RUST LICHLITER/JAMESON

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July 22, 1996

Susan Janek, P.E., Manager
Permits Section, Municipal Solid Waste Division (Mail Code 124)
Texas Natural Resource Conservation Commission
P.O.Box 13087
Austin, Tx. 78711-3087

Re: Austin Community Recycling and Disposal Facility - Permit No. MSW 249-C
Class I Permit Modification Request
Final Landfill Contours and Drainage System Modification

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Dear Susan:

On behalf of Waste Management of Texas, Inc., Rust Environment and Infrastructure is pleased to submit the enclosed documents as a modification of the Site Development Plan for the Austin Community Recycling and Disposal Facility (MSW 249-C). This permit modification request includes drawings showing revised final contours and drainage systems for the entire permitted facility and a drainage report providing erosion control and drainage design calculations.

The redesign has been undertaken in order to accommodate the improved final cover, methane control and landfill access designs associated with Subtitle D requirements as promulgated in 30TAC 330. In addition, a more effective drainage and erosion control design has also been developed for the final landfill surface. This request should be considered as a Class I modification under 30TAC305.70 (g)(15) which relates to "changes in closure or post-closure care requirements to reflect the requirements of revised regulations which provide for increased environmental protection" and/or under 30TAC305.70 (g)(20) which relates to "changes in the drainage control plan that improve internal stormwater runon/runoff handling without impacting offsite drainage".

The enclosed design is similar to that submitted on March 22, 1996 and includes additional information requested in an April 30 letter from Mike Graeber, P.E. The additions include five cross-sections of the proposed final contours, revised drawings and text labeled to replace superceeded sheets in the Site Development Plan (SDP), and additional discussion of the need for the changes and differences in the two designs.

The Permit Modification documents are comprised of the following:

- A nine sheet set of drawings sealed on July 22, 1996 which show revised final contours for the entire permitted site, cross-sections, drainage plans and drainage system details, .

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- A Site Drainage Report containing erosion control and drainage design calculations, and

- Revised text pages of the SDP.

Significant characteristics of and the need for the proposed design are summarized below:

The landfill footprint and final contour plan must be adjusted to match previously approved modifications of landfill basegrades, cell configurations and ancillary landfill facilities. The landfill has been set back from permanent facilities in the northeast portion of the site including the Longhorn Disposal offices, the Material Recovery Facility and the gatehouse. It also incorporates the following adjustments to the landfill perimeter based on approved Subtitle D designs for cells D-IV-3 and WD-1, 2 and 3 located in the north central portion of the landfill. The waste limit in this area is moved southward to generally provide a 35 foot offset from the existing paved road for drainage and geomembrane anchor trench use. The perimeter alignment has also been smoothed slightly to allow for improved cell geometry compatible with the leachate collection system. At the western end of the East landfill, a waste cell (D-V-1) was eliminated and the permitted limit of waste moved eastward. Subtitle D design modifications approved earlier redesignated this cell area as a leachate storage area which may contain a lined pond or storage tanks. These changes have not reduced the width of any buffer zones, and on the westernmost Phase VI area of the West landfill, the buffer zone is increased to 60 feet to better accommodate perimeter access and drainage.

The final contour modifications, in turn, require revisions to the surface drainage system. Further, the revisions submittted herein improve constructability in relation to the approved Subtitle D final cover systems and enhance long-term maintenance of the final cover system. The proposed stormwater management design consists of a series of drainage intercept berms constructed on the landfill sideslopes, lined rundown channels and perimeter ditches and culverts. Runoff will sheet flow across the gently sloped top surface of the landfill and a short distance down the 4:1 landfill sideslopes. Two foot high berms will be constructed above the final cover at 40 foot vertical intervals to intercept runoff and convey it laterally to rundown channels. These lined, flat bottomed channels route runoff straight down the sideslope to the base of landfill where perimeter ditches convey it to natural drainageways. The original aerial design contained flat terraces spaced horizontally down the sideslopes and has proven unreliable in maintaining sheetflow and controlling rainfall runoff without erosion of the final cover soil.

The peak elevation of the landfill has not changed. The top slope of the landfill is 5% (versus 6% in earlier designs), and the sideslopes remain at 25%. The sideslope drainage intercept berms are constructed at a 3% grade. The Universal Soil Loss Equation and the Rational Method have been used for the development of the stormwater management system design. Ditch and culvert designs are summarized on Attachment 8-3 of the plans. Additional design detail is provided in the Site Drainage Report.

Specific sheets in the SDP and Closure Plan to be replaced by the enclosed documents are listed below:

<u>**Closure Plan**</u> (Contained in the Subtitle D Permit Modification notebook dated October, 1994)

Text and Figures - Replace Table of Contents and Page 1; replace previous Figure 1 with Figures 1A and 1B. *These changes are required in order to show the revised final cover contours as revised by this modification.*

<u>**Part A and Site Development Plan**</u> (Contained in the Permit Amendment notebook submitted by Cook-Joyce, Inc. for MSW 249-C dated September 15, 1989 with Revision 1 on September 27, 1990)

Fly-Sheets - Replace the two fly-sheets at the front of the document. *These sheets indicate "Revision 2 - July 1996".*

Table of Contents - Replace the pages included in the main table of contents. *This needs to be done since figures and text are added or rearranged.*

Introduction - Replace page 1 of the introduction with the two revised pages. *Section 0.1, Permit Modification Summary, has been added to summarize recently approved permit modifications which may be contained in separate documents.*

Design Data - Replace pages 30-37. *This revision is required in order to revise text describing the site's drainage system as modified with this submittal.*

Attachments - Replace Attachments 7-1 and 7-2 with revised 7-1 and 7-2. *These new drawings revise the cross sections to show the revised grades included in the permit modification request.*

Replace Attachment 8-1 with new Attachments 8-1A and 8-1B. *These new drawings reflect the revised final contours and drainage configuration.*

Replace Attachment 8-3 with the new Attachment 8-3. *The new Attachment*

8-3 includes drainage details applicable to the modified final cover configuration and supersedes the previous details.

Remove Attachments 8-5 through 8-12. *These attachments contain items no longer applicable with this modification.*

Replace Attachment 9 with Attachments 9-1 and 9-2. *These drawings reflect the redesigned final contour plan.*

SDP Appendix 2 - Replace Appendix 2 fly-sheet, remove Appendices 2.3 and 2.4, and insert revised Appendix 2.3. *These changes replace the previous drainage calculations which have been redone in association with the modification.*

SDP Appendix 3 - Replace Sheets 7, 8 and 9 with the included Sheets 7,8 and 9. *These attachments are being replaced with identical copies of the drawings except a note indicates that the attachment has been superseded by the July, 1996 modification.*

Three copies of this permit modification request are enclosed. Please contact Rusty Fusilier, P.E.,Waste Management of Texas, at (512) 272-9372 or me at (512) 474-5500 if you have any questions or comments regarding this submittal.

Sincerely,

Brian Dudley, P.E.
Project Manager

enclosures

cc: Rusty Fusilier, P.E., WMTX

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COOK-JOYCE INC.
ENGINEERING AND CONSULTING
812 WEST ELEVENTH SUITE 205
AUSTIN, TEXAS 78701 512-474-9097

PART A
AND
SITE DEVELOPMENT PLAN
FOR THE
AUSTIN COMMUNITY LANDFILL EXPANSION
PERMIT AMENDMENT APPLICATION 249-C
TRAVIS COUNTY
VOLUME I
MAIN TEXT THROUGH ATTACHMENT 15

Applicant:

Texas Waste Systems, Inc.
1320 Greenway Drive, Suite 900
Irving, Texas 75038

Prepared By:

Cook-Joyce, Inc.
812 West Eleventh Street
Austin, Texas 78701

15 September 1989
Revision 1 - 27 September 1990
Revision 2 - July 1996 Modification
By: Rust Environment & Infrastructure

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surveys of the entire 290-acre site, with all related data submitted promptly to TDH. The said annual data shall include the original survey background analyses for the 74-acre expansion site and the 216-acre previously permitted site and the field data and interpretation of the most recent survey conducted.

3.5 DRINKING WATER PROTECTION

Deposition of solid waste in the Austin Community Landfill Site will not result in a hazard to a drinking water supply well, intake of a water treatment plant or raw water intake which furnishes water for human consumption. No such features are found within 500 feet of the site boundary. No intake of a water treatment plant or raw water intake has been identified within one mile of the site. A discussion of water wells within one mile of the site may be found in the Soils Report, Attachment 11.

3.6 SURFACE WATER PROTECTION

Surface water drainage improvements have been designed to prevent discharge of pollutants into waters of the State of Texas or the United States of America, to prevent non-point source pollution of the waters of the United States and to prevent the discharge of dredged or fill material into the waters of the United States with the exception of that associated with two drainage outfall structures which have been designed to fall within the limitation of the USCE Ft. Worth Districts General Permits for outfall structures. Furthermore, they have been designed to intercept all drainage from the completed landfill at its perimeter and channel it into the unnamed drainage way which crosses the west end of the site.

Surface drainage controls have been designed to minimize surface water runoff onto the working area. Drainage facilities will be of adequate size and grade and will be graded for adequate drainage. The slopes of the sides and toe will be graded in such a manner as to minimize the possibility of erosion.

Drainage calculations to generate design flows for design of internal structures are based on the 25-year rainfall intensity. All design flow calculations involve basins of less than 200-acres. 25-year flows were calculated by the Rational Method presented in the "City of Austin Drainage Criteria Manual" in accordance with accepted local engineering practice and by the Rational Method presented in the "State Department of Highways and Public Transportation Bridge Division Hydraulic Manual" as required by TDH regulations. Designs have been based on the larger, more conservative, of the two results.

Flood plain determination and analysis of impacts of the landfill development on area-wide drainage requires analysis of basins in excess of 200-acres in size. These calculations were made by means of the HEC 1 and HEC 2 computer programs.

Drainage calculations are presented in Appendix 2.

3.6.1 Surface Drainage Controls

This section summarizes the modifications which will be made to control the surface water runoff resulting from the 1989 Amendment to expand the landfill area westward and the July 1996 modification of the aerial portion of the landfill to incorporate Subtitle D improvements. These drainage improvements include the construction of:

* Interceptor Berms
* Rundown Channels
* Culverts and Appurtenances, and
* Perimeter Ditches

Rainfall runoff within the boundaries of the landfill area will be collected by a system of interceptor berms and rundown channels and directed to the perimeter ditches around the landfill area. The runoff will be collected along the perimeter by the ditches and conveyed to a natural discharge point as shown on Attachments 8-1A and 8-1B.

Surface water runoff control details are shown on Attachment 8-3. The hydrologic and hydraulic calculations and a more detailed discussion are included in Appendix 2.

3.6.2 Contaminated Water Control

The primary method of control of contaminated water is to prevent water from becoming contaminated. A detailed Run-off and Run-on Control Plan is contained in Appendix 1 of the Leachate and Contaminated Water Management Plan. Water running off undeveloped, closed or covered portions of the site is uncontaminated and will be drained into the surface water drainage systems by gravity where possible. Berms will be constructed just up slope of the active disposal area to divert drainage around the active area and prevent it from become contaminated. A toe berm will be maintained just down slope from the active disposal area to contain any water running off or seeping out of the working face. All berms will be a minimum of 2-feet high. The bottom of the disposal area will be graded to drain to a sump. Any water occurring outside the toe berm and diversion berms will be uncontaminated and will drain to this sump. From there it will be pumped into the surface water drainage system. Water occurring at the toe of the working face contained by the toe berm will be reabsorbed into the waste as fill operations progress. If excessive quantities of such water interfere with disposal operations, it will be disposed of in accordance with applicable TNRCC regulations. See the Leachate and Contaminated Water Management Plan for more detail.

3.6.3 100-Year Flood Plain

The 100-year flood plain of the unnamed creek within the western boundary of the site was determined and the results are shown on Attachment 5. No excavation, embankment or disposal activities are proposed within this flood plain area. The only activity proposed in the flood plain area are the two surface water drainage outfalls. Please refer to Section 3.6.5 and Attachments 8-1A and 8-1B. The runoff from the contributing drainage basin was modeled using the U.S. Army Corps of Engineers HEC-1 computer program. This model assumed an urbanized drainage basin and produced a 100-year flow through the project of 3,870 cubic feet per second (cfs). A model was also run to determine the existing 100-year flow. This model produced a 100-year flow through the project of 3,160 cfs.

In order to check the calibration of the HEC-2 model used, CJI obtained flows and cross sections used by the U.S. Army Crops of Engineers (USCOE) in preparation of their Expanded Flood Plain Information Study For Walnut Creek, City of Austin and Travis County, Texas, May 1980. This data was input into our HEC-2 model. The flood plain calculated by CJI, using USCOE data, closely matched the flood plain calculated by USCOE.

CJI then input our calculated 100-year, urbanized runoff rate and surveyed cross sections of the creek into the HEC-2 model and calculated the flood plain shown on Attachment 5. The basic shape and elevation of the flood plain calculated by CJI is in general conformity with the flood plain calculated by USCOE. CJI's calculated 100-year runoff rate is somewhat higher than that used by USCOE. The calculations and the results of the hydrologic and hydraulic modeling are included in Appendix 2.

3.6.4 Existing Drainage Conditions

The existing drainage of the expansion site was analyzed to aid in design of facilities to minimize the effect of development on the drainage in the surrounding area.

The site is bounded on the north and south by undeveloped property, on the east by the existing Austin Community Landfill site and on the west by the MKT Railroad and Springdale Road. Drainage from the site generally flows to the west to an unnamed creek located within the western boundary of the site. The existing topography is hilly and characterized by relatively steep terrain with average slopes in the 8 to 10 percent range. The existing drainage patterns for the site are shown on Attachment 5. There is a small drainage way north of, and roughly parallel to, the site boundary and there is a ridge which divides the property and determines the portion of the site (UD-1) which contributes runoff to this drainage way. This drainage way has its confluence with the unnamed creek crossing the subject property immediately upstream of the site boundary. The remainder of the site either contributes to the unnamed creek within the property or within approximately 400 feet downstream. There is a small portion of the site (UD-5 and UD-6, approximately 4.81 acres) which discharges near the southeast corner of the site. The drainage basin to which these two areas contribute has its confluence with the creek approximately 1,800 feet downstream of the site boundary.

There is very little cross drainage on the site except for the runoff conveyed through the site by the creek. There are some small areas along the east and west boundaries of the site which contribute off-site flows, but the amount of flow is insignificant.

3.6.5 Impact of Landfill Development on Existing Drainage Conditions

Natural drainage patterns will not be significantly altered.

All runoff from the developed site will be intercepted at the perimeter and channeled into the creek. Therefore, there will be no discharge from the developed site onto adjacent properties except in the creek.

When the expansion site is developed and connected to the existing landfill, some runoff from the existing site will be diverted through the expansion site and conveyed through the proposed drainage system. Drainage Channel 4 from the existing site will be intercepted and conveyed through the expansion property. The net result of these diversions on the existing site is a reduction in contributing drainage area of approximately 13 acres to the channel along the south property line on the existing site. Development of the expansion site and the installation of drainage improvements will increase the hydraulic efficiency for the drainage basin. All runoff from the site will be kept within the site boundary and will be discharged from the site at the intersection of the creek and the south property boundary. Since the runoff is directed to the creek on-site, flow is no longer discharged at other points along the boundary. As a result, many of the undeveloped drainage basins will have a reduction in contributing area and will thereby also have a reduction in flow. A comparison between the pre-and post-development runoff rates for undeveloped drainage basins UD-1, UD-3, UD-4, UD-5 and UD-6 is shown on Table 3-1 (Refer to Attachment 5).

The peak flow contributed at the analysis points within the creek by UD-1, UD-2, UD-3, UD-4, UD-5 and UD-6 combined in pre- and post-development conditions are shown on Table 3-2. Analysis point 1 is at the intersection of the creek and the south property line. Analysis point 2 and 3 are 400 and 1,800 feet, respectively, downstream of the property line.

The effect on the 25-year peak flow in the creek as a result of development was modeled using the HEC-1 Computer Program. The results of this model are presented in Table 3-3.

With the July 1996 permit modification, the surface water drainage system was revised. Calculations performed for the modified drainage system are included in Appendix 2.3 and show that the 25-year flow at point 1 from Attachment 5 totals approximately 205 cfs. This is less than the 241 cfs peak run-off calculated with the original drainage system approved with Amendment 249-C in 1989. The post-development drainage has therefore not been significantly altered from the previously approved design.

TABLE 3-1

PRE- AND POST-DEVELOPMENT RUNOFF TO ADJACENT PROPERTIES

BASIN	PRE-DEVELOPMENT (TOTAL FLOW)				POST-DEVELOPMENT (TOTAL FLOW)				POST-DEVELOPMENT (OFF-SITE FLOW CONTRIBUTED BY THE SITE)			
	Area (Ac.)	Q_{25}* (cfs)	Q_{100}* (cfs)	Q_{25} (cfs)	Area (Ac.)	Q_{25}* (cfs)	Q_{100} (cfs)	Q_{25}** (cfs)	Area (Ac.)	Q_{25}* (cfs)	Q_{100}* (cfs)	Q_{25}** (cfs)
UD-1	21.56	54	79	100	8.3	21.0	32.5	38.5	0	0	0	0
UD-3	4.04	13	18	18	0.9	3.0	4.5	4.0	0	0	0	0
UD-4	38.65	109	160	180	2.4	7.0	11.0	11.0	0	0	0	0
UD-5	3.44	11	16	16	2.0	6.5	10.0	9.5	0	0	0	0
UD-6	1.37	5	7	6	0.5	1.5	2.5	2.5	0	0	0	0

* Calculations based on City of Austin Drainage Criteria.

** Calculations based on Texas State Department of Highways and Public Transportation, Bridge Division Hydraulic Manual.

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TABLE 3-2

PRE- AND POST-DEVELOPMENT CONTRIBUTION TO CREEK AT ANALYSIS POINTS

ANALYSIS POINT	PRE-DEVELOPMENT (TOTAL FLOW)				POST-DEVELOPMENT (TOTAL FLOW)			
	Area (Ac.)	Q_{25}* (cfs)	Q_{100}* (cfs)	Q_{25}** (cfs)	Area (Ac.)	Q_{25}* (cfs)	Q_{100}* (cfs)	Q_{25}** (cfs)
1	44.02	103	151	200	97.87	241	366	445
2	86.71	199	293	384	101.16	245	373	448
3	91.52	198	293	361	103.16	236	359	407

NOTE: These flows are only those contributed by the undeveloped drainage areas which include subject site. Total creek flow is discussed in Section 3.6.3

* Calculations based on City of Austin Drainge Criteria.

** Calculations based on Texas State Department of Highways and Public Transportation, Bridge Division Hydraulic Manual.

TABLE 3-3

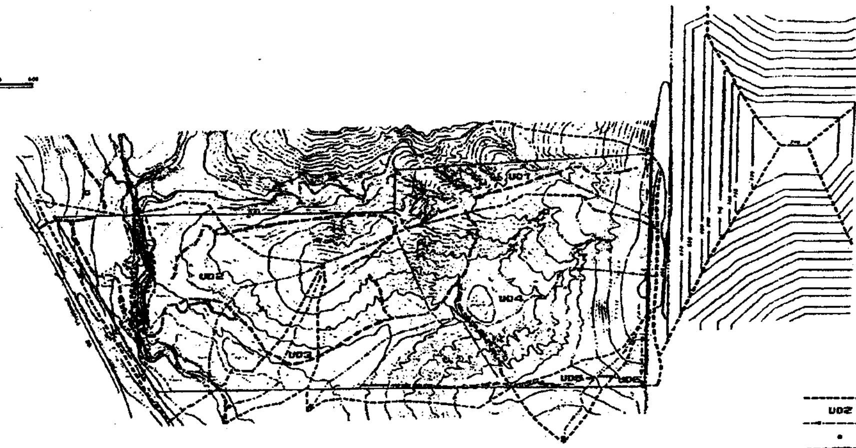
PRE- AND POST-DEVELOPMENT COMPARISON OF
25-YEAR PEAK FLOWS IN CREEK

LOCATION	PRE-DEVELOPMENT 25-YEAR FLOWRATE	POST-DEVELOPMENT 25-YEAR FLOWRATE	CHANGE
Upstream Property Line	2360	2346	0.6% Decrease
Downstream	2337	2393	2.4% Increase
400 feet downstream	2399	2410	0.5% Increase

3.6.6 Wetlands

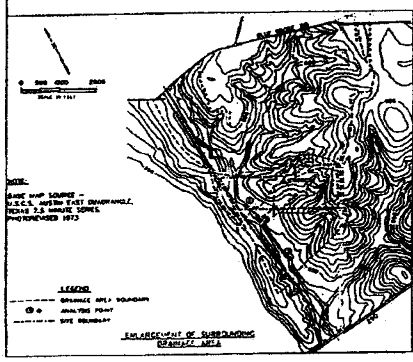
A request for determination of the presence or absence of jurisdictional wetlands has been submitted to the USCOE, Ft. Worth

Attachment 6



LEGEND

DRAINAGE AREA BOUNDARY
UD2 DRAINAGE AREA DESIGNATION
FLOW PATH
ANALYSIS POINT
APPROXIMATE LIMITS OF THE 100 YEAR FLOOD PLAIN
FLOW PATH OF CHANNEL 4, SHT 9 OF 10, PITTMAN ENGINEERING PLANS.



NOTE:
BASE MAP SOURCE – U.S.G.S. AUSTIN EAST QUADRANGLE, TEXAS 7.5 MINUTE SERIES PHOTOREVISED 1973

LEGEND
DRAINAGE AREA BOUNDARY
ANALYSIS POINT
SITE BOUNDARY

ENLARGEMENT OF SURROUNDING DRAINAGE AREA

FLOW FROM INDIVIDUAL AREAS

BASIN	AREA (ACRES)	t_c* (min.)	Q_{25}* (cfs)	Q_{100}* (cfs)	t_c** (min.)	Q_{25}** (cfs)
UD-1	21.36	29	54	78	20	100
UD-2	22.46	13	78	113	20	104
UD-3	4.94	18	13	18	20	16
UD-4	35.45	22	100	160	20	180
UD-5	3.44	10	11	18	20	16
UD-6	1.37	16	5	7	20	6

* CALCULATIONS BASED ON CITY OF AUSTIN DRAINAGE CRITERIA MANUAL

** CALCULATIONS BASED ON TEXAS DEPARTMENT OF HEALTH MUNICIPAL SOLID WASTE MANAGEMENT REGULATIONS AND THE STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION BRIDGE DIVISION HYDRAULIC MANUAL.

FLOW FROM COMBINED DRAINAGE AREAS

#	BASIN	AREA (ACRES)	t_c* (min.)	Q_{25}* (cfs)	Q_{100}* (cfs)	t_c** (min.)	Q_{25}** (cfs)
①	UD-1 TO UD-2	44.02	33	103	151	21	200
②	UD-3 TO UD-4	88.71	30	189	293	22	304
③	UD-1 TO UD-6	91.52	38	190	293	22	381

NOTES

BASE MAP SOURCE – METROPOLITAN AERIAL SURVEYS (7-24-87) AND PITTMAN ENGINEERING (12-6-85)

SITE DEVELOPMENT PLANS FOR THE EXISTING AUSTIN COMMUNITY LANDFILL ARE INCLUDED AS APPENDIX A.

100 YEAR FLOW THROUGH THE SITE ASSUMING AN URBANIZED WATERSHED IS 3870 C.F.S. THIS FLOW RESULTS IN A WATER SURFACE ELEVATION OF APPROXIMATELY 551.5 (M.S.L.) AT THE NORTH PROPERTY LINE AND APPROXIMATELY 546 (M.S.L.) AT THE SOUTH PROPERTY LINE.

STATE OF TEXAS
J. THOMAS JOYCE
53545
PROFESSIONAL ENGINEER

J. Thomas Joyce

AUSTIN COMMUNITY LANDFILL EXPANSION
PERMIT APPLICATION NO. 249-C
TRAVIS COUNTY, TEXAS

TEXAS WASTE SYSTEMS, INC.
HOUSTON, TEXAS
A WASTE MANAGEMENT COMPANY

COOK-JOYCE INC.
ENGINEERING AND CONSULTING
812 WEST ELEVENTH 512-474-9097
AUSTIN, TEXAS 78701

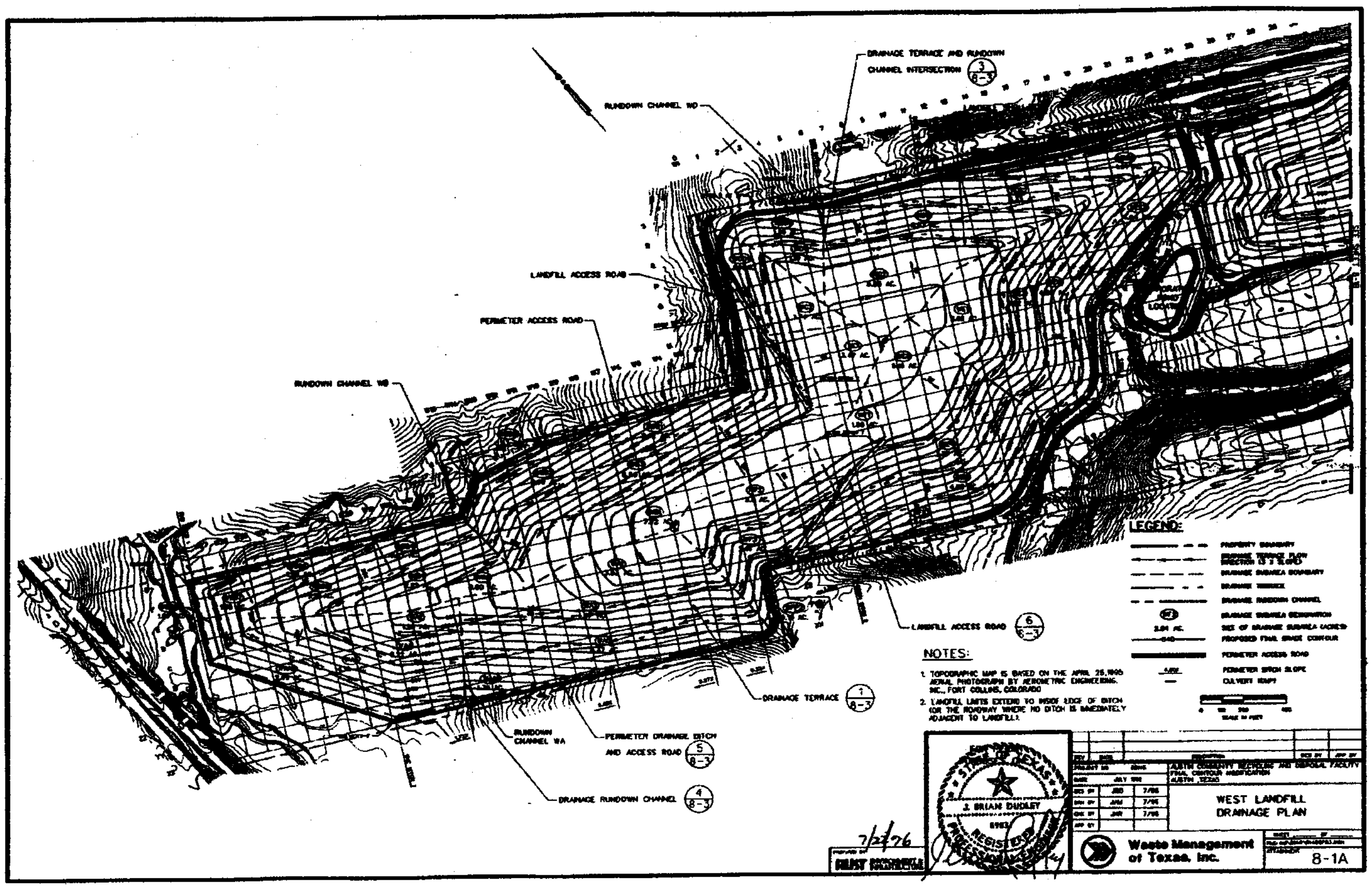
SHEET TITLE
CONTOUR MAP WITH PREDEVELOPMENT DRAINAGE CONDITIONS

PURPOSE: PERMIT APP.
SCALE: AS NOTED
ATTACHMENT NO. 5

WM-GOLD-00000411

Attachment 8

WM-GOLD-00000419



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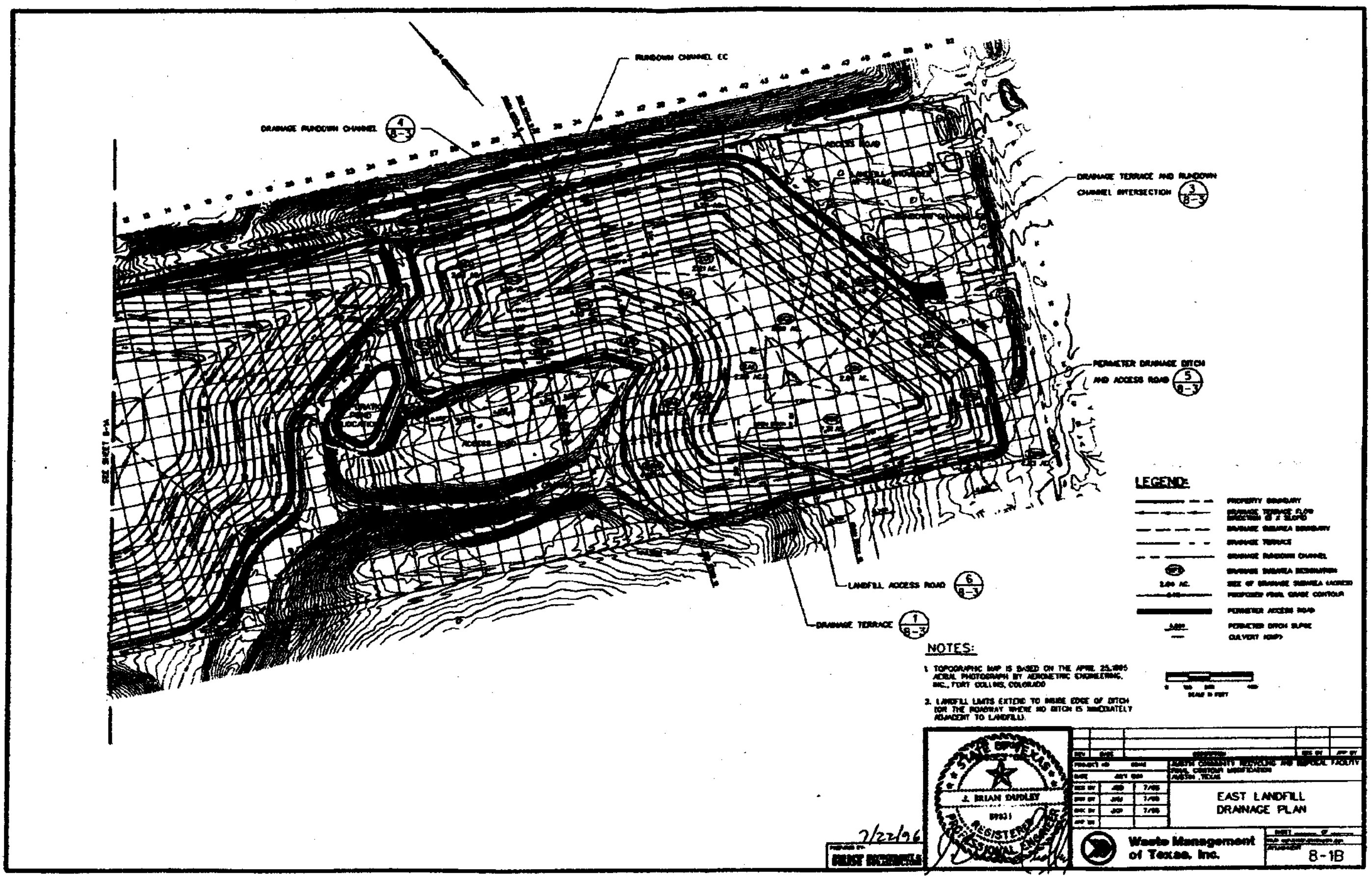

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APPENDIX 2.3

AUSTIN COMMUNITY RECYCLING AND DISPOSAL FACILITY

POST-DEVELOPMENT DRAINAGE CALCULATIONS

Prepared For:

Waste Management of Texas, Inc
9708 Giles Road
Austin, Texas 78754

Prepared By:

Rust Environment and Infrastructure
811 Barton Springs Rd., Suite 400
Austin, Texas 78704

Project No.: 68145.300

March 19, 1996

STATE OF TEXAS
J. BRIAN DUDLEY
59831
REGISTERED
PROFESSIONAL ENGINEER
7/22/96

INTRODUCTION

To control runoff and reduce the potential for erosion of final cover, a system of interceptor berms and drainage rundown channels has been designed for the landfill surface, and a perimeter ditch network has been designed to convey runoff to natural drainage ways.

The Austin Community Landfill facility consists of an east and west landfill separated by a natural drainageway oriented north-south across the site. Each landfill has been divided into several small drainage subareas as shown in Attachments 8-1A and 8-1B. The boundaries of these subareas consist of landfill ridge line high points, interceptor berms, rundown channels, or perimeter ditches. Runoff will sheet flow across the top surface of the landfill and a short distance down the 4:1 landfill side slope. Interceptor berms will be constructed at 40 foot vertical intervals down the side slope to intercept runoff and convey it laterally to rundown channels. These rundowns are lined, flat-bottom channels which route runoff down the side slope to the landfill toe. Once the runoff is conveyed to the base of the landfill, it is conveyed to natural drainage ways via perimeter drainage ditches.

INTERCEPTOR BERMS

The interceptor berms will be constructed above the final cover system at a 3% longitudinal slope along the sideslopes of the landfill. Uniform Soil Loss Equation calculations contained in this appendix demonstrate that a vertical spacing of 40 feet is an acceptable interval for placing the berms to control erosion. At this interval, soil loss due to sheet flow runoff is expected to be 2.84 ton/ac/yr, less than the recommended maximum of 3 ton/ac/yr. The berms form a 2.5 foot deep drainage swale with one side being the 4:1 side slope of the landfill and the other consisting of the 2.5:1 face of the intercept berm (see Attachment 8-3). Maximum calculated depth of flow is 1.45 feet with a velocity of 5 feet per second.

RUNDOWN CHANNELS

Rundown channels have been designed to convey the runoff flows from the interceptor berms to perimeter ditches or natural drainageways located at the base of the landfill. Runoff from several subareas will drain into the rundown channels which are aligned down the 25% landfill sideslope. To reduce the erosion potential, rundown channels will be provided with reno mattresses, grouted riprap, or HDPE geomembrane as shown on Attachment 8-3. The channels will flow directly into the perimeter ditches at the base of the landfill, or into catch basins and culverts to convey the runoff underneath the perimeter road. The channels will be constructed with nine foot wide flat bottoms and 2:1 sideslopes. Maximum depth of flow is calculated at 0.9 feet at 13.5 ft/sec. Design depth of the channels is 2.25 feet as shown on Attachment 8-3.

PERIMETER DITCHES

The perimeter ditches are located at the base of the landfill and have slopes varying from 0.9% to 11.0%. The ditch flowlines typically match the perimeter slope of the landfill toe and convey the runoff to natural drainageways. A minimum of one foot of freeboard will be provided above the 25-year storm depths of flow. For flow velocities less than 5 ft/sec, the ditches will have a vegetated surface. For higher velocities, rock riprap or erosion control mats will be used. Ditch designs are summarized in the Ditch Schedules on Attachment 8-3.

RUNOFF CALCULATION METHODS

Rainfall runoff has been calculated using the Rational Method as follows:

Q = CIA, (Rational Formula), where,

A - is the drainage area, in acres, associated with the particular area being analyzed.

C - is the runoff coefficient; as in previous drainage analyses for this site, a value was obtained using the City of Austin Drainage Criteria Manual Table 2-2 dated June 1, 1988. Landfill input characteristics include a developed area with slopes greater than 7% considered to be in "fair condition" (grass cover on 50 to 75 percent of the area). For this particular condition, the runoff coefficient is 0.46.

I - is the rainfall intensity of the 25 yr. storm calculated from the Texas Department of Transportation Hydraulic Manual intensity equation:

$(I=b/(T_c + d)^e)$

Using Travis County constants from Table 6:

b = 87
d = 8.6
e = 0.766
T_c = time of concentration

The time of concentration (T_c) is the time in minutes required for the runoff to flow from the most hydraulically remote point in the drainage area to the analysis point and is estimated from the drainage area characteristics of slope, surface conditions and degree of concentrated flow. The TxDOT Rational Method sheet flow velocities in Figure 5 of the Manual is used to estimate T_c for overland flow. Mannings equation is used to estimate channel velocities and T_c for flow along the intercept berm swales, rundown channels or in perimeter ditches. The computer program HYDROCALC by

Dodson & Associates incorporates Mannings equation and is used in the calculation of the depth of flow and velocity in each channel.

CALCULATION OF FLOW IN THE INTERCEPTOR SWALES

Runoff from each drainage subarea sheetflows across the landfill surface and is generally collected in an intercept berm swale and conveyed to the rundown channel. In a few locations, runoff will sheetflow directly to a perimeter ditch or natural drainageway. Runoff volumes from each subarea and flow conditions in intercept swales are shown in the Tables at the end of this appendix. For all subareas, the time of concentration was less than 10 minutes so T_c = 10 min. was used to calculate Q as recommended by §330.55. The typical swale is designed with a 3% flowline grade and a depth of 2.5 feet. This provides at least 1 foot of freeboard for the 25 year storm flow.

CALCULATION OF FLOW IN RUNDOWN CHANNELS

For most landfill areas, several interceptor swales drain into rundown channels to convey runoff down the side of the landfill. The channels exhibit high velocities and will be constructed using reno mattresses, grouted riprap, or HDPE geomembrane to prevent excessive erosion. A 9 foot bottom width is selected because it is a standard mattress width.

In order to determine the required channel depths, the total flow from all subareas that flow into a channel is calculated by adding the respective flows from the swales. As shown in the Rundown Channel Schedule on Attachment 8-3, the maximum 25 year depth of flow is 0.9 feet, and the channel depth will typically be 2.25 feet to provide a minimum of 1.35 feet of freeboard to contain turbulent flow or accommodate alignment variation during landfill settlement.

CALCULATION OF FLOW IN THE PERIMETER DITCHES

The perimeter ditches are divided into segments for design purposes. Segments are delineated by locations where the ditch slope changes and/or where significant flow enters the ditch such as at the intersection with a rundown channel. Runoff volumes in each segment are determined by the rational method along with continuity considerations so that design flows within perimeter ditches will not decrease in downstream segments. Segments are designed interatively beginning from the upper end of each ditch. The rational method flow volume is input into the HYDROCALC program, and flow depth, velocity and segment travel time is calculated. For each segment, a new time of concentration is developed for determination of the design runoff volume. The results of these calculations are presented in tabular form at the end of this appendix.

CULVERT DESIGN

A perimeter access road will be aligned along the toe of the landfill, and as a result, it is necessary to convey ditch flows under the road in culverts. Corrugated metal pipe culverts are proposed to range in size from 18 inches to 36 inches in diameter. Culvert sizing is accomplished by using the computer program, CULVERT ANALYSIS PROGRAM version 1.10, by Josef Valenta in San Antonio, Texas. The principles of the program are those found in Section 4 of the TxDOT Hydraulic Manual. In all cases, it is assumed that the tailwater is at the top of the pipe and a roughness coefficient of 0.024 is used. Culvert slope may be from 1 to 3 percent. Ditch depths will be transitioned within about 100 feet of the pipe invert to provide adequate headwater depth. Invert elevations and headwater requirements are shown on Attachment 8-3. Pipe outfalls have been set to provide non-erosive flow to natural drainage ways, or riprap splashpads will be provided to connect to the drainageways. Culvert calculations are provided at the end of this appendix.

SOIL LOSS CALCULATIONS

PROJECT NO.______

CLIENT WMX - ACL SUBJECT SOIL LOSS Prepared By AS Date 3/7/96

PROJECT DRAINAGE DITCH CALCULATION Reviewed By____ Date______

Approved By BD Date 3/8/96

OBJECTIVE:

To determine the expected soil loss from erosion of the final cover during landfill construction. The maximum recommended soil loss is 3 tons per acre per year[1] (TNRCC, pp. 14).

METHOD:

The Universal Soil Loss Equation (USLE) is used to determine average annual soil loss from the cover:

$$A = R*k*L_S*C*P$$

where,

- A = Soil Loss (tons/acre*year)
- R = Rainfall Erosion index
- k = Soil erodibility factor
- L_S = Slope length and steepness factor
- C = Vegetative cover/management factor
- P = Erosion control practice factor

CALCULATIONS:

R = Rainfall erosion index
= 280 (from Figure 1, TNRCC, pp. 4)

k = Soil erodibility factor
= 0.25 (Proposed soils to be used for cover are clay. See Table 1, TNRCC, pp. 6)

C = Vegetative cover/management factor
= 0.006 (Derived from TNRCC Table 2 for no appreciable canopy and 90 % ground cover)

P = Erosion control practice factor
= 0.9 (From TNRCC Table 3, for a slope of 25 % and terracing at the landfill)

L_S = Slope length and steepness factor
= 7.5 (Derived from TNRCC Figure 4 for a 25 % slope and an average run length of 165 feet between intercept berms)

A = Soil loss in tons/acre/year
= 280 x 0.25 x 0.006 x 0.9 x 7.5
= 2.84 tons/acre/year

ACLUSLE.WPD

PROJECT NO.

CLIENT WMX - ACL SUBJECT SOIL LOSS Prepared By AS Date 3/7/96

PROJECT DRAINAGE DITCH CALCULATION Reviewed By Date

Approved By BD Date 3/8/96

The projected soil loss of 2.84 tons/acre/year is less than the maximum recommended soil loss of the 3.0 tons/acre/year limit. Thus, the design provides acceptable landfill erosion control.

REFERENCE:

1. Use of the Universal Soil Loss Equation in Final Cover/Configuration Design. Texas Natural Resources Conservation Commission, Permits Section, Municipal Solid Waste Division, October 1993.

ACLUSLE.WPD

DRAINAGE AREA RUNOFF AND INTERCEPT SWALE FLOW

DRAINAGE AREA RUNOFF AND INTERCEPT SWALE FLOW
AUSTIN COMMUNITY LANDFILL
WEST LANDFILL AREA

DRAINAGE AREA	AREA (ACRES)	TOTAL Tc (MIN)	25-YR. INTENSITY (IN/HR)	25-YR. RUNOFF COEFF. C	25-YR. RUNOFF (CFS)	INTERCEPT SWALE FLOW DEPTH (FT)	INTERCEPT SWALE FLOW VELOCITY (FPS)
WA1	3.53	10.00	9.27	0.46	15.05	1.06	4.10
WA2	1.20	10.00	9.27	0.46	5.12	0.71	3.13
WA3	4.97	10.00	9.27	0.46	21.19	1.21	4.45
WA4	2.22	10.00	9.27	0.46	9.47	0.89	3.64
WA5	5.47	10.00	9.27	0.46	23.32	1.25	4.56
WA6	4.12	10.00	9.27	0.46	17.57	1.13	4.26
WAA1	1.70	10.00	9.27	0.46	7.25	N/A	N/A
WAA2	2.69	10.00	9.27	0.46	11.47	N/A	N/A
WB1	7.72	10.00	9.27	0.46	32.92	1.43	4.97
WB2	0.80	10.00	9.27	0.46	3.41	0.61	2.83
WB3	6.58	10.00	9.27	0.46	28.06	1.34	4.78
WB4	2.62	10.00	9.27	0.46	11.17	0.95	3.81
WBB1	2.92	10.00	9.27	0.46	12.45	N/A	N/A
WBB2	0.53	10.00	9.27	0.46	2.26	N/A	N/A
WBB3	2.90	10.00	9.27	0.46	12.37	N/A	N/A
WBB4	0.87	10.00	9.27	0.46	3.71	N/A	N/A
WBB5	2.61	10.00	9.27	0.46	11.13	N/A	N/A
WBB6	1.28	10.00	9.27	0.46	5.46	N/A	N/A
WBB7	1.35	10.00	9.27	0.46	5.76	N/A	N/A
WBB8	1.07	10.00	9.27	0.46	4.56	N/A	N/A
WC1	3.47	10.00	9.27	0.46	14.80	N/A	N/A
WC2	1.74	10.00	9.27	0.46	7.42	0.82	3.42
WCC1	1.01	10.00	9.27	0.46	4.31	N/A	N/A
WD1	1.19	10.00	9.27	0.46	5.07	0.71	3.12
WD2	5.83	10.00	9.27	0.46	24.86	1.28	4.63
WD3	3.83	10.00	9.27	0.46	16.33	1.10	4.18
WDD1	1.39	10.00	9.27	0.46	5.93	N/A	N/A
WDD2	3.33	10.00	9.27	0.46	14.20	N/A	N/A
WDD3	1.94	10.00	9.27	0.46	8.27	N/A	N/A
WE1	3.66	10.00	9.27	0.46	15.61	1.08	4.13
WE2	5.16	10.00	9.27	0.46	22.00	1.23	4.50
WE3	3.22	10.00	9.27	0.46	13.73	1.03	4.00
WE4	3.37	10.00	9.27	0.46	14.37	1.05	4.04
WE5	4.28	10.00	9.27	0.46	18.25	1.14	4.30
WE6	4.60	10.00	9.27	0.46	19.61	1.17	4.37
WEE2	4.04	10.00	9.27	0.46	17.23	N/A	N/A
WF1	1.80	10.00	9.27	0.46	7.68	0.83	3.45
WF2	3.90	10.00	9.27	0.46	16.63	1.10	4.20
WF3	2.14	10.00	9.27	0.46	9.13	0.88	3.61
WFF1	2.54	10.00	9.27	0.46	10.83	N/A	N/A
WFF2	0.19	10.00	9.27	0.46	0.81	N/A	N/A

Runoff Q = CiA
Intensity "i" = b/(Tc+d)^e
b = : 87
d = : 8.6
e = : 0.766

Depth and velocity calculated by Mannings equation with n=.04, s=3%, ss=2.5:1 and 4:1.

DRAINAGE AREA RUNOFF AND INTERCEPT SWALE FLOW
AUSTIN COMMUNITY LANDFILL
EAST LANDFILL AREA

DRAINAGE AREA	AREA (ACRES)	TOTAL Tc (MIN)	25-YR. INTENSITY (IN./HR.)	25-YR. RUNOFF COEFF. "C"	25-YR. RUNOFF (CFS)	INTERCEPT SWALE FLOW DEPTH (FT)	INTERCEPT SWALE FLOW VELOCITY (fps)
EA1	2.90	10.00	9.27	0.46	12.37	0.99	3.89
EA2	2.64	10.00	9.27	0.46	11.26	0.95	3.81
EA3	2.49	10.00	9.27	0.46	10.62	0.93	3.75
EA4	3.33	10.00	9.27	0.46	14.20	1.04	4.03
EA5	3.81	10.00	9.27	0.46	16.25	1.09	4.18
EAA1	1.80	10.00	9.27	0.46	7.68	0.83	3.45
EAA2	1.58	10.00	9.27	0.46	6.74	N/A	N/A
EAA3	4.15	10.00	9.27	0.46	17.70	N/A	N/A
EB1	0.80	10.00	9.27	0.46	3.41	0.61	2.83
EB2	7.31	10.66	9.02	0.46	30.34	1.38	4.87
EB3	3.50	10.00	9.27	0.46	14.92	1.06	4.09
EBB1	0.83	10.00	9.27	0.46	3.54	N/A	N/A
EBB2	1.68	10.00	9.27	0.46	7.16	N/A	N/A
EC1	2.21	10.00	9.27	0.46	9.42	0.89	3.63
EC2	1.68	10.00	9.27	0.46	7.16	0.81	3.39
EC3	8.00	10.00	9.27	0.46	34.11	1.45	5.01
EC4	2.63	10.00	9.27	0.46	11.21	0.95	3.81
EC5	5.27	10.00	9.27	0.46	22.47	1.24	4.52
ECC1	3.48	10.00	9.27	0.46	14.84	N/A	N/A
ECC2	3.20	10.00	9.27	0.46	13.65	N/A	N/A

Runoff Q = CiA
Intensity "i" = b/(Tc+d)^e

b =:	87
d =:	8.6
e =:	0.766

Depth and velocity calculated by Mannings equation with n=.04, s=3%, ss=2.5:1 and 4:1.

PERIMETER DITCH DESIGN

Austin Community Landfill
Perimeter Ditch Design

Ditch Segment	Segment Slope (%)	Drainage Areas	Area (Acres)	Ditch Length (Ft.)	Channel Velocity (Fps)	Tc (Min.)	i25 (In/Hr)	Segment Q25 (by Manning's) (Cfs)	Design Q25 (by continuity) (Cfs)
Ditch One :									
1A	2.43	WBB1	2.92	270	4.06	10.00	9.27	12.45	12.45
1B	2.43	WBB1	2.92	320	4.06	10.00	9.27	12.45	12.45
1C	6.25	WBB1,2	3.45	950	5.77	10.00	9.27	14.71	14.71
1D	1.61	WBB1,2	3.45	330	3.63	11.52	8.73	13.85	14.71
1E	1.00	WBB1,2	3.45	200	2.98	12.63	8.38	13.29	14.71
1F	2.44	WBB1,2,3,4,5 + WB 1,2,3,4	27.55	530	4.12	14.78	7.78	98.60	98.60
1G	3.33	Above + WBB 6,7,8	31.25	760	7.67	16.43	7.38	106.15	106.15
Ditch Two :									
2A	7.00	WC1,2	5.21	400	6.96	10.00	9.27	22.22	22.22
2B	7.00	WC 1,2 + WCC1	6.22	520	6.96	11.25	8.82	25.24	25.24
2C	1.00	Above + WDD1 +WD 1,2,3	18.46	500	3.97	13.34	8.17	69.35	69.35
Ditch Three:									
3A	2.94	WDD 2	3.33	270	4.5	10.00	9.27	14.20	14.20
3B	6.25	WDD2	3.33	130	5.96	10.36	9.13	13.99	14.20
3C	2.43	WDD2	3.33	220	4.17	11.24	8.82	13.51	14.20
3D	1.33	WDD 2,3	5.27	220	3.31	12.35	8.46	20.51	20.51
3E	2.03	WDD 2,3	5.27	210	4.29	13.17	8.22	19.92	20.51
3F	3.70	WDD 2,3	5.27	200	5.35	13.79	8.04	19.50	20.51
3G	1.25	WDD 2,3	5.27	280	3.53	15.11	7.70	18.66	20.51
3H	2.08	WDD 2,3 + WEE 2 (part)	7.11	430	4.23	16.81	7.30	23.88	23.88
3I	1.56	WDD 2,3 + WE	9.31	350	4.04	18.25	7.00	29.97	29.97
Ditch Four :									
4A	1.51	part of WEE 2	0.75	350	2.42	10.00	9.27	3.20	3.20
Ditch Five :									
5A	1.00	part of WEE 2	0.4	200	1.77	10.00	9.27	1.71	1.71
Ditch Six :									
6A	9.09	WFF 1	2.54	490	6.43	10.00	9.27	10.83	10.83
6B	4.76	WFF 1	2.54	140	5.03	10.46	9.10	10.63	10.83
6C	1.00	WFF 1	2.54	830	2.8	15.40	7.62	8.91	10.83

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Ditch Seven :									
7A	9.00	WF 1,2	5.7	300	7.46	10.00	9.27	24.30	24.30
7B	9.00	WF 1,2	5.7	370	7.46	10.83	8.97	23.51	24.30
7C	1.00	WF 1,2,3	7.84	120	3.41	11.41	8.76	31.61	31.61
7D	7.69	WF 1,2,3 +WFF	8.03	350	7.9	12.15	8.52	31.49	31.61
7E	6.25	WAA 1	9.73	260	7.28	12.75	8.34	37.34	37.34
7F	2.27	WAA 1	9.73	480	5.21	14.28	7.91	35.40	37.34
7G	6.66	WAA 1	9.73	700	7.68	15.80	7.53	33.70	37.34
7H*	1.72	WF 1,2,3 +WFF 2	31.2	350	4.28	17.16	7.22	103.66	103.66
(* 6 ft. Flat Bottom)		+WAA1+WA 1to6							
7I*	1.00	WF 1,2,3 +WFF 2	31.2	400	4.83	18.54	6.94	99.59	103.66
(* 6 ft. Flat Bottom)		+WAA1+WA 1to6							
Ditch Eight :									
8A	0.86	ECC2 (part)	0.75	680	1.96	10.00	9.27	3.20	3.20
Ditch Nine :									
9A	3.70	EBB 1	0.83	500	3.48	10.00	9.27	3.54	3.54
9B	0.90	EBB 1	0.83	650	2.04	10.00	9.27	3.54	3.54
9C	0.90	EBB 1,2,3	6.01	520	2.04	14.25	7.92	21.89	21.89
9D	0.90	EB 1,2+ECC 1	18.84	1000	3.22	19.42	6.77	58.69	58.69
		+EBB 1,2,3							
9E	1.56	EB 1,2+ECC 1	18.84	400	5.07	20.74	6.54	56.66	58.69
		+EBB 1,2,3							
9F	1.33	EB 1,2+ECC 1	18.84	400	4.73	22.15	6.31	54.66	58.69
		+EBB 1,2,3							
Ditch Ten :									
10A	3.20	EAA 3 (part)	1.7	230	3.93	10.00	9.27	7.25	7.25
10B	5.90	EAA 3 (part)	1.7	490	4.95	10.00	9.27	7.25	7.25
Ditch Eleven :									
11A	3.12	EAA 1	1.8	240	3.94	10.00	9.27	7.68	7.68
11B	1.00	EAA 1,2	3.38	180	2.58	10.00	9.27	14.41	14.41
Ditch Twelve :									
12A	0.90	ECC 2 (part)	0.75	220	1.99	10.00	9.27	3.20	3.20
12B	4.00	ECC 2 (part)	0.75	240	3.49	10.00	9.27	3.20	3.20
12C	11.00	ECC 2 (part)	0.75	60	5.11	10.00	9.27	3.20	3.20
12D	8.33	ECC 2 (part)	0.75	80	4.6	10.00	9.27	3.20	3.20
12 E	1.51	ECC 2 (part)	1.9	400	2.42	10.00	9.27	8.10	8.10

Note:
Manning's roughness coefficient (channel), n = 0.035
Runoff coeff., C = 0.46
Minimum Tc = 10 minutes

Austin Community Landfill
West Landfill Ditch Schedule

Ditch	Channel Slope (Ft./Ft.)	Q25 (Design) (Cfs)	Side Slope H:V	Side Slope H:V	Bottom Width (Ft.)	Depth of Flow (Ft.)	Velocity (Fps)	Erosion Control Required
1	2.43	12.45	3	3	0	1.01	4.06	Grass
1	2.43	12.45	3	3	0	1.01	4.06	Grass
1	6.25	14.71	3	3	0	0.9	6.02	3 in. Rock
1	1.61	14.71	3	3	0	1.16	3.63	Grass
1	1.00	14.71	3	3	0	1.27	3.03	Grass
1	2.44	98.60	3	3	0	2.2	6.81	6 in. Rock
1	3.33	106.15	3	3	0	2.13	7.81	6 in. Rock
2	7.00	22.22	3	3	0	1.03	6.96	6 in. Rock
2	7.00	25.24	3	3	0	1.08	7.2	6 in. Rock
2	1.00	69.35	3	3	0	2.28	4.46	Grass
3	2.94	14.20	3	3	0	1.03	4.5	Grass
3	6.25	14.20	3	3	0	0.89	5.96	3 in. Rock
3	2.43	14.20	3	3	0	1.06	4.2	Grass
3	1.33	20.51	3	3	0	1.37	3.66	Grass
3	2.03	20.51	3	3	0	1.26	4.29	Grass
3	3.70	20.51	3	3	0	1.13	5.39	3 in. Rock
3	1.25	20.51	3	3	0	1.38	3.58	Grass
3	2.08	23.88	3	3	0	1.33	4.5	Grass
3	1.56	29.97	3	3	0	1.53	4.28	Grass
4	1.51	3.20	3	3	0	0.66	2.42	Grass
5	1.00	1.71	3	3	0	0.57	1.77	Grass
6	9.09	10.83	3	3	0	0.75	6.43	3 in. Rock
6	4.76	10.83	3	3	0	0.85	5.03	3 in. Rock
6	1.00	10.83	3	3	0	1.13	2.81	Grass
7	9.00	24.30	3	3	0	1.02	7.85	6 in. Rock
7	9.00	24.30	3	3	0	1.02	7.85	6 in. Rock
7	1.00	31.61	3	3	0	1.69	3.67	Grass
7	7.69	31.61	3	3	0	1.15	7.9	6 in. Rock
7	6.25	37.34	3	3	0	1.28	7.6	6 in. Rock
7	2.27	37.34	3	3	0	1.55	5.21	3 in. Rock
7	6.66	37.34	3	3	0	1.26	7.78	6 in. Rock
7	1.72	103.66	3	3	6	1.62	5.88	3 in. Rock
7	1.00	103.66	3	3	6	1.86	4.83	Grass

Austin Community Landfill
East Landfill Ditch Schedule

Ditch	Channel Slope (Ft./Ft.)	Q25 (Design) (Cfs)	Side Slope H:V	Side Slope H:V	Bottom Width (Ft.)	Depth of Flow (Ft.)	Velocity (Fps)	Erosion Control Required
8	0.86	3.20	3	3	0	0.74	1.96	Grass
9	3.70	3.54	3	3	0	0.58	3.48	Grass
9	0.90	3.54	3	3	0	0.76	2.04	Grass
9	0.90	21.89	3	3	0	1.51	3.22	Grass
9	0.90	58.69	3	3	0	2.18	4.12	Grass
9	1.56	58.69	3	3	0	1.96	5.07	3 in. Rock
9	1.33	58.69	3	3	0	2.02	4.77	Grass
10	3.20	7.25	3	3	0	0.78	3.93	Grass
10	5.90	7.25	3	3	0	0.7	4.95	Grass
11	3.12	7.68	3	3	0	0.81	3.94	Grass
11	1.00	14.41	3	3	0	1.26	3.01	Grass
12	0.90	3.20	3	3	0	0.73	1.99	Grass
12	4.00	3.20	3	3	0	0.55	3.49	Grass
12	11.00	3.20	3	3	0	0.46	5.11	3 in. Rock
12	8.33	3.20	3	3	0	0.48	4.6	Grass
12	1.51	8.10	3	3	0	0.94	3.06	Grass

Note:
For Erosion Control, if Velocity < 5 fps, use Grass
if Velocity > 5 fps but < 6.5 fps, then use 3" rock
if Velocity > 6.5 fps, use 6" rock

CULVERT DESIGN

CULVERT DESIGN

AUSTIN COMMUNITY LANDFILL

```
       CORRUGATED METAL PIPE CULVERT 1

NUMBER OF BARRELS = 2
DIAMETER =     3.00 FT
LENGTH OF CULVERT =     50.00 FT
ROUGHNESS COEFFICIENT = 0.024
PROPOSED CULVERT SLOPE = 0.0300 FT/FT
TAILWATER DEPTH =    3.00 FT
ENTRANCE LOSS COEFFICIENT = 0.50
TOTAL DISCHARGE =    106.20 C.F.S.
DISCHARGE PER BARREL =     53.10 C.F.S.

  CULVERT HAS TYPE III B CONDITIONS.
OUTLET VELOCITY IS BASED ON FULL FLOW AT THE OUTLET.
THE ENTRANCE IS SUBMERGED.

HEADWATER DEPTH =    4.47 FT
OUTLET VELOCITY =    7.51 FT/S

CRITICAL SLOPE =  0.0232 FT/FT
CRITICAL DEPTH =   2.37 FT
CRITICAL VELOCITY =   8.87 FT/SEC
```

Calculation Software by Josef Valenta, San Antonio, Texas. Based on Section 4 of TxDOT Hydraulic Manual

CORRUGATED METAL PIPE CULVERT 2

NUMBER OF BARRELS = 2
DIAMETER = 3.00 FT
LENGTH OF CULVERT = 50.00 FT
ROUGHNESS COEFFICIENT = 0.024
PROPOSED CULVERT SLOPE = 0.0300 FT/FT
TAILWATER DEPTH = 3.00 FT
ENTRANCE LOSS COEFFICIENT = 0.50
TOTAL DISCHARGE = 69.40 C.F.S.
DISCHARGE PER BARREL = 34.70 C.F.S.

THE CULVERT HAS TYPE III B CONDITIONS.
OUTLET VELOCITY IS BASED ON FULL FLOW AT THE OUTLET.
THE ENTRANCE IS UNSUBMERGED.

HEADWATER DEPTH = 3.09 FT
OUTLET VELOCITY = 4.91 FT/S

CRITICAL SLOPE = 0.0170 FT/FT
CRITICAL DEPTH = 1.91 FT
CRITICAL VELOCITY = 7.29 FT/SEC

CORRUGATED METAL PIPE CULVERT 3/4

NUMBER OF BARRELS = 1
DIAMETER = 3.00 FT
LENGTH OF CULVERT = 50.00 FT
ROUGHNESS COEFFICIENT = 0.024
PROPOSED CULVERT SLOPE = 0.0200 FT/FT
TAILWATER DEPTH = 3.00 FT
ENTRANCE LOSS COEFFICIENT = 0.50
TOTAL DISCHARGE = 33.20 C.F.S.
DISCHARGE PER BARREL = 33.20 C.F.S.

THE CULVERT HAS TYPE III B CONDITIONS.
OUTLET VELOCITY IS BASED ON FULL FLOW AT THE OUTLET.
THE ENTRANCE IS UNSUBMERGED.

HEADWATER DEPTH = 3.01 FT
OUTLET VELOCITY = 4.70 FT/S

CRITICAL SLOPE = 0.0167 FT/FT
CRITICAL DEPTH = 1.87 FT
CRITICAL VELOCITY = 7.16 FT/SEC

CORRUGATED METAL PIPE CULVERT 5/6

NUMBER OF BARRELS = 2
DIAMETER = 3.00 FT
LENGTH OF CULVERT = 50.00 FT
ROUGHNESS COEFFICIENT = 0.024
PROPOSED CULVERT SLOPE = 0.0200 FT/FT
TAILWATER DEPTH = 3.00 FT
ENTRANCE LOSS COEFFICIENT = 0.50
TOTAL DISCHARGE = 95.50 C.F.S.
DISCHARGE PER BARREL = 47.75 C.F.S.

THE CULVERT HAS TYPE IV B CONDITIONS. THE FLOW IS CONTROLED BY OUTLET.
OUTLET VELOCITY IS BASED ON TAILWATER AT THE OUTLET.
THE ENTRANCE IS SUBMERGED.

HEADWATER DEPTH = 3.94 FT
OUTLET VELOCITY = 6.76 FT/S

CRITICAL SLOPE = 0.0210 FT/FT
CRITICAL DEPTH = 2.25 FT
CRITICAL VELOCITY = 8.40 FT/SEC

CORRUGATED METAL PIPE CULVERT 7

NUMBER OF BARRELS = 2
DIAMETER = 3.00 FT
LENGTH OF CULVERT = 50.00 FT
ROUGHNESS COEFFICIENT = 0.024
PROPOSED CULVERT SLOPE = 0.0200 FT/FT
TAILWATER DEPTH = 3.00 FT
ENTRANCE LOSS COEFFICIENT = 0.50
TOTAL DISCHARGE = 103.70 C.F.S.
DISCHARGE PER BARREL = 51.85 C.F.S.

THE CULVERT HAS TYPE IV B CONDITIONS. THE FLOW IS CONTROLED BY OUTLET.
OUTLET VELOCITY IS BASED ON TAILWATER AT THE OUTLET.
THE ENTRANCE IS SUBMERGED.

HEADWATER DEPTH = 4.28 FT
OUTLET VELOCITY = 7.34 FT/S

CRITICAL SLOPE = 0.0227 FT/FT
CRITICAL DEPTH = 2.34 FT
CRITICAL VELOCITY = 8.76 FT/SEC

CORRUGATED METAL PIPE CULVERT 8

NUMBER OF BARRELS = 1
F METER = 1.50 FT
TH OF CULVERT = 60.00 FT
GHNESS COEFFICIENT = 0.024
PROPOSED CULVERT SLOPE = 0.0100 FT/FT
TAILWATER DEPTH = 1.50 FT
ENTRANCE LOSS COEFFICIENT = 0.50
TOTAL DISCHARGE = 3.20 C.F.S.
DISCHARGE PER BARREL = 3.20 C.F.S.

THE CULVERT HAS TYPE II CONDITIONS. THE FLOW IS CONTROLED BY OUTLET.
OUTLET VELOCITY IS BASED ON TAILWATER AT THE OUTLET.
THE ENTRANCE IS UNSUBMERGED.

HEADWATER DEPTH = 1.17 FT
OUTLET VELOCITY = 1.81 FT/S

CRITICAL SLOPE = 0.0177 FT/FT
CRITICAL DEPTH = 0.68 FT
CRITICAL VELOCITY = 4.10 FT/SEC

CORRUGATED METAL PIPE CULVERT 9

NUMBER OF BARRELS = 3
DIAMETER = 3.00 FT
LENGTH OF CULVERT = 50.00 FT
IGHNESS COEFFICIENT = 0.024
POSED CULVERT SLOPE = 0.0100 FT/FT
ILWATER DEPTH = 3.00 FT
ENTRANCE LOSS COEFFICIENT = 0.50
TOTAL DISCHARGE = 113.50 C.F.S.
DISCHARGE PER BARREL = 37.83 C.F.S.

THE CULVERT HAS TYPE IV B CONDITIONS. THE FLOW IS CONTROLED BY OUTLET.
OUTLET VELOCITY IS BASED ON TAILWATER AT THE OUTLET.
THE ENTRANCE IS SUBMERGED.

HEADWATER DEPTH = 3.72 FT
OUTLET VELOCITY = 5.35 FT/S

CRITICAL SLOPE = 0.0178 FT/FT
CRITICAL DEPTH = 2.00 FT
CRITICAL VELOCITY = 7.55 FT/SEC

CORRUGATED METAL PIPE CULVERT 10

NUMBER OF BARRELS = 1
DIAMETER = 1.50 FT
LENGTH OF CULVERT = 50.00 FT
ROUGHNESS COEFFICIENT = 0.024
PROPOSED CULVERT SLOPE = 0.0100 FT/FT
TAILWATER DEPTH = 1.50 FT
ENTRANCE LOSS COEFFICIENT = 0.50
TOTAL DISCHARGE = 7.30 C.F.S.
DISCHARGE PER BARREL = 7.30 C.F.S.

THE CULVERT HAS TYPE IV B CONDITIONS. THE FLOW IS CONTROLED BY OUTLET.
OUTLET VELOCITY IS BASED ON TAILWATER AT THE OUTLET.
THE ENTRANCE IS SUBMERGED.

HEADWATER DEPTH = 2.22 FT
OUTLET VELOCITY = 4.13 FT/S

CRITICAL SLOPE = 0.0237 FT/FT
CRITICAL DEPTH = 1.05 FT
CRITICAL VELOCITY = 5.55 FT/SEC

CORRUGATED METAL PIPE CULVERT 11

NUMBER OF BARRELS = 2
DIAMETER = 3.00 FT
LENGTH OF CULVERT = 50.00 FT
ROUGHNESS COEFFICIENT = 0.024
PROPOSED CULVERT SLOPE = 0.0100 FT/FT
TAILWATER DEPTH = 1.00 FT
ENTRANCE LOSS COEFFICIENT = 0.50
TOTAL DISCHARGE = 79.10 C.F.S.
DISCHARGE PER BARREL = 39.55 C.F.S.

THE CULVERT HAS TYPE IV B CONDITIONS. THE FLOW IS CONTROLED BY OUTLET.
OUTLET VELOCITY IS BASED ON CRITICAL DEPTH AT OUTLET.
THE ENTRANCE IS SUBMERGED.

HEADWATER DEPTH = 3.35 FT
OUTLET VELOCITY = 7.70 FT/S

CRITICAL SLOPE = 0.0183 FT/FT
CRITICAL DEPTH = 2.05 FT
CRITICAL VELOCITY = 7.70 FT/SEC

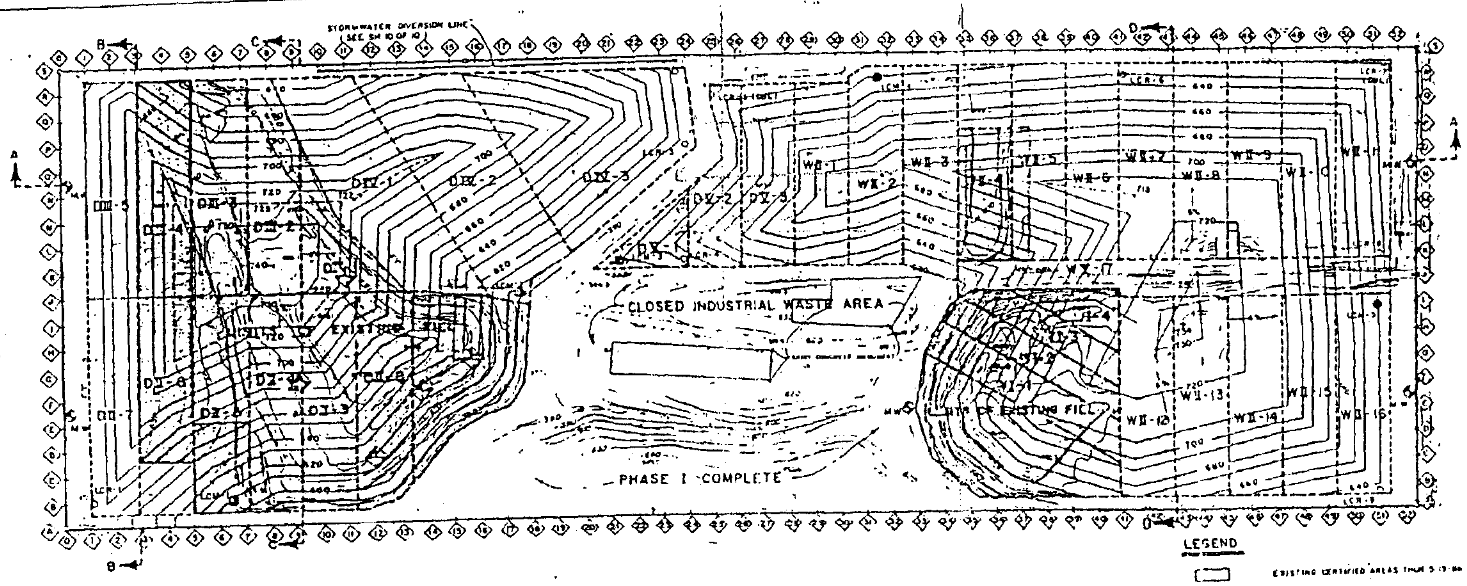
CORRUGATED METAL PIPE CULVERT 12

NUMBER OF BARRELS = 1
DIAMETER = 1.50 FT
LENGTH OF CULVERT = 50.00 FT
ROUGHNESS COEFFICIENT = 0.024
PROPOSED CULVERT SLOPE = 0.0100 FT/FT
TAILWATER DEPTH = 1.50 FT
ENTRANCE LOSS COEFFICIENT = 0.50
TOTAL DISCHARGE = 8.10 C.F.S.
DISCHARGE PER BARREL = 8.10 C.F.S.

THE CULVERT HAS TYPE IV B CONDITIONS. THE FLOW IS CONTROLED BY OUTLET.
OUTLET VELOCITY IS BASED ON TAILWATER AT THE OUTLET.
THE ENTRANCE IS SUBMERGED.

HEADWATER DEPTH = 2.50 FT
OUTLET VELOCITY = 4.58 FT/S

CRITICAL SLOPE = 0.0255 FT/FT
CRITICAL DEPTH = 1.10 FT
CRITICAL VELOCITY = 5.82 FT/SEC



NOTES

1. IN ACCORDANCE WITH TEXAS DEPARTMENT OF HEALTH REGULATION No. 325.502 (c), GRID MARKERS WILL BE SPACED ALONG SITE BOUNDARIES AT 100 FOOT STATIONS. THESE MARKERS WILL BE INSTALLED TO ENCOMPASS THE CURRENT FILL AREAS AND THE AREAS TO BE FILLED WITHIN A THREE YEAR PERIOD AND EXPANDED PROGRESSIVELY AS NEEDED.
2. DESIGN SLOPES SHOWN ARE CONSTRUCTION GRADES. SHEET 8 DEPICTS ANTICIPATED FINAL SLOPES AFTER SETTLEMENT.

LEGEND

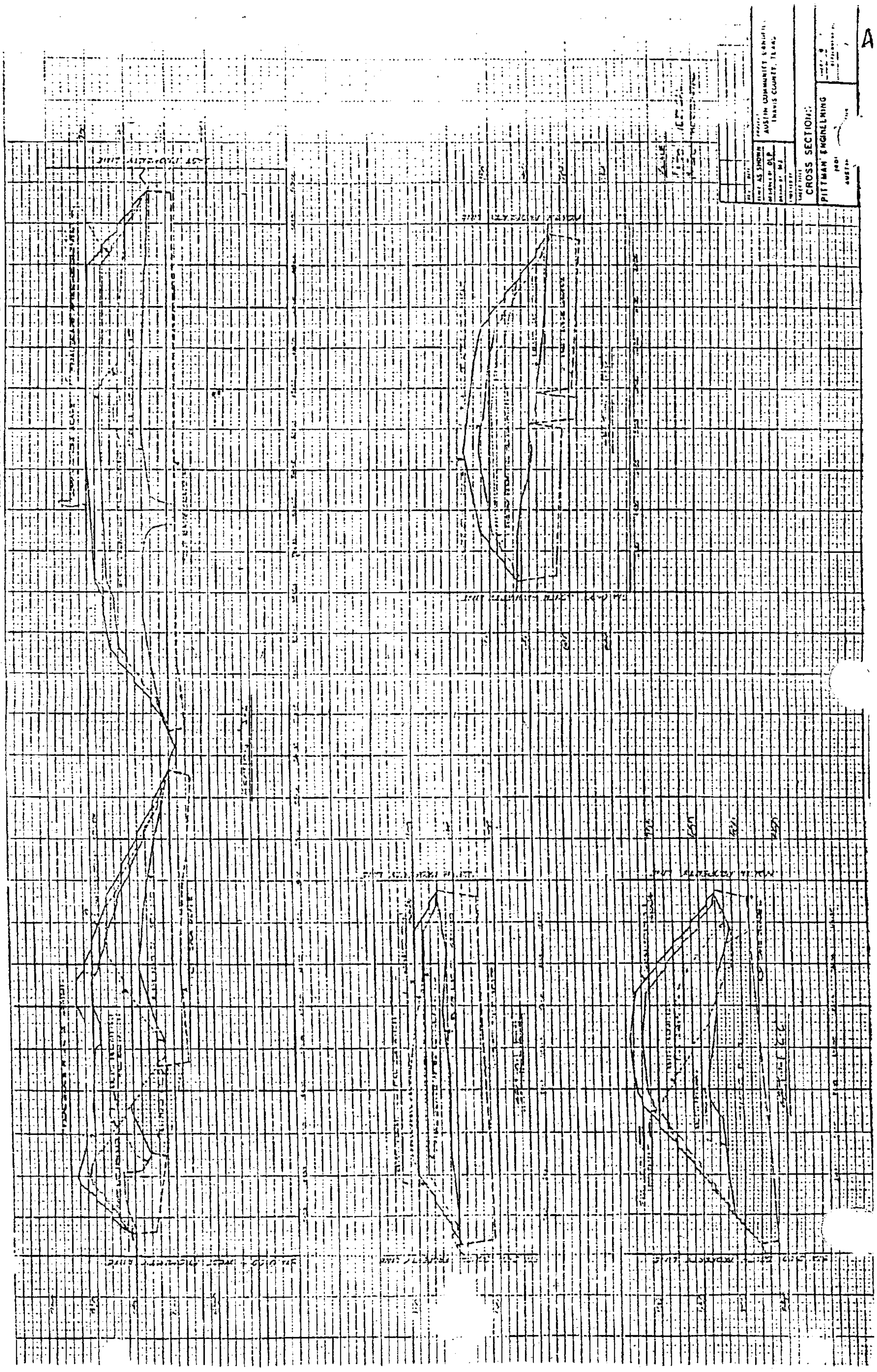
▭	EXISTING CERTIFIED AREAS THRU 5-13-86
	TOPOGRAPHIC COORDINATES
	EXISTING SPOT ELEVATION
	EXISTING CONTOUR
B	CROSS SECTION LOCATION
	PROPERTY LINE
	[illegible]
D IV - 1	[illegible]
MW	MONITOR WELL LOCATION
	EXISTING LEACHATE RISER (GAS VENT)
660	PROPOSED CONSTRUCTED CONTOUR
660	PROPOSED CONSTRUCTED SPOT ELEVATION
LCM-1 ●	LEACHATE COLLECTION MANHOLE
LCR-1 ○	LEACHATE COLLECTION RISER
	SITE GRID MARKER

SCALE 1" = 200'	PROJECT AUSTIN COMMUNITY LANDFILL TRAVIS COUNTY, TEXAS
DESIGNED DLP	
DRAWN BY DR/MJ	
SHEET TITLE LANDFILL COMPLETION PLAN	
PITTMAN ENGINEERING, AUSTIN TEXAS	SHEET 7 OF 10
	3

THIS ATTACHMENT HAS BEEN SUPERCEDED
BY THE JULY, 1996 PERMIT MODIFICATION.
REFER TO ATTACHMENTS 9-1 AND 9-2 FOR
THE LATEST VERSION.

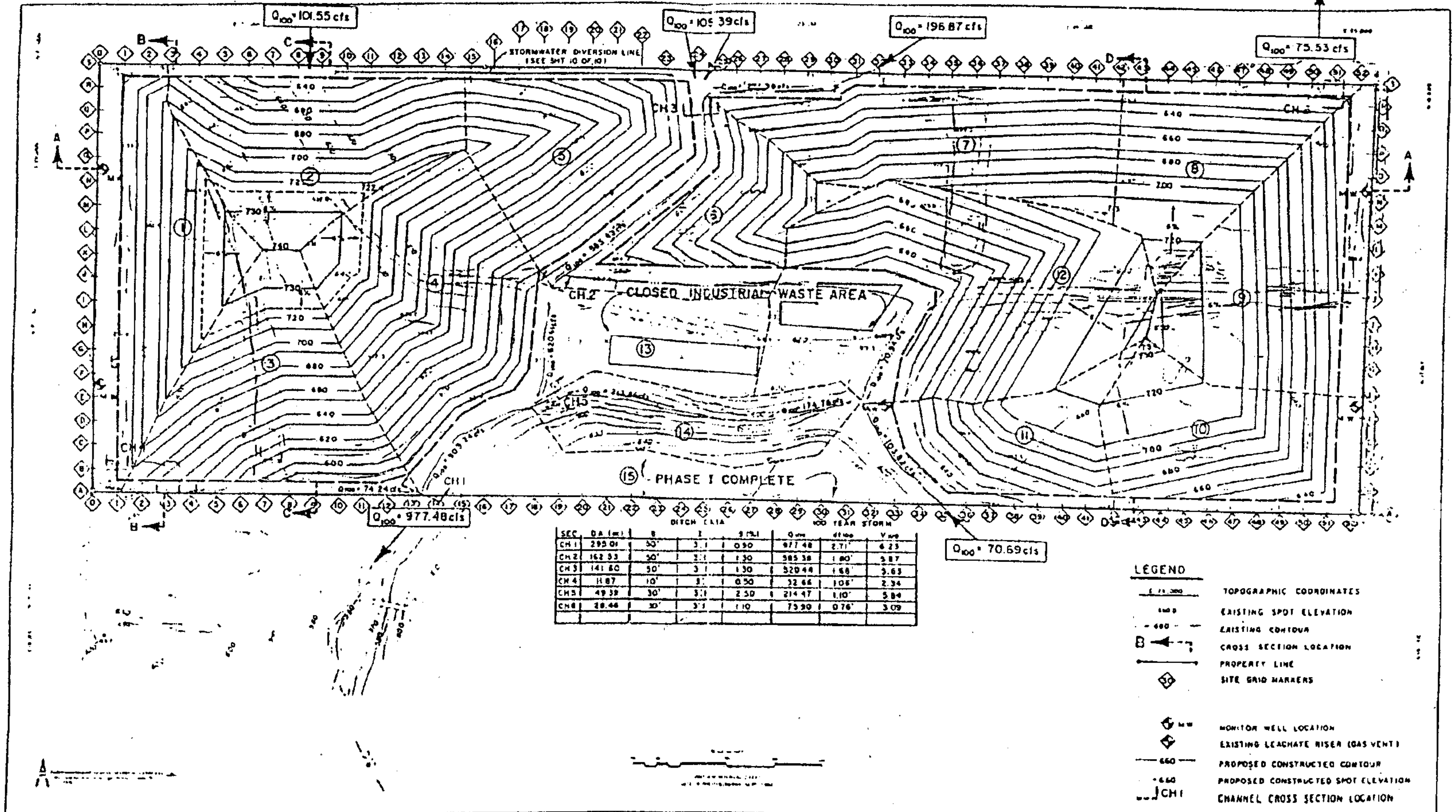
46

THIS ATTACHMENT HAS BEEN SUPERCEDED BY THE JULY, 1996 PERMIT MODIFICATION. REFER TO ATTACHMENTS 7-1 AND 7-2 FOR THE LATEST VERSION.



WM-019670

THIS ATTACHMENT HAS BEEN SUPERSEDED
BY THE JULY, 1996 PERMIT MODIFICATION.
REFER TO ATTACHMENTS 8-1A AND 8-1B
FOR THE LATEST VERSION.



DITCH DATA — 100 YEAR STORM

SEC	DA (ac)	B	Z	S (%)	Q_{100}	d_{100}	V_{100}
CH 1	295.01	50'	3:1	0.50	977.48	2.71'	6.23
CH 2	162.53	50'	3:1	1.30	585.38	1.80'	5.87
CH 3	141.60	50'	3:1	1.30	520.44	1.68'	5.63
CH 4	11.87	10'	3:1	0.50	32.66	1.05'	2.34
CH 5	49.39	30'	3:1	2.50	214.47	1.10'	5.84
CH 6	28.44	30'	3:1	1.10	75.90	0.76'	3.09

100 YEAR STORM

DA	AREA (ac)	Tc	I	C	Q
1	11.67	42.7	3.5	0.50	32.64
2	13.46	40.9	3.6	0.50	43.23
3	16.00	31.5	3.0	0.52	41.60
4	19.84	31.9	3.0	0.52	51.38
5	15.34	33.2	6.1	0.52	48.66
6	10.70	35.4	3.6	0.52	31.16
7	16.64	32.4	4.3	0.52	34.51
8	11.17	48.3	5.2	0.51	29.62
9	17.31	47.6	5.2	0.51	45.91
10	13.52	44.1	3.4	0.50	33.80
11	13.25	50.8	5.0	0.50	33.13
12	27.82	49.9	5.0	0.51	70.24
13	8.15	15.5	8.3	0.52	35.18
14	8.32	12.7	9.4	0.50	39.10
15	6.74	49.2	5.1	0.50	17.19

NOTES

1. IN ACCORDANCE WITH TEXAS DEPARTMENT OF HEALTH REGULATION No. 325.602 (c), GRID MARKERS WILL BE SPACED ALONG SITE BOUNDARIES AT 100 FOOT STATIONS. THESE MARKERS WILL BE INSTALLED TO ENCOMPASS THE CURRENT FILL AREAS AND THE AREAS TO BE FILLED WITHIN A THREE YEAR PERIOD AND EXPANDED PROGRESSIVELY AS NEEDED.
2. DESIGN SLOPES SHOWN ARE CONSTRUCTION GRADES. SHEET 8 DEPICTS ANTICIPATED FINAL SLOPES AFTER SETTLEMENT.

SCALE 1" = 200'
DESIGNED BY DLP
DRAWN BY DR/MJ

AUSTIN COMMUNITY LANDFILL
TRAVIS COUNTY, TEXAS

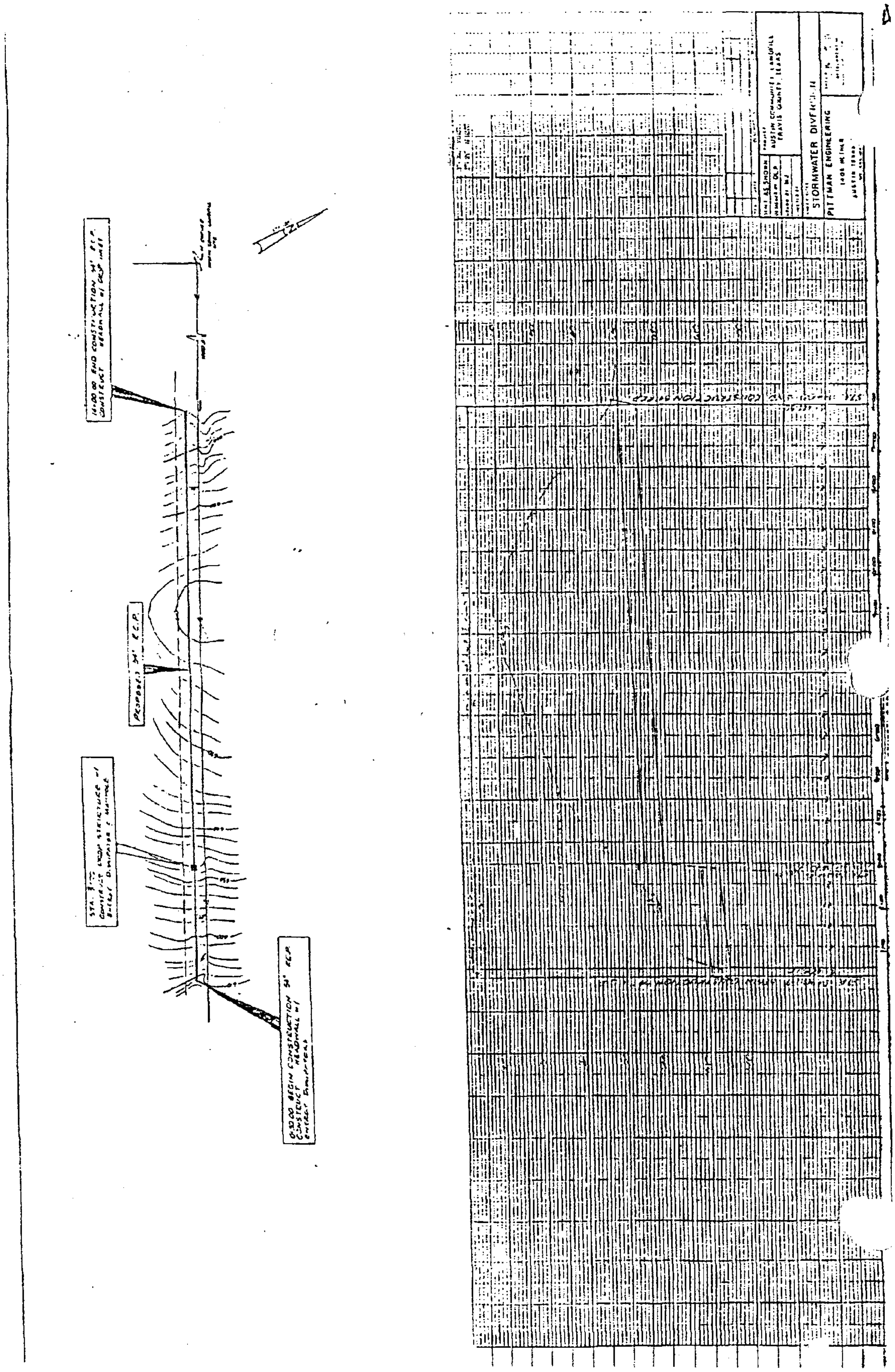
DEVELOPED SURFACE WATER PLAN

PITTMAN ENGINEERING
1406 HETHER
AUSTIN TEXAS 78704

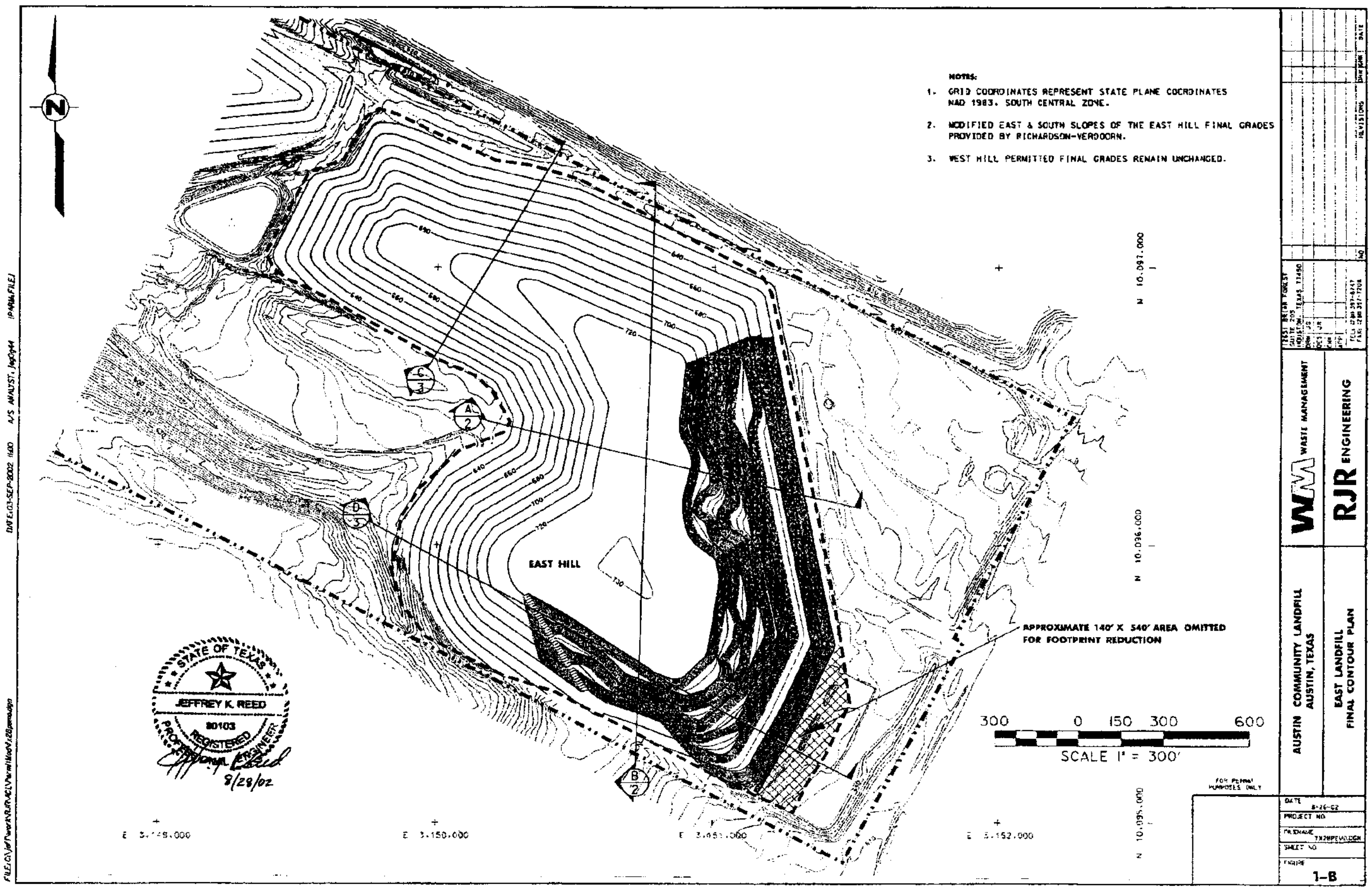
SHEET ... OF 10

A

WM-019671

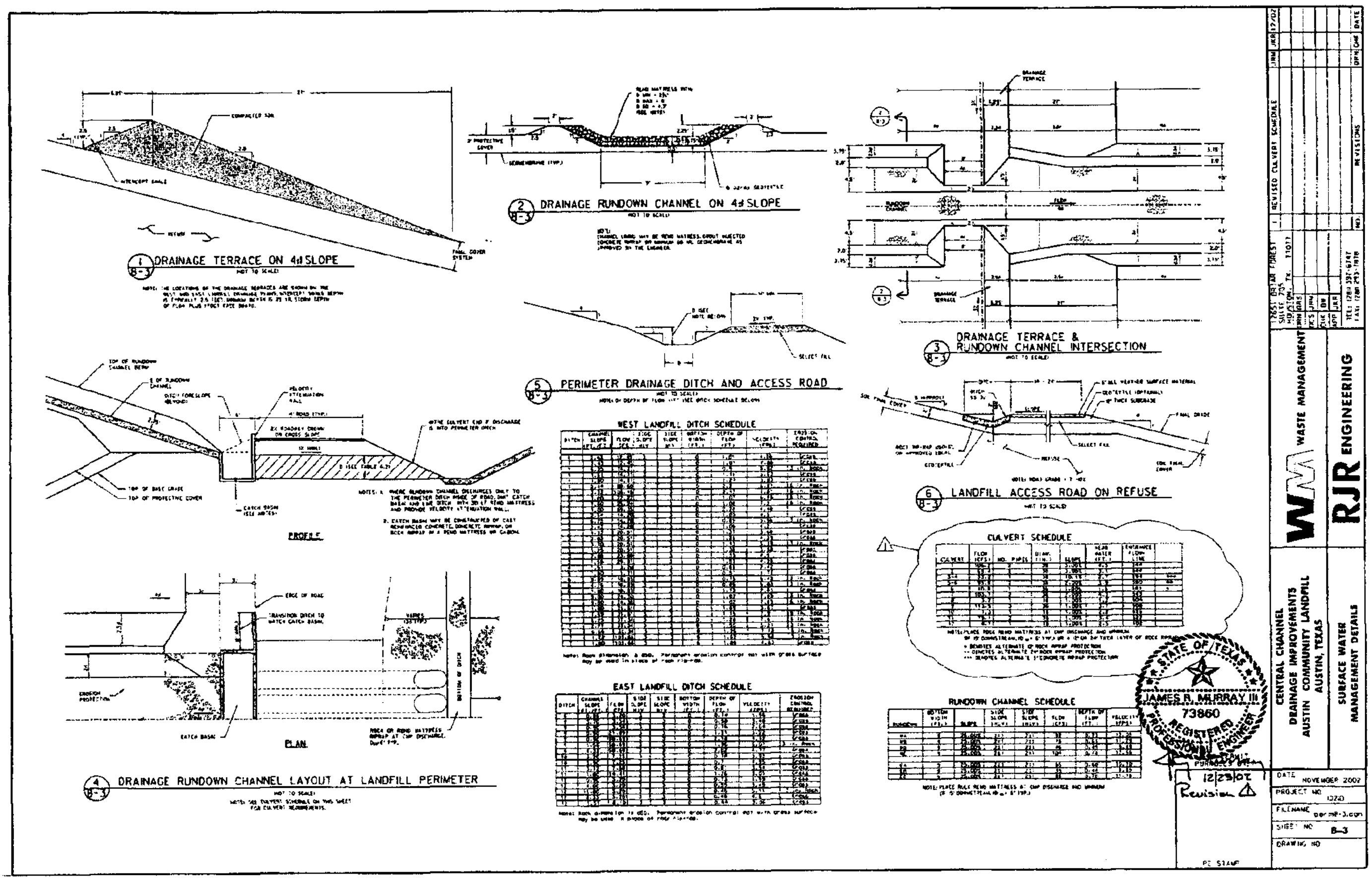

SCALE AS SHOWN
AUSTIN COMMUNITY LANDFILL
STORMWATER DIVERSION
PITTMAN ENGINEERING

WM-019672



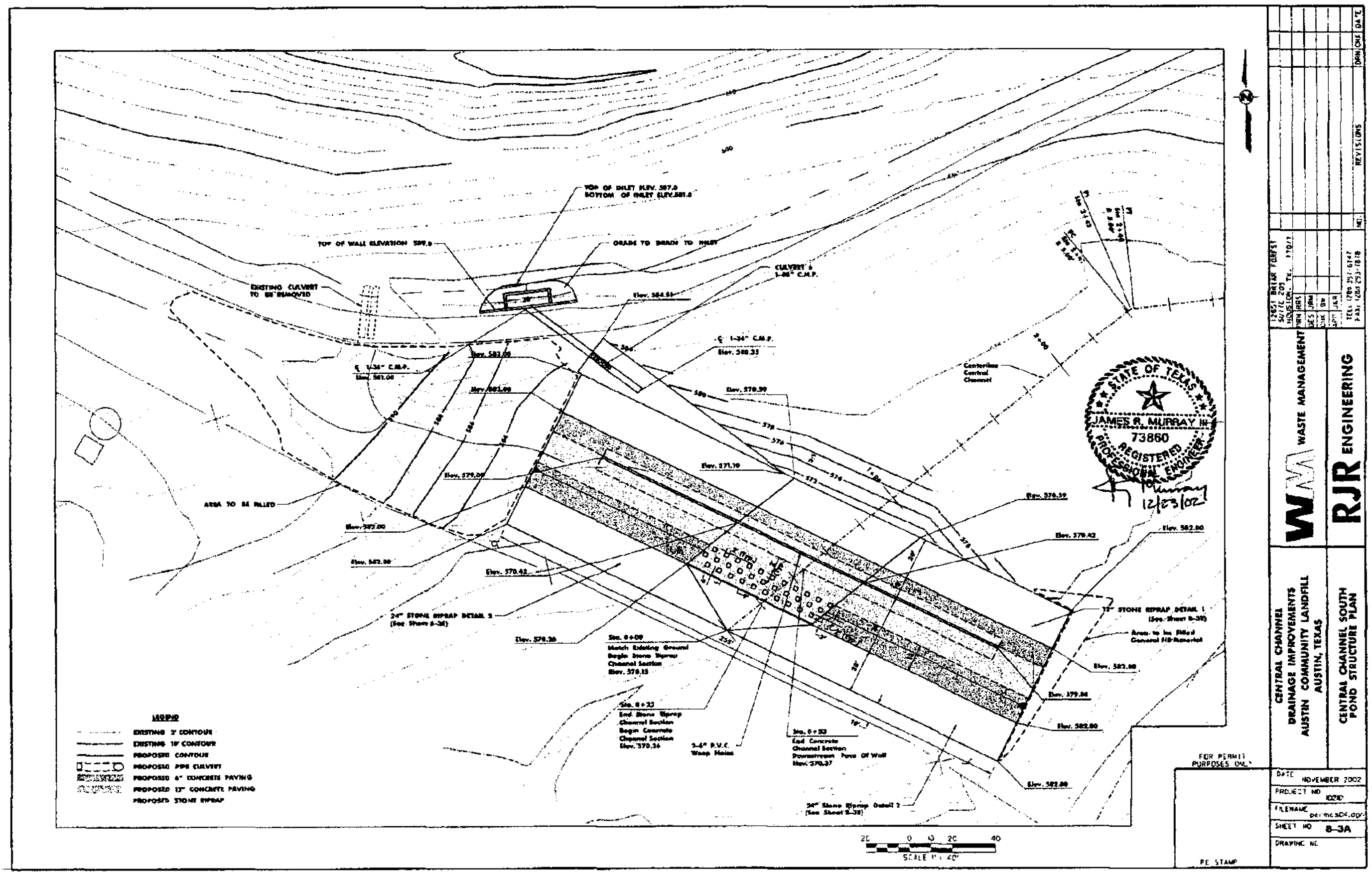
NOTES:
1. GRID COORDINATES REPRESENT STATE PLANE COORDINATES NAD 1983, SOUTH CENTRAL ZONE.
2. MODIFIED EAST & SOUTH SLOPES OF THE EAST HILL FINAL GRADES PROVIDED BY RICHARDSON-VERDOORN.
3. WEST HILL PERMITTED FINAL GRADES REMAIN UNCHANGED.
EAST HILL
APPROXIMATE 140' X 540' AREA OMITTED FOR FOOTPRINT REDUCTION
300 0 150 300 600
SCALE 1" = 300'
STATE OF TEXAS
JEFFREY K. REED
80103
REGISTERED
PROFESSIONAL ENGINEER
8/28/02
WASTE MANAGEMENT
RJR ENGINEERING
AUSTIN COMMUNITY LANDFILL
AUSTIN, TEXAS
EAST LANDFILL
FINAL CONTOUR PLAN
DATE 8-26-02
PROJECT NO.
SHEET NO.
FIGURE 1-B

WM-019673

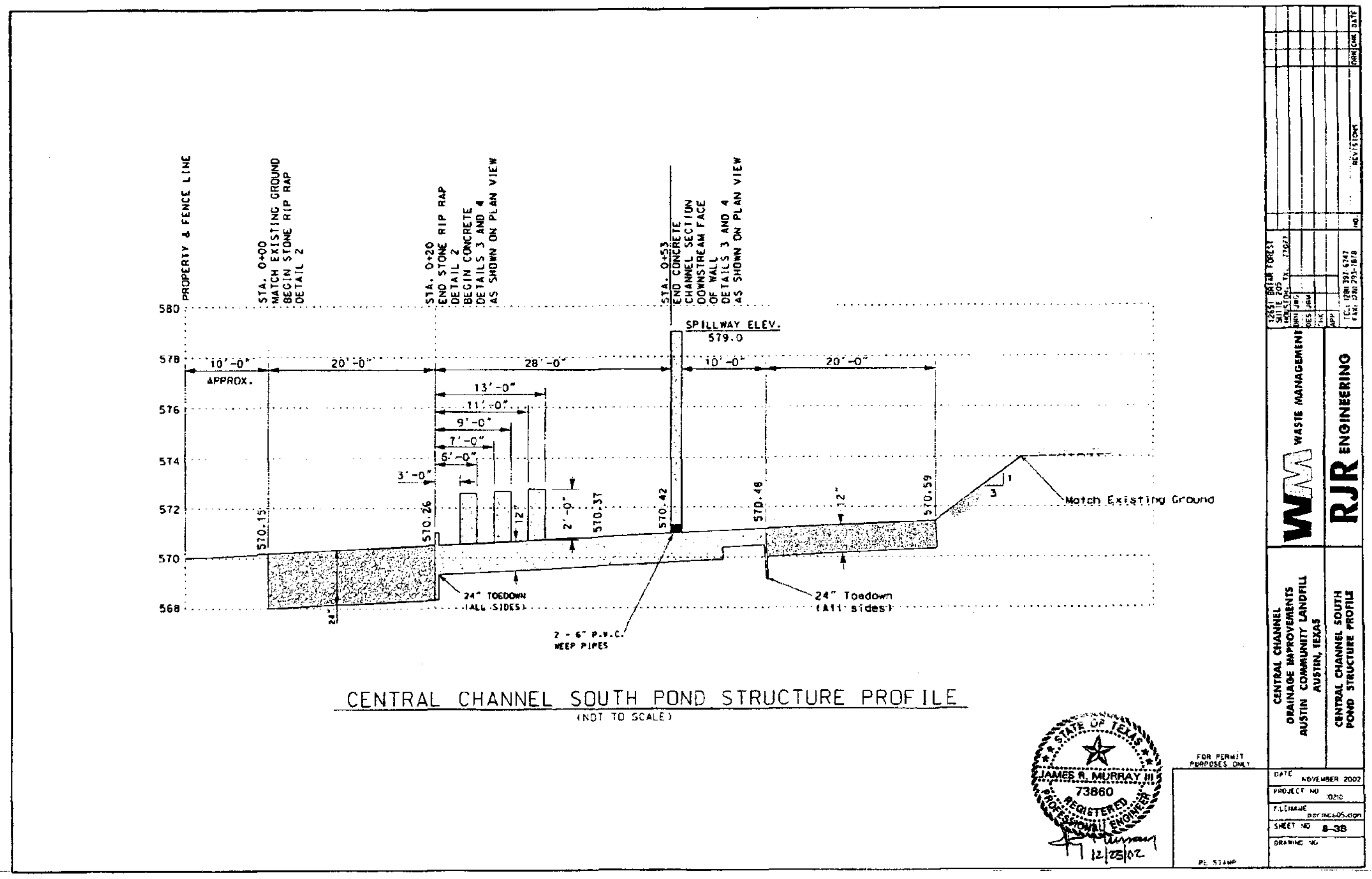


DRAINAGE TERRACE ON 4:1 SLOPE
NOT TO SCALE
DRAINAGE RUNDOWN CHANNEL ON 4:1 SLOPE
NOT TO SCALE
DRAINAGE TERRACE & RUNDOWN CHANNEL INTERSECTION
NOT TO SCALE
PERIMETER DRAINAGE DITCH AND ACCESS ROAD
NOT TO SCALE
LANDFILL ACCESS ROAD ON REFUSE
NOT TO SCALE
PROFILE
PLAN
DRAINAGE RUNDOWN CHANNEL LAYOUT AT LANDFILL PERIMETER
NOT TO SCALE
WEST LANDFILL DITCH SCHEDULE
EAST LANDFILL DITCH SCHEDULE
CULVERT SCHEDULE
RUNDOWN CHANNEL SCHEDULE
STATE OF TEXAS
JAMES R. MURRAY III
73860
REGISTERED PROFESSIONAL ENGINEER
12/23/07
Revision 1
PE STAMP
1 REVISED CULVERT SCHEDULE JRM JKR 12/02
NO. REVISIONS DRN CHK DATE
12651 BRIAR FOREST
SUITE 205
HOUSTON, TX. 77077
DRN RRS
DES JRM
CHK DW
APP JKR
TEL: (281) 597-6747
FAX: (281) 293-7818
WM WASTE MANAGEMENT
RJR ENGINEERING
CENTRAL CHANNEL
DRAINAGE IMPROVEMENTS
AUSTIN COMMUNITY LANDFILL
AUSTIN, TEXAS
SURFACE WATER
MANAGEMENT DETAILS
DATE NOVEMBER 2002
PROJECT NO 1020
FILENAME permit-3.dgn
SHEET NO B-3
DRAWING NO

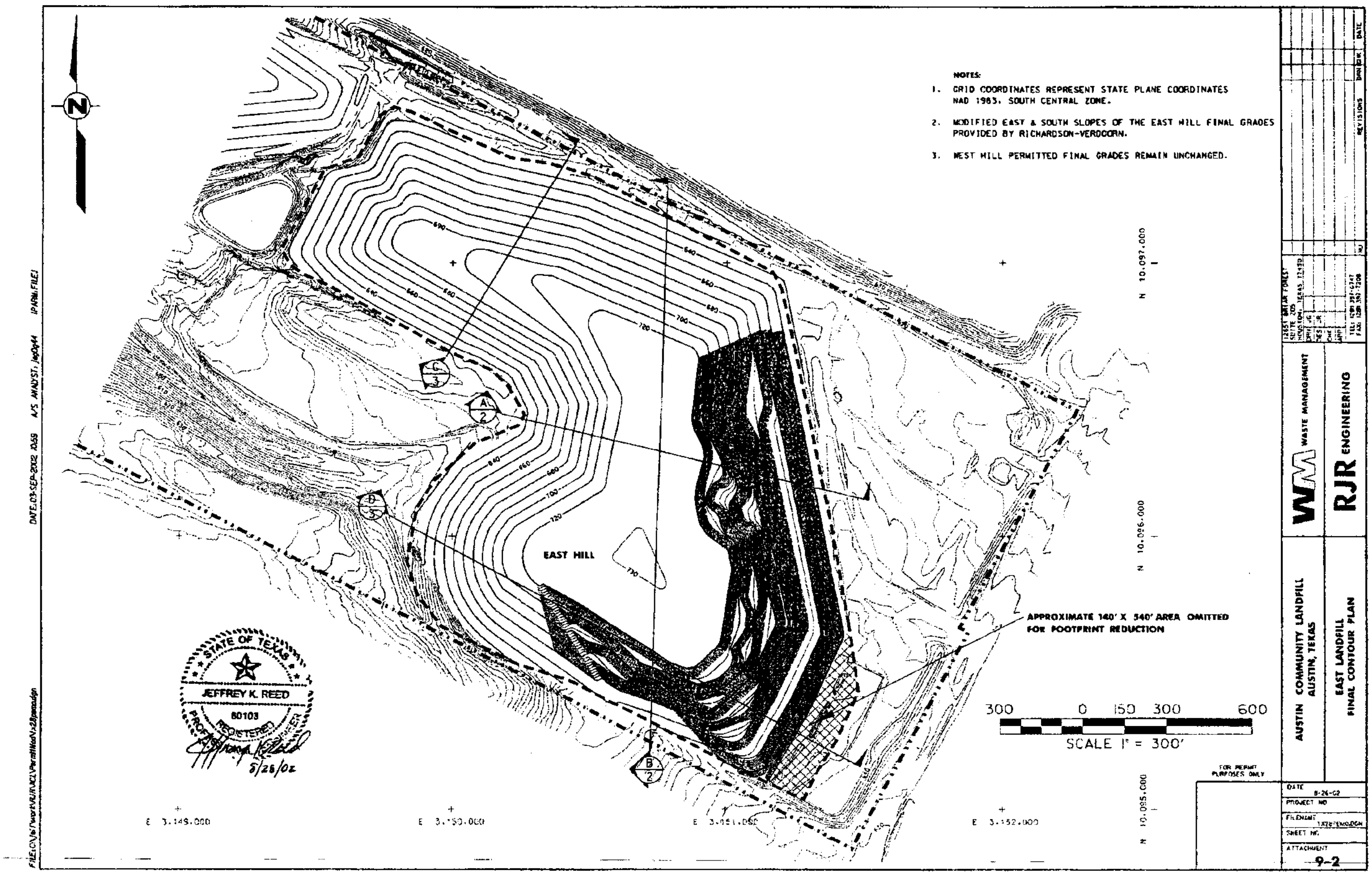
WM-019674


TOP OF INLET ELEV. 587.0
BOTTOM OF INLET ELEV. 581.0
TOP OF WALL ELEVATION 589.0
GRADE TO DRAIN TO INLET
EXISTING CULVERT TO BE REMOVED
AREA TO BE FILLED
Centerline Central Channel
JAMES R. MURRAY III
73860
REGISTERED PROFESSIONAL ENGINEER
12/23/02
LEGEND
EXISTING 2' CONTOUR
EXISTING 10' CONTOUR
PROPOSED CONTOUR
PROPOSED PIPE CULVERT
PROPOSED 6" CONCRETE PAVING
PROPOSED 12" CONCRETE PAVING
PROPOSED STONE RIPRAP
FOR PERMIT PURPOSES ONLY
PE STAMP
SCALE 1" = 40'
12651 BRIAR FOREST SUITE 205 HOUSTON, TX. 77077
TEL: (281) 597-6747
FAX: (281) 293-1818
NO.
REVISIONS
WASTE MANAGEMENT
RJR ENGINEERING
CENTRAL CHANNEL
DRAINAGE IMPROVEMENTS
AUSTIN COMMUNITY LANDFILL
AUSTIN, TEXAS
CENTRAL CHANNEL SOUTH
POND STRUCTURE PLAN
DATE NOVEMBER 2002
PROJECT NO
FILENAME
SHEET NO 8-3A
DRAWING NO.

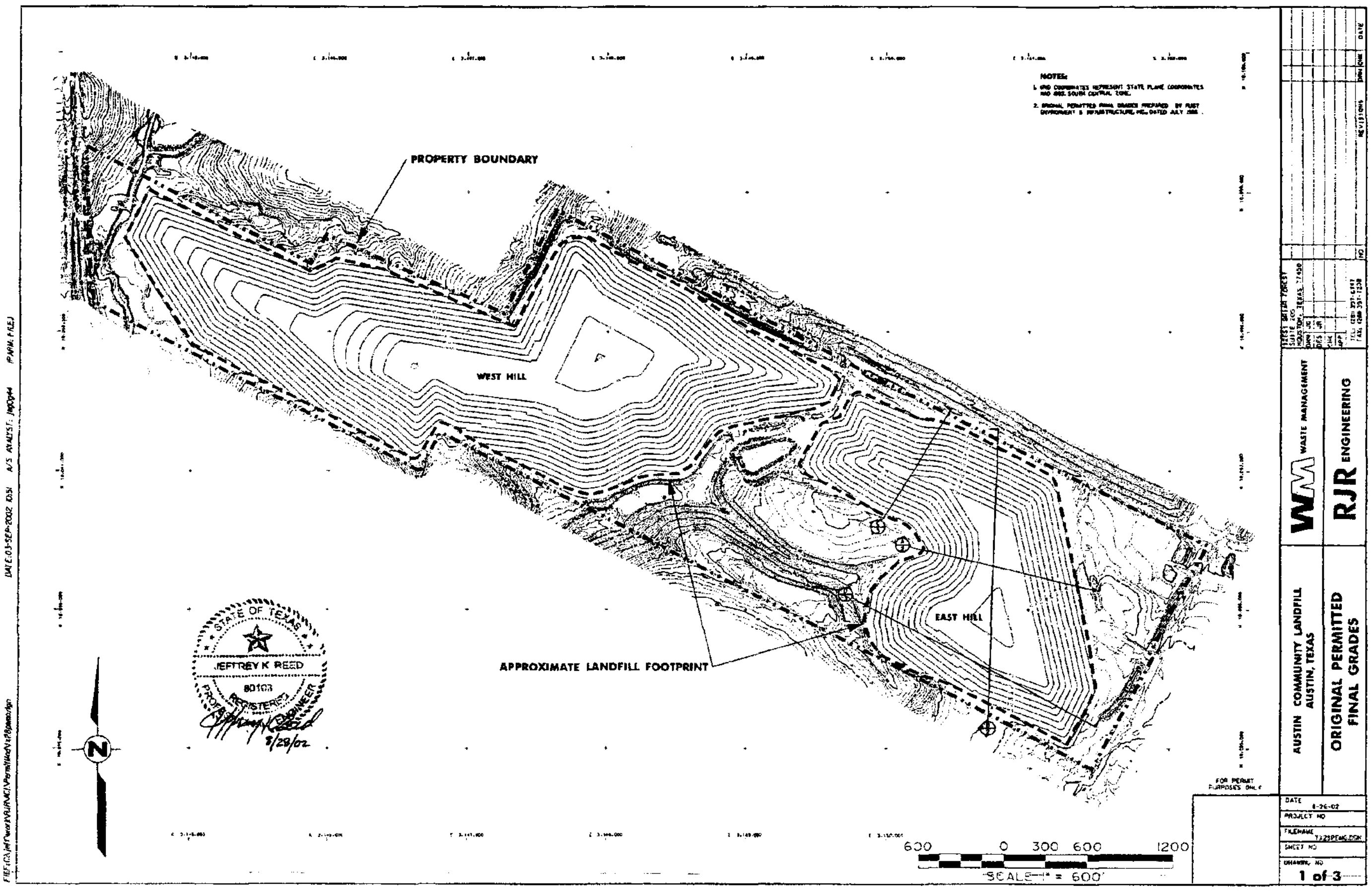
WM-019675


PROPERTY & FENCE LINE
STA. 0+00 MATCH EXISTING GROUND BEGIN STONE RIP RAP DETAIL 2
STA. 0+20 END STONE RIP RAP DETAIL 2 BEGIN CONCRETE DETAILS 3 AND 4 AS SHOWN ON PLAN VIEW
STA. 0+53 END CONCRETE CHANNEL SECTION DOWNSTREAM FACE OF WALL DETAILS 3 AND 4 AS SHOWN ON PLAN VIEW
SPILLWAY ELEV. 579.0
10'-0" APPROX.
20'-0"
28'-0"
10'-0"
20'-0"
13'-0"
11'-0"
9'-0"
7'-0"
6'-0"
3'-0"
2'-0"
12"
570.15
570.26
570.37
570.42
570.48
570.59
24" TOEDOWN (ALL SIDES)
24" Toedown (All sides)
2 - 6" P.V.C. WEEP PIPES
Match Existing Ground
580
578
576
574
572
570
568
CENTRAL CHANNEL SOUTH POND STRUCTURE PROFILE
(NOT TO SCALE)
WM WASTE MANAGEMENT
RJR ENGINEERING
CENTRAL CHANNEL DRAINAGE IMPROVEMENTS AUSTIN COMMUNITY LANDFILL AUSTIN, TEXAS
CENTRAL CHANNEL SOUTH POND STRUCTURE PROFILE
DATE NOVEMBER 2002
SHEET NO 8-38
FOR PERMIT PURPOSES ONLY
PE STAMP
STATE OF TEXAS
JAMES R. MURRAY III
73860
REGISTERED PROFESSIONAL ENGINEER
12/23/02
REVISIONS

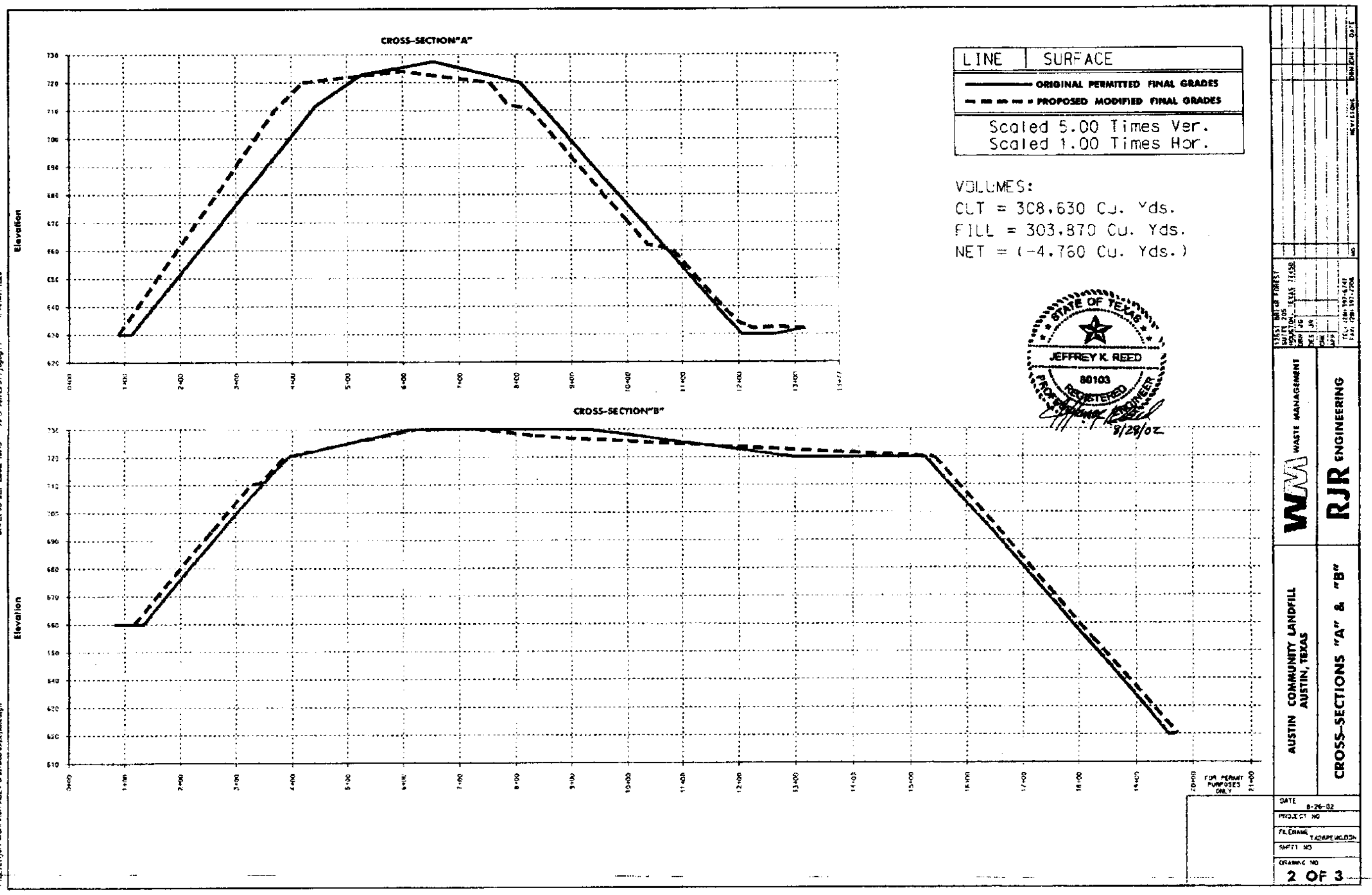
WM-019676


NOTES:
1. GRID COORDINATES REPRESENT STATE PLANE COORDINATES NAD 1983, SOUTH CENTRAL ZONE.
2. MODIFIED EAST & SOUTH SLOPES OF THE EAST HILL FINAL GRADES PROVIDED BY RICHARDSON-VERDOORN.
3. WEST HILL PERMITTED FINAL GRADES REMAIN UNCHANGED.
EAST HILL
APPROXIMATE 140' X 540' AREA OMITTED FOR FOOTPRINT REDUCTION
300 0 150 300 600
SCALE 1" = 300'
FOR PERMIT PURPOSES ONLY
N 10,097,000
N 10,096,000
N 10,095,000
E 3,149,000
E 3,150,000
E 3,151,000
E 3,152,000
STATE OF TEXAS
JEFFREY K. REED
80103
REGISTERED
8/26/02
WASTE MANAGEMENT
RJR ENGINEERING
AUSTIN COMMUNITY LANDFILL
AUSTIN, TEXAS
EAST LANDFILL
FINAL CONTOUR PLAN
DATE 8-26-02
PROJECT NO
FILENAME
SHEET NO
ATTACHMENT
9-2
REVISIONS

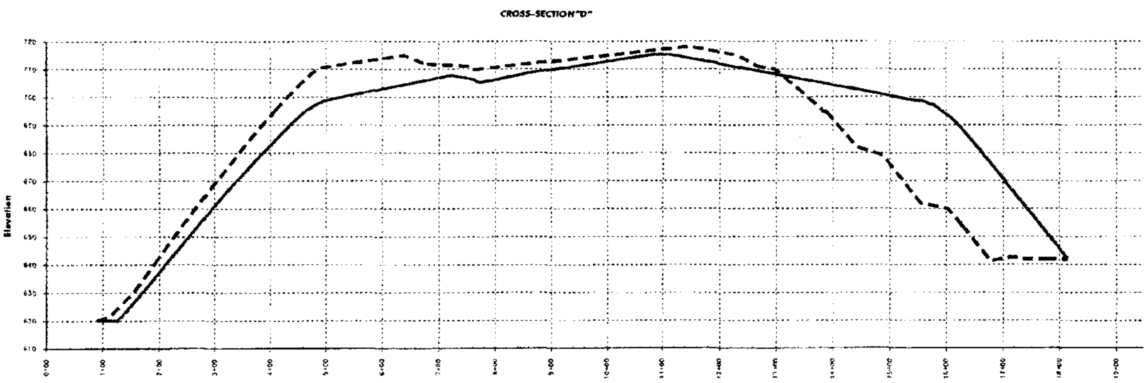
WM-019677


PROPERTY BOUNDARY
WEST HILL
EAST HILL
APPROXIMATE LANDFILL FOOTPRINT
STATE OF TEXAS
JEFFREY K REED
80103
REGISTERED
PROFESSIONAL ENGINEER
8/29/02
N
600 0 300 600 1200
SCALE 1" = 600'
AUSTIN COMMUNITY LANDFILL
AUSTIN, TEXAS
ORIGINAL PERMITTED
FINAL GRADES
WASTE MANAGEMENT
RJR ENGINEERING
REVISIONS
DATE 8-26-02
PROJECT NO
FILENAME
SHEET NO
DRAWING NO
1 of 3

WM-019678


CROSS-SECTION "A"
CROSS-SECTION "B"
Elevation
LINE | SURFACE
ORIGINAL PERMITTED FINAL GRADES
PROPOSED MODIFIED FINAL GRADES
Scaled 5.00 Times Ver.
Scaled 1.00 Times Hor.
VOLUMES:
CUT = 308,630 Cu. Yds.
FILL = 303,870 Cu. Yds.
NET = (-4,760 Cu. Yds.)
STATE OF TEXAS
JEFFREY K. REED
80103
REGISTERED
PROFESSIONAL ENGINEER
8/28/02
FOR PERMIT PURPOSES ONLY
WASTE MANAGEMENT
RJR ENGINEERING
AUSTIN COMMUNITY LANDFILL
AUSTIN, TEXAS
CROSS-SECTIONS "A" & "B"
DATE 8-26-02
PROJECT NO
FILENAME
SHEET NO
DRAWING NO
2 OF 3

WM-019679



LINE	SURFACE
————	ORIGINAL PERMITTED FINAL GRADES
— — — —	PROPOSED MODIFIED FINAL GRADES

Scaled 5.00 Times Ver.
Scaled 1.00 Times Hor.

VOLUMES:
CUT = 308,630 Cu. Yds.
FILL = 303,870 Cu. Yds.
NET = (-4,760 Cu. Yds.)

STATE OF TEXAS
JEFFREY K. REED
80103
REGISTERED
PROFESSIONAL ENGINEER
8/28/02

FOR PERMIT PURPOSES ONLY

WM WASTE MANAGEMENT

RJR ENGINEERING

AUSTIN COMMUNITY LANDFILL
AUSTIN, TEXAS

CROSS-SECTION "C" & "D"

DATE 8-28-02
FILENAME TX2BPEMG.DGN
DRAWING NO 3 OF 3

WM-019680