 $C = 333.7680'$

C-2  
 $\Delta = 23^{\circ}18'52''$   
 $R = 425.0865'$   
 $T = 87.6999'$   
 $L = 172.9729'$   
 $C = 171.7830'$



Sheet 1 of 1

NO.	DATE	DESCRIPTION	BY

LHAAP - LANDFILL 12 TOPO  
 PLAN VIEW ---- TOP SOIL

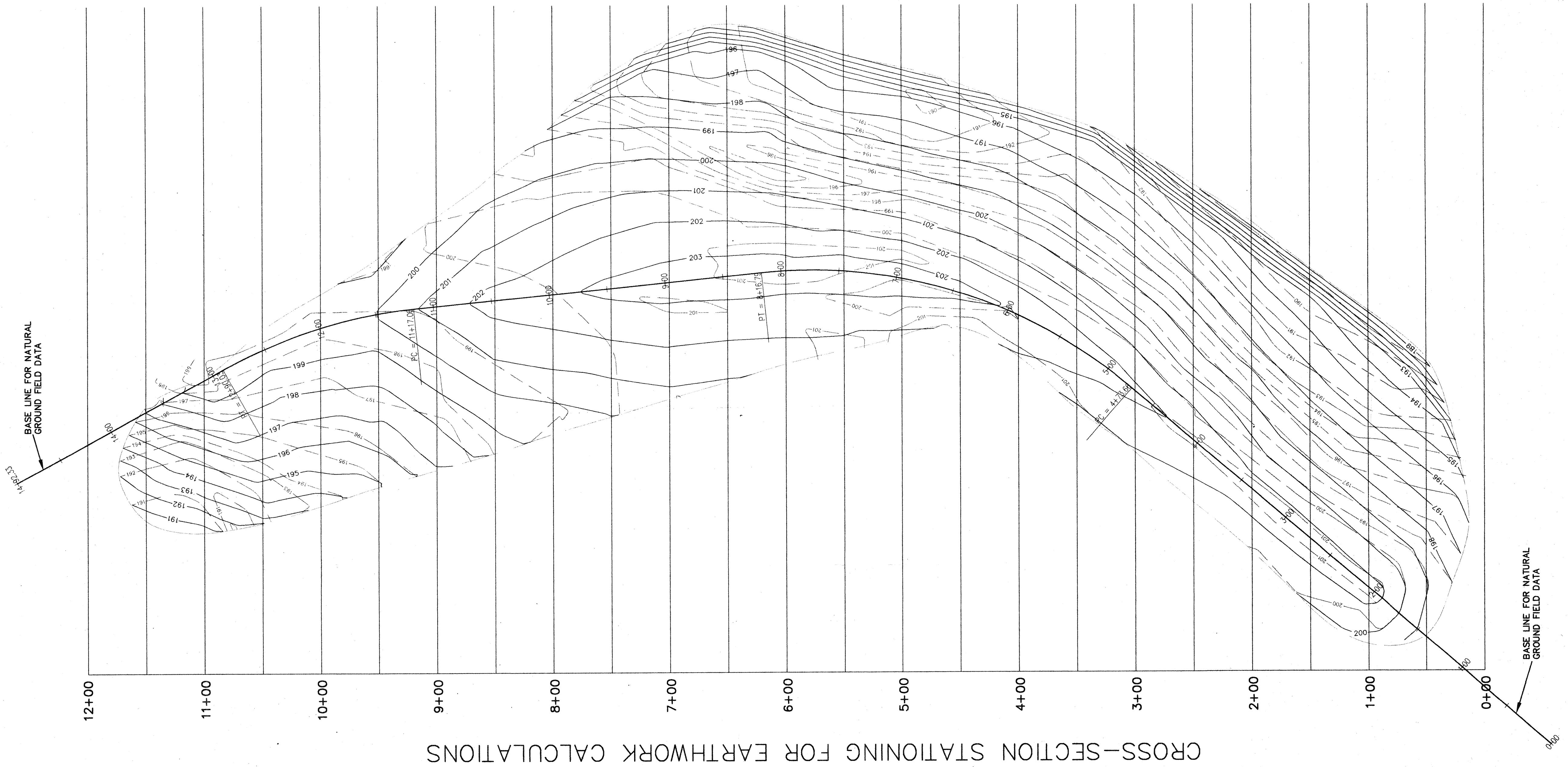
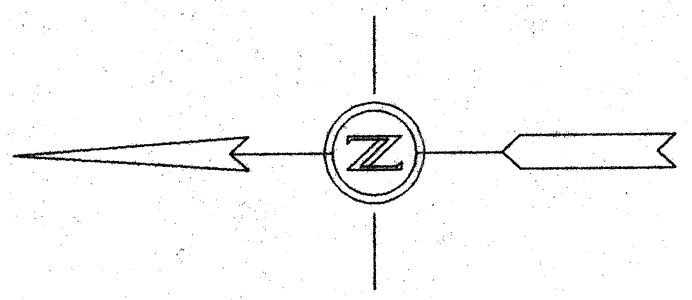
PREPARED BY  
**WINN ENVIRONMENTAL SERVICES, INC.**

P.O. Box 7351  
 DATE: 10/21/97  
 DRAWN BY: SCALE: JOB NO. 97-2008  
 1900 SE LOOP 281  
 LONGVIEW, TX. 75607  
 903-758-1171  
 FAX 903-758-1171  
 DWG NAME: TOPSOIL.DWG

Data Acquired:  
 OCTOBER 17, 1997







CROSS-SECTION STATIONING FOR EARTHWORK CALCULATIONS

TOTAL FILL = 20,573 CU YD  
 (fill volume represents bank yardage with no shrinkage factor applied)

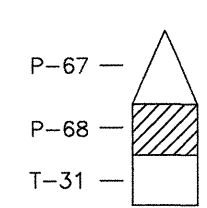
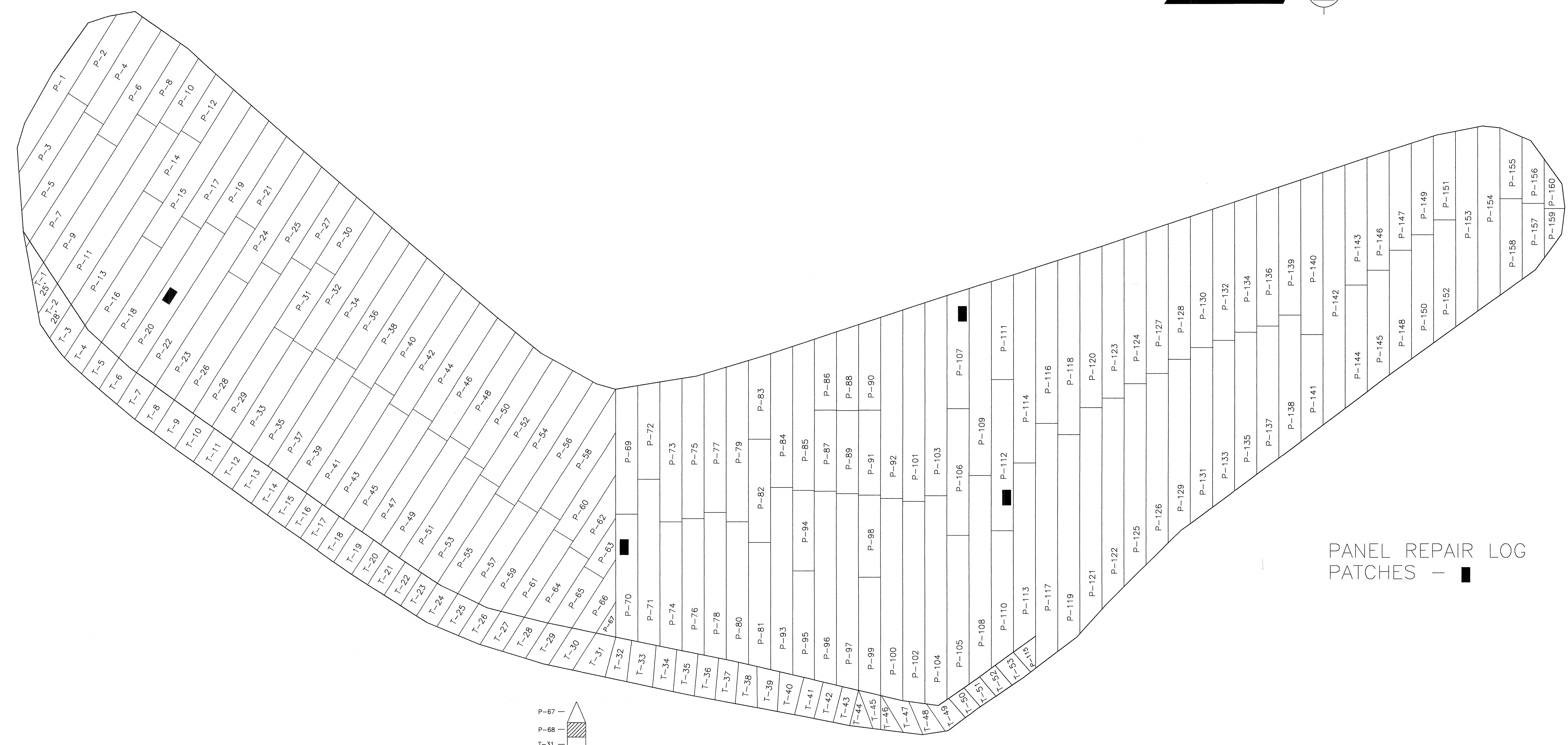
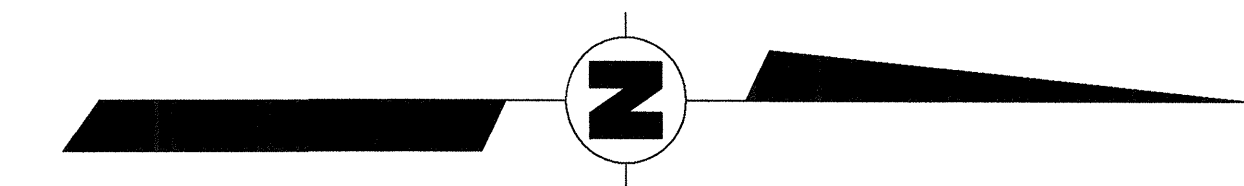
REVISIONS  
 August 8, 1997

Data Acquired:  
 July 17 & 21, 1997

NOTE  
 There are two independent sets of stationing shown on this plan. The Base line stations were used to gather natural ground field data. The Cross-Section stations were used for volume calculations. The Cross-Section stations were spaced at 20 ft intervals and were done using the Average End Area method, applying sections at 2 ft intervals (e.g. 2+02, 2+04, 2+06, etc) over the entire site. For illustrative purposes, only the 50 ft station intervals are shown.

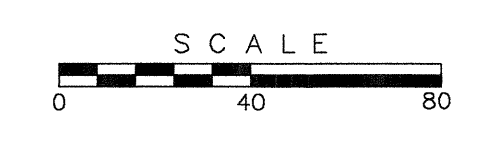
LHAAP - LANDFILL 12  
 PLAN VIEW

PREPARED BY  
**HART ENGINEERING CO.**  
 CONSULTING ENGINEERS  
 AND SURVEYORS  
 P.O. Box 2804  
 DATE: 1 AUG 97  
 DRAWN BY: DLB  
 SCALE: 1" = 50'  
 JOB NO: 12.913  
 DIB: LF-12-1-DWG  
 LONGVIEW, TX 75006  
 415 N. CENTER ST.  
 903-758-0166  
 FAX 758-2527



NOTE: P-68 IS LOCATED BETWEEN P-67 AND T-31

- GENERAL NOTES:
1. ROLLS USED FOR THIS PROJECT WERE 17.5'x200' FOR 20 MIL, AND 17.5'x170' 30 MIL TEXTURED.
  2. TEXTURED 30 MIL WAS USED ON ALL SLOPES WHERE INDICATED IN THE DRAWING.
  3. PANEL BREAKS ARE ACTUAL.



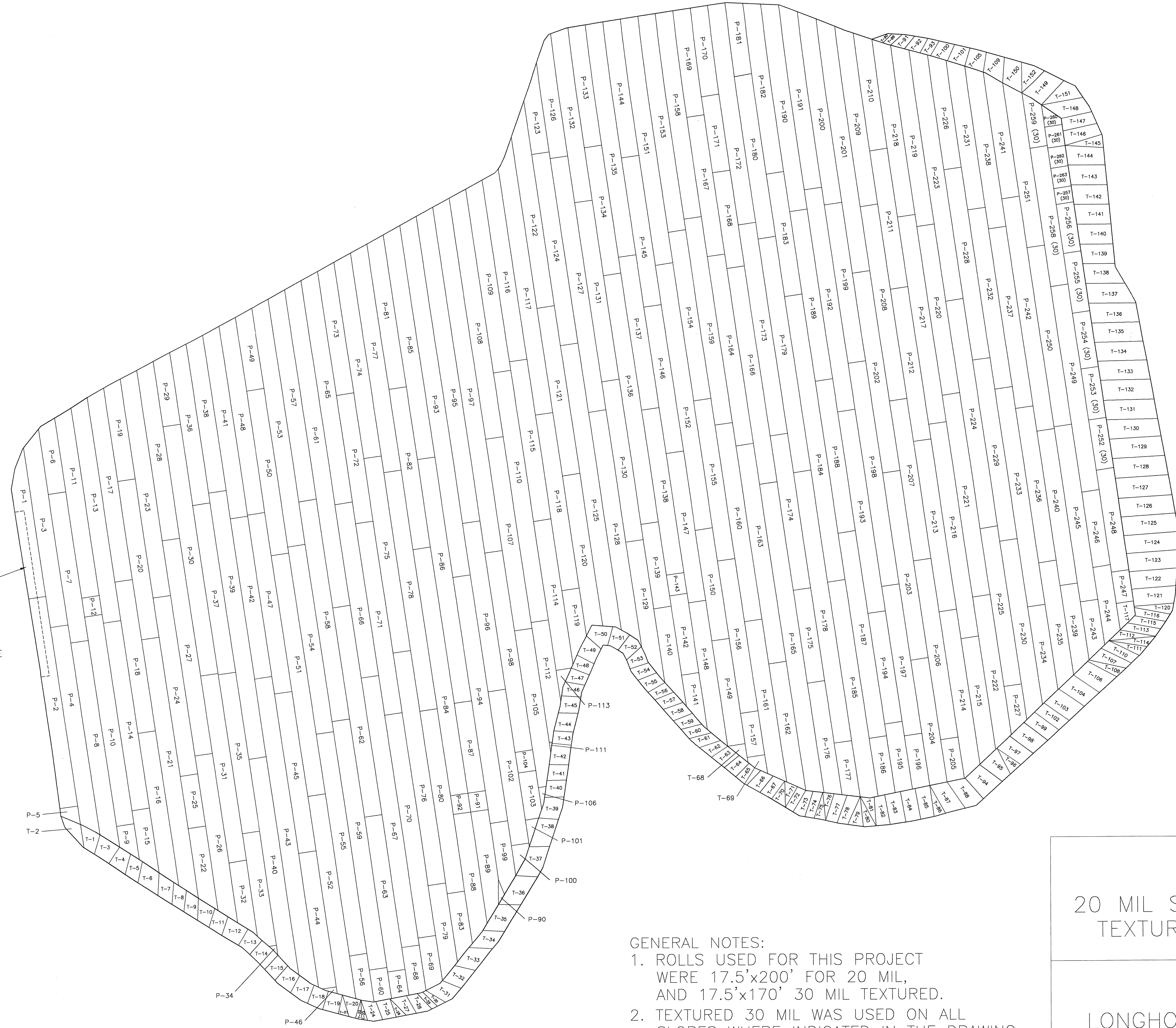
PANEL REPAIR LOG PATCHES - ■

LANDFILL 12  
20 MIL SMOOTH GUNSEAL AND 30 MIL TEXTURED GUNSEAL PANEL LAYOUT

LONGHORN ARMY AMMUNITION PLANT  
KARNACK, TEXAS

REVISED BY: OHM  
DATE: NOVEMBER 1998

12PNL.DWG



NOTE:  
 A PIECE OF 20 MIL LINER  
 17.5'x70' WAS CUT TO  
 8.75'x140' IN LENGTH.  
 THIS WAS PLACED BECAUSE  
 OF ROUGH EDGES ON  
 THE ANCHOR TRENCH.

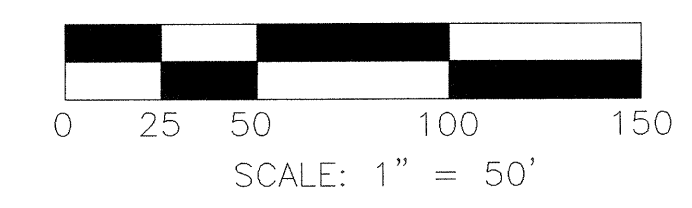
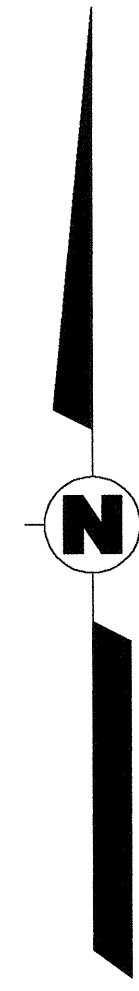
- GENERAL NOTES:
1. ROLLS USED FOR THIS PROJECT WERE 17.5'x200' FOR 20 MIL, AND 17.5'x170' 30 MIL TEXTURED.
  2. TEXTURED 30 MIL WAS USED ON ALL SLOPES WHERE INDICATED IN THE DRAWING.
  3. PANEL BREAKS ARE ACTUAL.
  4. 30 MIL PLACEMENT FOR 20 MIL FROM P-252 - P-263

LANDFILL 16  
 20 MIL SMOOTH GUNSEAL AND 30 MIL  
 TEXTURED GUNSEAL PANEL LAYOUT

LONGHORN ARMY AMMUNITION PLANT  
 KARNACK, TEXAS

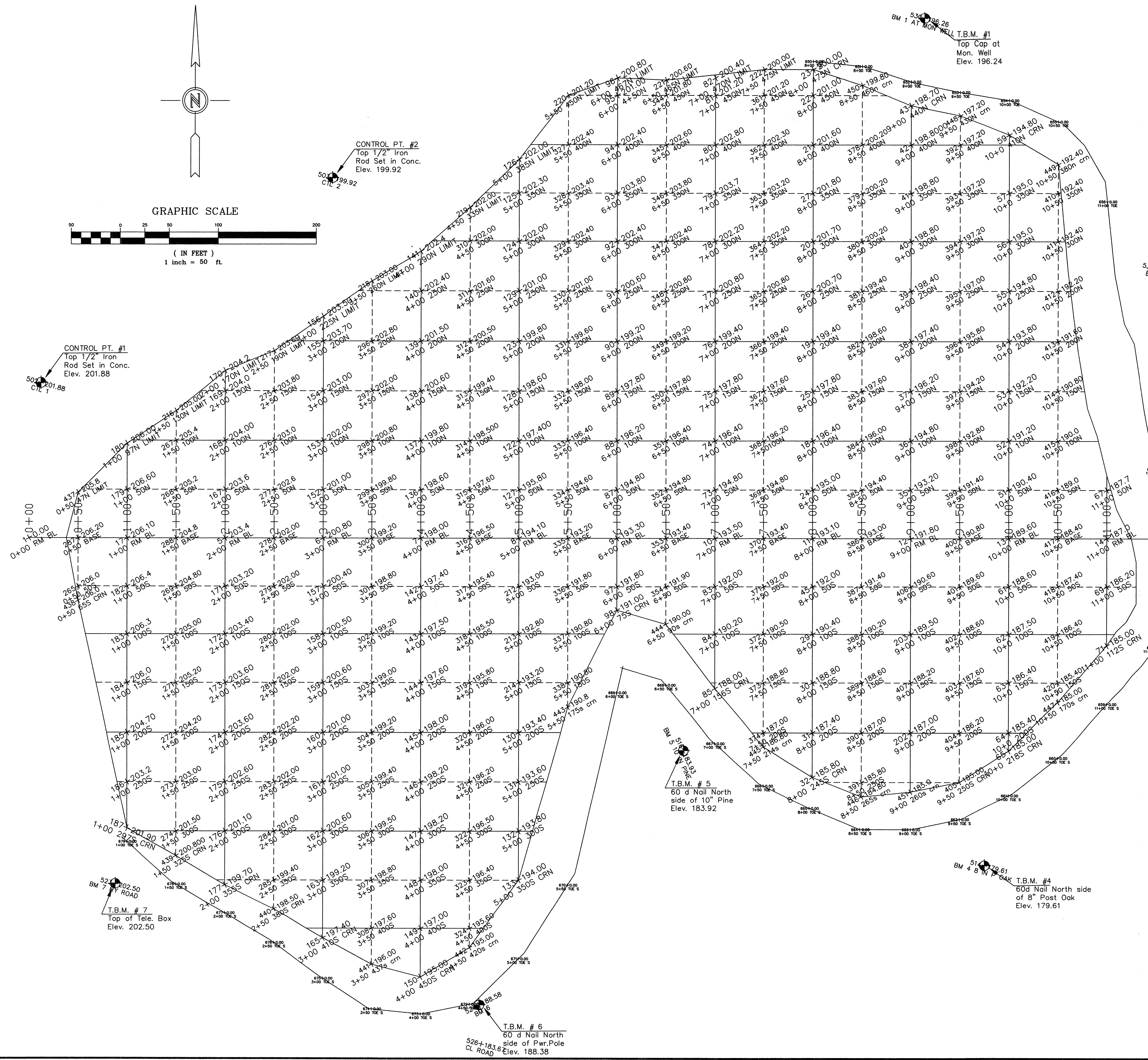
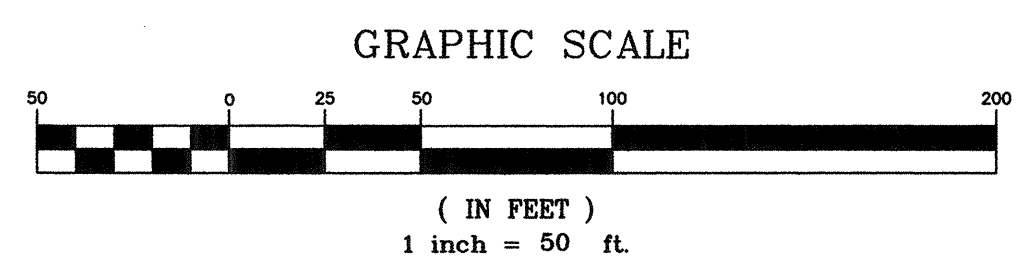
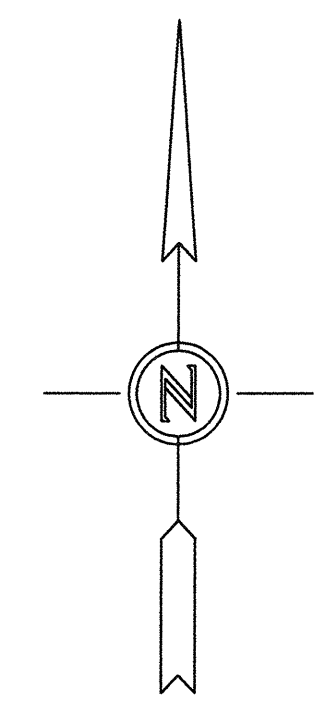
REVISED BY: OHM  
 DATE: NOVEMBER 1998

16PNL.DWG



5+00 N  
4+50 N  
4+00 N  
3+50 N  
3+00 N  
2+50 N  
2+00 N  
1+50 N  
1+00 N  
0+50 N  
RM B/L  
0+50 S  
1+00 S  
1+50 S  
2+00 S  
2+50 S  
3+00 S  
3+50 S  
4+00 S  
4+50 S  
5+00 S

4+50 N  
4+00 N  
3+50 N  
3+00 N  
2+50 N  
2+00 N  
1+50 N  
1+00 N  
0+50 N  
RM B/L  
0+50 S  
1+00 S  
1+50 S  
2+00 S  
2+50 S  
3+00 S



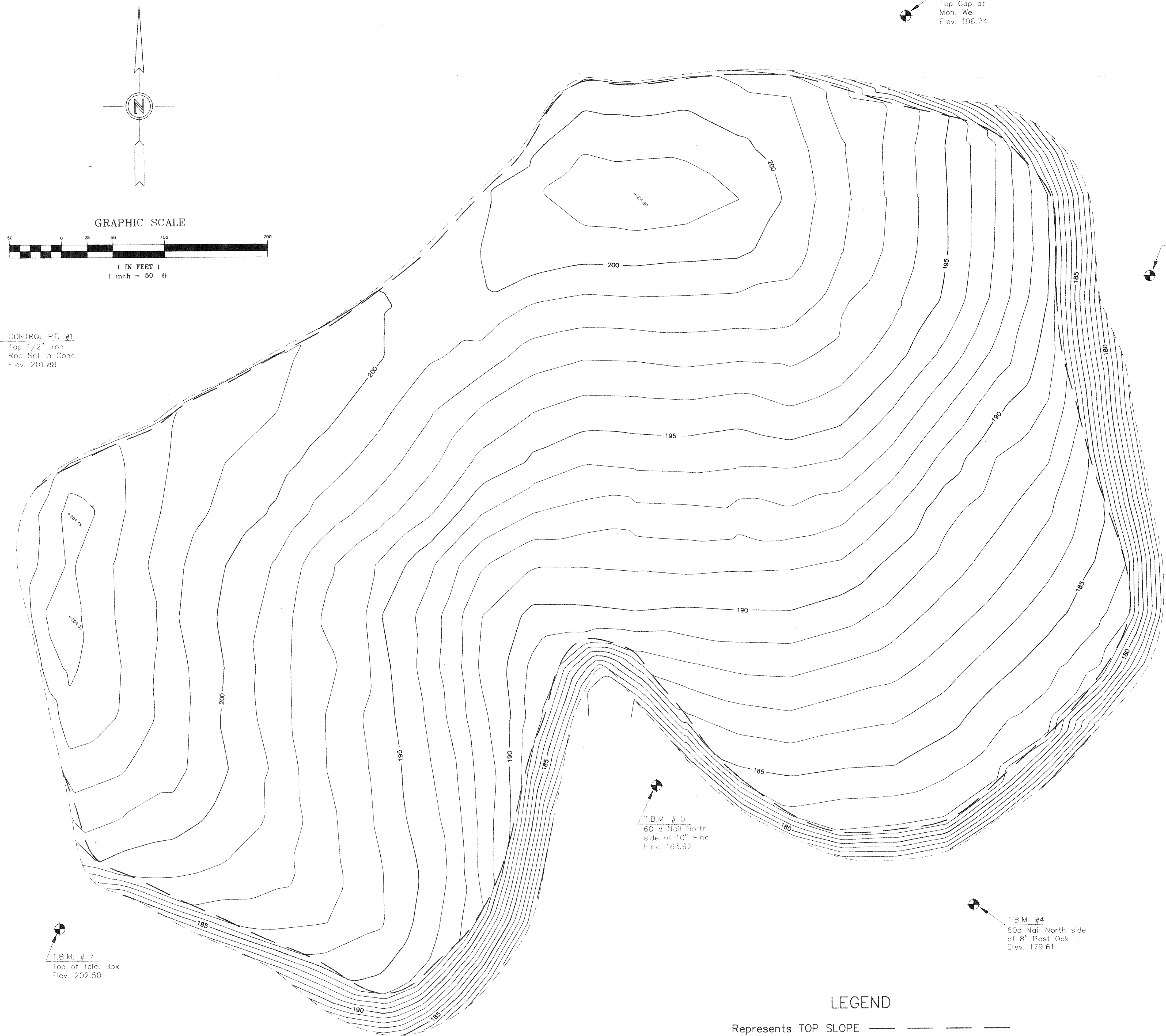
TYPE "G"  
Conc. Monument  
Elev. 203.72

### "FINISHED GRADE ELEVATIONS"

LHAAP - LANDFILL 16  
PLAN VIEW - FINISHED GRADE

PREPARED BY  
WINN ENVIRONMENTAL SERVICES, INC.

P.O. Box 7351	1900 SE LOOP 281	LONGVIEW, TX, 75607
DATE: 11/21/97	FAX 758-2701	903-758-1171
DRAWN BY	SCALE	JOB NO.
JLD	1"=50'	97-2008
		DWG NAME
		LF16FIN2.DWG



T.B.M. #1  
Top Cap at  
Mon. Well  
Elev. 196.24

T.B.M. #2  
Elev. 182.28

T.B.M. #3  
60d Nail in West  
side of 18" Cypress  
Elev. 178.41

T.B.M. #5  
60 d Nail North  
side of 10" Pine  
Elev. 183.92

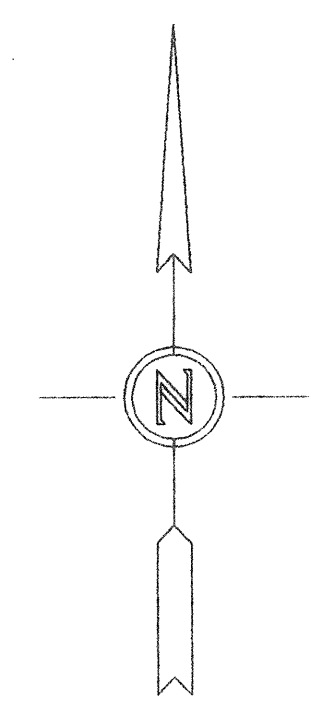
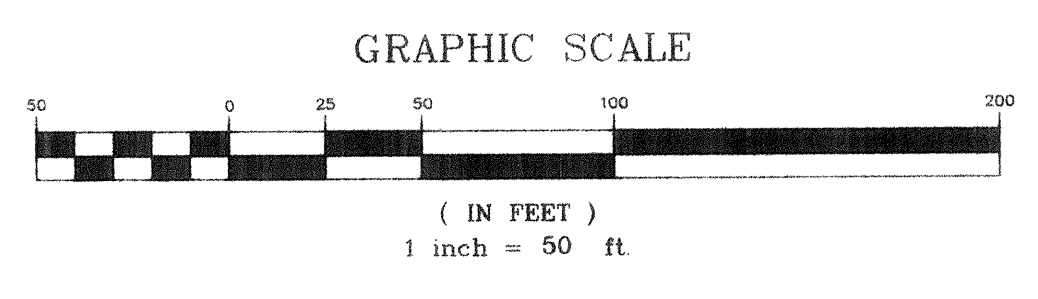
T.B.M. #4  
60d Nail North side  
of 8" Post Oak  
Elev. 179.61

T.B.M. #7  
Top of Tele. Box  
Elev. 202.50

T.B.M. #6  
60 d Nail North  
side of Pwr.Pole  
Elev. 188.38

CONTROL PT. #1  
Top 1/2" Iron  
Rod Set in Conc.  
Elev. 201.88

TYPE "G"  
Conc. Monument  
Elev. 203.72



LEGEND  
 Represents TOP SLOPE ————  
 Represents TOE SLOPE - - - - -

**"SUB-GRADE ELEVATIONS"**

LHAAP -- LANDFILL 16  
 PLAN VIEW -- SUBGRADE

PREPARED BY  
**HART ENGINEERING COMPANY**  
 CONSULTING ENGINEERS  
 AND SURVEYORS

P.O. Box 2084	415 No. Center St.	Longview, TX 75606
DATE: 05/22/98	FAX: 758-2402	903-758-0166
DRAWN BY: JWH	SCALE: 1"=50'	JOB NO.: 12913-3
		DWG NAME: 12913-16.DWG



**"COVER SOIL CONTOURS"**

**LHAAP - LANDFILL 16  
PLAN VIEW - COVER SOIL**

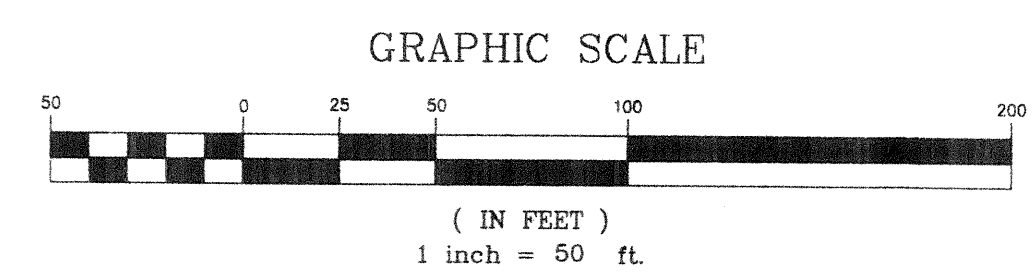
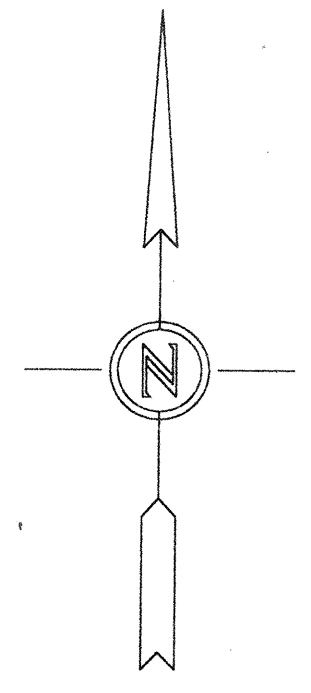
PREPARED BY  
**HART ENGINEERING COMPANY**  
CONSULTING ENGINEERS  
AND SURVEYORS

P.O. Box 2084 415 No. Center St. Longview, TX. 75606  
DATE: 08/13/98 FAX: 758-2402 903-758-0166

DRAWN BY	SCALE	JOB NO.	DWG NAME
JWH	1"=50'	12913-3	12913-16.DWG

Plotted: 08-13-98  
Contoured: 08-12-98

805 178.37  
ACTUAL PLOT IS OFF PAPER  
(Mon. on south side road  
between two creeks)



CONC. MONUMENT  
Top of Nail  
Elev. 203.72

T.B.M. # 7  
Top of Tele. Box  
Elev. 202.50

T.B.M. # 5  
60 d Nail North  
side of 10" Pine  
Elev. 183.92

T.B.M. # 6  
60 d Nail North  
side of Pwr. Pole  
Elev. 188.38

GPS BASE  
POINT  
H 200.42

T.B.M. #1  
Top Cap at  
Mon. Wall  
Elev. 196.24

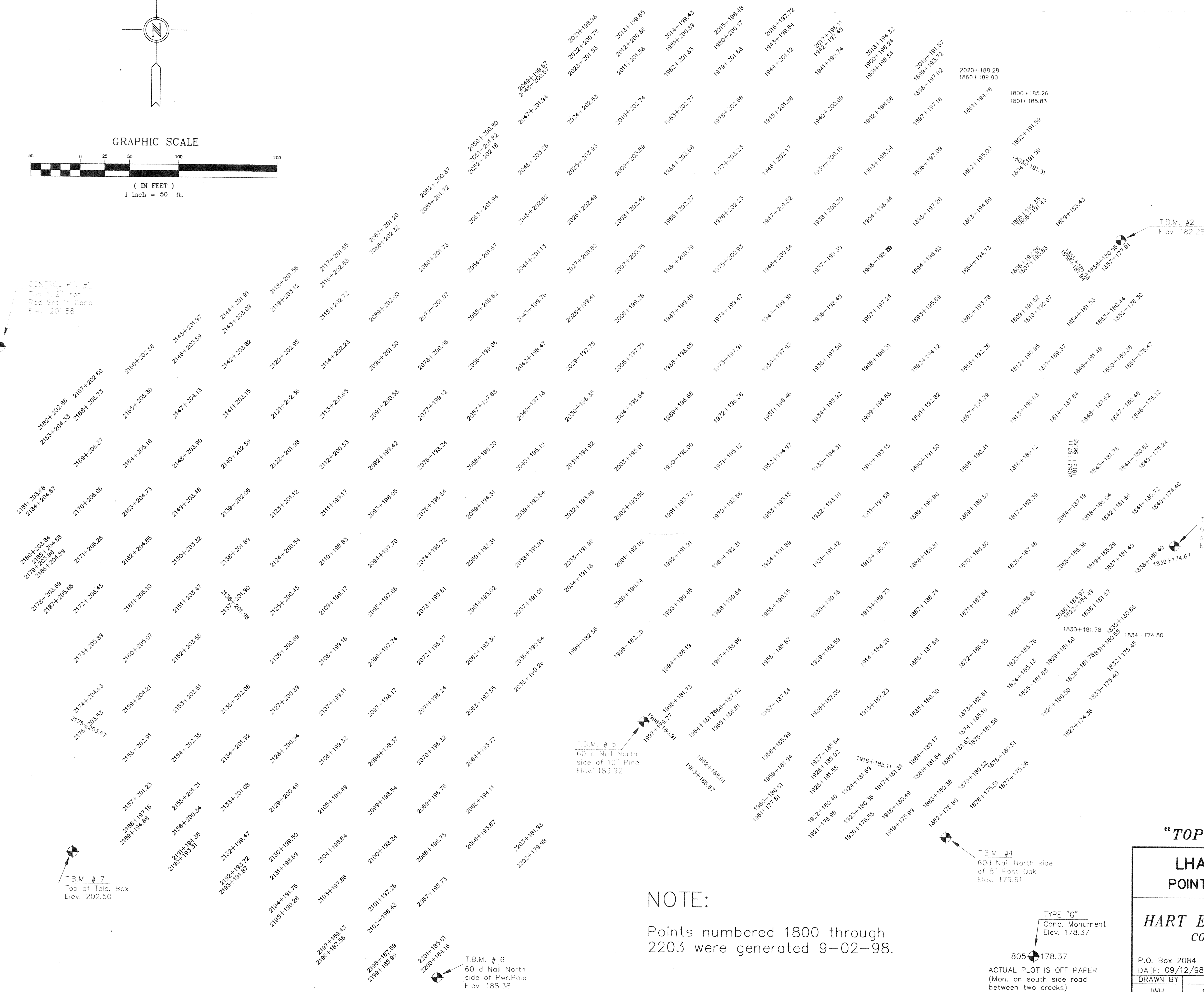
T.B.M. #2  
Elev. 182.28

T.B.M. #3  
60d Nail in West  
side of 12" Cypress  
Elev. 178.41

T.B.M. #4  
60d Nail North side  
of 8" Post Oak  
Elev. 179.61

TYPE "G"  
Conc. Monument  
Elev. 178.37

805  
178.37  
ACTUAL PLOT IS OFF PAPER  
(Mon. on south side road  
between two creeks)



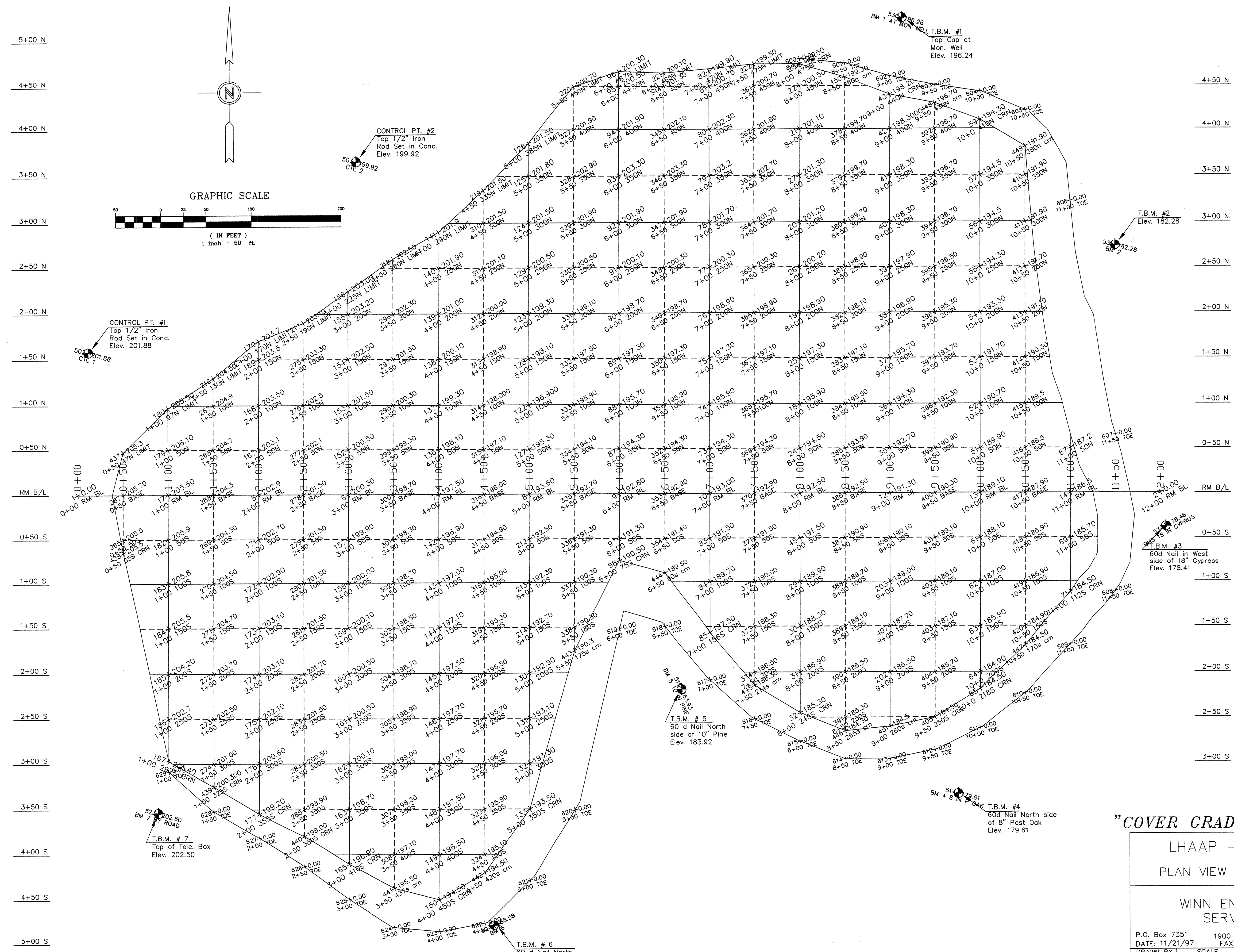
NOTE:  
Points numbered 1800 through  
2203 were generated 9-02-98.

**"TOP SOIL ELEVATIONS"**  
**LHAAP - LANDFILL 16**  
**POINT NOS. AND ELEVATIONS**

PREPARED BY  
**HART ENGINEERING COMPANY**  
CONSULTING ENGINEERS  
AND SURVEYORS

P.O. Box 2084 415 No. Center St. Longview, TX. 75606  
DATE: 09/12/98 FAX: 758-2402 903-758-0166

DRAWN BY	SCALE	JOB NO.	DWG NAME
JWH	1"=50'	12913-5	FINIS2.DWG



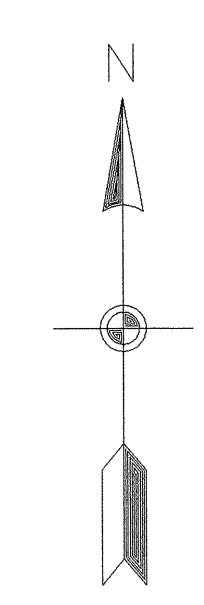
**"COVER GRADE ELEVATIONS"**

LHAAP - LANDFILL 16  
 PLAN VIEW - COVER GRADE

PREPARED BY  
**WINN ENVIRONMENTAL SERVICES, INC.**

P.O. Box 7351	1900 SE LOOP 281	LONGVIEW, TX. 75607
DATE: 11/21/97	FAX: 758-2701	903-758-1171
DRAWN BY: JLD	SCALE: 1"=50'	JOB NO.: 97-2008
		DWG NAME: LF16COV2.DWG



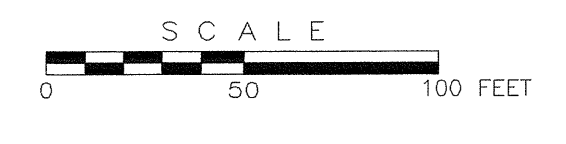


**LEGEND**

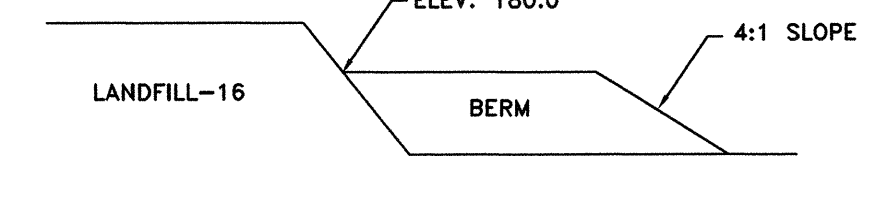
- - - - DITCH
- - - - CENTERLINE OF 16' WIDE ROAD
- - - - EXISTING CONTOURS
- - - - FINAL CONTOURS

ELEVATION DATUM BASED ON N.G.V.D. 1929 DATUM.  
 COORDINATE DATUM IS BASED ON THE NAD 83(92) TEXAS STATE PLANE COORDINATE SYSTEM, N.CEN., ZONE (4202)

COMBINED SCALE FACTOR: 0.99988410



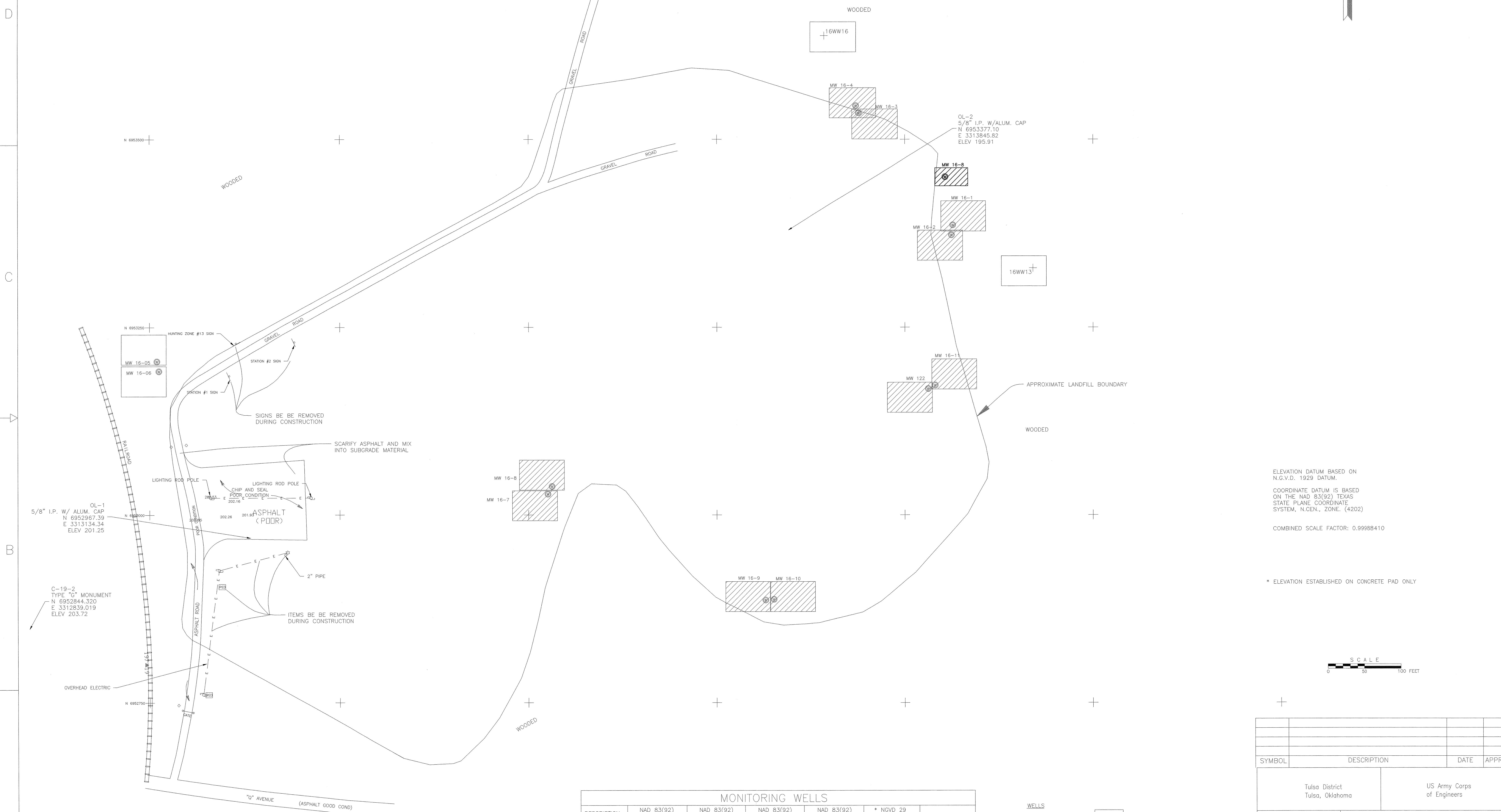
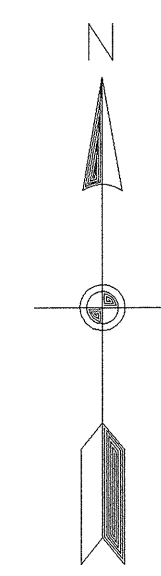
**DETAIL "A"**  
 BERM KEY-IN ON EAST & SOUTH SLOPE AT ELEVATION 180.00 - BERM SLOPE 4:1



3-95 (NOT SHOWN)  
 TYPE "C" MONUMENT  
 N 6952411.298  
 E 3314136.438  
 ELEV 178.39

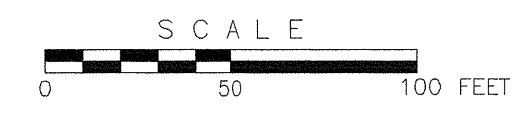
SYMBOL	DESCRIPTION	DATE	APPR
	Tulsa District Tulsa, Oklahoma		US Army Corps of Engineers
DESIGNED BY:	LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS		
DRAWN BY:	LANDFILL LHAAP16		
REVIEWED BY:	SUBGRADE PLAN		
SUBMITTED BY:			
REVISED BY OHM NOVEMBER 1998			
PLOT SCALE: AS SHOWN	DWG. CODE:	CONTRACT DATE:	SHEET REFERENCE NUMBER
DESIGN FILE: LH16SGPL.DGN		INVIATION NO. DACA56- -B-	C16
PLOT DATE: DECEMBER 1995	SHEET OF	CONTRACT NO. DACA56-94-0-0020	

N 6953750 E 3314000  
N 6953500 E 3313250  
N 6953250 E 3312500  
N 6953000 E 3311750  
N 6952750 E 3311250

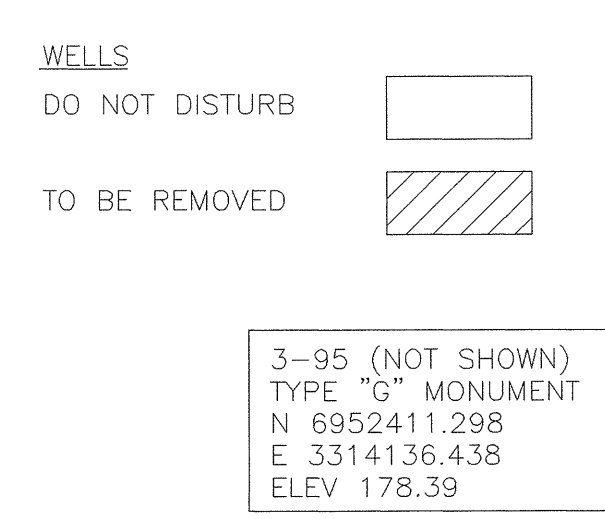


ELEVATION DATUM BASED ON N.G.V.D. 1929 DATUM.  
COORDINATE DATUM IS BASED ON THE NAD 83(92) TEXAS STATE PLANE COORDINATE SYSTEM, N.CEN., ZONE: (4202)  
COMBINED SCALE FACTOR: 0.99988410

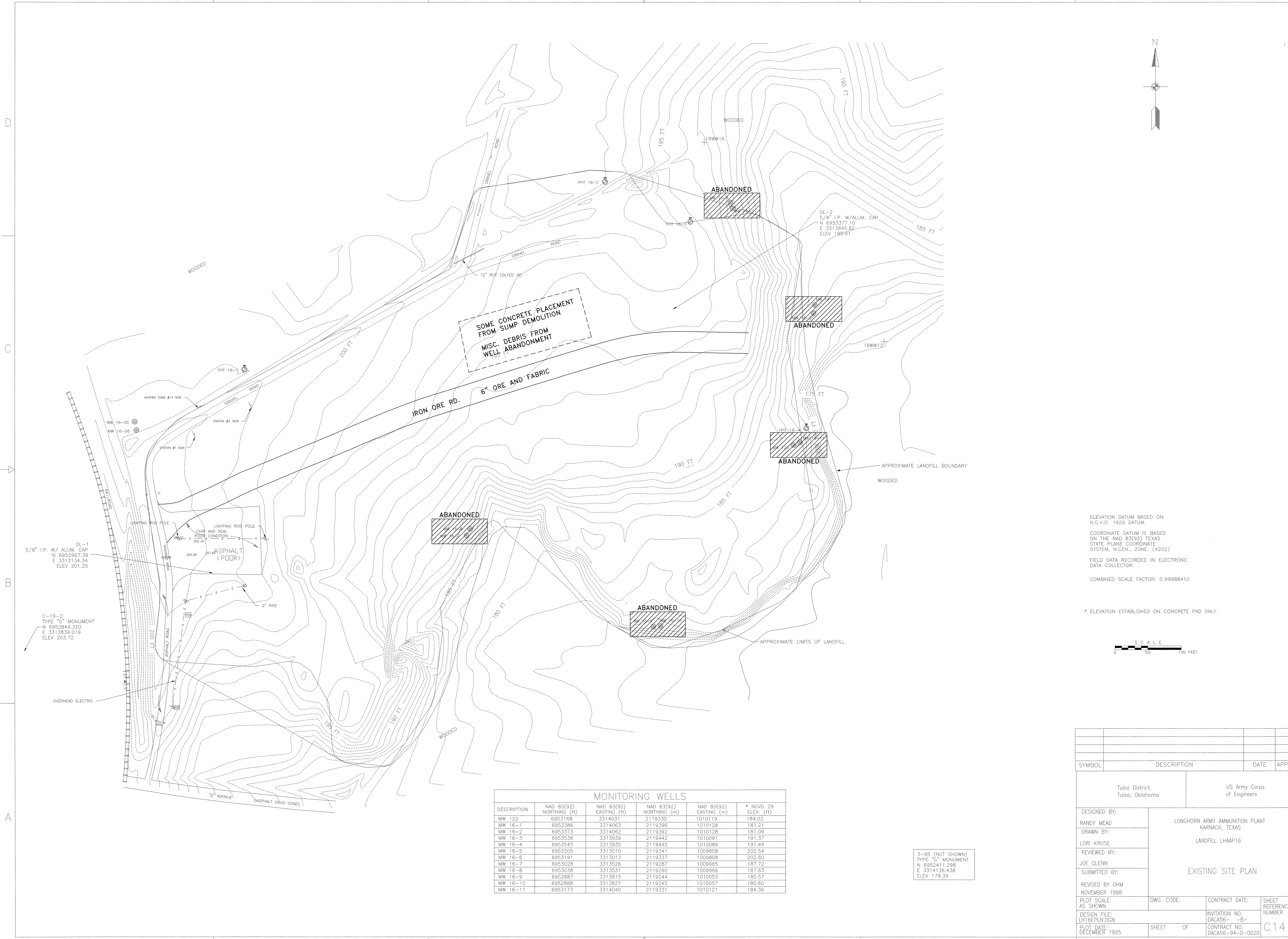
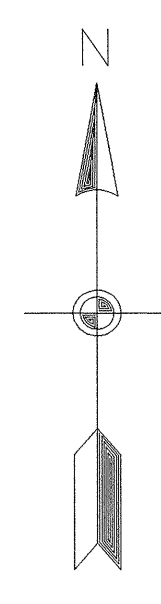
\* ELEVATION ESTABLISHED ON CONCRETE PAD ONLY



MONITORING WELLS					
DESCRIPTION	NAD 83(92) NORTHING (ft)	NAD 83(92) EASTING (ft)	NAD 83(92) NORTHING (m)	NAD 83(92) EASTING (m)	* NGVD 29 ELEV. (ft)
MW 122	6953168	3314031	2119330	1010119	184.02
MW 16-1	6953386	3314063	2119396	1010128	181.21
MW 16-2	6953373	3314062	2119392	1010128	181.09
MW 16-3	6953536	3313939	2119442	1010091	191.37
MW 16-4	6953545	3313935	2119445	1010089	191.44
MW 16-5	6953205	3313010	2119341	1009808	202.54
MW 16-6	6953191	3313013	2119337	1009808	202.60
MW 16-7	6953028	3313526	2119287	1009965	187.72
MW 16-8	6953038	3313531	2119290	1009966	187.63
MW 16-9	6952887	3313815	2119244	1010053	180.57
MW 16-10	6952888	3313827	2119245	1010057	180.60
MW 16-11	6953173	3314040	2119331	1010121	184.36
MW 16-13	6953638	3313894			DO NOT DISTURB
MW 16-16	6953329	3314171			DO NOT DISTURB



SYMBOL	DESCRIPTION	DATE	APPR
	Tulsa District Tulsa, Oklahoma		US Army Corps of Engineers
DESIGNED BY:	LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS		
DRAWN BY:	LANDFILL LHAA16		
REVIEWED BY:	DEMOLITION PLAN		
SUBMITTED BY:			
REVISED BY:	OHM NOVEMBER 1998		
PLOT SCALE:	DWG. CODE:	CONTRACT DATE:	SHEET REFERENCE NUMBER
50:1	LH16DPLN.DGN		
DESIGN FILE:	SHEET OF	CONTRACT NO.	C-15
PLOT DATE:		DACA56-94-D-0020	



SOME CONCRETE PLACEMENT FROM SUMP DEMOLITION  
MISC. DEBRIS FROM WELL ABANDONMENT

IRON ORE RD. 6" ORE AND FABRIC

ABANDONED

ABANDONED

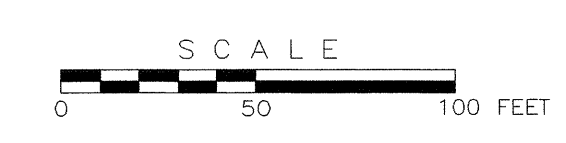
ABANDONED

ABANDONED

ABANDONED

ELEVATION DATUM BASED ON N.G.V.D. 1929 DATUM.  
COORDINATE DATUM IS BASED ON THE NAD 83(92) TEXAS STATE PLANE COORDINATE SYSTEM, N.GEN., ZONE: (4202)  
FIELD DATA RECORDED IN ELECTRONIC DATA COLLECTOR.  
COMBINED SCALE FACTOR: 0.99988410

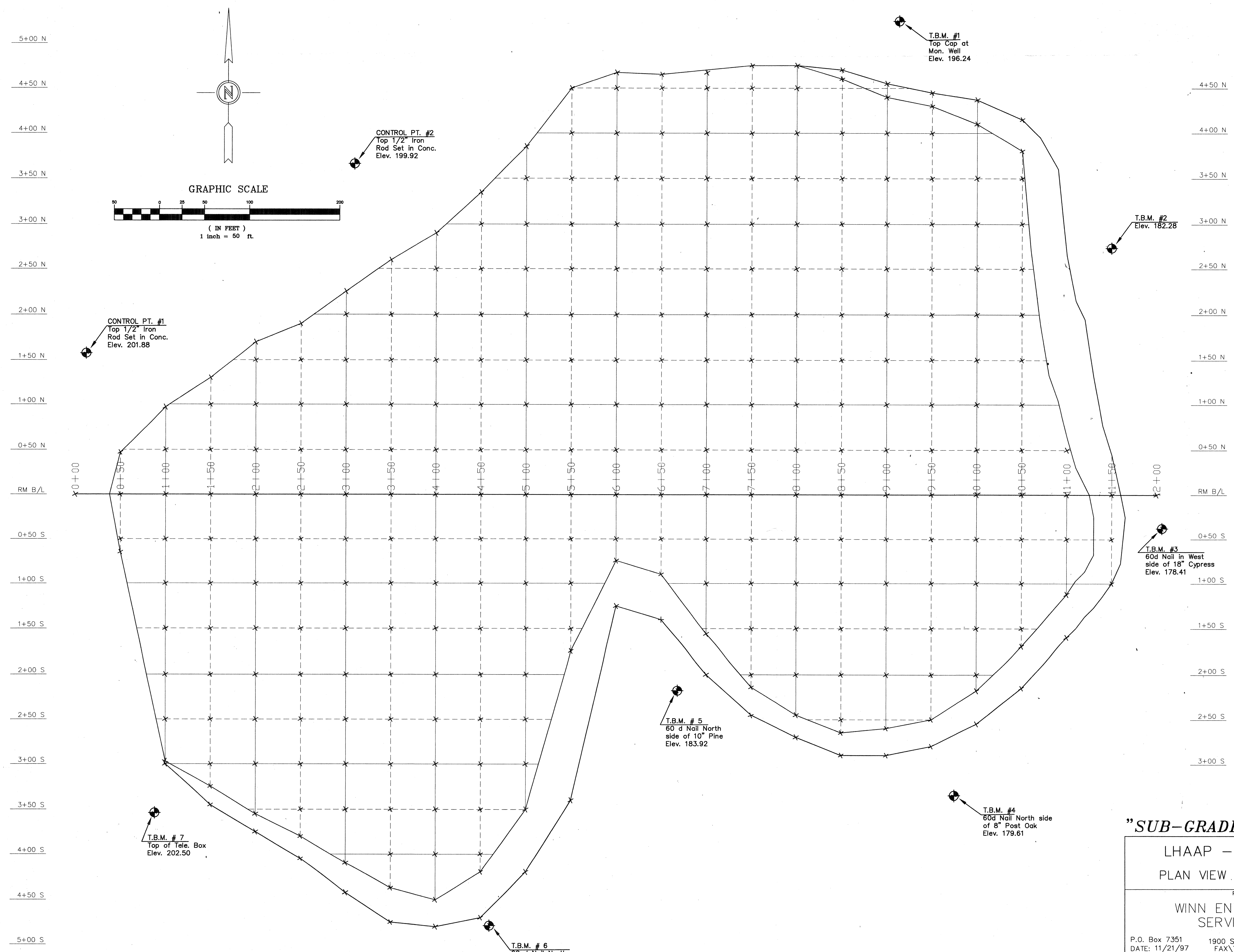
\* ELEVATION ESTABLISHED ON CONCRETE PAD ONLY



MONITORING WELLS					
DESCRIPTION	NAD 83(92) NORTHING (ft)	NAD 83(92) EASTING (ft)	NAD 83(92) NORTHING (m)	NAD 83(92) EASTING (m)	* NGVD 29 ELEV. (ft)
MW 122	6953168	3314031	2119330	1010119	184.02
MW 16-1	6953386	3314063	2119396	1010128	181.21
MW 16-2	6953373	3314062	2119392	1010128	181.09
MW 16-3	6953536	3313939	2119442	1010091	191.37
MW 16-4	6953545	3313935	2119445	1010089	191.44
MW 16-5	6953205	3313010	2119341	1009908	202.54
MW 16-6	6953191	3313013	2119337	1009908	202.60
MW 16-7	6953028	3313526	2119287	1009965	187.72
MW 16-8	6953038	3313531	2119290	1009966	187.63
MW 16-9	6952887	3313815	2119244	1010053	180.57
MW 16-10	6952888	3313827	2119245	1010057	180.60
MW 16-11	6953173	3314040	2119331	1010121	184.36

3-95 (NOT SHOWN)  
TYPE "C" MONUMENT  
N 6952411.298  
E 3314136.438  
ELEV 178.39

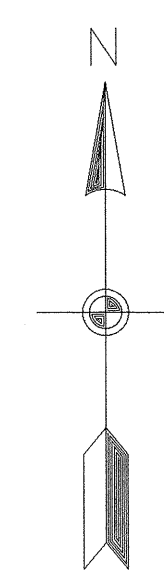
SYMBOL	DESCRIPTION	DATE	APPR
Tulsa District Tulsa, Oklahoma		US Army Corps of Engineers	
DESIGNED BY: RANDY MEAD	LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS		
DRAWN BY: LORI KRUSE	LANDFILL LHAP16		
REVIEWED BY: JOE GLENN	EXISTING SITE PLAN		
SUBMITTED BY:			
REVISED BY OHM NOVEMBER 1998			
PLOT SCALE: AS SHOWN	DWG. CODE:	CONTRACT DATE:	SHEET REFERENCE NUMBER
DESIGN FILE: LH16EPLN.DGN		INVITATION NO. DACA56--B-	C14
PLOT DATE: DECEMBER 1995	SHEET OF	CONTRACT NO. DACA56-94-D-0020	



**"SUB-GRADE ELEVATIONS"**

LHAAP - LANDFILL 16  
PLAN VIEW -- SUBGRADE

PREPARED BY			
WINN ENVIRONMENTAL SERVICES, INC.			
P.O. Box 7351	1900 SE LOOP 281	LONGVIEW, TX. 75607	
DATE: 11/21/97	FAX 758-2701	903-758-1171	
DRAWN BY	SCALE	JOB NO.	DWG NAME
JLD	1"=50'	97-2008	LF16ESIZE.DWG

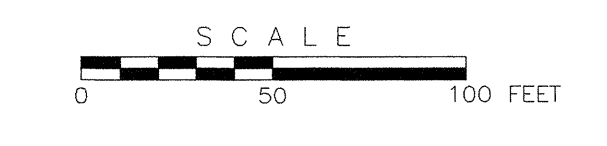


NOTE  
FIELD-LOCATED BERM  
IS OMITTED FOR CLARITY  
OF COVER SOIL GRADING

LEGEND

- DITCH
- - - CENTERLINE OF 16' WIDE ROAD
- - - EXISTING CONTOURS
- - - FINAL CONTOURS
- - - 100-YEAR FLOORPLAIN CONTOUR

ELEVATION DATUM BASED ON  
N.G.V.D. 1929 DATUM.  
COORDINATE DATUM IS BASED  
ON THE NAD 83(92) TEXAS  
STATE PLANE COORDINATE  
SYSTEM, N.CEN., ZONE. (4202)



DISCHARGE APPROX. 500 FT  
NW TO TRIBUTARY OF CENTRAL CREEK,  
THENCE APPROX. 4,000 FT TO  
CENTRAL CREEK, THENCE APPROX.  
2,000 FT TO CADDO LAKE,  
DITCH OUTFALL (TYP.)

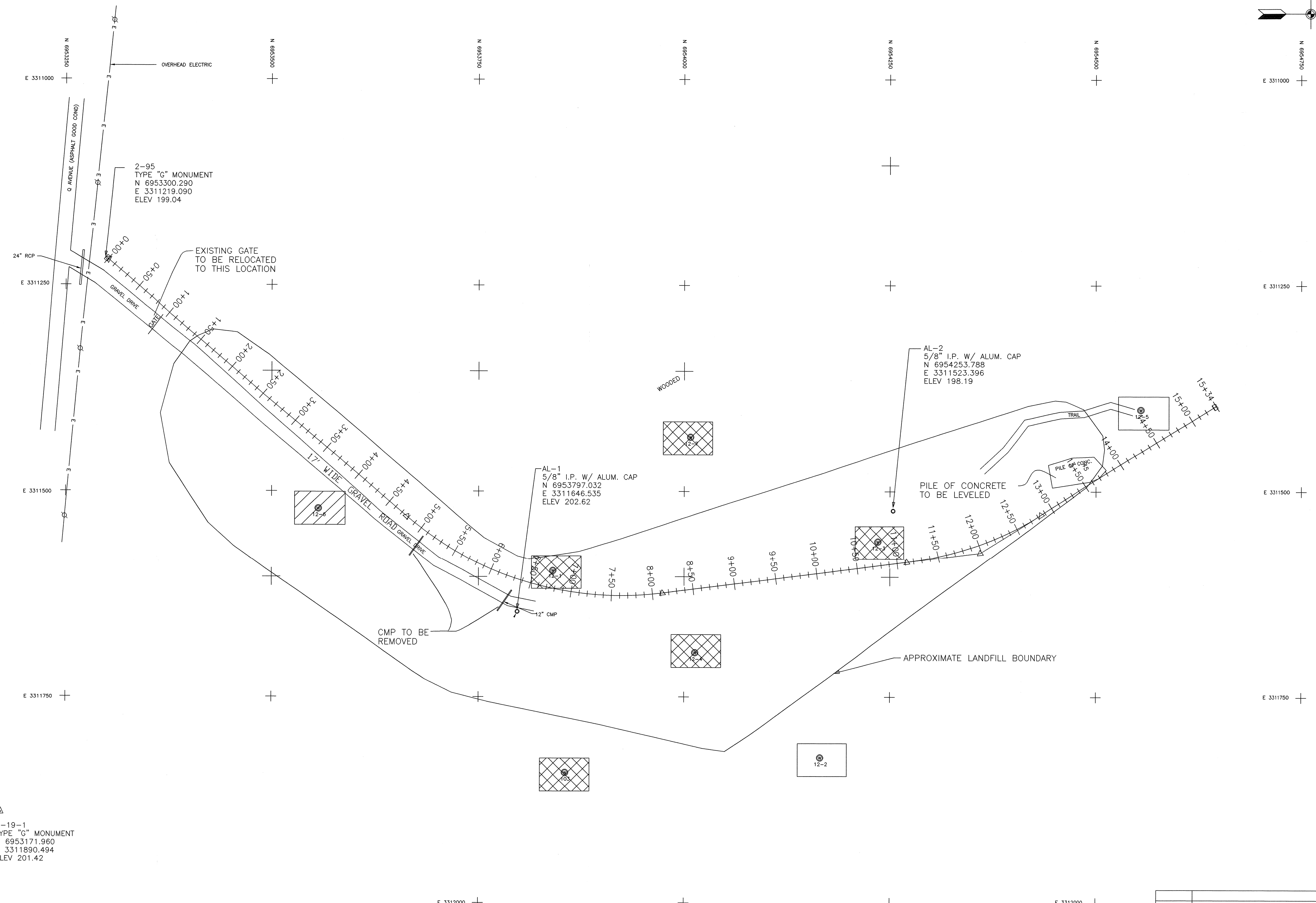
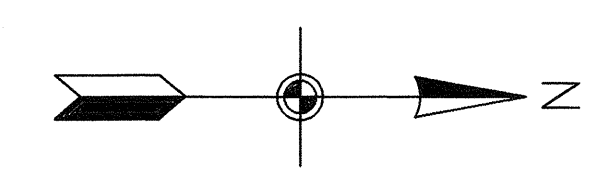
DISCHARGE OVERLAND 400 TO 500 FT  
SE TO HARRISON BAYOU,  
THENCE APPROX. 5,000 FT TO  
CADDO LAKE.

100 YEAR FLOOD PLAIN  
FOLLOWING CONSTRUCTION

DISCHARGE OVERLAND 400 TO 500 FT  
SE TO HARRISON BAYOU,  
THENCE APPROX. 5,000 FT TO  
CADDO LAKE.

3-95 (NOT SHOWN)  
TYPE "G" MONUMENT  
N 6952411.298  
E 3314136.438  
ELEV 178.39

SYMBOL		DESCRIPTION	DATE	APPR
		Tulsa District Tulsa, Oklahoma		US Army Corps of Engineers
DESIGNED BY:	LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS			
RANDY MEAD	LANDILL LHAA16			
DRAWN BY:				
LORI KRUSE				
REVIEWED BY:	FINAL GRADING PLAN			
JOE GLENN				
SUBMITTED BY:				
REVISD BY OHM NOVEMBER 1998				
PLOT SCALE: AS SHOWN	DWG. CODE:	CONTRACT DATE:	SHEET REFERENCE NUMBER	
DESIGN FILE: LH16FGPL.DGN		INVITATION NO. DACA56--B-	C17	
PLOT DATE: DECEMBER 1995	SHEET OF	CONTRACT NO. DACA56-94-D-0020		



△  
C-19-1  
TYPE "G" MONUMENT  
N 6953171.960  
E 3311890.494  
ELEV 201.42

2-95  
TYPE "G" MONUMENT  
N 6953300.290  
E 3311219.090  
ELEV 199.04

AL-1  
5/8" I.P. W/ ALUM. CAP  
N 6953797.032  
E 3311646.535  
ELEV 202.62

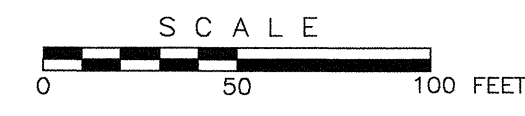
AL-2  
5/8" I.P. W/ ALUM. CAP  
N 6954253.788  
E 3311523.396  
ELEV 198.19

MONITORING WELLS						
DESCRIPTION	NAD 83(92) NORTHING (ft)	NAD 83(92) EASTING (ft)	NAD 83(92) NORTHING (m)	NAD 83(92) EASTING (m)	* NGVD 29 ELEV. (ft)	STATUS OF WELL
MW 103	6953855	3311842	2119539.2	1009451.4	192.78	C
MW 12-1	6953840	3311597	2119534.7	1009376.7	200.20	C
MW 12-2	6954164	3311824	2119633.6	1009446.0	200.28	A
MW 12-3	6954235	3311561	2119655.2	1009365.8	199.75	C
MW 12-4	6954013	3311696	2119587.5	1009407.0	200.81	C
MW 12-5	6954555	3311400	2119752.5	1009316.8	188.46	A
MW 12-6	6953555	3311521	2119447.9	1009353.6	188.39	B
MW 12-7	6954008	3311434	2119585.8	1009327.1	201.34	C

\* ELEVATION ESTABLISHED ON CONCRETE PAD ONLY

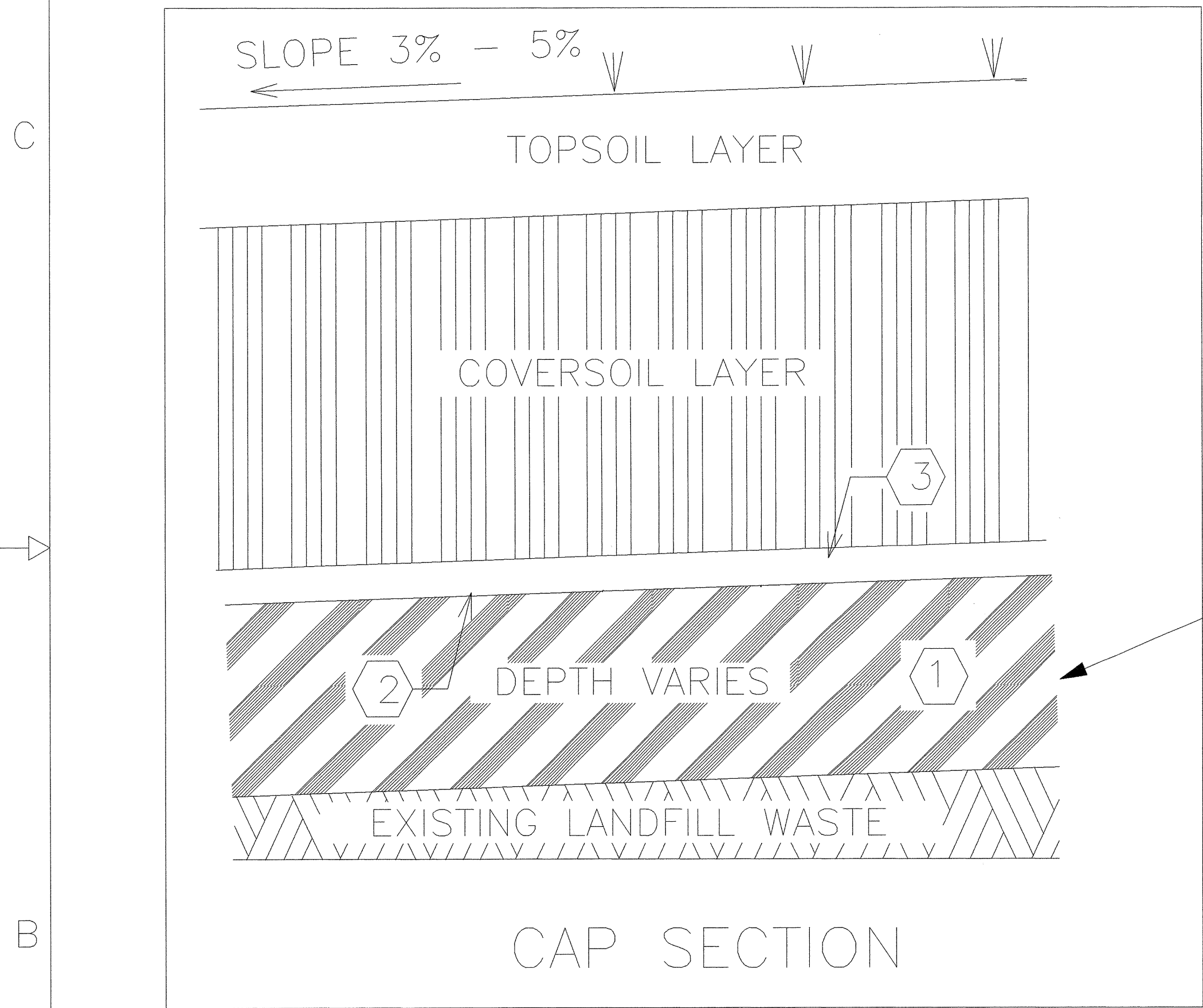
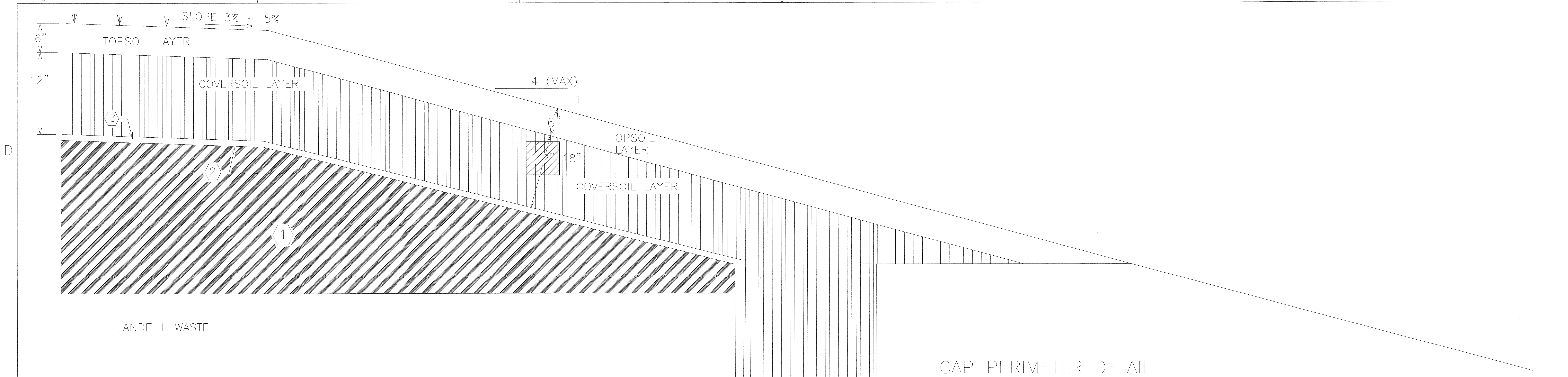
- A = DO NOT DISTURB
- B = TO BE REMOVED
- C = REMOVED BY PREVIOUS CONTRACTOR

ELEVATION DATUM BASED ON N.G.V.D. 1929 DATUM  
O ELEVATION ESTABLISHED ON CONCRETE PAD ONLY  
COORDINATE DATUM IS BASED ON THE NAD 83(92) TEXAS STATE PLANE COORDINATE SYSTEM, N.CEN. ZONE, (4202)  
FIELD DATA RECORDED IN ELECTRONIC DATA COLLECTOR.



1-95 (NOT SHOWN)  
TYPE "G" MONUMENT  
N 6953336.621  
E 3310185.015  
ELEV 203.93

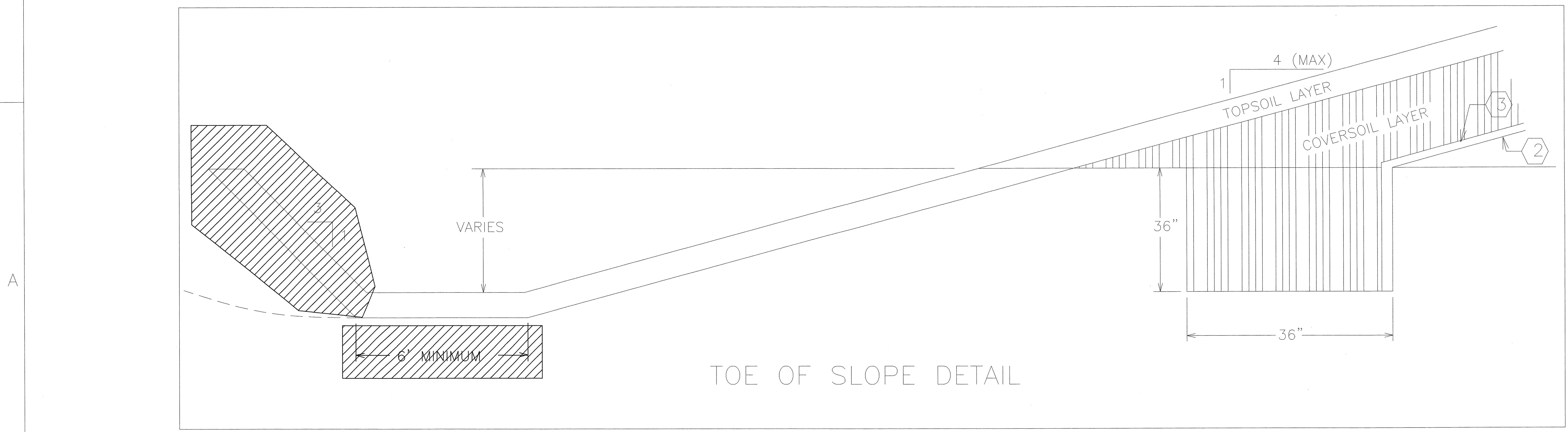
SYMBOL	DESCRIPTION	DATE	APPR
	Tulsa District Tulsa, Oklahoma		
	US Army Corps of Engineers		
DESIGNED BY: RANDY MEAD	LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS LANDFILL LHAAP 12		
DRAWN BY: DARRELL JONES			
REVIEWED BY: JOE GLENN			
SUBMITTED BY: REVISED BY OHM NOVEMBER 1998			
<b>DEMOLITION PLAN</b>			
PLOT SCALE: 50:1	DWG. CODE:	CONTRACT DATE:	SHEET REFERENCE NUMBER
DESIGN FILE: LH12DPLN.DGN		INVIATION NO. DACA56--B-	
PLOT DATE:	SHEET OF	CONTRACT NO. DACA56-94-D-0020	C-07



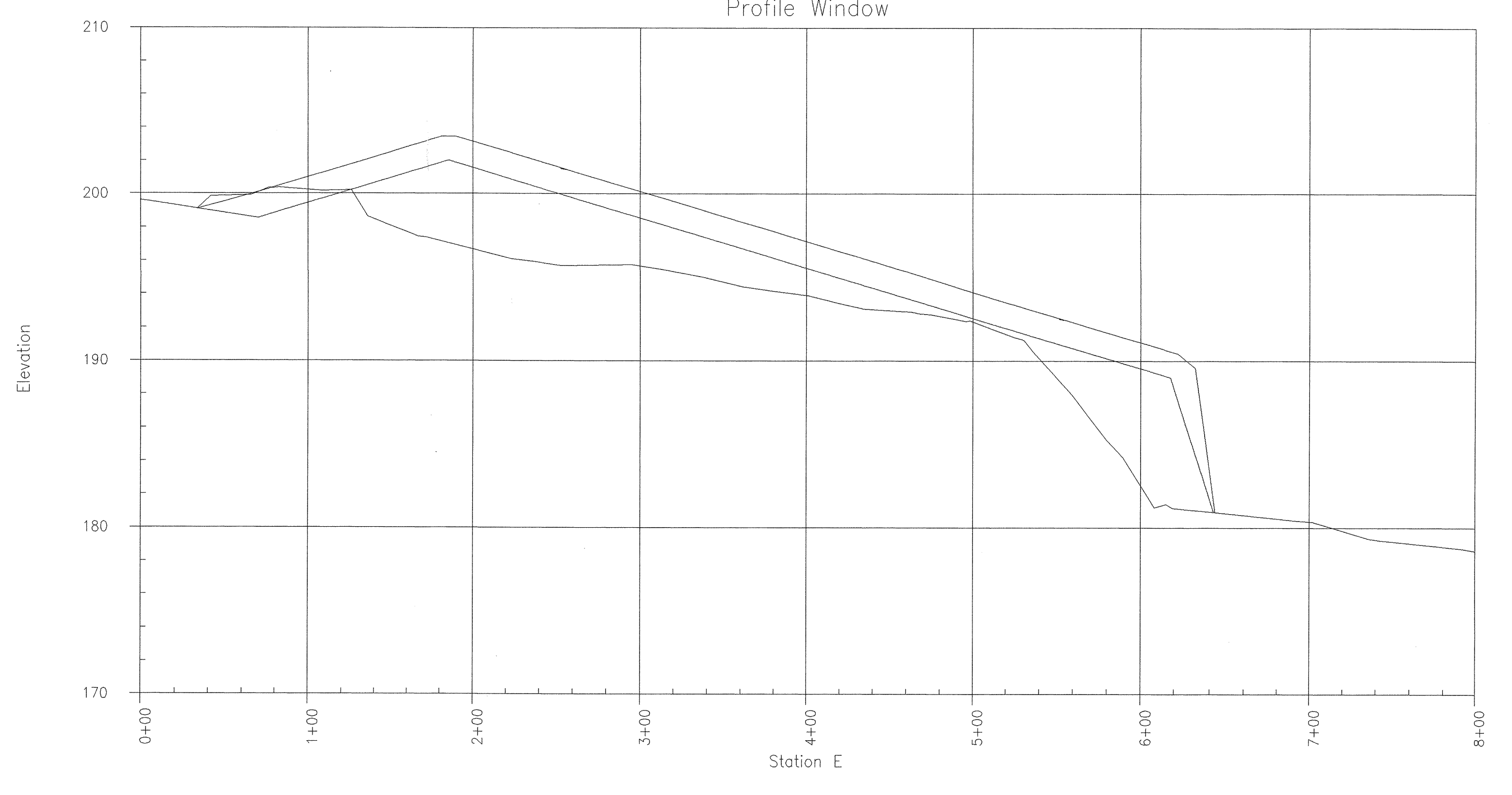
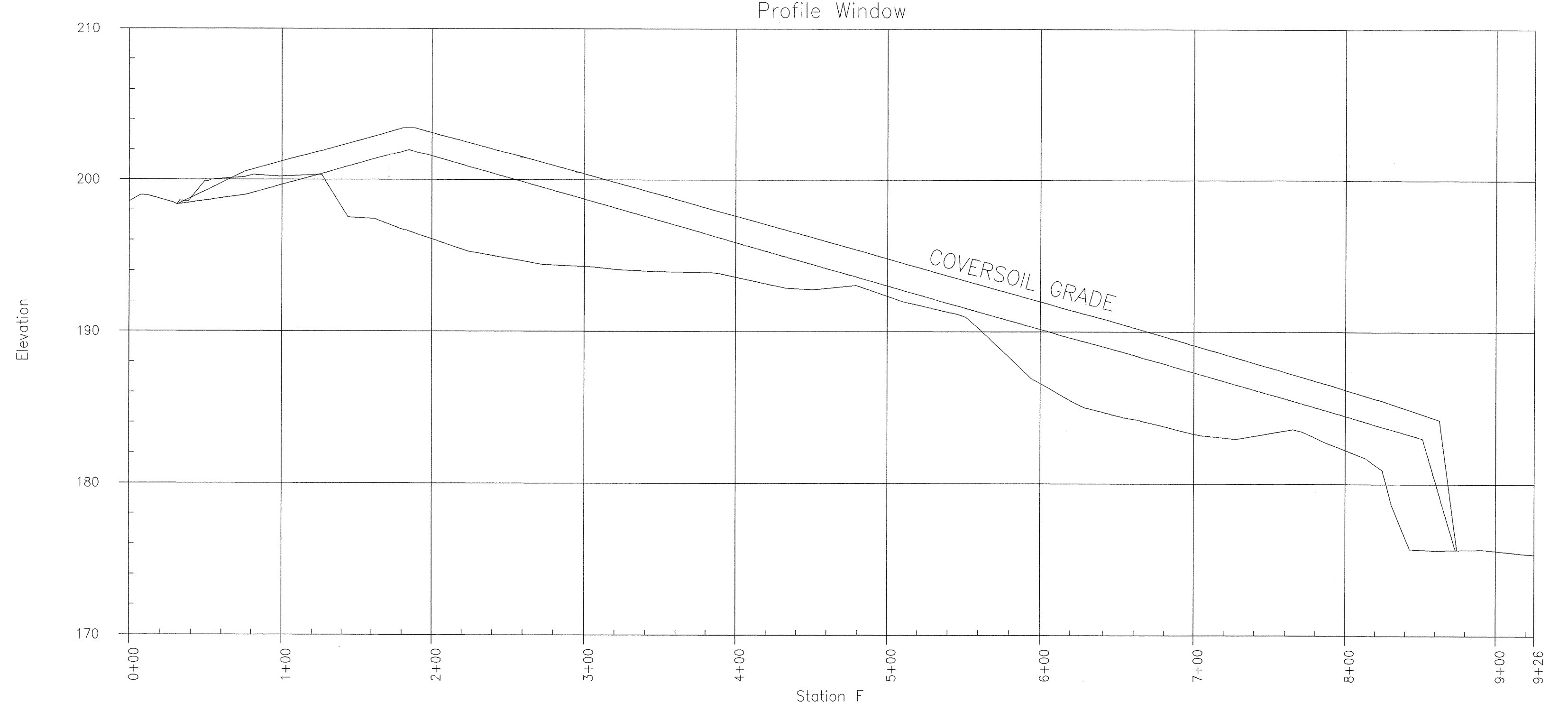
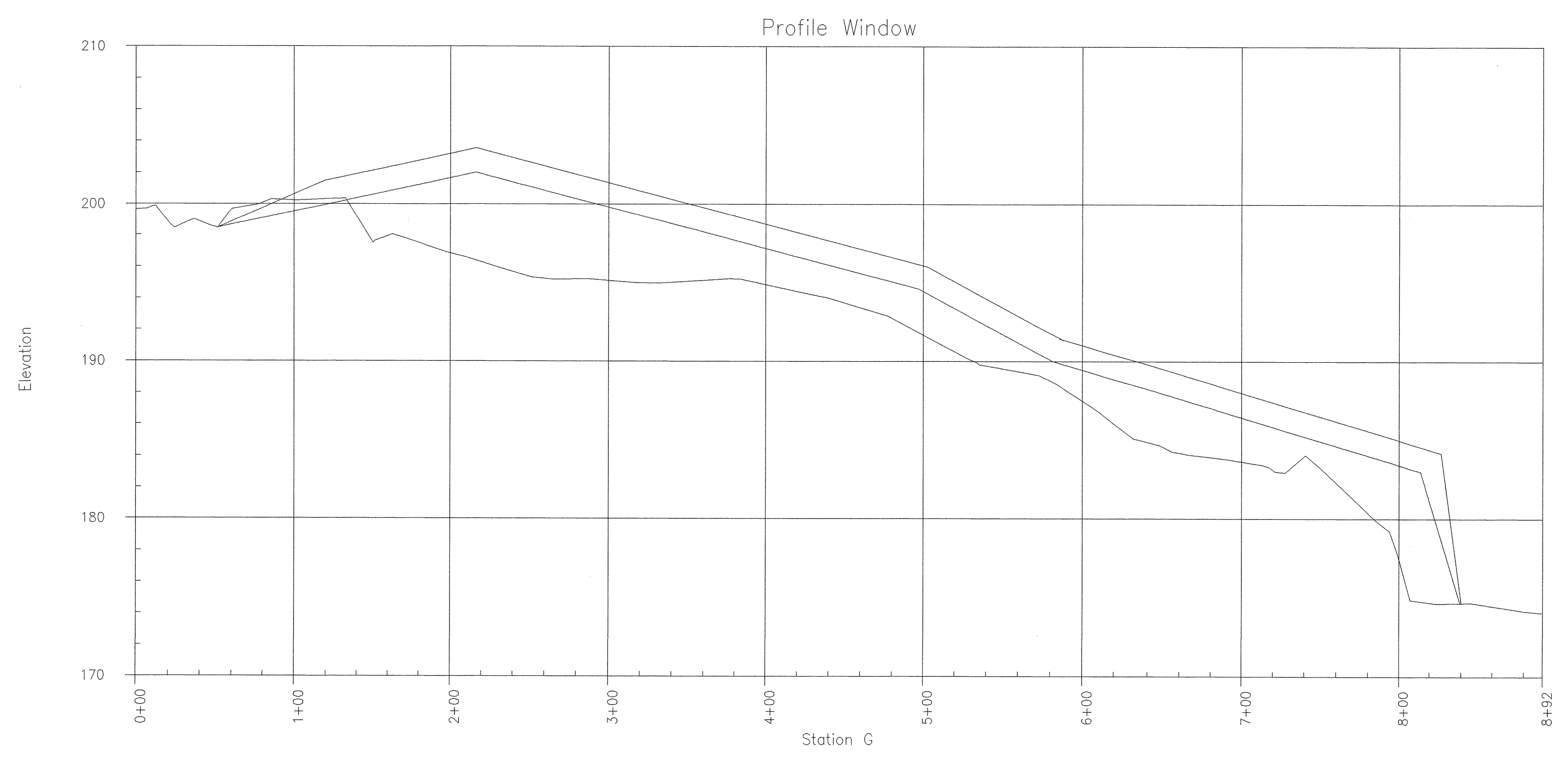
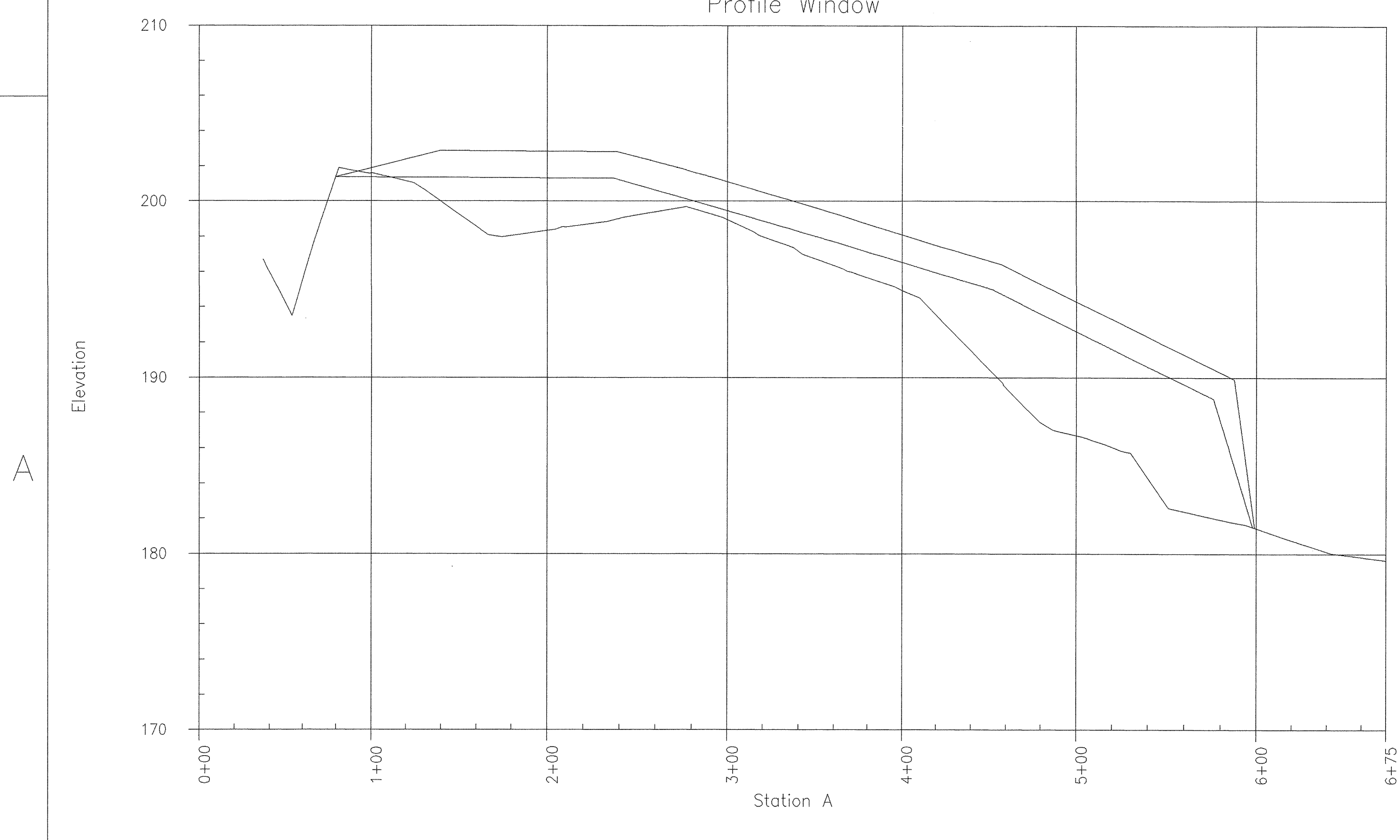
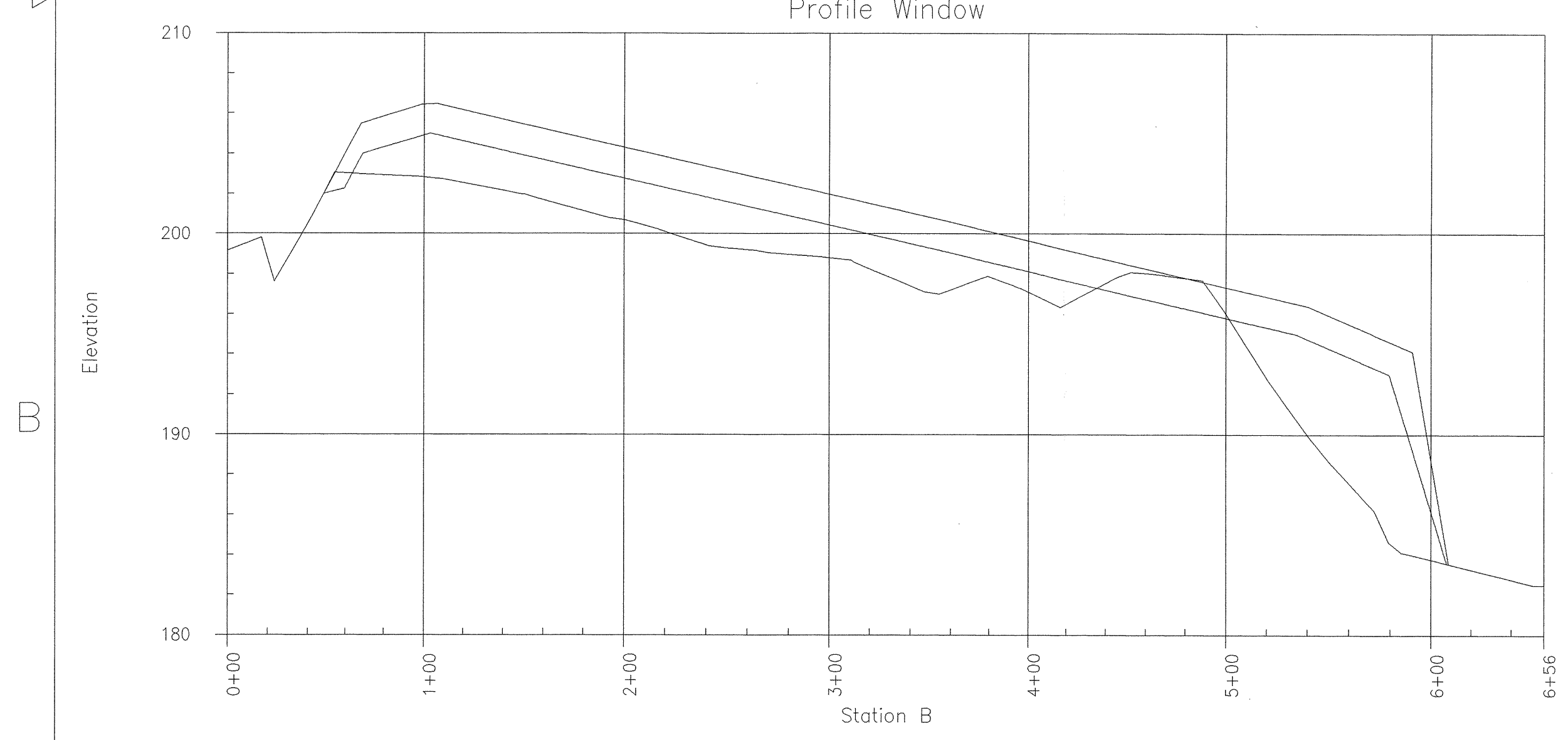
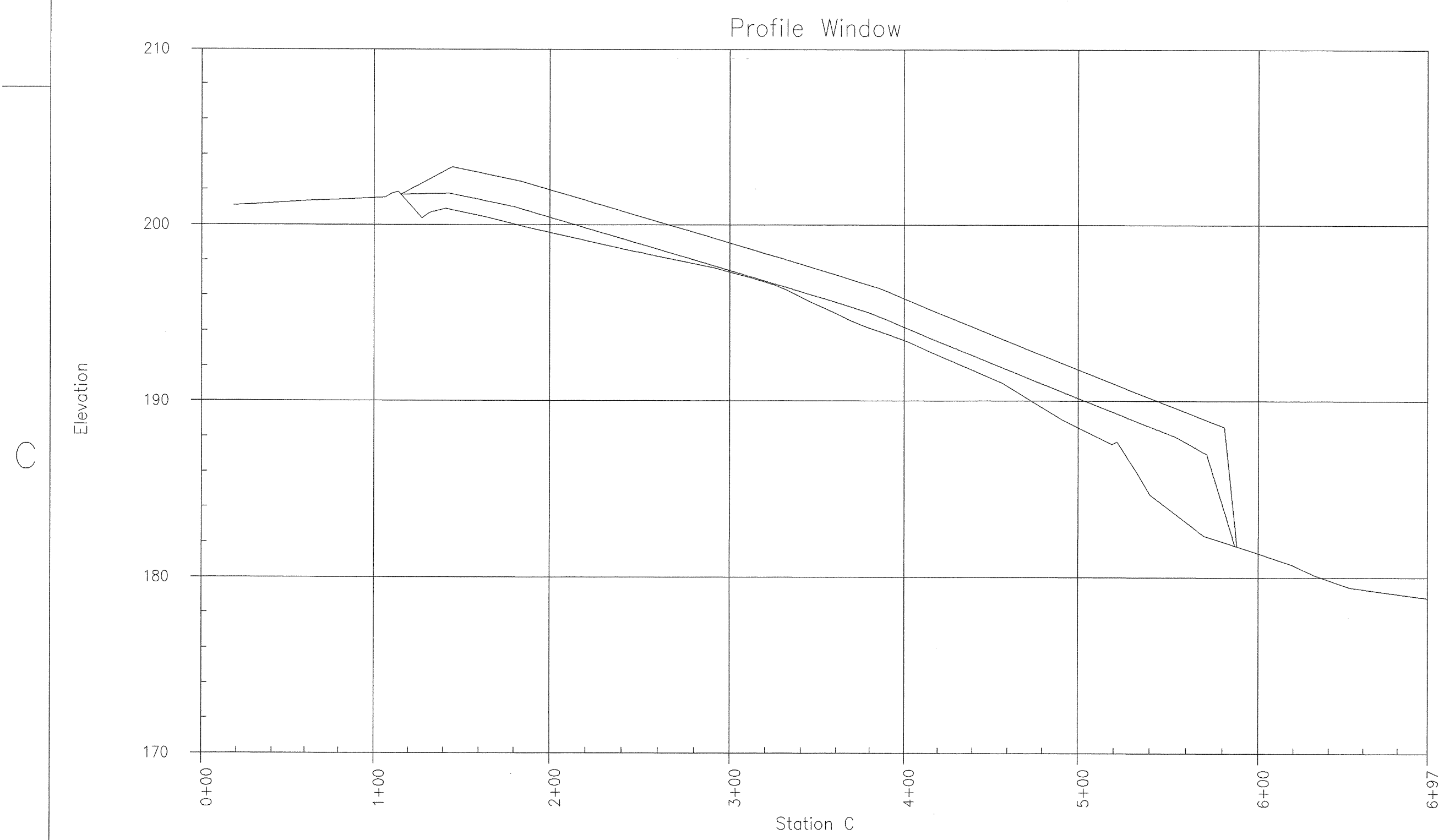
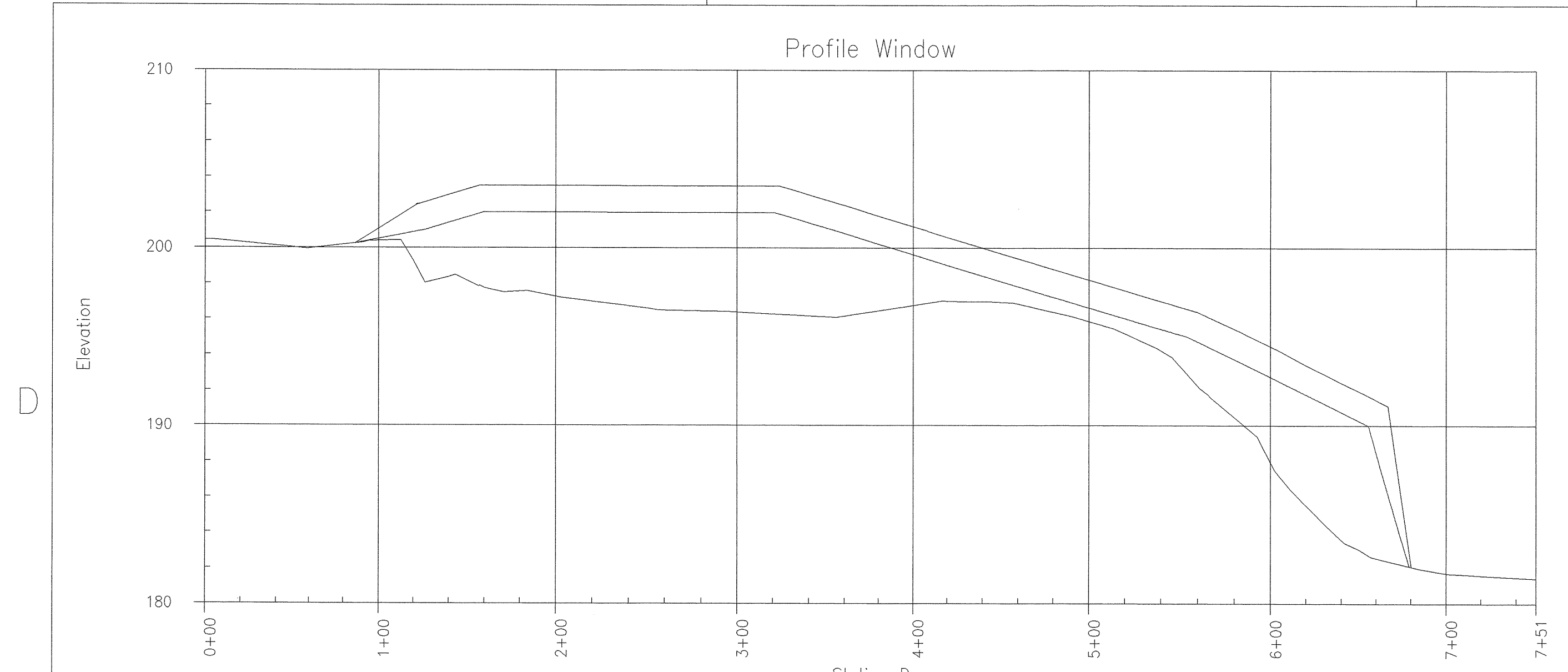
NOTE: NO LARGE DEBRIS WILL BE PLACED WITHIN 3' OF 2

LEGEND

- ① - SUBGRADE LAYER (PLACED BY OHM)
- ② - GEOCOMPOSITE CLAY LINER
- ③ - 40 mil GEOMEMBRANE  
20 mil



SYMBOL	DESCRIPTION	DATE	APPR
Tulsa District Tulsa, Oklahoma		US Army Corps of Engineers	
DESIGNED BY: RANDY MEAD	LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS		
DRAWN BY: DARRELL JONES	LANDFILL LHAAP 12 AND 16		
REVIEWED BY: JOE GLENN	TYPICAL SECTION AND DETAIL		
SUBMITTED BY:			
REVISED BY OHM NOVEMBER 1998			
PLOT SCALE:	DWC. CODE:	CONTRACT DATE:	SHEET REFERENCE NUMBER
DESIGN FILE: 12DETAIL.DGN	SHEET OF	CONTRACT NO. DACAS6-94-D-0020	C-20
PLOT DATE: DECEMBER 1995			



LINE	SURFACE	OFFSET
ORIG16	0.00	0.00
subgrade1	0.00	0.00
Scaled 10.00 Times Ver.		
Scaled 1.00 Times Hor.		

SYMBOL	DESCRIPTION	DATE	APPR
	Tulsa District Tulsa, Oklahoma		
	US Army Corps of Engineers		
DESIGNED BY: RANDY MEAD	LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS LANDFILL LHAAP 16		
DRAWN BY: RANDY MEAD DARRELL JONES			
REVIEWED BY: JOE GLENN			
SUBMITTED BY:			
REVISED BY OHM NOVEMBER 1998	CROSS SECTIONS		
PLOT SCALE:	DWG. CODE:	CONTRACT DATE:	SHEET REFERENCE NUMBER
DESIGN FILE: 16SECT.DGN			
PLOT DATE:	SHEET OF	CONTRACT NO. DACA56-94-D-0020	C-19

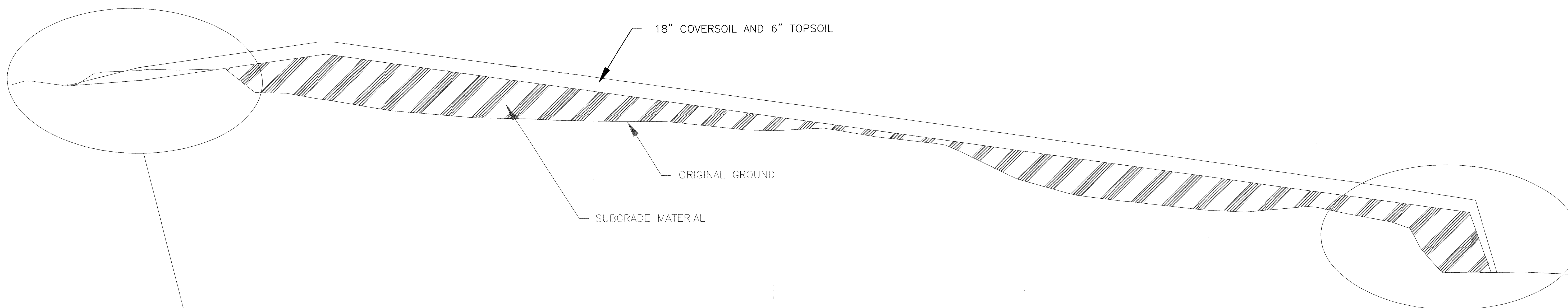


D

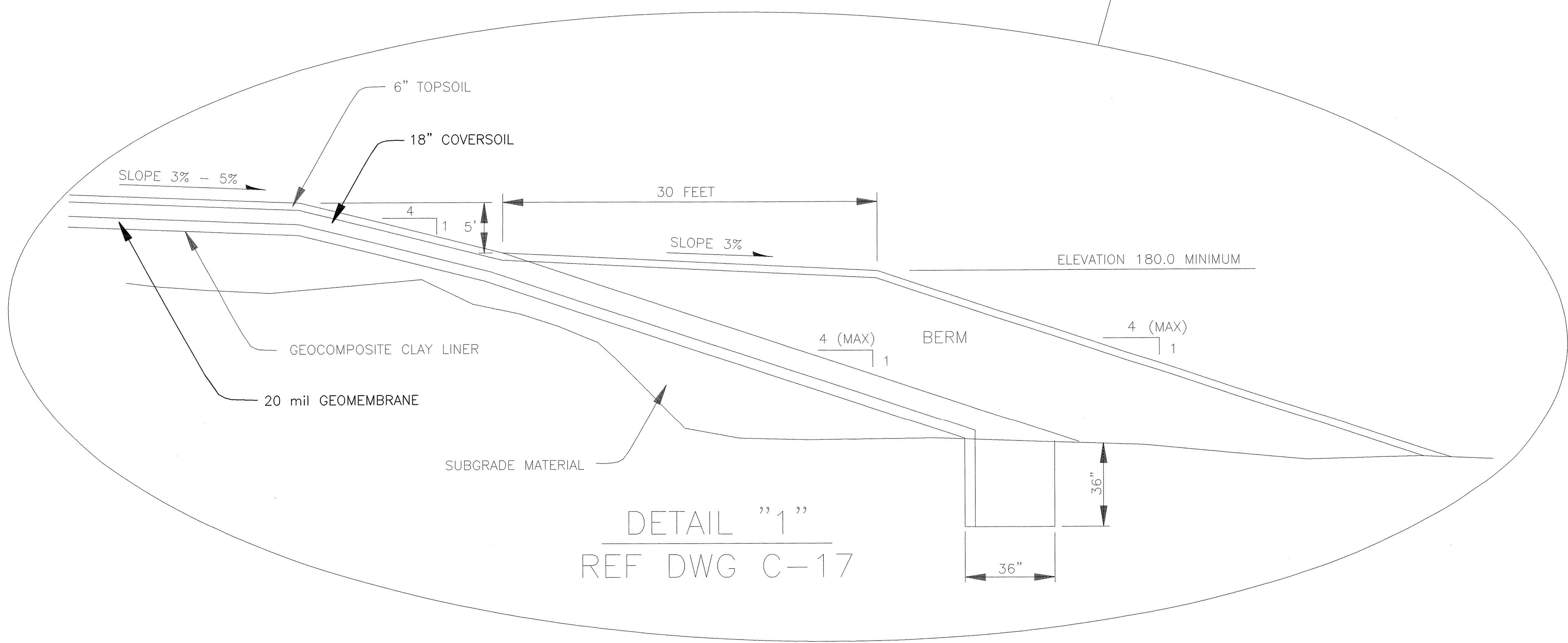
C

B

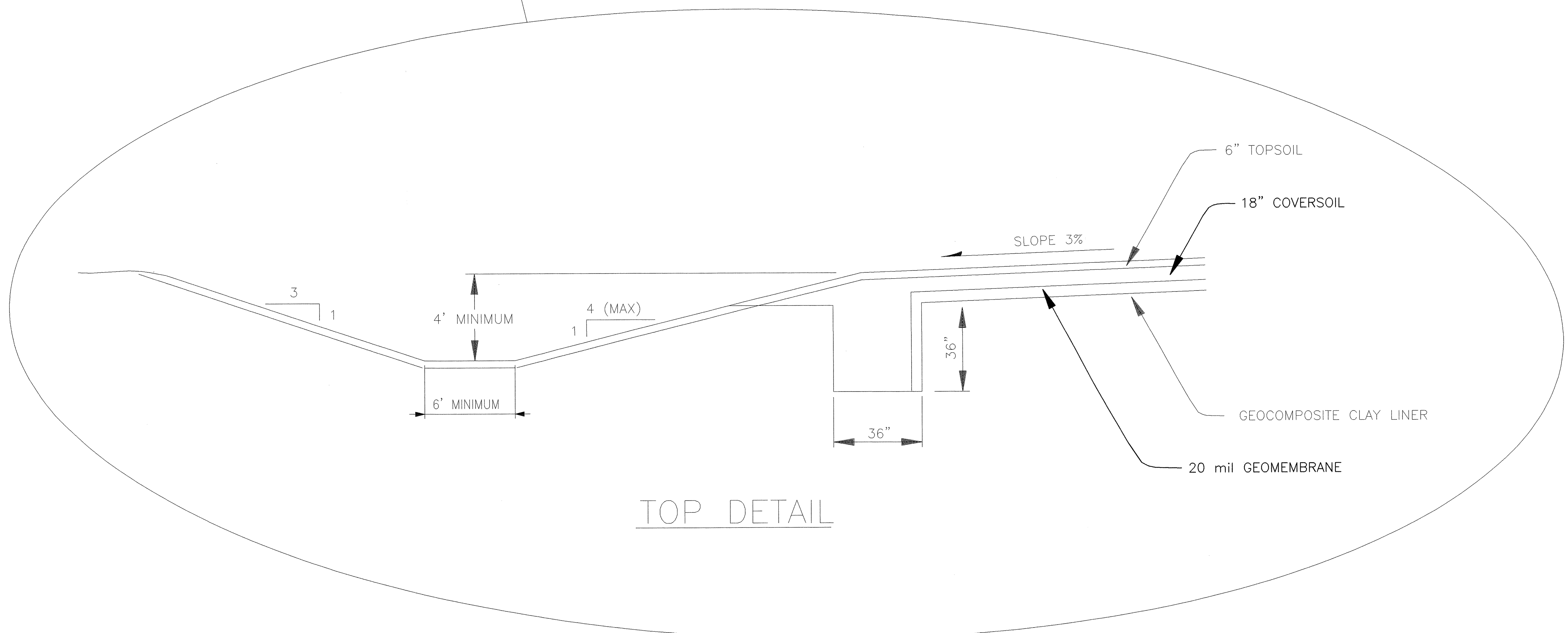
A



TYPICAL SECTION

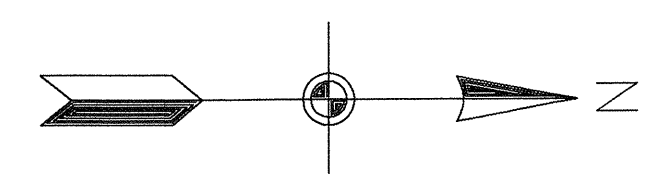


DETAIL "1"  
REF DWG C-17



TOP DETAIL

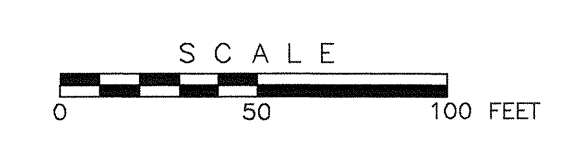
SYMBOL	DESCRIPTION	DATE	APPR
	Tulsa District Tulsa, Oklahoma		
	US Army Corps of Engineers		
DESIGNED BY: RANDY MEAD	LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS LANDFILL LHAAP 16		
DRAWN BY: DARRELL JONES			
REVIEWED BY: JOE GLENN			
SUBMITTED BY:			
REVISED BY OHM NOVEMBER 1998			
PLOT SCALE: NTS	DWG. CODE:	CONTRACT DATE:	SHEET REFERENCE NUMBER
DESIGN FILE: 16TYPE.DGN			
PLOT DATE:	SHEET OF	CONTRACT NO. DACAS6-94-0-0020	C-18



HORIZONTAL ALIGNMENT		
STATION	NORTHING	EASTING
0+00	6953300.29	3311219.09
4+77.21(PC)	6953662.01	3311530.35
PI#1	6953922.92	3311227.15
8+12.33(PT)	6953973.71	3311623.91
11+11.69(PC)	6954270.61	3311585.90
PI#2	6954219.81	3311189.14
12+84.43	6954432.02	3311528.21
15+33.88	6954643.47	3311395.88

CURVE DATA					
CURVE	RADIUS	DELTA	LENGTH	TANGENT	CHORD
1	400.00	46 33'17"	335.16	178.12	325.44
2	400.00	24 44'40"	172.75	87.74	171.41

VERTICAL ALIGNMENT		
STATION	SUBGRADE ELEVATION	FINISH ELEVATION
1+45	199.5	201.5
1+50	201.5	203.5
1+85	201.5	203.5
3+50	201.5	203.5
7+00	203.6	205.6
9+00	203.6	205.6
10+50	202.4	204.4
11+50	200.0	202.0
13+00	204.0	202.0
13+50	197.5	199.5
14+05	192.0	194.0



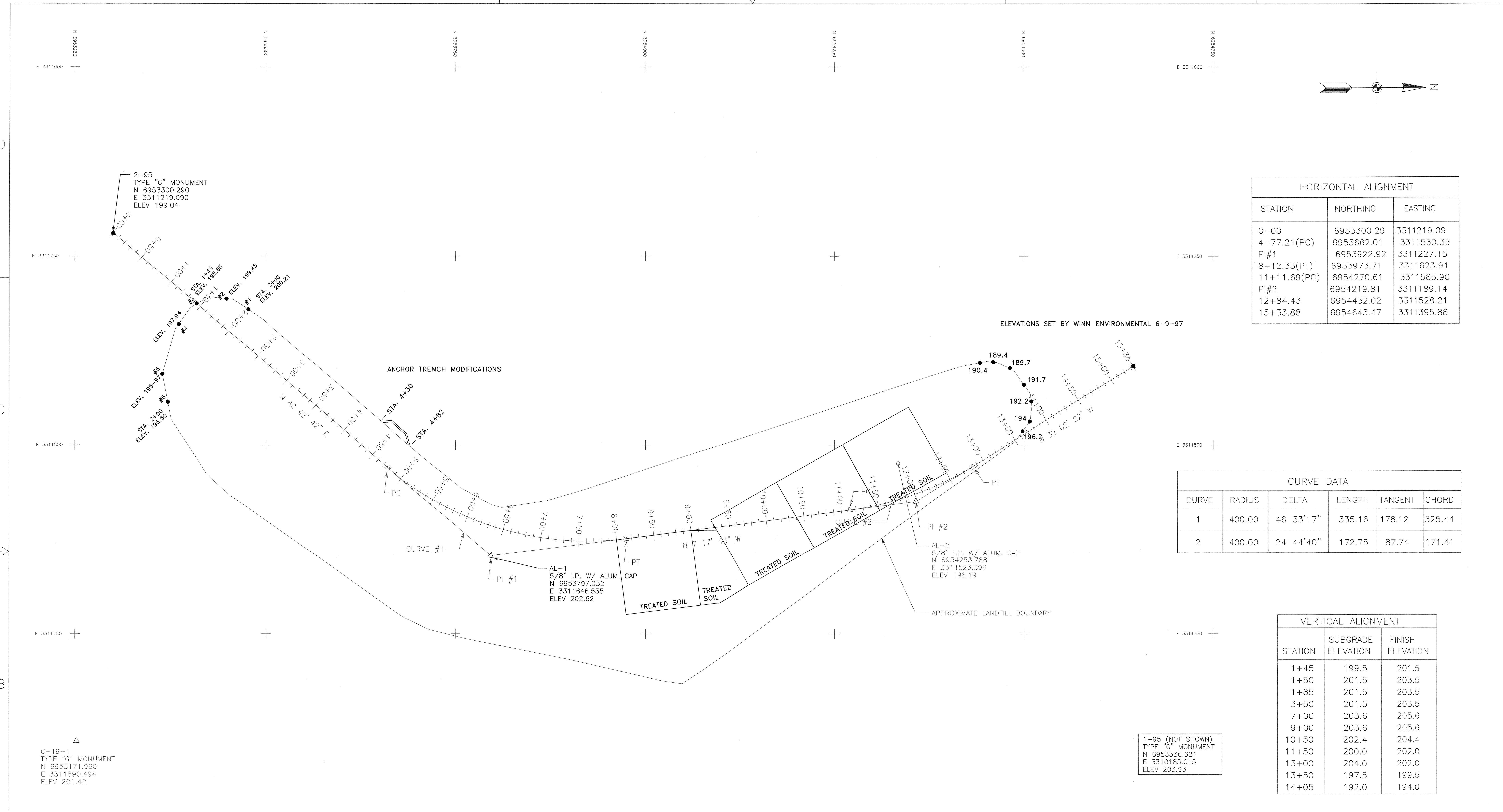
Tulsa District Tulsa, Oklahoma		US Army Corps of Engineers	
DESIGNED BY: RANDY MEAD	LONGHORN ARMY AMMUNITION PLANT KARVACK, TEXAS		
DRAWN BY: LORI KRUSE	LANDFILL LHAP12		
REVIEWED BY: JOE GLENN	CONTROL PLAN		
SUBMITTED BY: REVISED BY OHM NOVEMBER 1998			
PLOT SCALE: AS SHOWN	DWG. CODE:	CONTRACT DATE:	SHEET REFERENCE NUMBER
DESIGN FILE: LH12CPLN.DGN		INVITATION NO. DACA56--B-	C08
PLOT DATE: JANUARY 1996	SHEET OF	CONTRACT NO. DACA56-94-D-0020	

2-95  
TYPE "G" MONUMENT  
N 6953300.290  
E 3311219.090  
ELEV 199.04

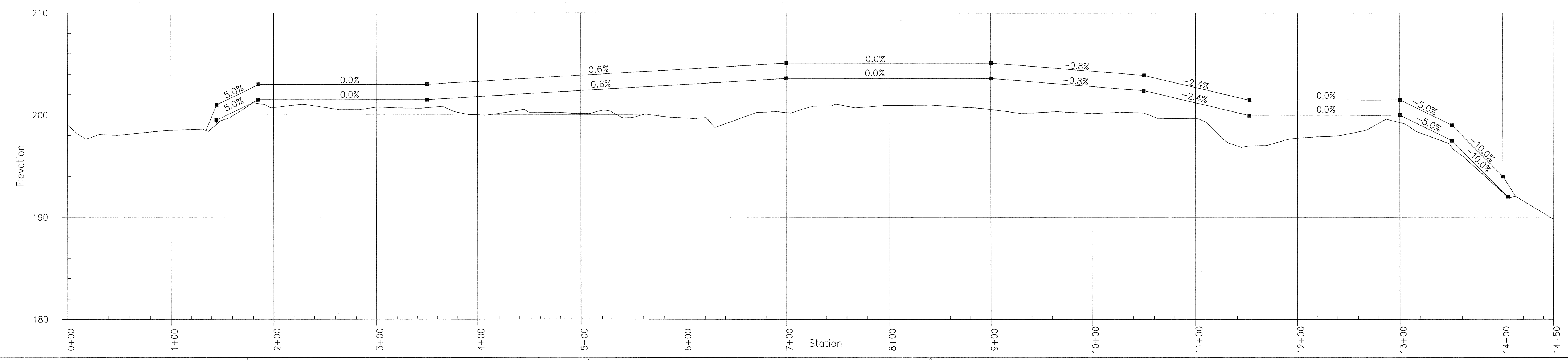
C-19-1  
TYPE "G" MONUMENT  
N 6953171.960  
E 3311890.494  
ELEV 201.42

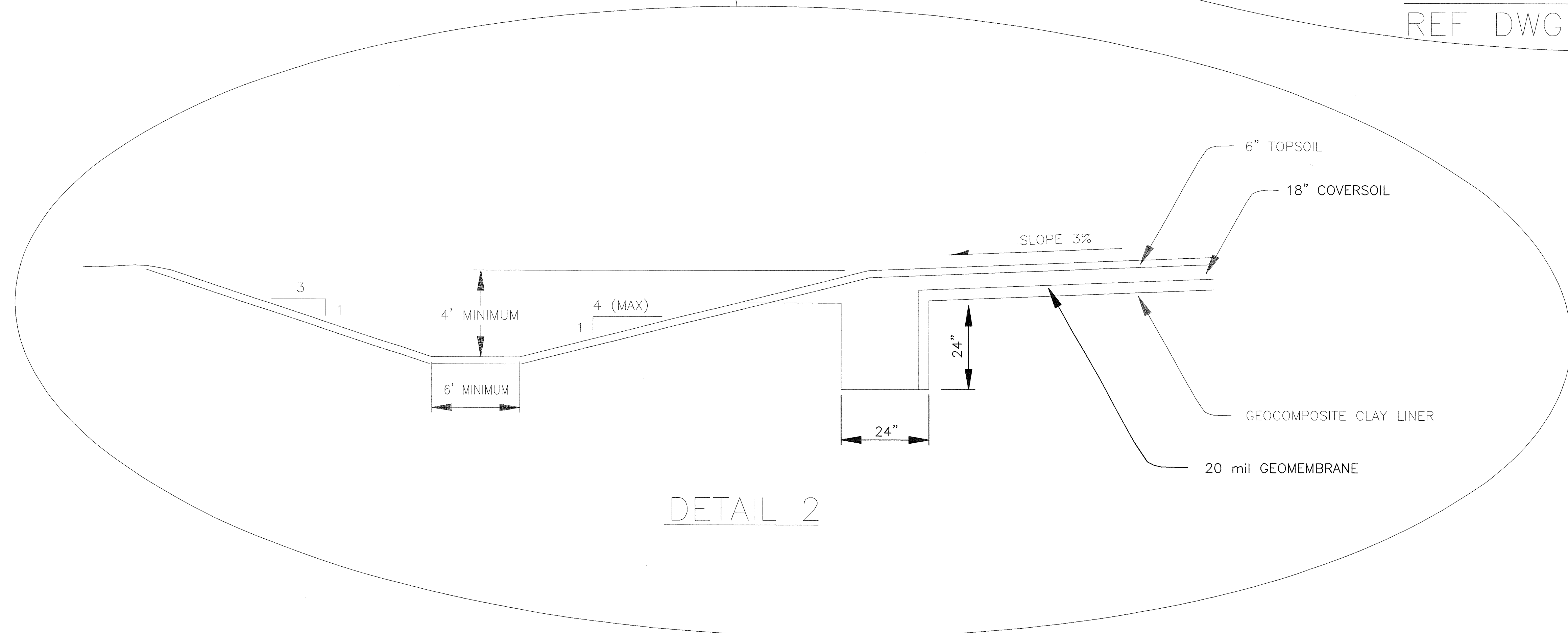
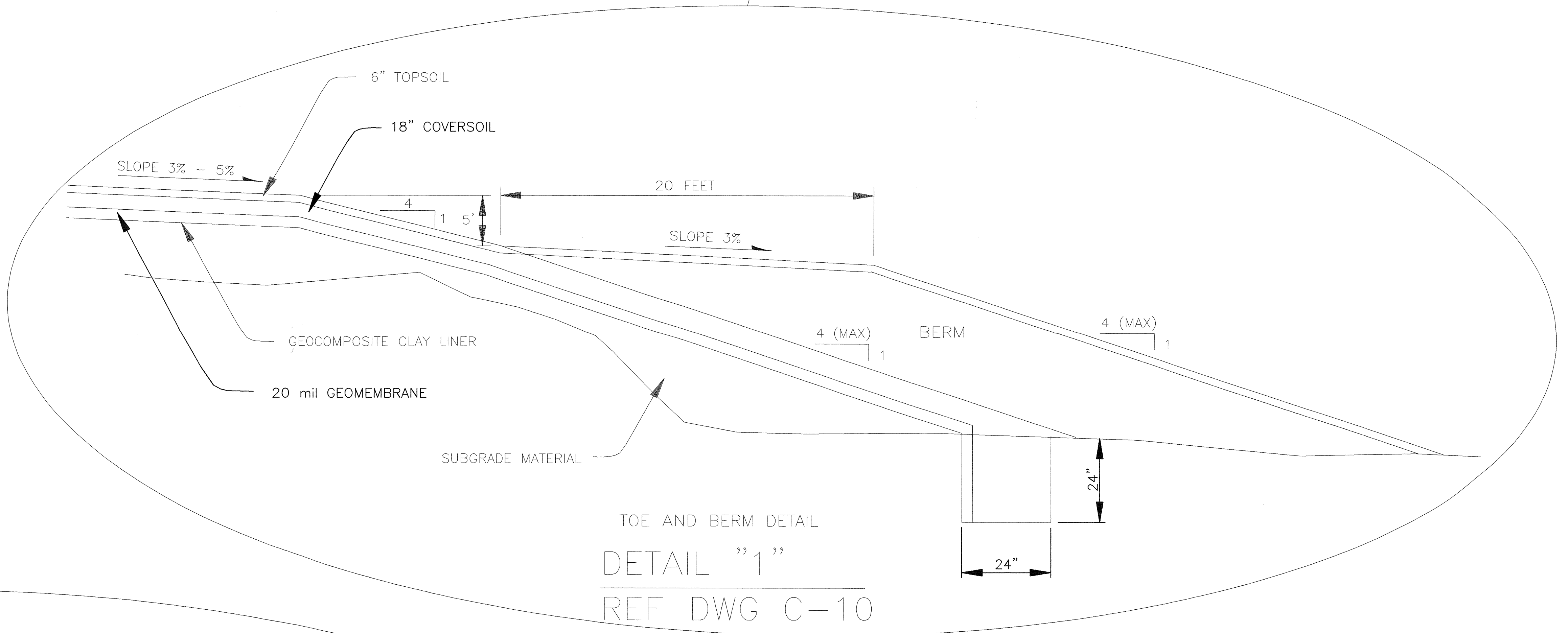
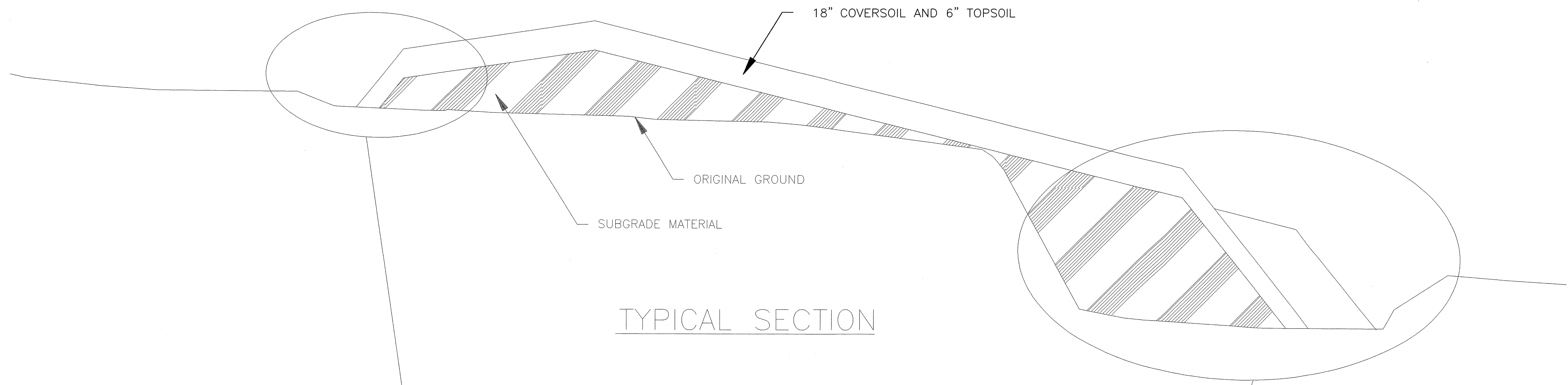
AL-1  
5/8" I.P. W/ ALUM. CAP  
N 6953797.032  
E 3311646.535  
ELEV 202.62

AL-2  
5/8" I.P. W/ ALUM. CAP  
N 6954253.788  
E 3311523.396  
ELEV 198.19



Profile Window



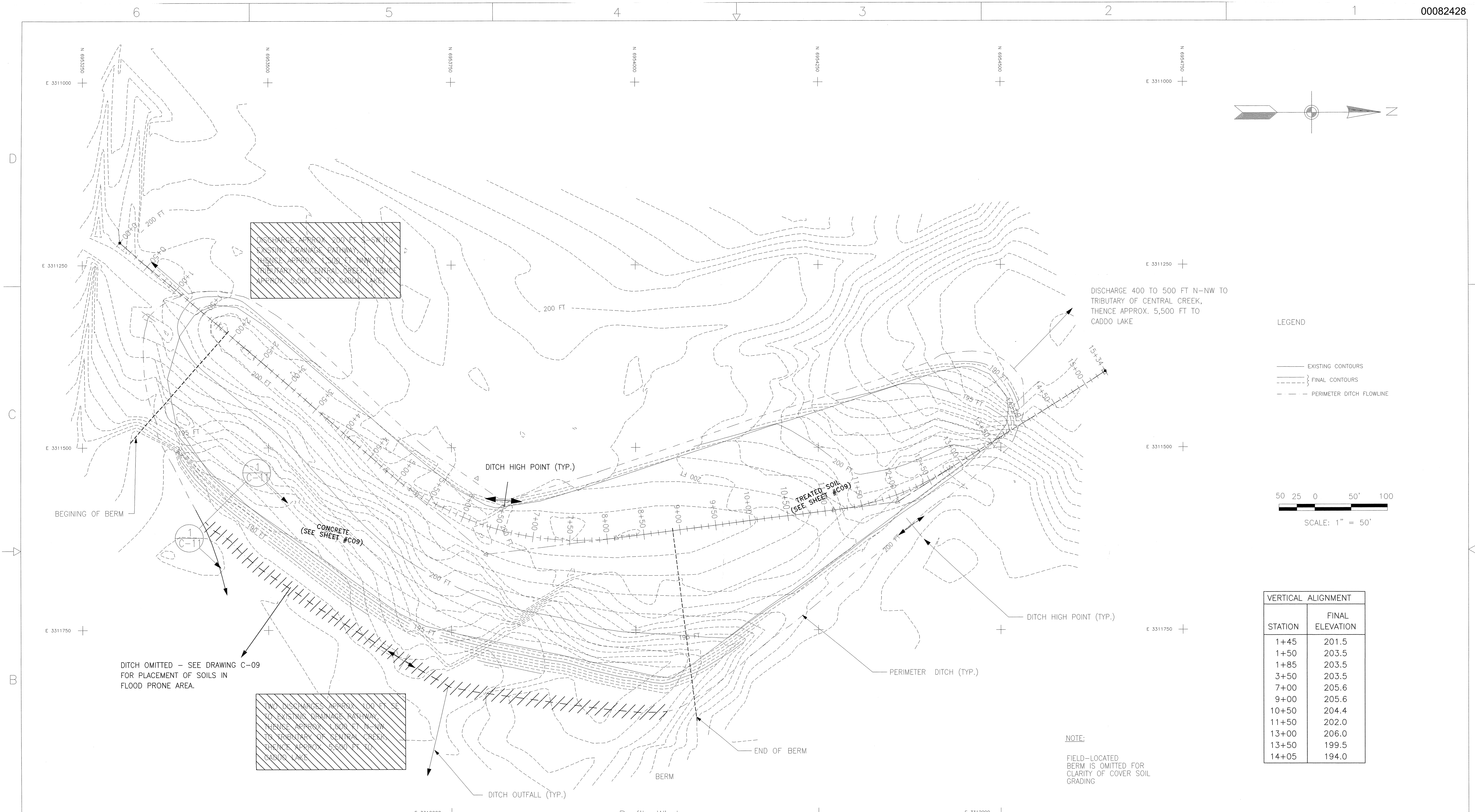


**NOTE:**  
 BERM LIMITS:  
 STATION 2+40 TO STATION 8+90.  
 TRANSITION FROM STATION 1+90  
 TO STATION 2+40 AND FROM  
 STATION 8+90 TO STATION 9+40.  
 SEE PLAN DRAWING C10.

SYMBOL	DESCRIPTION	DATE	APPR

Tulsa District Tulsa, Oklahoma	US Army Corps of Engineers		
DESIGNED BY: RANDY MEAD	LONGHORN ARMY AMMUNITION PLANT KARNAK, TEXAS  LANDFILL LHAAP 12  <b>TYPICAL SECTION</b>		
DRAWN BY: DARRELL JONES			
REVIEWED BY: JOE GLENN			
SUBMITTED BY:			
REVISED BY OHM NOVEMBER 1998			
PLOT SCALE: NTS	DWG. CODE:	CONTRACT DATE:	SHEET REFERENCE NUMBER
DESIGN FILE: 12TYPE.DGN			
PLOT DATE:	SHEET OF	CONTRACT NO. DACA56-94-D-0020	C-11

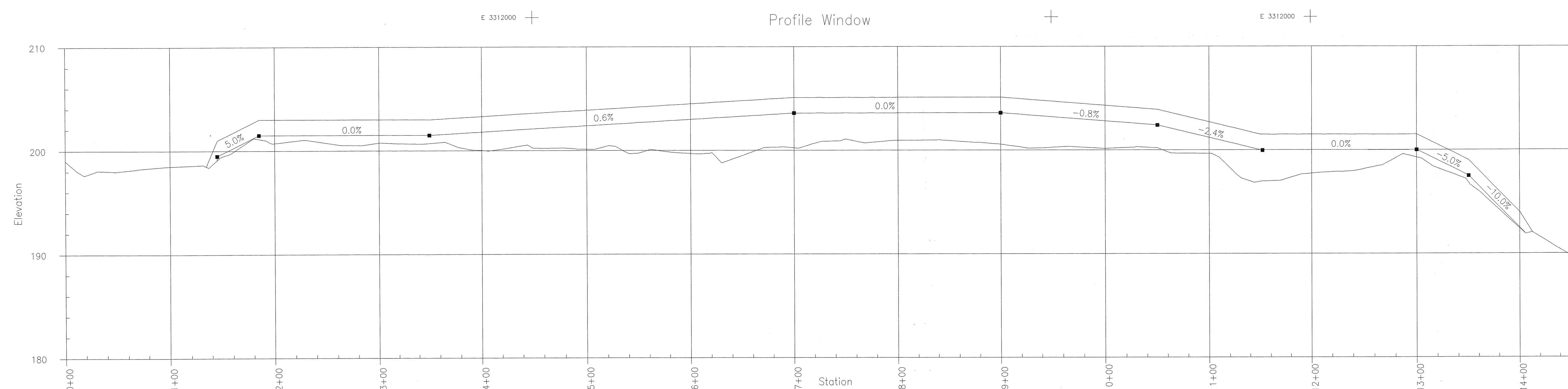


DISCHARGE APPROX. 200 FT. S-W TO EXISTING DRAINAGE PATHWAY, THENCE APPROX. 1,500 FT. NW TO A TRIBUTARY OF CENTRAL CREEK, THENCE APPROX. 5,500 FT. TO CADDO LAKE.

TWO DISCHARGES APPROX. 100 FT. SE TO EXISTING DRAINAGE PATHWAY, THENCE APPROX. 1,000 FT. N-W TO TRIBUTARY OF CENTRAL CREEK, THENCE APPROX. 5,500 FT. TO CADDO LAKE.

DITCH OMITTED - SEE DRAWING C-09 FOR PLACEMENT OF SOILS IN FLOOD PRONE AREA.

SYMBOL	DESCRIPTION	DATE	APPR
Tulsa District Tulsa, Oklahoma		US Army Corps of Engineers	
DESIGNED BY:	LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS		
DRAWN BY:	LANDFILL LHAAP 12		
REVIEWED BY:	FINAL GRADING PLAN		
SUBMITTED BY:			
REVISED BY OHM NOVEMBER 1998	CONTRACT DATE:	SHEET REFERENCE NUMBER	
PLOT SCALE: 50:1	DWG. CODE:	CONTRACT NO.:	C10
DESIGN FILE: LH12FGPL.DGN	SHEET OF	CONTRACT NO.:	
PLOT DATE: JANUARY 1996		DACA56-94-D-0020	



Tulsa District Tulsa, Oklahoma		US Army Corps of Engineers	
DESIGNED BY: RANDY MEAD	LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS		
DRAWN BY: LORI KRUSE	LANDFILL LHAAP 12		
REVIEWED BY: JOE GLENN	SUBGRADE GRADING PLAN		
SUBMITTED BY:			
REVISED BY OHM NOVEMBER 1998	DWG. CODE:	CONTRACT DATE:	SHEET REFERENCE NUMBER
PLOT SCALE: 50:1			
DESIGN FILE: LH12BGPL.DGN	INVIATION NO. DACA56--B-	C09	
PLOT DATE: JANUARY 1996	SHEET OF		

