NMSS/RWM

Water, Waste & Land, Inc.

CONSULTING ENGINEERS AND SCIENTISTS

SELECTED RECLAMATION PLAN CONCEPT

FOR THE CONQUISTA SITE

Prepared for:

Conquista Project
P. O. Box 309
Falls City, Texas 78113

July 23, 1984

01594

OFFICIAL DOCKET COPY

NEW

Water, Waste & Land, Inc.

CONSULTING ENGINEERS AND SCIENTISTS

SELECTED RECLAMATION PLAN CONCEPT FOR THE CONQUISTA SITE

Prepared for:

Conquista Project
P. O. Box 309
Falls City, Texas 78113

July 23, 1984

0159H

Water, Waste & Land, Inc.
CONSULTING ENGINEERS & SCIENTISTS

SELECTED RECLAMATION PLAN CONCEPT

FOR THE CONQUISTA SITE

Prepared for:

Conquista Project
P. O. Box 309
Falls City, Texas 78113

Prepared by:

Water, Waste & Land, Inc.
1311 South College Avenue
Fort Collins, Colorado 80524

Thomas A. Shepherd, Ph.D.
President

Richard E. Wardwell, P.E., Ph.D.
Project Manager

July 23, 1984

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

SELECTED RECLAMATION PLAN CONCEPT FOR THE CONQUISTA SITE

1 INTRODUCTION

The selection of a reclamation plan concept for the Conquista Projec' tailings impoundment for presentation to the State has been the principle objective of the first part of the Reclamation Plan Project undertaken by Water, Waste & Land, Inc. (WWL) and Conquista personnel. This report describes the selection process and the selected reclamation plan concept.

The selection process entailed three levels of reclamation plan alternative development and analysis. The first stage in the process was a thorough review of existing site data and a familiarization by personnel in order to gain an overall understanding of the history of the tailings disposal operation and the project. During this first stage, WWL and Conquista personnel interacted to exchange views and to develop a common philosophy about reclamation for the site so that the goals of the project could be clearly and commonly defined. These goals were developed at the outset of the project and can be stated as follows:

1. Develop a reclamation plan for the site that will provide long-term containment of the tailings and control the potential for escape of radioactive and chemical contaminants either in seepage or as radon gas so that the long-term human health and environmental quality are not jeopardized.

2. Design the reclamation plan so that the goals stated in #1 are achieved without the need for ongoing, long-term maintenance.

3. Develop a reclamation plan that achieves the goals stated in #1 and #2 in the most cost efficient manner.

Underlying these goals is the stated intent to satisfy all applicable State and Federal regulations, not only in letter, but also in the spirit in which the regulations have been developed.

Section 2 of this report describes the selection process used to arrive at a reclamation plan concept. The selected alternative is the Conforming Surface which is described in Section 3. Section 4 outlines the other alternative considered with the comparison between the alternatives presented in Section 5.

2 SELECTION PROCESS

2.1 Initial Alternative Development and Screening

The first step in the selection process was to develop as wide a range of reclamation plan concepts as reasonable, given the nature of the tailings and the site specific characteristics. This was done in an iterative process, with input coming from both Conquista and WWL personnel. The results of this initial process was the development of three basic design concepts for contouring the reclamation surface and controlling surface flows. These included: a Conforming Surface, a Dome Surface, and a Controlled Discharge reclamation surface.

In order to develop the surface configurations of these concepts, certain design criteria had be to established. These criteria are that:

1. The minimum slope for the top of the reclamation surfaces is to be one-half of one percent (1/2%).
2. The minimum cover thickness is to be three feet.
3. Existing embankments at 3:1 provide acceptable long-term stability and would not be altered.

The cover thickness was based upon calculated radon attenuation using actual tailings radium content and soil properties of identified cover material. The actual calculated thickness necessary to control radon emanation at 20 $pCi/m^2/sec$ was approximately 15 inches. Appendix A presents the report of the radon calculations and provides the results of radon flux measurements taken on a portion of the fill already placed. Three feet was selected as reasonable thickness that would assure long-term stability and be constructable. As such, radon emanation will not be a controlling factor in regards to cover thickness at the site.

With these criteria as a basis, the three concepts were translated into 11 alternative plans which represented variations of the basic concept. The initial 11 alternatives were then subjected to a screening process based on qualitative and quantitative selection criteria. The elements of this screening are summarized in Table 1. The principle quantitative selection criteria were the potential environmental impact, the required volume of fill and cover, and the constructability of each alternative. With all these alternatives, long-term stabilization due to flood intrusion should not be a problem. The upstream drainage area is less than 310 acres. Water from this small area will be diverted around the pile using stable drainageways capable of handling the PMF event. Therefore, there should be no long-term impacts on the stability of the reclaimed impoundment associated with offsite influences.

Plans of several of the initial alternatives, representative of the surfaces that would be created by the alternatives, are presented in Appendix B. The cut and fill volumes, as well as the surface configurations, were generated by computer simulation, inputing the existing tailings surface and the basic surface conditions for each alternative. A relative rating of the three basic concepts based on the selection criteria is presented in Table 2. The results of the volume estimation are presented in Table 1 and summarized in Table 3.

The results of this initial alternative development and screening was the decision that two concepts should be developed and evaluated further. These were the Conforming Surface and the Controlled Discharge with an outlet at the west side of the impoundment area.

TABLE 1

Initial Screening of Alternative Reclamation Plans

Alternative	Min. Elev.	Max. Elev.	Fill Volume (cu.yd)	Cut Volume (cu.yd)	Need to Excavate	Need for External Excavation	Discharge Condition	Embankment Breach	External Impact	Permenant Pond	Areas of Concern	Realative Impact Potential
1 Conforming Surface (no discharge)	404 414	426 426	2,563,147 4,249,333	-0- -0-	No	No	N.A.	No	None	Yes	Potential Seepage	Low
2 Conforming Surface (installed outlet)	404	426	2,563,147	-0-	Yes In Slimes	Yes	N.A.	Yes But Repaired	Yes	Yes but Controlled	Potential Seepage & Stab. of Emb.Outlet	Low
3 Domed Surface (constant top elev.)	426	438	8,721,163	-0-	No	Yes	Uniform Embankment	No but Stab. Nessecery	Yes Uncontrolled	No	Erosion of Embankment	High
4 Domed Surface (constant slope)	426?	438	8,721,163	-0-	No	Yes	Uniform Embankment	No but Stab. Nessecery	Yes Uncontrolled	No	Erosion of Embankment	High
5 Domed Surface (controlled discharge)	426	?	>8,700,000	-0-	No	Yes in Discharge location	N.A.	Yes	Yes Controlled	No	Stab. of Discharge Location & Drainage	Modrate
6 Controlled Discharge (west-416)	416	435.6	16,117,526	77,128	Yes	Yes in Discharge location	In Native Ground	Yes	Yes Conquista Creek	No	Stab. of Discharge Location & Drainage	Moderate
7 Controlled Discharge (west-413)	413	433.5	4,634,380	217,509	Yes	Yes in Discharge location	In Native Ground	Yes	Yes Conquista Creek	No	Stab. of Discharge Location & Drainage	Moderate
8 Controlled Discharge (south-414)	414	434.5	5,353,822	112,071	Yes	Yes in Discharge location	In Embankment	Yes	Yes Conquista Creek	No	Stab. of Discharge Location & Drainage	Moderate
9 Controlled Discharge (east-416)	413	434.7	5,075,180	140,976	Yes in Highest Embankment	Yes in Discharge location	In Embankment At Highest Point	Yes	Yes Conquista Creek	No	Stab. of Discharge Location & Drainage	Moderate
10 Controlled Discharge III (west-south)	416	430.8	4,672,514	141,063	Yes in Highest Embankment	Yes in Discharge locations	Native Ground and Embankment	Yes	Yes Conquista Creek	No	Stab. of Discharge Location & Drainage	Moderate
11 Controlled Discharge II (west-east)	416	429.4	4,409,738	127,356	Yes in Highest Embankment	Yes in Discharge locations	Native Ground & High Embankment	Yes	Yes Conquista Creek	No	Stab. of Discharge Location & Drainage	Moderate

TABLE 2
RELATIVE RATING OF CONCEPTS

GENERAL CONCEPT	RELATIVE RATING FACTORS 1. Environmental Impact	2. Cut & Fill Volumes	3. Constructability	COMMENTS (Relating To Relative Rating Factors)
CONFORMING SURFACE	1	1	1	Factor 1. Minimum environmental impact since tailings and surface water contained and controlled; no erosional problems; stability of impoundment not affected. 2. Minimum fill; no excavation. 3. Constructability good, no extreme designs needed.
DOMED SURFACE	2	3	3	1. Large fill resulting in large impoundment instability; potential slope erosion. 2. Largest amount of fill required but no extreme design necesary. 3. Instability due to fill.
CONTROLLED DISCHARGE	3	2	2	1. Potential offsite impacts due to concentrated release of surface water. 2. Balanced cut & fill. 3. Excavation of tailings needed and constructon of discharge structure.

*Rating Scale: 1 is most desirable rating for each Factor, 3 is least desirable rating.

TABLE 3

ESTIMATED VOLUMES AND ELEVATIONS

OF INITIAL ALTERNATIVES

SURFACE ALTERNATIVE CONFIGURATION	FILL VOLUME	CUT VOLUME	MAXIMUM ELEVATION	MINIMUM ELEVATION
CONFORMING SURFACE				
1a. Min. Elev. 404.5	2,563,147	------	426.00	404.50
1b. Min. Elev. 414.5	4,249,333	------	426.00	414.50
DOMED SURFACE				
3. CONSTANT TOE ELEVATION	3,182,863	------	438.00	426.00
4. CONSTANT SLOPE	8,721,163	------	438.00	------
CONTROLLED DISCHARGE				
6. SINGLE OUTLET WEST	6,117,526	77,128	435.62	416.00
7. SINGLE OUTLET WEST	4,634,380	217,509	433.53	413.00
8. SINGLE OUTLET SOUTH	5,353,822	112,071	434.52	414.00
9. SINGLE OUTLET EAST	5,075,180	140,976	434.66	413.00
10. DUAL OUTLET WEST & SOUTH	4,672,514	141,063	430.81	416.00
11. DUAL OUTLET WEST & EAST	4,409,738	127,356	429.37	416.00

2.2 Second Level Alternative Development and Evaluation

During the second level of development and evaluation, alternatives were developed from the Conforming Surface and Controlled Discharge concepts. These alternatives were based on design conditions developed to reflect the experience gained as a result of the current filling activities.

These conditions are that:

1. The minimum slope of drainage pathways on the surface of the reclamation area is maintained at one-half of one percent (1/2%).

2. The maximum elevation of the reclamation surface at the perimeters of the area is set at 435 so that the embankment height does not have to be increased.

3. Reclamation surfaces other than the drainage pathways can exceed 1/2 percent but for longer slopes one percent is considered an upper limit too assure erosional stability.

4. Based on experience gained during recent fill construction, a minimum cover thickness at the perimeter of the tailings area is approximately five feet for constructibility.

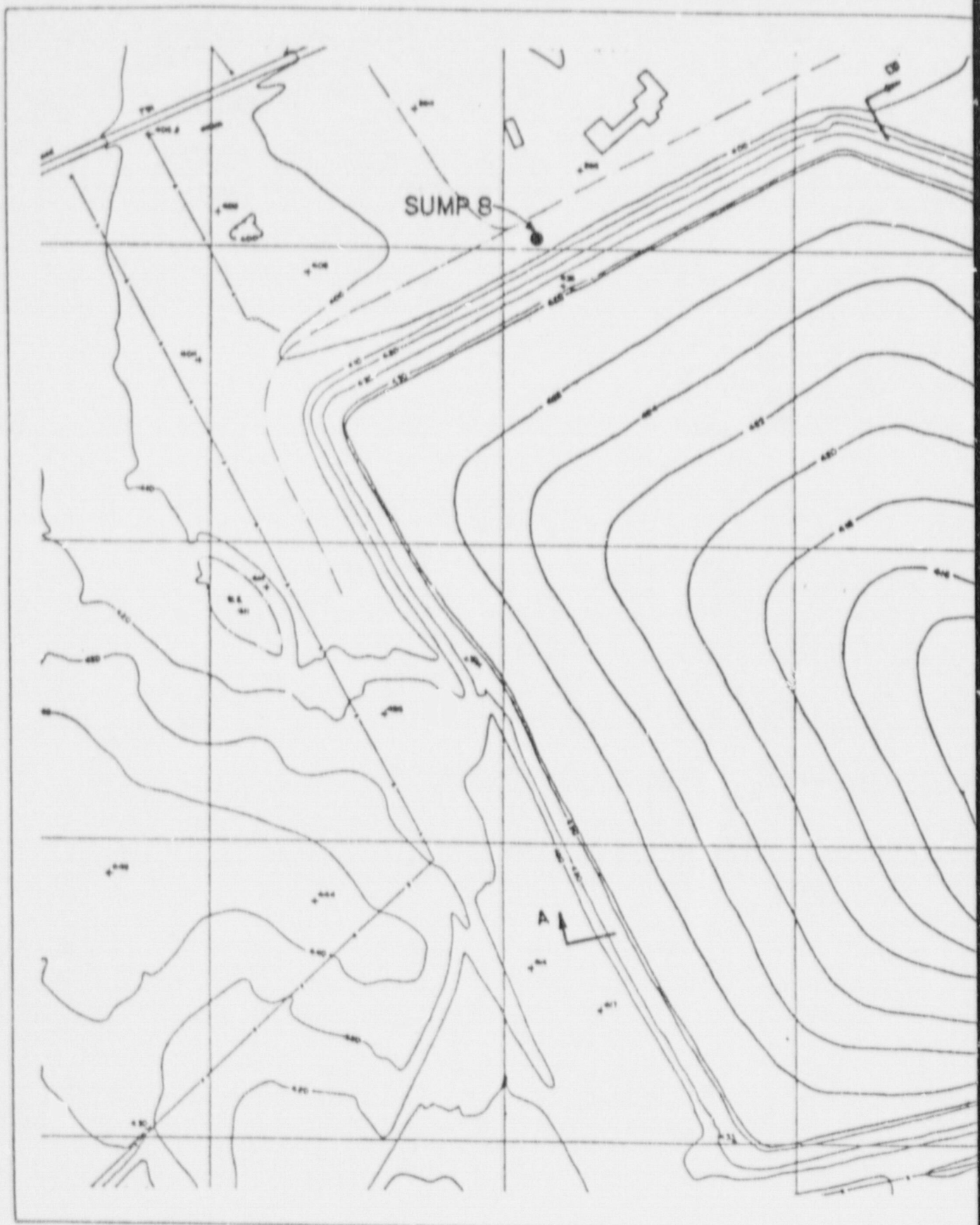
The Conforming Surface concept as presented in the initial screening remained essentially unchanged as one alternative (Alternative 1A). A modification to this concept which eliminates a permanent impoundment was a second alternative. This is called the Containment Surface, Alternative 2A. Two surface configurations for the Controlled Discharge concept became the third and fourth alternatives, Alternatives 3A and 4A.

All four of the second level alternatives would achieve the long-term stability and containment goals established. The principle difference between the alternatives is the amount of fill required, the need for tailings excavation, and the cost of special design structures, such as discharge locations. The selected alternative, Conforming Surface, is described in Section 3. Each of the other alternatives are described in Section 4.

3 SELECTED ALTERNATIVE - ALTERNATIVE 1A: CONFORMING SURFACE

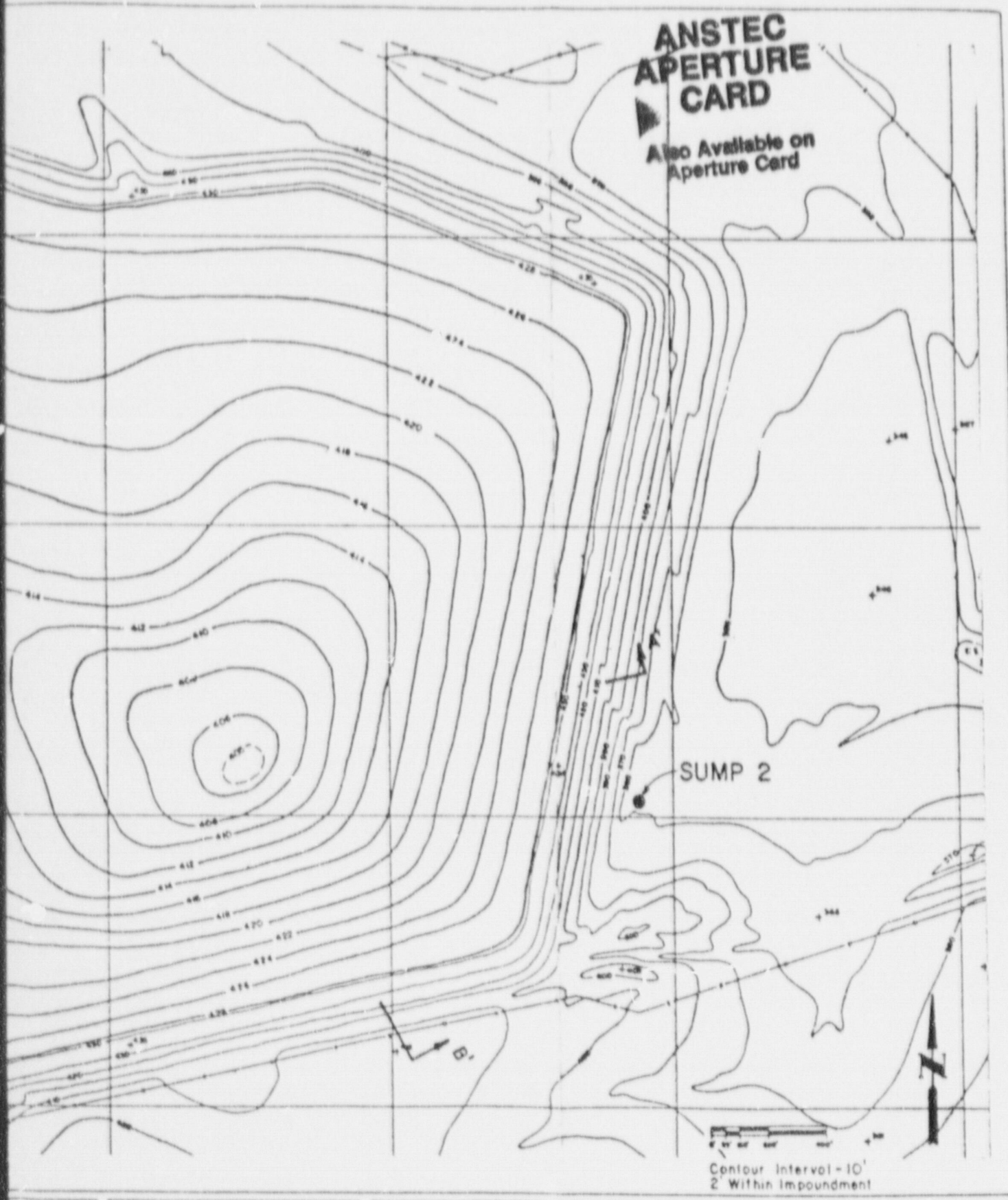
The selected reclamation plan concept for the site is the Conforming Surface. Figure 1 and Sheet 1 at larger scale, shows the general configuration that will result from implementation of this plan. Cross-sections through the impoundment are shown on Sheet 2. The reclamation surface is developed by allowing the stabilizing fill to conform to the surface of the tailings. This design minimizes the amount of fill necessary. The final cover will be placed on top of the fill. The fill-cover thicknesses used to produce the surface shown in Figure 1 and Sheet 1 is based upon experience gained to date in actual fill placement at the site. However, as the fill is advanced into the deeper portions of the impoundment, fill-tailings behavior may change which could result in a slightly different final surface configuration. However, this would not alter the basic concept.

This alternative is the same as Alternatives 1 (Initial Screening), except that the cover-fill thickness at the perimeter of the impoundment is increased from three feet to approximately five feet with a top elevation of approximately 428. The cover-fill thickness is increased to 15 feet at the deepest section of the impoundment. The resulting estimated fill volume is 2,800,000 c.y. with no tailings excavation required. Under normal precipitation conditions, a permanent pond would result with a surface elevation that is estimated to fluctuate about 1/2 foot around elevation 422. Ample capacity exists to store a Probable Maximum Precipitation (PMP) event. Water balance calculations on which these predictions are based, are provided in Appendix C.



Conquista

Falls City, Texas



Project	Water, Waste & Land Inc	FIGURE 1 Alternative 1A Conforming Surface	Date: 7/23/84 Project: 2011

980106O027- 01

The strengths of the Conforming Surface concept are that it provides exceptional long-term stability while minimizing the potential for long-term environmental impact. Tailings are contained with no breaching of the original embankments and all surface runoff is confined in the reclamation area. In addition, it is the most cost-effective concept which requires no extensive design elements, such as stabilized discharge locations and excavation of tailings.

The permanent impoundment of water on the surface does raise the potential for long-term ground water impact and the question of long-term quality of the impounded water. No prediction of long-term water quality of the surface pond has been made at this time. However, our initial interpretation is that it will be no worse than exists in the stock water tanks common to the area. With regard to long-term ground water impacts, our evaluation of present seepage conditions and hydrogeology of the site indicates no evidence of seepage or contaminant migration through the thick sequence of clay underlying the site. There is evidence that the drain system in the embankment does collect some water. This water is presently collected in a series of sumps and returned to the impoundment. The water collected in this drain system contains no significant concentrations of hazardous elements, although elevated concentrations of Total Dissolved Solids (TDS) are present. Appendix D presents historical data on water quality from Sumps 2 and 8, located on Figure 1. The long-term implication of this water collection as well as the potential for deep percolation will be addressed in the design of the Conforming Surface reclamation plan. No final design will be implemented unless the evaluation of long-term seepage shows that no adverse impacts will result. Initial studies of the overall seepage conditions, site conditions, design options, and fill and cover material

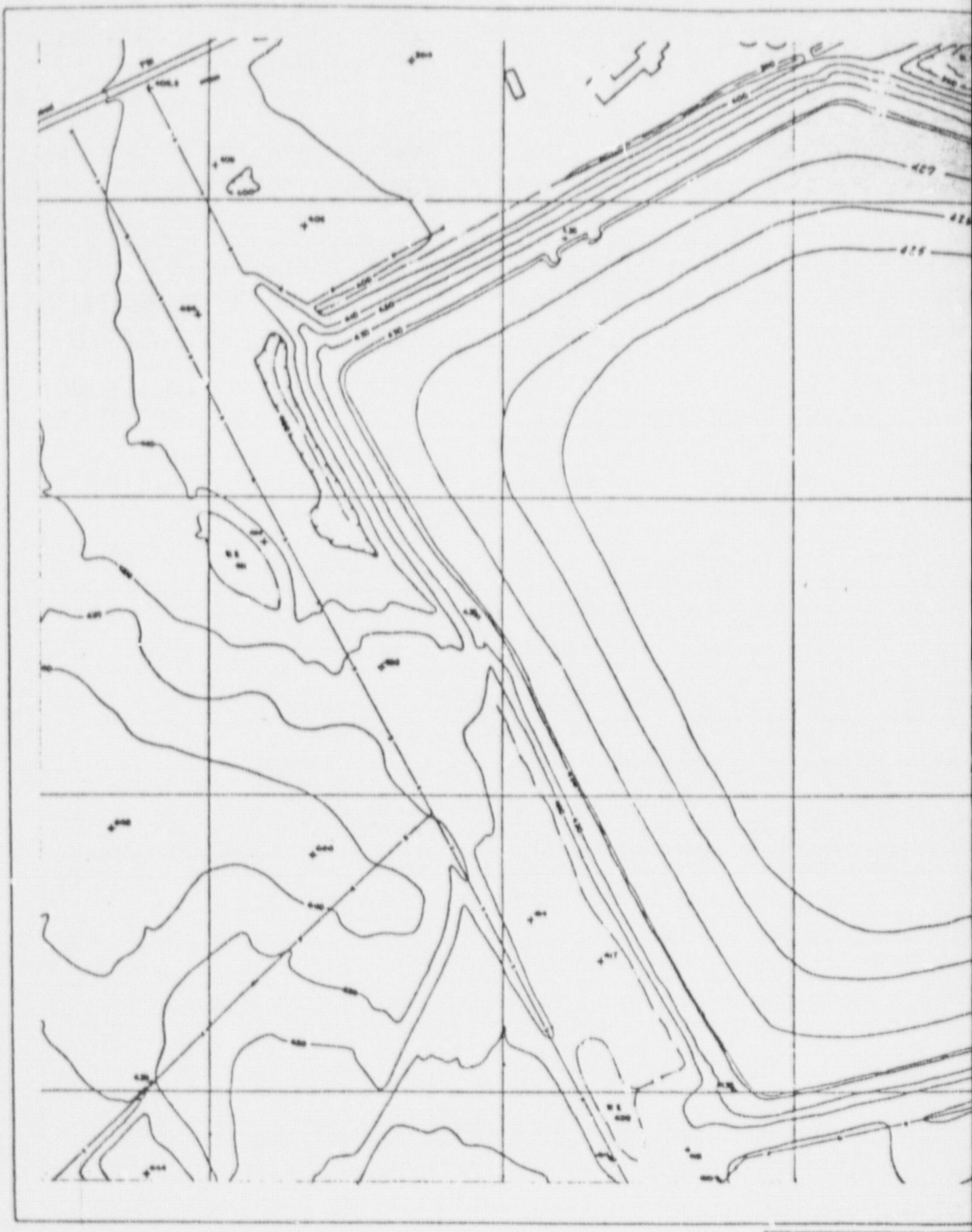
characteristics, indicate that no long-term impact due to seepage from the impoundment will occur. Thus evaluation will be verified during the final design of this concept.

4 SECONDARY ALTERNATIVES

4.1 Alternative 2A - Containment Surface

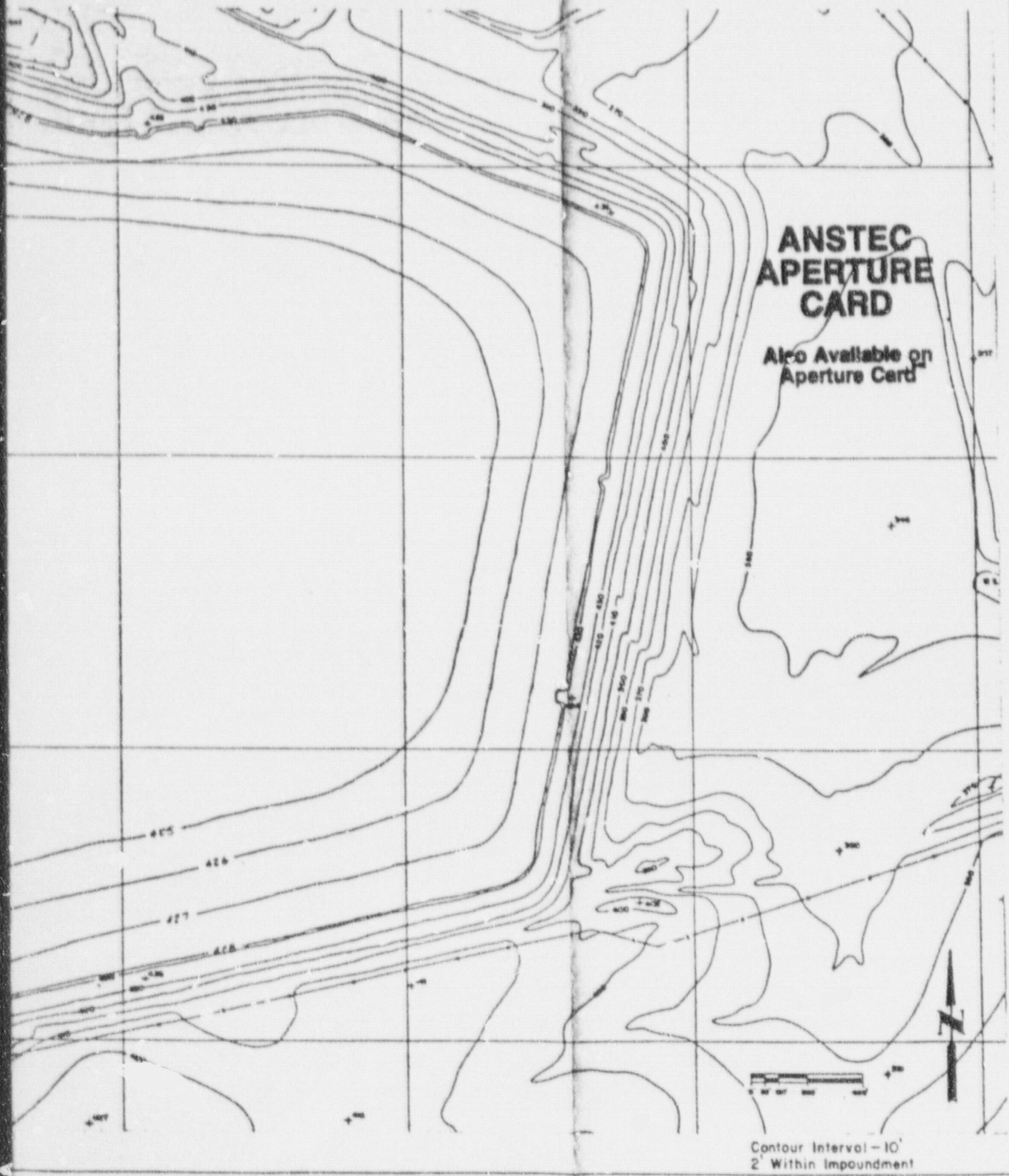
The Containment Surface alternative is a modification of the conforming surface concept and is shown in Figure 2. This alternative is designed to create a large enough surface so that evaporation will remove normal precipitation, thus preventing permanent impoundment of water. The evaporation surface needed is estimated to be 128 acres. This surface is depressed from the perimeter elevation of 428 at a one percent grade to conserve total fill. The resulting estimated fill volume is 4,550,000 c.y. No tailings excavation is required. The illustrated configuration in Figure 2 represents the upper limit of required fill for this concept. The surface could be modified on the basis of modeled and actual monthly rainfall and evaporation data to optimize surface conditions.

Ample capacity exists on the surface to store a PMP event, estimated at 31 inches in 6 hours. If a PMP were to occur, water from that storm and normal precipitation would remain on the surface for approximately one year. Our initial evaluation of seepage conditions at the site and the expected hydraulic properties of the cover and fill suggest that no adverse ground water impact would result from this temporary impoundment.



Conquista

Falls City, Texas



Project	Water, Waste & Land Inc	FIGURE 2 Alternative 2A Containment Surface	Date: 7/23/84 Project: 2011

9801060027-02

4.2 Alternative 3A - Controlled Discharge: Twin Swales

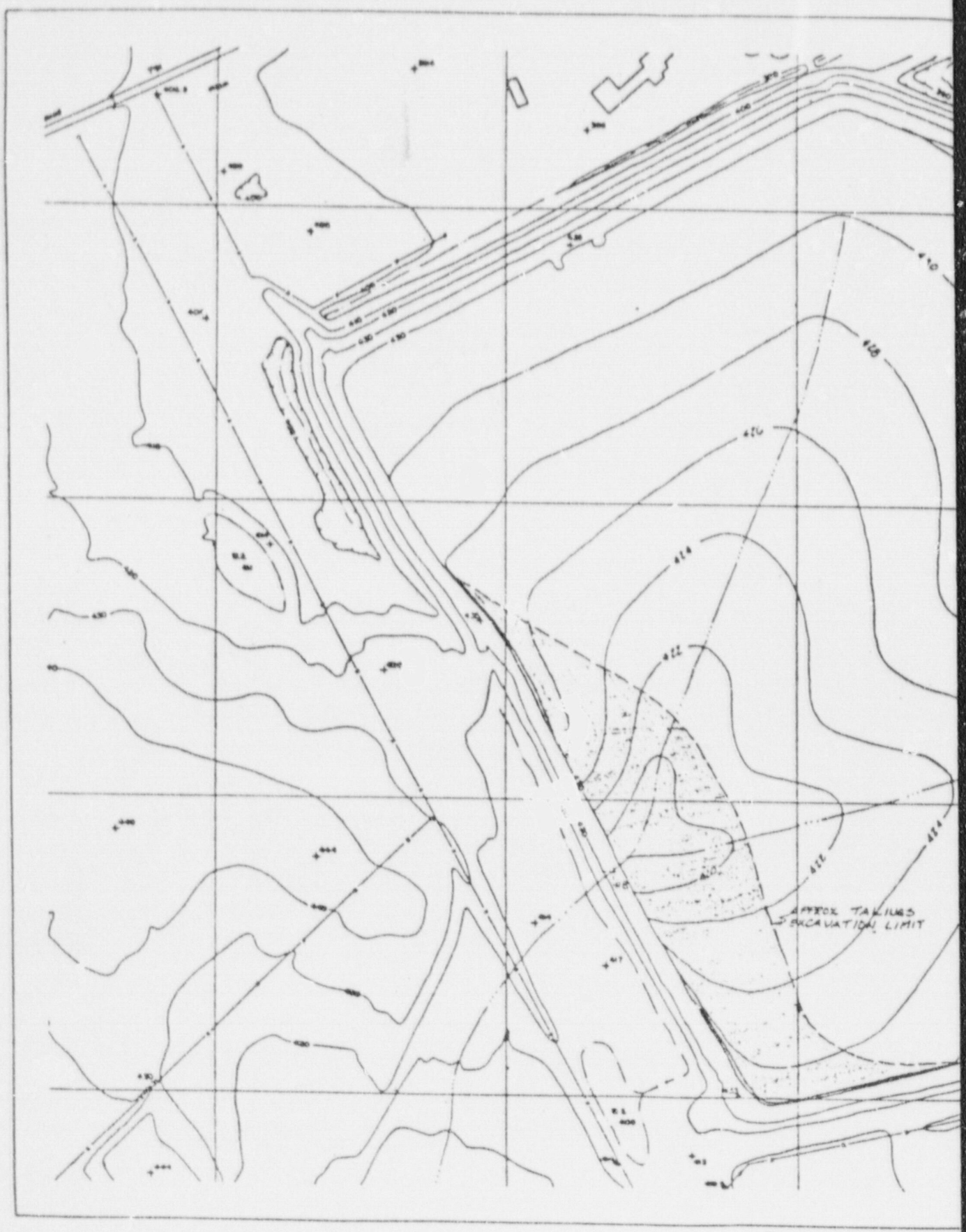
The Controlled Discharge: Twin Swales alternative is a modification of the earlier Alternatives 6 and 7 (Initial Screening) and is shown in Figure 3. This alternative was developed to improve drainage grading control of the reclamation surface. The discharge elevation of 418 resulted from establishing a maximum elevation of the surface at 435, the top of the existing embankments, and a drainage swale slope of one-half of one percent (1/2%). Estimated fill volume is 6,090,000 c.y. and estimated tailings excavation of 60,000 c.y. This compares with the earlier alternatives as shown:

	DISCHARGE ELEVATION	FILL	TAILINGS EXCAVATION
Twin Swales	418	6,090,000	60,000
Alternative 6 (4/24/84)	416	6,120,000	80,000
Alternative 7 (4/24/84)	413	4,635,500	220,000

The discharge elevation could be lowered, saving fill volume, but more tailings would have to be excavated. The method and economics of tailings excavation must still be determined. Lowering the discharge elevation also reduces the drop necessary to route water from the impoundment surface to the existing sediment pond or Conquista Creek. This would reduce the extent of the required discharge-area stabilization but would increase the amount of embankment excavation.

4.3 Alternative 4A - Controlled Discharge: Perimeter Swale

The Controlled Discharge: Perimeter Swale alternative is presented in Figure 4. This alternative was developed, as was the twin swales alternative, to improve drainage grading control of the reclamation surface. It is an attempt to simulate the drainage conditions presently utilized on the existing overburden stockpiles. An alternative similar to the Perimeter Swale surface

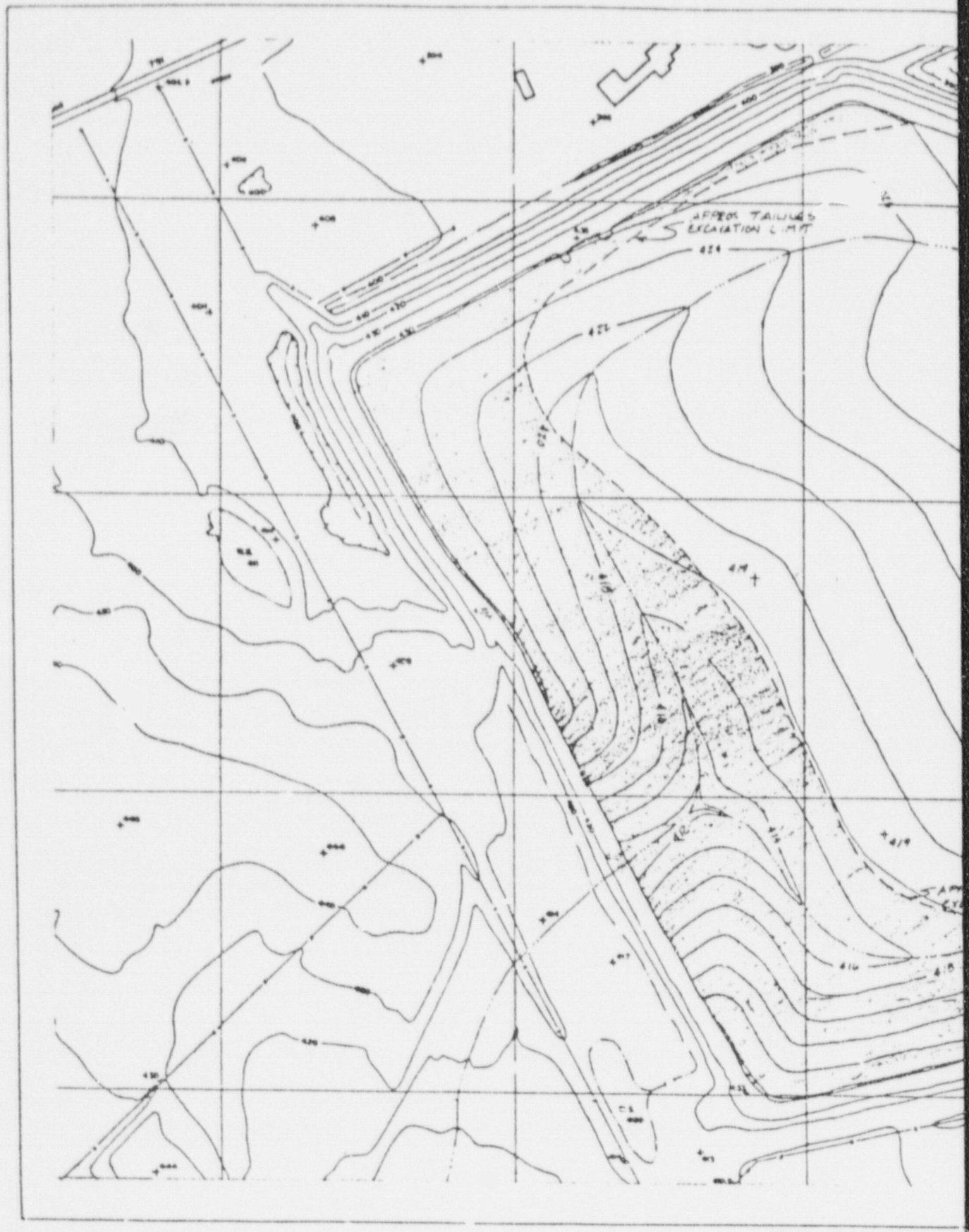


Conquist

Falls City, Tex

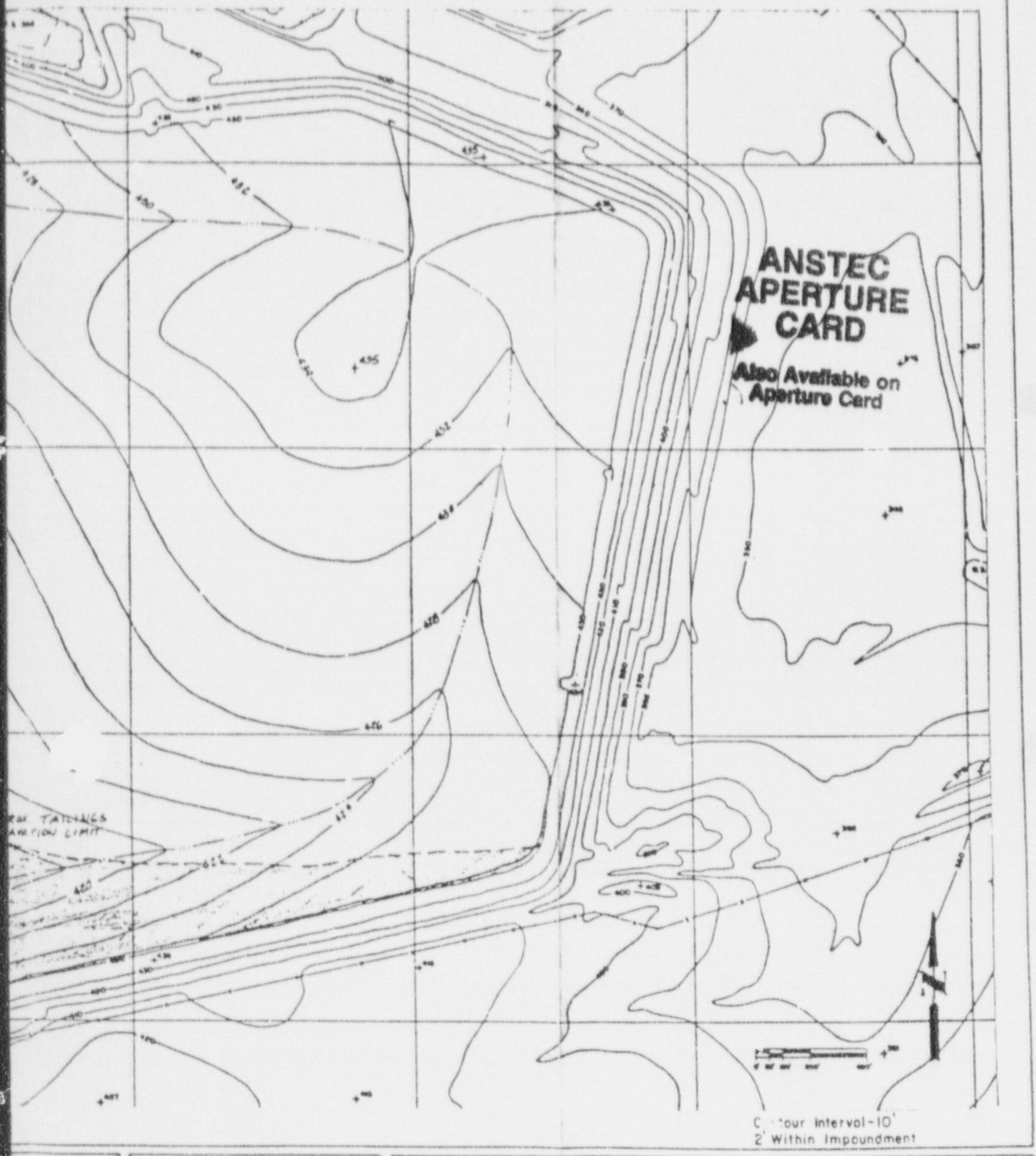
a Project	Water, Waste & Land Inc	FIGURE 3 Alternative 3A Controlled Discharge: Twin Swales	Date: 7/23/84 Project: 2011

9801060027-03



Conquis

Falls City Je



ta Projec:	Water, Waste & Land Inc	FIGURE 4 Alternative 4A Controlled Discharge: Perimeter Swales	Date: 7/23/84 Project: 2011

9801060027-04

was not evaluated during the initial screening process. The calculated fill volume is 4,440,000 c.y. and the calculated tailings excavation volume is 495,000 c.y. The discharge elevation of 410 results from establishing a maximum surface elevation of 435 and a one-half of one percent (1/2%) slope in the drainage swales. The reason the discharge elevation is lower than for the Twin Swales alternative is that the length of the drainage channel is greater.

5 ALTERNATIVE COMPARISON

The relative comparisons for the general concepts presented in Table 2 still apply to the second level alternatives. Table 4 provides a comparison of these alternatives, similar to that provided for in the initial screening. This comparison is based to a large extent on a somewhat qualitative evaluation of long-term stability and containment performance characteristics based on the combined experience of the Conquista and WWL staff. As in the initial screening, the single quantitative element is the estimate of fill and tailings excavation volume. On the basis of this comparison it is clear that the conforming surface concept is the most economic and provides the best long-term performance characteristics. The fact that no surface water will be discharged from the site, even under extreme precipitation conditions, assures the long-term stability of the site. In addition, implementation of the plan is not complicated by the design and construction of discharge works or by the need to excavate tailings, for which the capability at an economic cost is as yet untested.

TABLE 4

COMPARISON OF SECOND LEVEL ALTERNATIVES

ALTERNATIVE	ESTIMATED FILL VOLUME c.y.	TAILINGS EXCAVATION c.y.	CONST. COST RANK	DISCHARGE ELEVATION	PERMANENT IMPOUNDMENT	LONG-TERM STABILITY	POTENTIAL GROUND WATER SUPPORT
1A. Conforming Surface	2,800,000	none	lowest	none	YES	excellent	none
2A. Containment Surface	4,550,000	none	moderate	none	NO	excellent	none
3A. Controlled Discharge - Twin Swales	6,090,000	60,000	highest	418 (west)	NO	acceptable	none
4A. Controlled Discharge - Perimeter Swale	4,440,000	495,000	high	410 (west)	NO	acceptable	none

6 CLOSURE

Not all aspects of the selected reclamation alternative plan concept have been analyzed in detail. However, the basic elements of the plan and the response of the site to them over the long-term are well enough understood to allow the Conforming Surface to be the first choice for presentation to the State at this time. As must be recognized, the specifics of the plan cannot be developed until input from the State is determined. All alternatives developed and evaluated in the second level of the selection process would provide very acceptable long-term performance characteristics. The Conforming Surface concept, on the basis of the evaluation done to date, minimizes the environmental impact of the reclaimed site while optimizing both long-term performance and cost efficiency.

APPENDIX A

RADON ATTENUATION CALCULATIONS

R
A
E

Rogers & Associates Engineering Corporation

Post Office Box 330
Salt Lake City, Utah 84110
(801) 263-1600

April 10, 1984

Dr. Thomas Shepherd
Water, Waste & Land, Inc.
1311 So. College Ave.
Ft. Collins, CO 80524

Dear Tom:

Enclosed are the calculations of radon flux that you requested this morning for a thick tailings material (Ra=90 pCi/gram, dry density = 1.47 g/cm^3, moist = 20% and a cover with a dry density of 1.12 g/cm^3 and a moisture content of 32% (dry wt.). The calculations indicate that only 37 cm. of the cover soil would be required to reduce the calculated flux from 29 pCi/m^2/sec to 20 pCi/m^2/sec. Radon diffusion coefficients were estimated from the predictive correlation.

The total charge for these calculations is $115.

Please call if there are any questions on these results or the parameters used.

Sincerely,

Kirk K. Nielson

KKN/b

cc: V.C. Rogers

TOM SHEPHERD'S TAILINGS COVER DESIGN CALCULATION (KKN 30-APR-84)

********** I N P U T P A R A M E T E R S **********

NUMBER OF LAYERS :	2	
RADON FLUX INTO LAYER 1 :	0.000	pCi/m2/sec
SURFACE RADON CONCENTRATION :	0.000	pCi/liter
LAYER 2 ADJUSTED TO MEET Jcrit :	20.0	+/- 0.100E-02 pCi/m2/sec
BARE SOURCE FLUX (Jo) FROM LAYER 1 :	29.32	pCi/m2/sec

LAYER	THICKNESS (cm)	DIFF COEFF (cm2/sec)	POROSITY	SOURCE (pCi/cm3/sec)	MOISTURE (dry wt. percent)
1	300.	5.8337E-03	0.4560	1.2200E-04	20.00
2	100.	9.8732E-03	0.5850	0.0000E-01	32.00

***** R E S U L T S O F R A D O N D I F F U S I O N C A L C U L A T I O N *****

LAYER	THICKNESS (cm)	EXIT FLUX (pCi/m2/sec)	EXIT CONC. (pCi/liter)	MIC
1	300.	2.2906E+01	1.2703E+04	0.5233
2	37.	1.9996E+01	0.0000E-01	0.5464

RADON FLUX MEASUREMENTS ON PAD #2

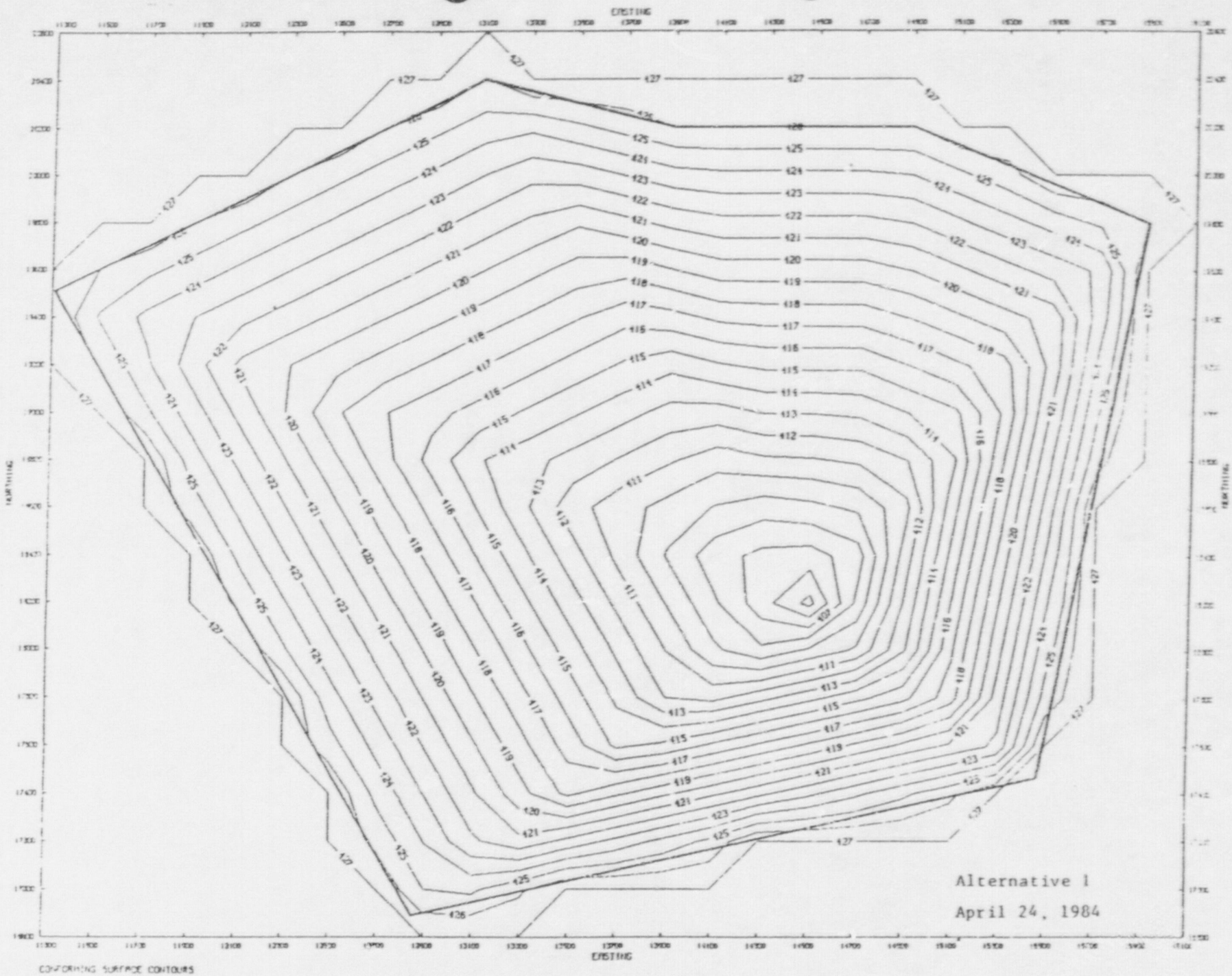
(July 5, 1984)

Drill Location	Radon Flux
CQ-1	0.78 ± 0.13 pCi/m^2-sec
CQ-4	0.14 ± 0.04 pCi/m^2-sec
CQ-8	0.14 ± 0.04 pCi/m^2-sec
CQ-11	0.22 ± 0.04 pCi/m^2-sec

APPENDIX B

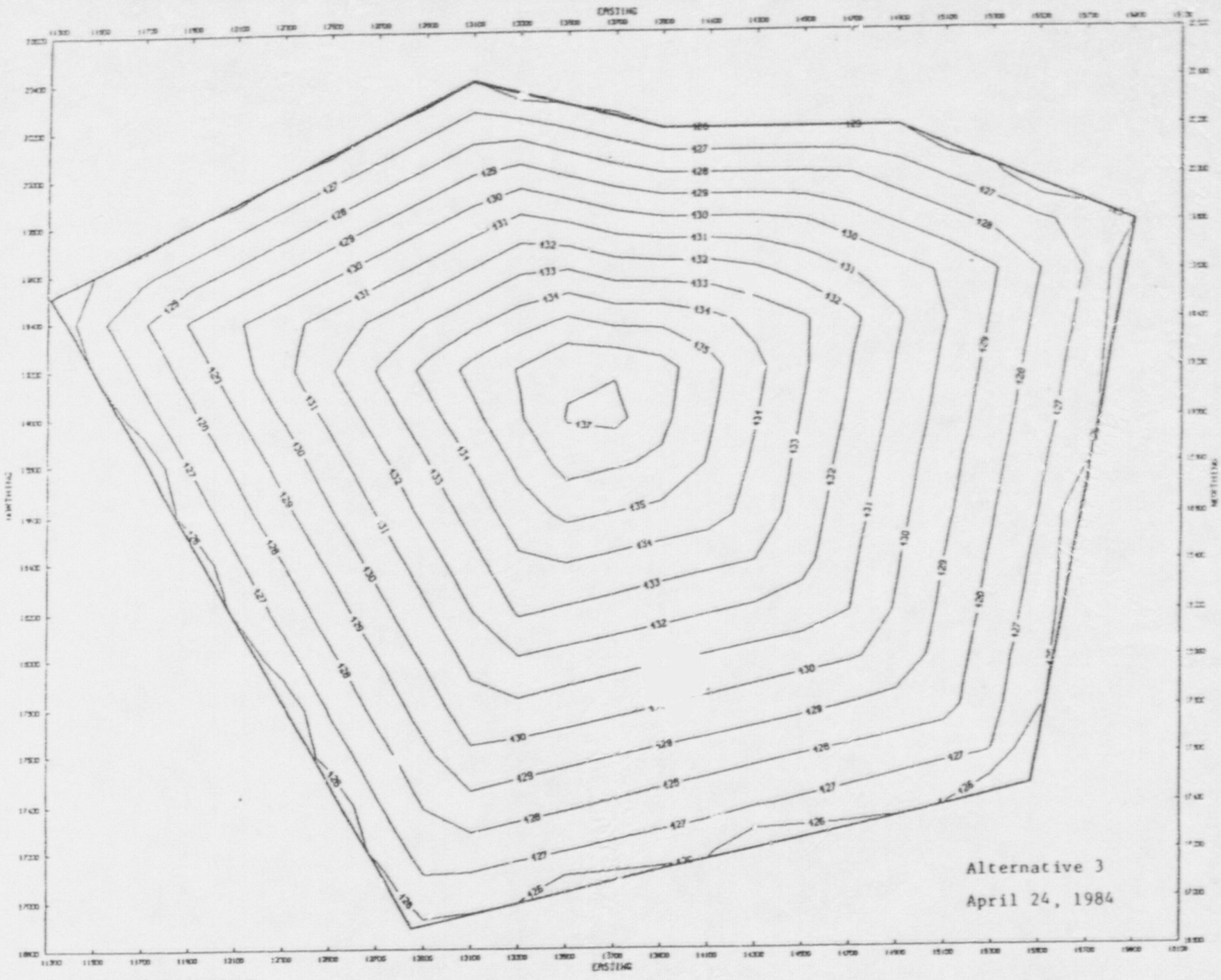
REPRESENTATIVE SURFACE CONFIGURATIONS

FOR INITIAL ALTERNATIVES



Conquista Reclamation Plan

WWL Project No. 2011

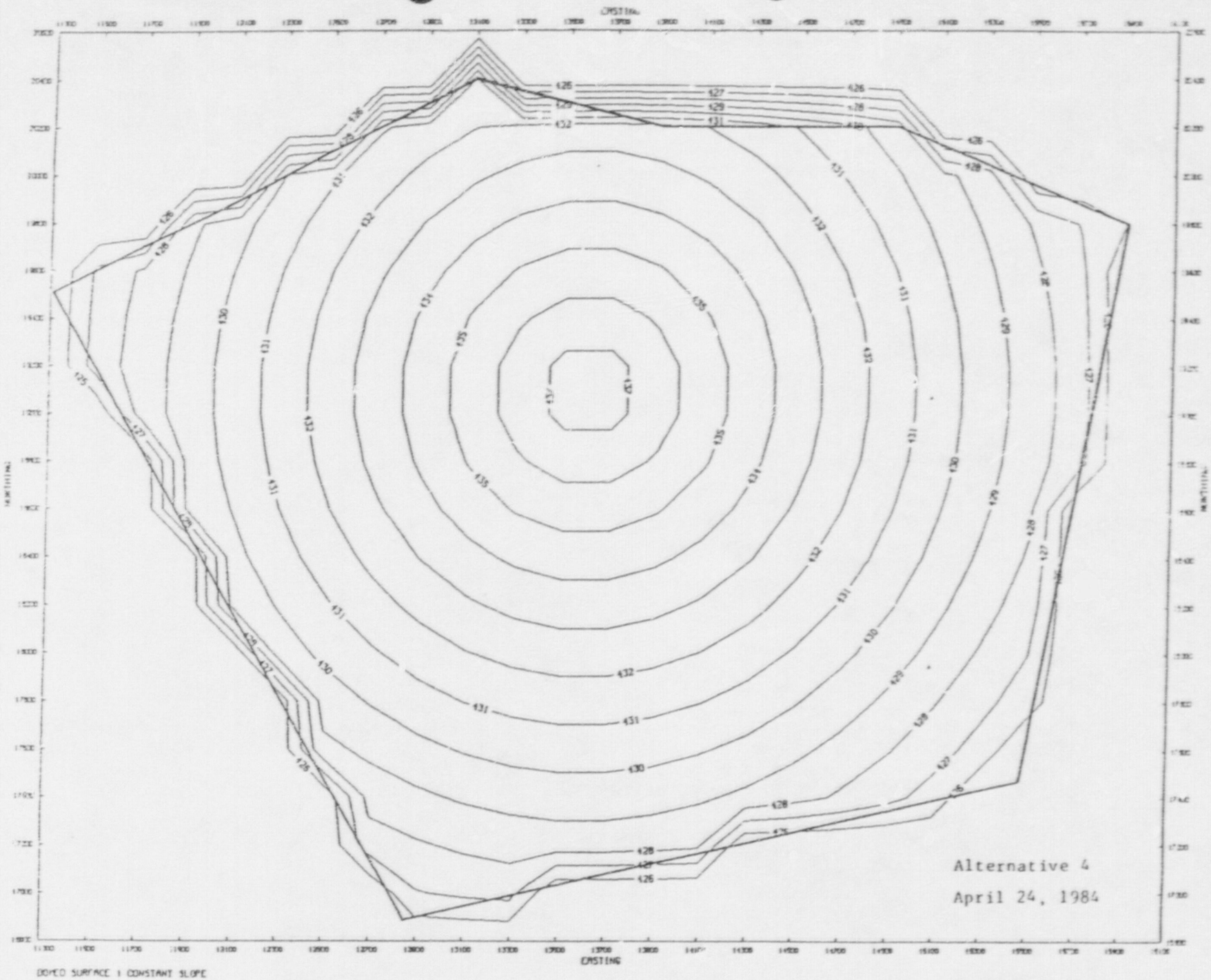


DOMED SURFACE 2 CONSTANT TOE ELEVATION

Conquista Reclamation Plan

WWL Project No. 2011

2

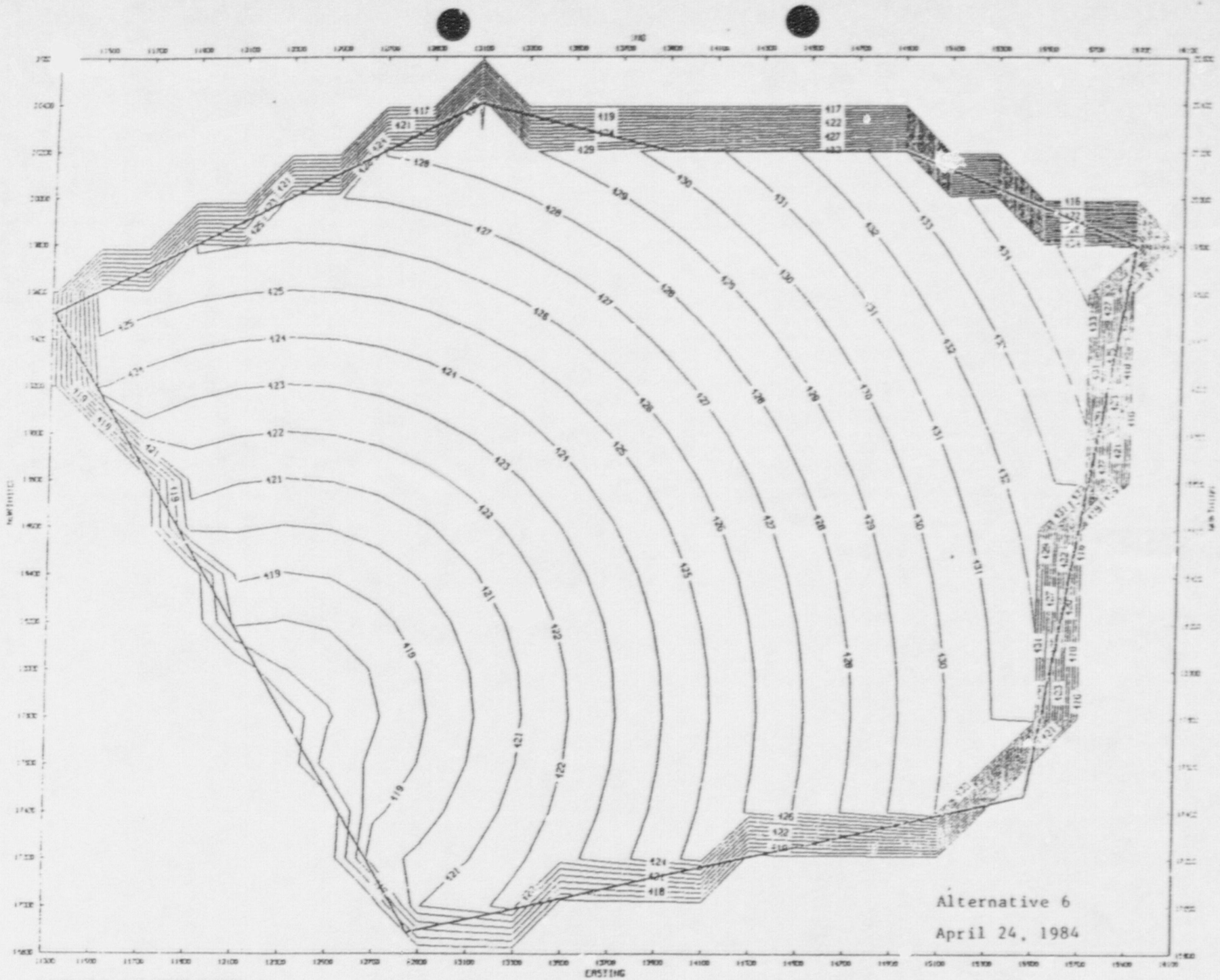


Alternative 4

April 24, 1984

Conquista Reclamation Plan

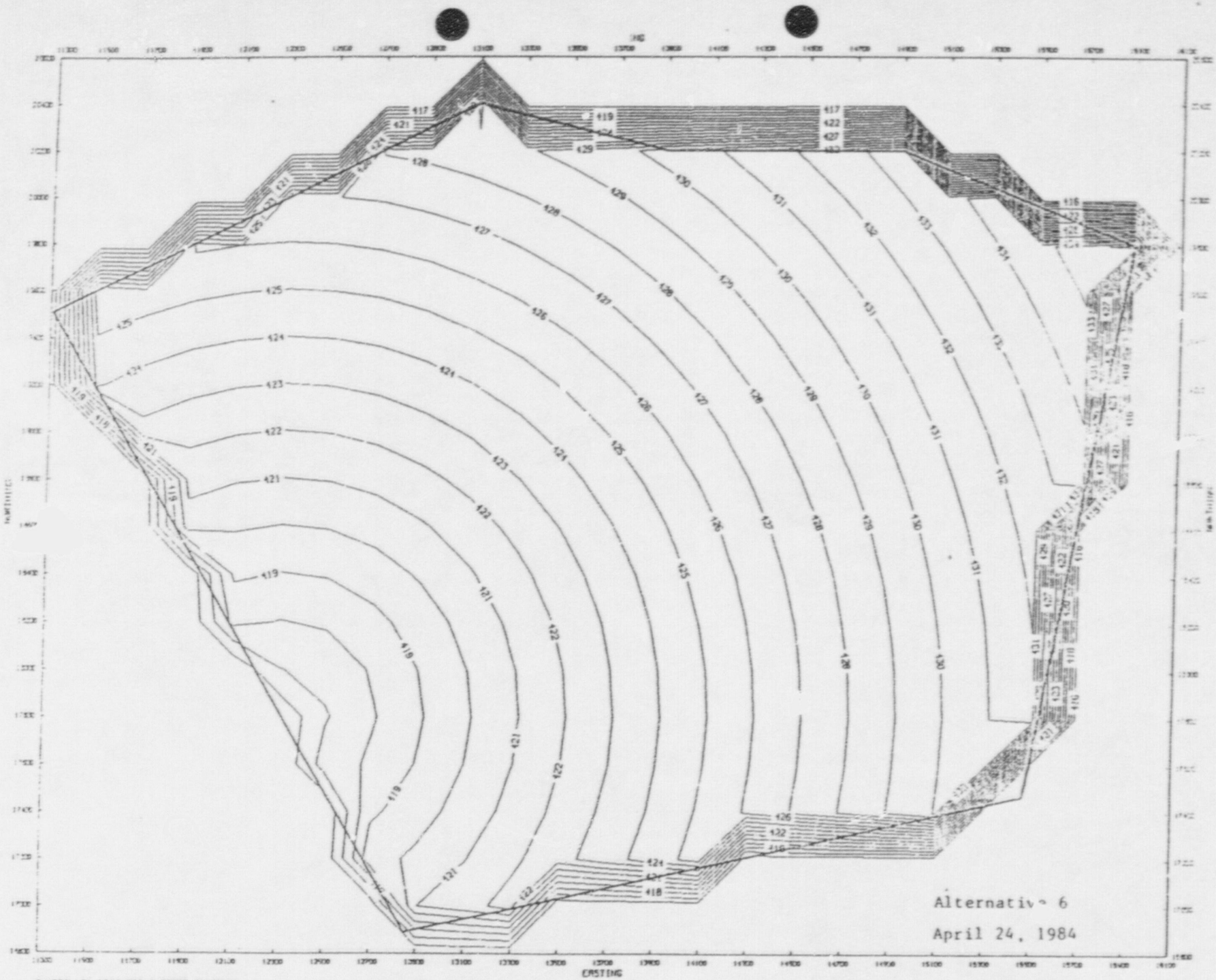
WWL Project No. 2011



CONTROLLED DRAINAGE SURFACE CONTOURS

Conquista Reclamation Plan

WWL Project No. 2011



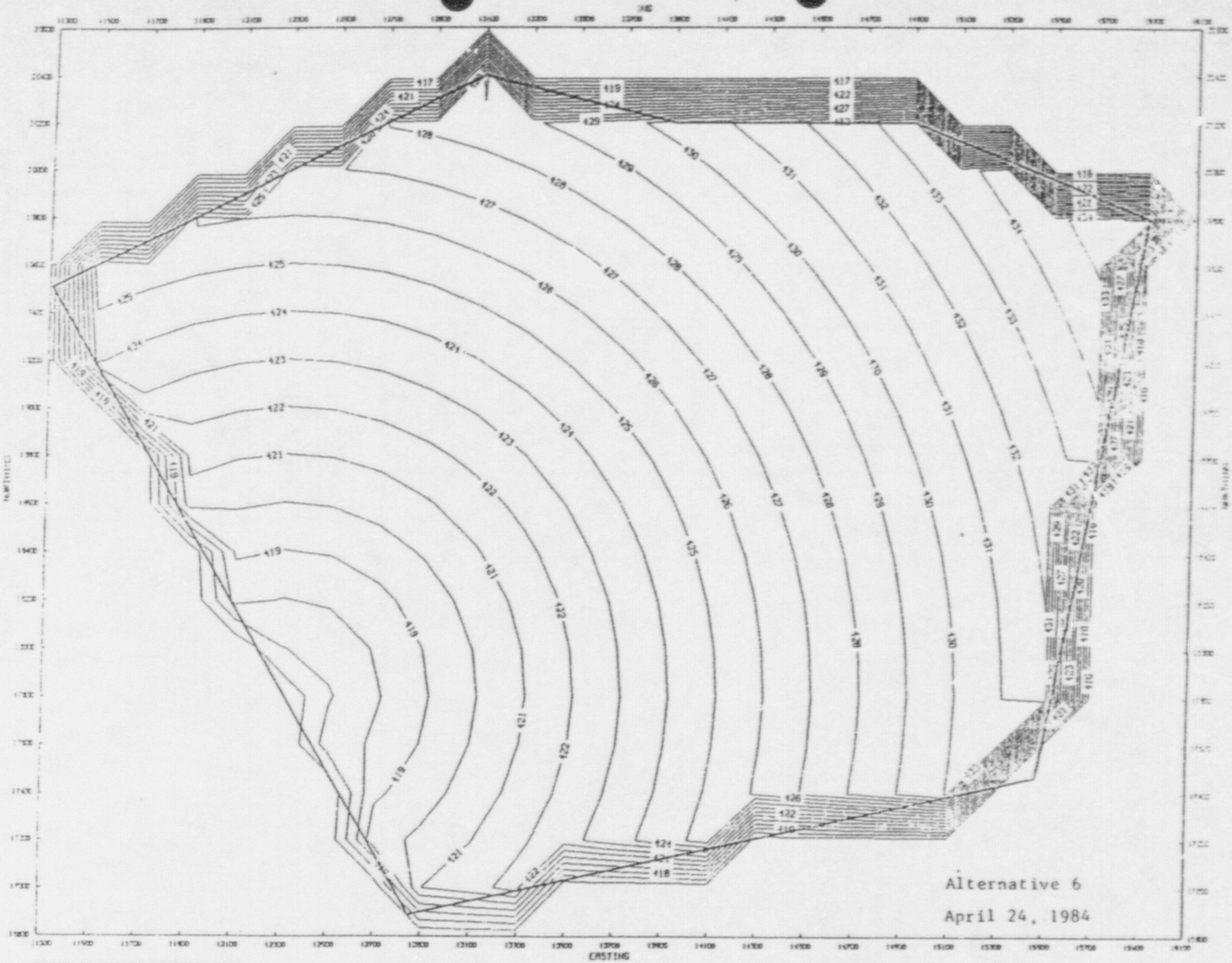
CONTROLLED DRAINAGE SURFACE CONTOURS

Conquista Reclamation Plan

Alternative 6

April 24, 1984

WWL Project No. 2011



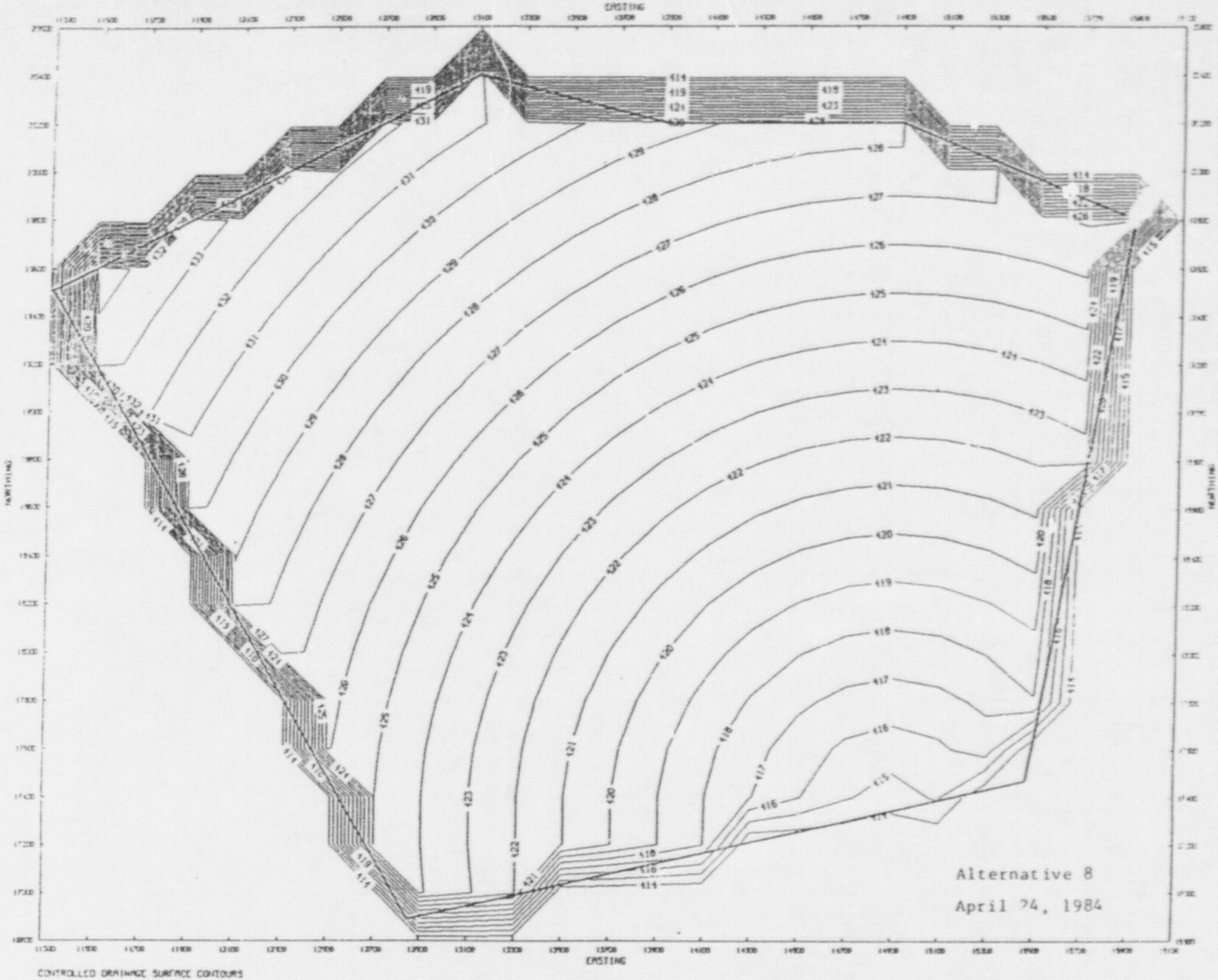
CONTROLLED DRAINAGE SURFACE CONTOURS

Alternative 6

April 24, 1984

Conquista Reclamation Plan

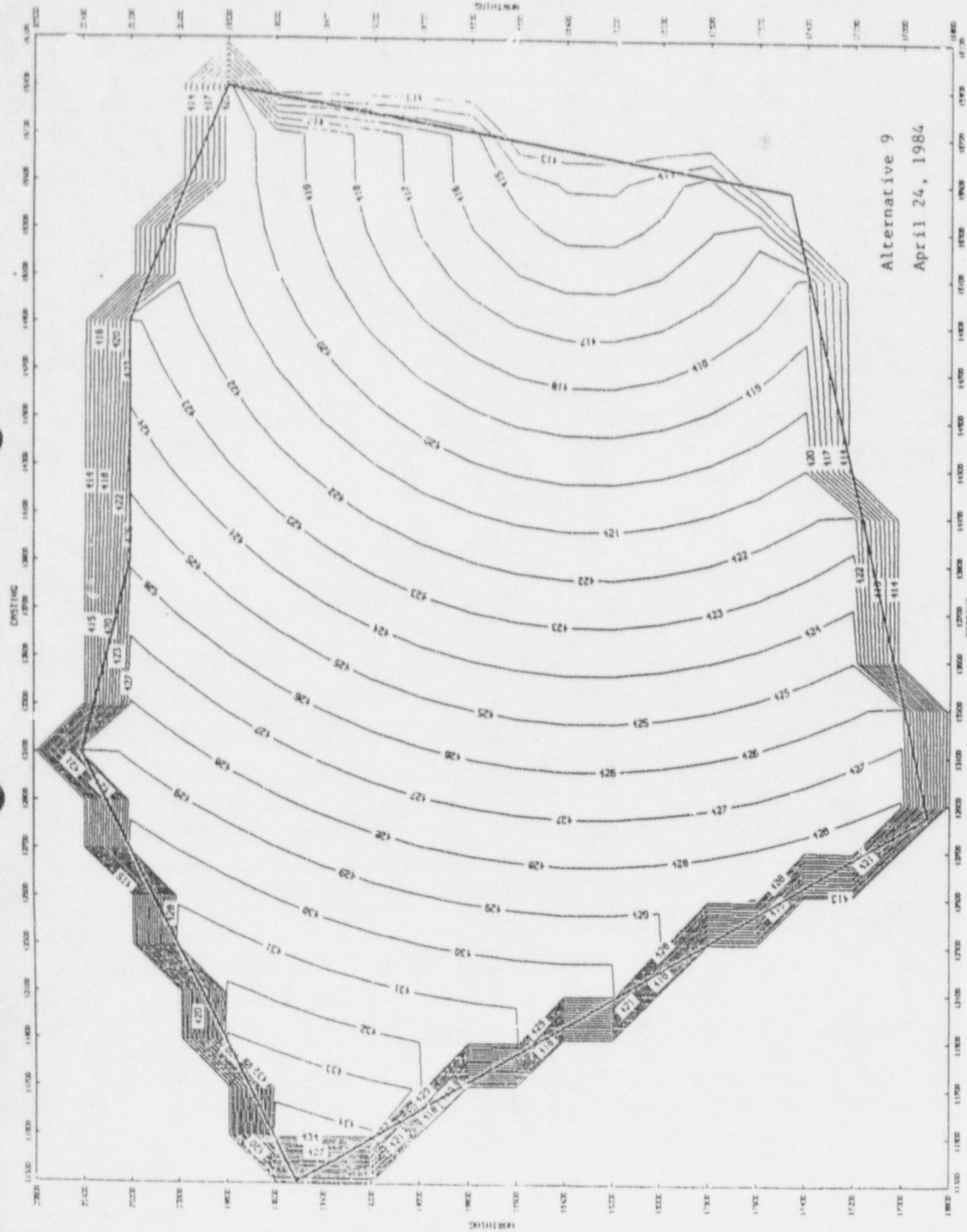
WWL Project No. 2011

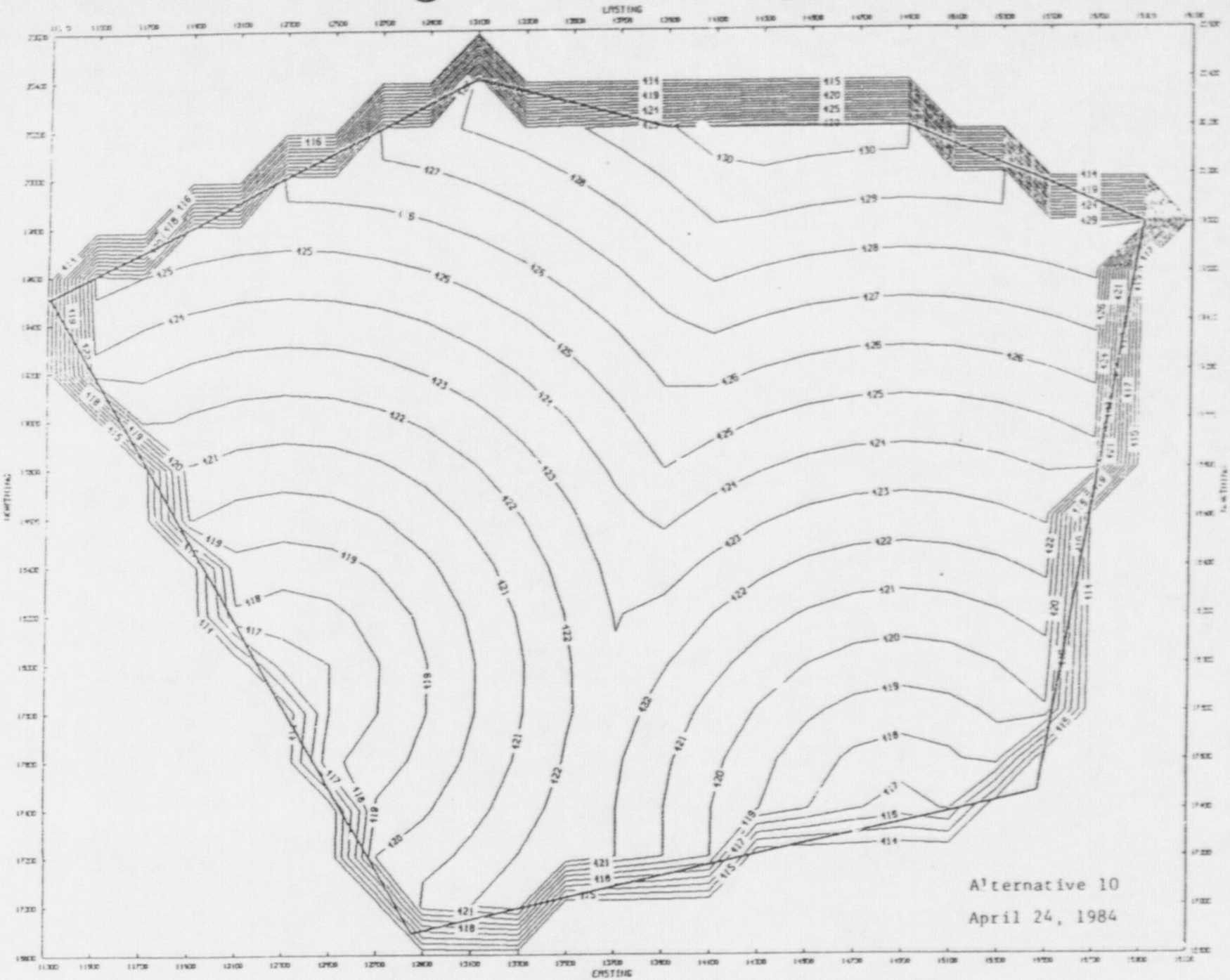


CONTROLLED DRAINAGE SURFACE CONTOURS

Conquista Reclamation Plan

WWL Project No. 2011


Alternative 9
April 24, 1984
WWL Project No. 2011
Conquista Reclamation Plan
CONTROLLED DRAINAGE SURFACE CONTOURS
EXISTING
EXISTING



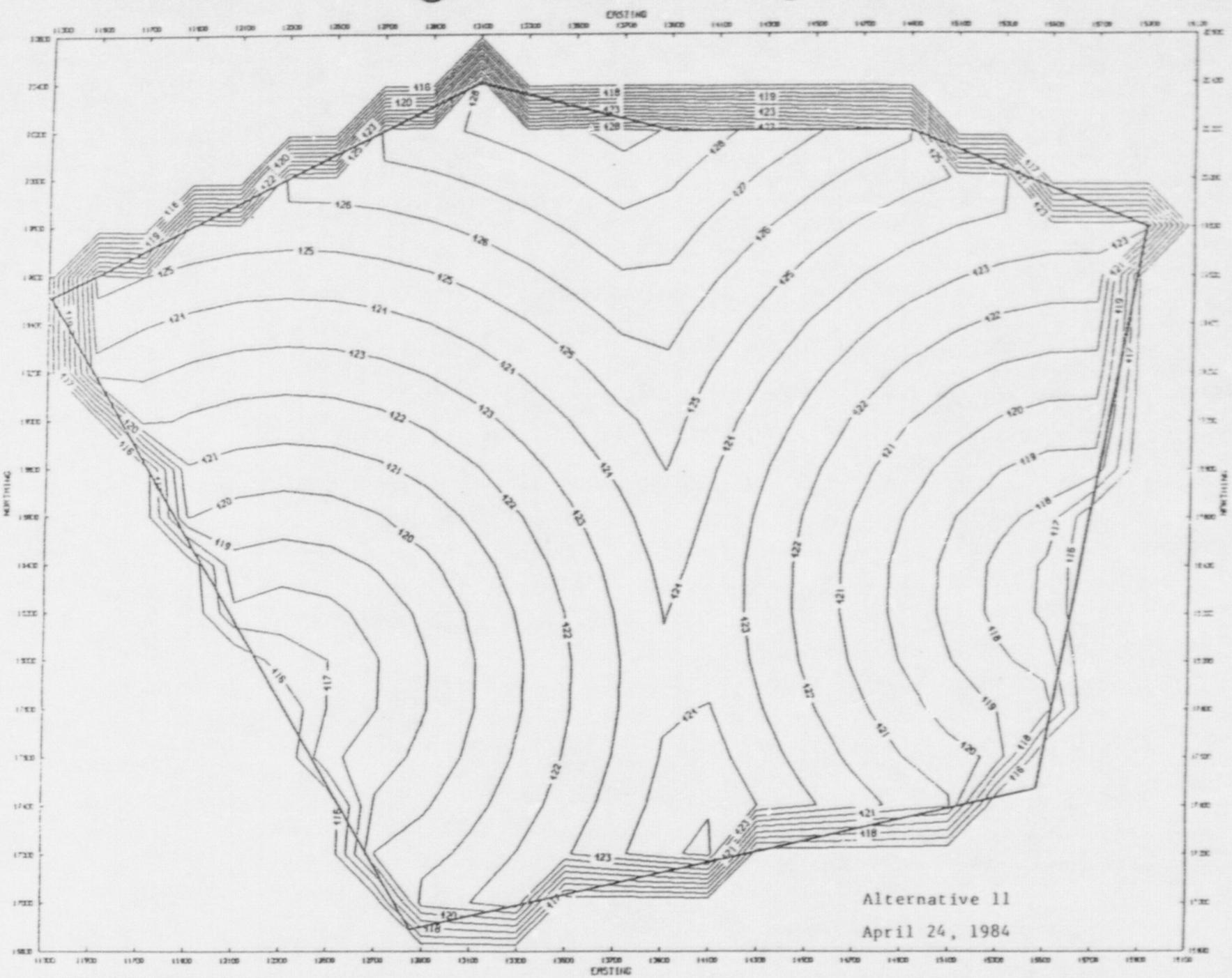
TWO CONTROLLED DRAINAGE SURFACE CONTOURS

Alternative 10

April 24, 1984

Conquista Reclamation Plan

WWL Project No. 2011



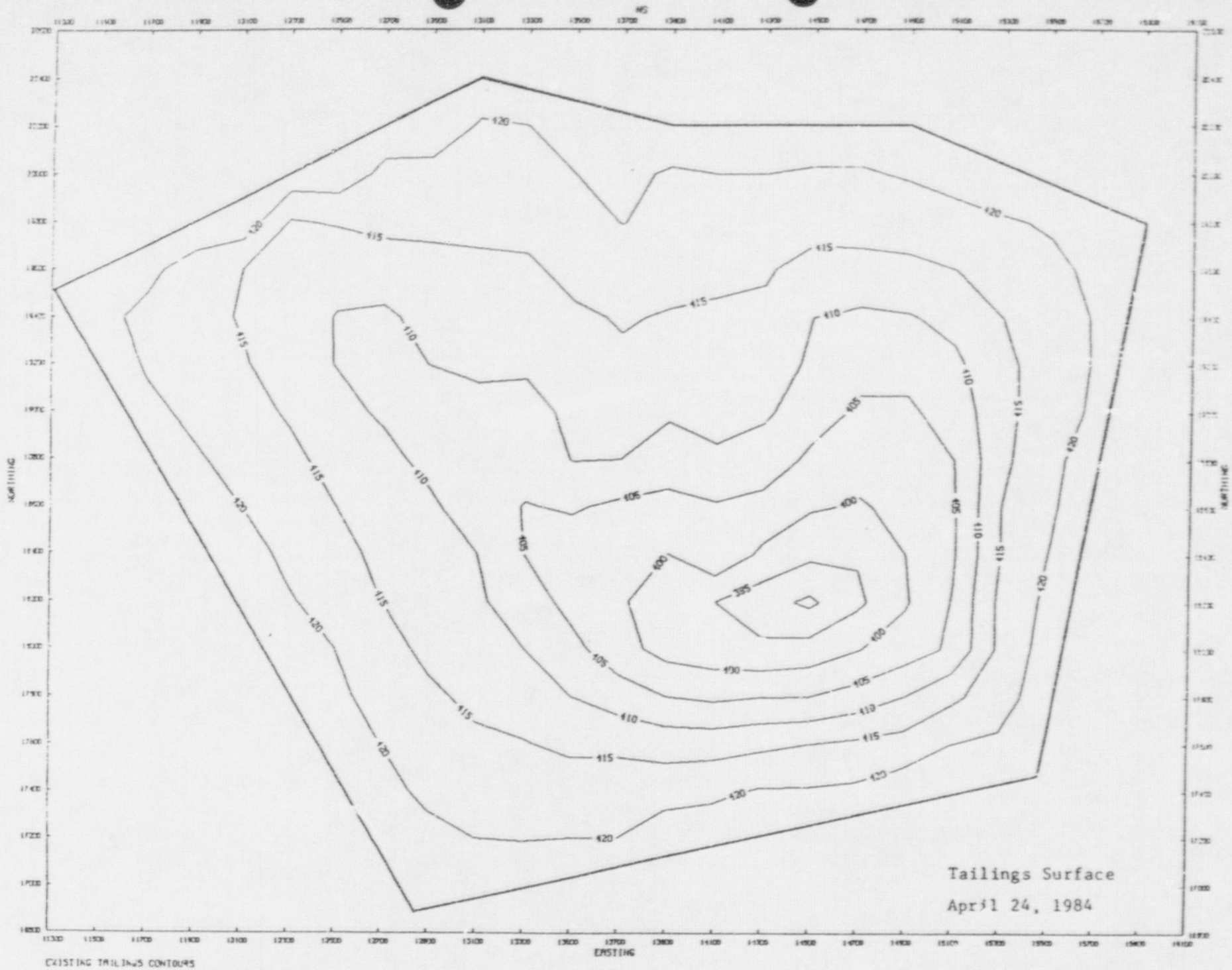
Alternative 11

April 24, 1984

TWO CONTROLLED DRAINAGE SURFACE CONTOURS

Conquista Reclamation Plan

WWL Project No. 2011



Conquista Reclamation Plan

WWL Project No. 2011

APPENDIX C

WATER BALANCE CALCULATIONS

Assumptions Used in Water Balance Calculations

1. Lake evaporation is used which is calculated to be 70% of pan evaporation.
2. No infiltration of precipitation into cover material occurs.
3. No transpiration included in total evaporation amounts.
4. At the end of year 20 a PMP event occurs at the site.

Conquista Conforming Surface Water Balance
Stage-Area-Volume Data
Adjusted Pan Evaporation Data (EP * 0.70)

Elevation, Surface Area, Volume Relationship

Point No.	Elevation (ft)	Area (acres)	Capacity (ac-ft)
1	405.00	0.0	0.0
2	406.00	0.32	0.91
3	408.00	6.09	8.49
4	410.00	13.07	27.65
5	412.00	22.15	62.87
6	414.00	33.69	118.71
7	416.00	48.89	201.29
8	418.00	69.48	319.66
9	420.00	93.52	482.66
10	422.00	124.05	700.23
11	424.00	156.53	980.81
12	426.00	192.02	1329.36
13	428.00	234.43	1755.81
14	435.00	250.00	3451.32

Monthly Precipitation and Evaporation Data

Month No.	Precipitation (inches)	Evaporation (inches)
1	1.57	2.17
2	2.04	2.94
3	1.31	4.12
4	2.84	4.83
5	3.45	5.64
6	2.90	6.51
7	1.75	7.16
8	2.34	6.73
9	3.42	5.04
10	2.76	4.12
11	2.03	2.94
12	1.74	2.39

Results of Water Balance Calculations

Period Ending mm/yy)	Water Volume Added (ac-ft)	Water Volume Removed (ac-ft)	Volume Water in Pond (ac-ft)	Pond Surface Area (acres)	Water Surface Elevation (feet)	Pond Water Depth (feet)
12/ 0	--	--	0.0	0.0	405.00	0.0
Year Number:	1				Year Number:	1
1/ 1	32.71	1.27	31.44	14.05	410.22	5.22
2/ 1	42.50	4.60	69.34	23.49	412.23	7.23
3/ 1	27.29	8.72	87.91	27.33	412.90	7.90
4/ 1	59.17	12.85	134.23	36.55	414.38	9.38
5/ 1	71.88	19.44	186.66	46.20	415.65	10.65
6/ 1	60.42	26.69	220.39	52.21	416.32	11.32
7/ 1	36.46	31.43	225.42	53.09	416.41	11.41
8/ 1	48.75	30.65	243.51	56.23	416.71	11.71
9/ 1	71.25	25.29	289.47	64.23	417.49	12.49
10/ 1	57.50	23.06	323.91	70.11	418.05	13.05
11/ 1	42.29	17.62	348.58	73.75	418.35	13.35
12/ 1	36.25	15.00	369.83	76.88	418.62	13.62
Year Number:	2				Year Number:	2
1/ 2	32.71	14.15	388.38	79.62	418.84	13.84
2/ 2	42.50	19.91	410.97	82.95	419.12	14.12
3/ 2	27.29	28.45	409.81	82.78	419.11	14.11
4/ 2	59.17	34.06	434.92	86.48	419.41	14.41
5/ 2	71.88	41.69	465.10	90.93	419.78	14.78
6/ 2	60.42	49.76	475.76	92.50	419.92	14.92
7/ 2	36.46	54.41	457.81	89.86	419.70	14.70
8/ 2	48.75	50.33	456.24	89.62	419.68	14.68
9/ 2	71.25	38.64	488.85	94.39	420.06	15.06
10/ 2	57.50	33.00	513.35	97.83	420.28	15.28
11/ 2	42.29	24.28	531.36	100.35	420.45	15.45
12/ 2	36.25	20.21	547.40	102.60	420.60	15.60
Year Number:	3				Year Number:	3
1/ 3	32.71	18.73	561.37	104.56	420.72	15.72
2/ 3	42.50	25.91	577.96	106.89	420.88	15.88
3/ 3	27.29	36.47	568.78	105.60	420.79	15.79
4/ 3	59.17	42.98	584.97	107.88	420.94	15.94
5/ 3	71.88	51.38	605.47	110.75	421.13	16.13
6/ 3	60.42	60.10	605.79	110.80	421.13	16.13
7/ 3	36.46	64.92	577.33	106.80	420.87	15.87
8/ 3	48.75	59.46	566.62	105.30	420.77	15.77
9/ 3	71.25	45.00	592.87	108.98	421.01	16.01
10/ 3	57.50	37.90	612.47	111.73	421.19	16.19
11/ 3	42.29	27.63	627.13	113.79	421.33	16.33
12/ 3	36.25	22.85	640.52	115.67	421.45	16.45

Results of Water Balance Calculations
(continued)

Period Ending mm/yy)	Water Volume Added (ac-ft)	Water Volume Removed (ac-ft)	Volume Water in Pond (ac-ft)	Pond Surface Area (acres)	Water Surface Elevation (feet)	Pond Water Depth (feet)
Year Number:	4				Year Number:	4
1/ 4	32.71	21.07	652.16	117.31	421.56	16.56
2/ 4	42.50	28.98	665.69	119.20	421.68	16.68
3/ 4	27.29	40.60	652.38	117.34	421.56	16.56
4/ 4	59.17	47.56	663.98	118.96	421.67	16.67
5/ 4	71.88	56.44	679.42	121.13	421.81	16.81
6/ 4	60.42	65.51	674.32	120.41	421.76	16.76
7/ 4	36.46	70.43	640.35	115.65	421.45	16.45
8/ 4	48.75	64.25	624.85	113.47	421.31	16.31
9/ 4	71.25	48.33	647.77	116.69	421.52	16.52
10/ 4	57.50	40.48	664.79	119.08	421.67	16.67
11/ 4	42.29	29.40	677.68	120.89	421.79	16.79
12/ 4	36.25	24.25	689.68	122.57	421.90	16.90
Year Number:	5				Year Number:	5
1/ 5	32.71	22.30	700.09	124.03	422.00	17.00
2/ 5	42.50	30.56	712.03	125.42	422.08	17.08
3/ 5	27.29	42.73	696.60	123.54	421.97	16.97
4/ 5	59.17	49.96	705.80	124.69	422.04	17.04
5/ 5	71.88	58.97	718.71	126.19	422.13	17.13
6/ 5	60.42	68.21	710.92	125.29	422.08	17.08
7/ 5	36.46	73.29	674.08	120.38	421.76	16.76
8/ 5	48.75	66.80	656.03	117.85	421.59	16.59
9/ 5	71.25	50.12	677.16	120.81	421.79	16.79
10/ 5	57.50	41.87	692.80	123.01	421.93	16.93
11/ 5	42.29	30.33	704.76	124.57	422.03	17.03
12/ 5	36.25	24.94	716.06	125.88	422.11	17.11
Year Number:	6				Year Number:	6
1/ 6	32.71	22.87	725.90	127.02	422.18	17.18
2/ 6	42.50	31.28	737.12	128.32	422.26	17.26
3/ 6	27.29	43.72	720.69	126.42	422.15	17.15
4/ 6	59.17	51.08	728.78	127.36	422.20	17.20
5/ 6	71.88	60.18	740.47	128.71	422.29	17.29
6/ 6	60.42	69.53	731.36	127.65	422.22	17.22
7/ 6	36.46	74.79	693.03	123.04	421.93	16.93
8/ 6	48.75	68.24	673.54	120.30	421.75	16.75
9/ 6	71.25	51.12	693.67	123.13	421.94	16.94
10/ 6	57.50	42.60	708.56	125.01	422.06	17.06
11/ 6	42.29	30.79	720.06	126.35	422.14	17.14
12/ 6	36.25	25.29	731.02	127.61	422.22	17.22

Results of Water Balance Calculations
(continued)

Period Ending mm/yy)	Water Volume Added (ac-ft)	Water Volume Removed (ac-ft)	Volume Water in Pond (ac-ft)	Pond Surface Area (acres)	Water Surface Elevation (feet)	Pond Water Depth (feet)
Year Number: 7					Year Number: 7	
1/ 7	32.71	23.18	740.55	128.72	422.29	17.29
2/ 7	42.50	31.69	751.36	129.97	422.36	17.36
3/ 7	27.29	44.28	734.37	128.00	422.24	17.24
4/ 7	59.17	51.70	741.84	128.87	422.30	17.30
5/ 7	71.88	60.87	752.84	130.14	422.38	17.38
6/ 7	60.42	70.28	742.97	129.00	422.30	.30
7/ 7	36.46	75.62	703.81	124.46	422.03	.03
8/ 7	48.75	69.03	683.53	121.71	421.85	16.85
9/ 7	71.25	51.69	703.09	124.38	422.02	17.02
10/ 7	57.50	43.00	717.59	126.06	422.12	17.12
11/ 7	42.29	31.05	728.84	127.36	422.20	17.20
12/ 7	36.25	25.49	739.60	128.61	422.28	17.28
Year Number: 8					Year Number: 8	
1/ 8	32.71	23.36	748.95	129.69	422.35	17.35
2/ 8	42.50	31.93	759.52	130.91	422.42	17.42
3/ 8	27.29	44.60	742.22	128.91	422.30	17.30
4/ 8	59.17	52.06	749.33	129.73	422.35	17.35
5/ 8	71.88	61.27	759.93	130.96	422.43	17.43
6/ 8	60.42	70.71	749.64	129.77	422.35	17.35
7/ 8	36.46	76.06	710.03	125.18	422.07	17.07
8/ 8	48.75	69.46	689.32	122.52	421.90	16.90
9/ 8	71.25	52.00	708.57	125.02	422.06	17.06
10/ 8	57.50	43.21	722.86	126.67	422.16	17.16
11/ 8	42.29	31.19	733.96	127.95	422.24	17.24
12/ 8	36.25	25.61	744.60	129.19	422.32	17.32
Year Number: 9					Year Number: 9	
1/ 9	32.71	23.46	753.85	130.26	422.38	17.38
2/ 9	42.50	32.06	764.29	131.47	422.46	17.46
3/ 9	27.29	44.78	746.80	129.44	422.33	17.33
4/ 9	59.17	52.26	753.70	130.24	422.38	17.38
5/ 9	71.88	61.50	764.07	131.44	422.46	17.46
6/ 9	60.42	70.96	753.52	130.22	422.38	17.38
7/ 9	36.46	76.32	713.66	125.60	422.10	17.10
8/ 9	48.75	69.71	692.70	122.99	421.93	16.93
9/ 9	71.25	52.17	711.78	125.39	422.08	17.08
10/ 9	57.50	43.34	725.94	127.03	422.18	17.18
11/ 9	42.29	31.28	736.95	128.30	422.26	17.26
12/ 9	36.25	25.68	747.53	129.52	422.34	17.34

Results of Water Balance Calculations
(continued)

Period Ending mm/yy)	Water Volume Added (ac-ft)	Water Volume Removed (ac-ft)	Volume Water in Pond (ac-ft)	Pond Surface Area (acres)	Water Surface Elevation (feet)	Pond Water Depth (feet)
Year Number:	10				Year Number:	10
1/10	32.71	23.52	756.71	130.59	422.40	17.40
2/10	42.50	32.14	767.07	131.79	422.48	17.48
3/10	27.29	44.89	749.47	129.75	422.35	17.35
4/10	59.17	52.39	756.25	130.54	422.40	17.40
5/10	71.88	61.64	766.49	131.72	422.47	17.47
6/10	60.42	71.11	755.79	130.48	422.40	17.40
7/10	36.46	76.47	715.78	125.85	422.11	17.11
8/10	48.75	69.86	694.67	123.27	421.95	16.95
9/10	71.25	52.28	713.65	125.60	422.10	17.10
10/10	57.50	43.41	727.74	127.23	422.20	17.20
11/10	42.29	31.33	738.70	128.50	422.27	17.27
12/10	36.25	25.72	749.23	129.72	422.35	17.35
Year Number:	11				Year Number:	11
1/11	32.71	23.55	758.38	130.78	422.41	17.41
2/11	42.50	32.19	768.69	131.98	422.49	17.49
3/11	27.29	44.95	751.03	129.93	422.36	17.36
4/11	59.17	52.46	757.74	130.71	422.41	17.41
5/11	71.88	61.72	767.90	131.88	422.48	17.48
6/11	60.42	71.20	757.12	130.64	422.41	17.41
7/11	36.46	76.56	717.02	125.99	422.12	17.12
8/11	48.75	69.94	695.82	123.43	421.96	16.96
9/11	71.25	52.34	714.74	125.73	422.10	17.10
10/11	57.50	43.45	728.78	127.35	422.20	17.20
11/11	42.29	31.36	739.72	128.62	422.28	17.28
12/11	36.25	25.74	750.23	129.84	422.36	17.36
Year Number:	12				Year Number:	12
1/12	32.71	23.58	759.36	130.89	422.42	17.42
2/12	42.50	32.22	769.64	132.09	422.49	17.49
3/12	27.29	44.99	751.94	130.04	422.37	17.37
4/12	59.17	52.50	758.61	130.81	422.42	17.42
5/12	71.88	61.76	768.72	131.98	422.49	17.49
6/12	60.42	71.25	757.89	130.73	422.41	17.41
7/12	36.46	75.61	717.74	126.08	422.12	17.12
8/12	48.75	69.99	696.49	123.53	421.97	16.97
9/12	71.25	52.37	715.37	125.80	422.11	17.11
10/12	57.50	43.48	729.40	127.43	422.21	17.21
11/12	42.29	31.38	740.31	128.69	422.29	17.29
12/12	36.25	25.75	750.81	129.91	422.36	17.36

Results of Water Balance Calculations
(continued)

Period Ending mm/yy)	Water Volume Added (ac-ft)	Water Volume Removed (ac-ft)	Volume Water in Pond (ac-ft)	Pond Surface Area (acres)	Water Surface Elevation (feet)	Pond Water Depth (feet)
Year Number:	13				Year Number:	13
1/13	32.71	23.5[illegible]	759.93	130.96	422.43	17.43
2/13	42.50	32.23	770.20	132.15	422.50	17.50
3/13	27.29	45.01	752.48	130.10	422.37	17.37
4/13	59.17	52.52	759.12	130.87	422.42	17.42
5/13	71.88	61.79	769.20	132.03	422.49	17.49
6/13	60.42	71.28	758.34	130.78	422.41	17.41
7/13	36.46	76.64	718.16	126.13	422.13	17.13
8/13	48.75	70.02	696.89	123.58	421.97	16.97
9/13	71.25	52.39	715.74	125.85	422.11	17.11
10/13	57.50	43.49	729.75	127.47	422.21	17.21
11/13	42.29	31.39	740.66	128.73	422.29	17.29
12/13	36.25	25.76	751.15	129.94	422.36	17.36
Year Number:	14				Year Number:	14
1/14	32.71	23.59	760.26	131.00	422.43	17.43
2/14	42.50	32.24	770.52	132.19	422.50	17.50
3/14	27.29	45.02	752.79	130.13	422.37	17.37
4/14	59.17	52.54	759.42	130.90	422.42	17.42
5/14	71.88	61.81	769.48	132.07	422.49	17.49
6/14	60.42	71.29	758.61	130.81	422.42	17.42
7/14	36.46	76.66	718.40	126.15	422.13	17.13
8/14	48.75	70.04	697.11	123.61	421.97	16.97
9/14	71.25	52.40	715.96	125.87	422.11	17.11
10/14	57.50	43.50	729.96	127.49	422.21	17.21
11/14	42.29	31.39	740.86	128.75	422.29	17.29
12/14	36.25	25.77	751.35	129.97	422.36	17.36
Year Number:	15				Year Number:	15
1/15	32.71	23.60	760.45	131.02	422.43	17.43
2/15	42.50	32.25	770.71	132.21	422.50	17.50
3/15	27.29	45.03	752.97	130.15	422.38	17.38
4/15	59.17	52.55	759.59	130.92	422.42	17.42
5/15	71.88	61.81	769.65	132.09	422.49	17.49
6/15	60.42	71.30	758.76	130.83	422.42	17.42
7/15	36.46	76.67	718.55	126.17	422.13	17.13
8/15	48.75	70.05	697.25	123.63	421.97	16.97
9/15	71.25	52.41	716.09	125.89	422.11	17.11
10/15	57.50	43.50	730.08	127.51	422.21	17.21
11/15	42.29	31.40	740.98	128.77	422.29	17.29
12/15	36.25	25.77	751.46	129.98	422.37	17.37

Results of Water Balance Calculations
(continued)

Period Ending mm/yy)	Water Volume Added (ac-ft)	Water Volume Removed (ac-ft)	Volume Water in Pond (ac-ft)	Pond Surface Area (acres)	Water Surface Elevation (feet)	Pond Water Depth (feet)
Year Number:	16				Year Number:	16
1/16	32.71	23.60	760.57	131.03	422.43	17.43
2/16	42.50	32.25	770.82	132.22	422.50	17.50
3/16	27.29	45.04	753.07	130.17	422.38	17.38
4/16	59.17	52.55	759.69	130.93	422.42	17.42
5/16	71.88	61.82	769.74	132.10	422.50	17.50
6/16	60.42	71.31	758.85	130.84	422.42	17.42
7/16	36.46	76.68	718.63	126.18	422.13	17.13
8/16	48.75	70.06	697.33	123.64	421.97	16.97
9/16	71.25	52.41	716.16	125.89	422.11	17.11
10/16	57.50	43.51	730.15	127.51	422.21	17.21
11/16	42.29	31.40	741.05	128.78	422.29	17.29
12/16	36.25	25.77	751.53	129.99	422.37	17.37
Year Number:	17				Year Number:	17
1/17	32.71	23.60	760.63	131.04	422.43	17.43
2/17	42.50	32.25	770.88	132.23	422.50	17.50
3/17	27.29	45.04	753.13	130.17	422.38	17.38
4/17	59.17	52.55	759.75	130.94	422.42	17.42
5/17	71.88	61.82	769.80	132.10	422.50	17.50
6/17	60.42	71.31	758.90	130.84	422.42	17.42
7/17	36.46	76.68	718.68	126.19	422.13	17.13
8/17	48.75	70.06	697.37	123.65	421.97	16.97
9/17	71.25	52.42	716.20	125.90	422.11	17.11
10/17	57.50	43.51	730.20	127.52	422.21	17.21
11/17	42.29	31.40	741.09	128.78	422.29	17.29
12/17	36.25	25.77	751.57	129.99	422.37	17.37
Year Number:	18				Year Number:	18
1/18	32.71	23.60	760.67	131.05	422.43	17.43
2/18	42.50	32.25	770.92	132.23	422.50	17.50
3/18	27.29	45.04	753.17	130.18	422.38	17.38
4/18	59.17	52.55	759.78	130.94	422.42	17.42
5/18	71.88	61.82	769.83	132.11	422.50	17.50
6/18	60.42	71.31	758.93	130.85	422.42	17.42
7/18	36.46	76.68	718.71	126.19	422.13	17.13
8/18	48.75	70.06	697.40	123.65	421.97	16.97
9/18	71.25	52.42	716.23	125.90	422.11	17.11
10/18	57.50	43.51	730.22	127.52	422.21	17.21
11/18	42.29	31.40	741.11	128.78	422.29	17.29
12/18	36.25	25.77	751.59	130.00	422.37	17.37

Results of Water Balance Calculations
(continued)

Period Ending mm/yy)	Water Volume Added (ac-ft)	Water Volume Removed (ac-ft)	Volume Water in Pond (ac-ft)	Pond Surface Area (acres)	Water Surface Elevation (feet)	Pond Water Depth (feet)
Year Number:	19				Year Number:	19
1/19	32.71	23.60	760.70	131.05	422.43	17.43
2/19	42.50	32.25	770.94	132.24	422.50	17.50
3/19	27.29	45.04	753.19	130.18	422.38	17.38
4/19	59.17	52.56	759.80	130.95	422.42	17.42
5/19	71.88	61.83	769.85	132.11	422.50	17.50
6/19	60.42	71.32	758.95	130.85	422.42	17.42
7/19	36.46	76.68	718.73	126.19	422.13	17.13
8/19	48.75	70.06	697.41	123.65	421.97	16.97
9/19	71.25	52.42	716.24	125.90	422.11	17.11
10/19	57.50	43.51	730.23	127.52	422.21	17.21
11/19	42.29	31.40	741.13	128.78	422.29	17.29
12/19	36.25	25.77	751.60	130.00	422.37	17.37
Year Number:	20				Year Number:	20
1/20	32.71	23.60	760.71	131.05	422.43	17.43
2/20	42.50	32.25	770.95	132.24	422.50	17.50
3/20	27.29	45.04	753.20	130.18	422.38	17.38
4/20	59.17	52.56	759.81	130.95	422.42	17.42
5/20	71.88	61.83	769.86	132.11	422.50	17.50
6/20	60.42	71.32	758.96	130.85	422.42	17.42
7/20	36.46	76.69	718.74	126.19	422.13	17.13
8/20	48.75	70.06	697.42	123.66	421.97	16.97
9/20	71.25	52.42	716.25	125.91	422.11	17.11
10/20	57.50	43.51	730.24	127.52	422.21	17.21
11/20	42.29	31.40	741.13	128.79	422.29	17.29
12/20	36.25	25.77	751.61	130.00	422.37	17.37

Results of Water Balance Calculations.

Period Ending mm/yy)	Water Volume Added (ac-ft)	Water Volume Removed (ac-ft)	Volume Water in Pond (ac-ft)	Pond Surface Area (acres)	Water Surface Elevation (feet)	Pond Water Depth (feet)
12/20	--	--	1397.86	198.83	426.32	21.32
Year Number:	21				Year Number:	21
1/21	32.71	35.93	1394.64	198.51	426.31	21.31
2/21	42.50	48.56	1388.58	197.91	426.28	21.28
3/21	27.29	67.25	1348.62	193.94	426.09	21.09
4/21	59.17	77.68	1330.10	192.09	426.00	21.00
5/21	71.88	89.84	1312.13	190.27	425.90	20.90
6/21	60.42	102.07	1270.48	186.02	425.66	20.66
7/21	36.46	108.80	1198.14	178.66	425.25	20.25
8/21	48.75	98.77	1148.12	173.57	424.96	19.96
9/21	71.25	72.86	1146.51	173.40	424.95	19.95
10/21	57.50	59.50	1144.51	173.20	424.94	19.94
11/21	42.29	42.43	1144.37	173.18	424.94	19.94
12/21	36.25	34.51	1146.11	173.36	424.95	19.95
Year Number:	22				Year Number:	22
1/22	32.71	31.36	1147.45	173.50	424.96	19.96
2/22	42.50	42.51	1147.45	173.50	424.96	19.96
3/22	27.29	59.00	1115.74	170.27	424.77	19.77
4/22	59.17	68.34	1106.56	169.33	424.72	19.72
5/22	71.88	79.40	1099.03	168.57	424.68	19.68
6/22	60.42	90.59	1068.86	165.50	424.51	19.51
7/22	36.46	96.91	1008.41	159.34	424.16	19.16
8/22	48.75	88.19	968.97	155.16	423.92	18.92
9/22	71.25	65.31	974.90	155.85	423.96	18.96
10/22	57.50	53.59	978.81	156.30	423.99	18.99
11/22	42.29	38.35	982.76	156.73	424.01	19.01
12/22	36.25	31.27	987.74	157.24	424.04	19.04
Year Number:	23				Year Number:	23
1/23	32.71	28.47	991.98	157.67	424.06	19.06
2/23	42.50	38.68	995.80	158.06	424.09	19.09
3/23	27.29	53.77	969.33	155.20	423.92	18.92
4/23	59.17	62.39	966.10	154.83	423.90	18.90
5/23	71.88	72.74	965.23	154.73	423.89	18.89
6/23	60.42	83.22	942.43	152.09	423.73	18.73
7/23	36.46	88.93	889.95	146.01	423.35	18.35
8/23	48.75	80.85	857.85	142.30	423.12	18.12
9/23	71.25	60.04	869.06	143.59	423.20	18.20
10/23	57.50	49.46	877.09	144.52	423.26	18.26
11/23	42.29	35.51	883.88	145.31	423.31	18.31
12/23	36.25	29.03	891.11	146.15	423.36	18.36

Results of Water Balance Calculations
(continued)

Period Ending mm/yy)	Water Volume Added (ac-ft)	Water Volume Removed (ac-ft)	Volume Wat r in Pond (ac-ft)	Pond Surface Area (acres)	Water Surface Elevation (feet)	Pond Water Depth (feet)
Year Number:	24				Year Number:	24
1/24	32.71	26.49	897.32	146.87	423.40	18.40
2/24	42.50	36.07	903.75	147.61	423.45	18.45
3/24	27.29	50.21	880.82	144.96	423.29	18.29
4/24	59.17	58.36	881.63	145.05	423.29	18.29
5/24	71.88	68.27	885.23	145.47	423.32	18.32
6/24	60.42	78.33	867.31	143.39	423.19	18.19
7/24	36.46	83.92	819.85	137.90	422.85	17.85
8/24	48.75	76.44	792.16	134.69	422.66	17.66
9/24	71.25	56.93	806.48	136.35	422.76	17.76
10/24	57.50	47.03	816.96	137.56	422.83	17.83
11/24	42.29	33.82	825.42	138.54	422.89	17.89
12/24	36.25	27.69	833.98	139.53	422.95	17.95
Year Number:	25				Year Number:	25
1/25	32.71	25.31	841.38	140.39	423.01	18.01
2/25	42.50	34.51	849.37	141.31	423.06	18.06
3/25	27.29	48.10	828.56	138.91	422.91	17.91
4/25	59.17	55.99	831.74	139.27	422.94	17.94
5/25	71.88	65.63	837.99	140.00	422.98	17.98
6/25	60.42	75.46	822.94	138.26	422.87	17.87
7/25	36.46	80.96	778.44	133.10	422.56	17.56
8/25	48.75	73.84	753.36	130.20	422.38	17.38
9/25	71.25	55.09	769.52	132.07	422.49	17.49
10/25	57.50	45.59	781.43	133.45	422.58	17.58
11/25	42.29	32.83	790.90	134.55	422.65	17.65
12/25	36.25	26.91	800.24	135.63	422.71	17.71
Year Number:	26				Year Number:	26
1/26	32.71	24.61	808.34	136.56	422.77	17.77
2/26	42.50	33.59	817.25	137.60	422.83	17.83
3/26	27.29	46.84	797.70	135.33	422.69	17.69
4/26	59.17	54.58	802.28	135.86	422.73	17.73
5/26	71.88	64.07	810.08	136.77	422.78	17.78
6/26	60.42	73.76	796.74	135.22	422.69	17.69
7/26	36.46	79.21	753.99	130.27	422.38	17.38
8/26	48.75	72.30	730.44	127.55	422.22	17.22
9/26	71.25	54.00	747.69	129.54	422.34	17.34
10/26	57.50	44.74	760.45	131.02	422.43	17.43
11/26	42.29	32.24	770.50	132.18	422.50	17.50
12/26	36.25	26.44	780.31	133.32	422.57	17.57

Results of Water Balance Calculations
(continued)

Period Ending mm/yy)	Water Volume Added (ac-ft)	Water Volume Removed (ac-ft)	Volume Water in Pond (ac-ft)	Pond Surface Area (acres)	Water Surface Elevation (feet)	Pond Water Depth (fee*)
Year Number:	27				Year Number:	27
1/27	32.71	24.20	788.82	134.31	422.63	17.63
2/27	42.50	33.04	798.28	135.40	422.70	17.70
3/27	27.29	46.11	779.46	133.22	422.56	17.56
4/27	59.17	53.75	784.88	133.85	422.60	17.60
5/27	71.88	63.15	793.60	134.86	422.67	17.67
6/27	60.42	72.76	781.26	133.43	422.58	17.58
7/27	36.46	78.17	739.54	128.60	422.28	17.28
8/27	48.75	71.39	716.90	125.98	422.12	17.12
9/27	71.25	53.36	734.80	128.05	422.25	17.25
10/27	57.50	44.23	748.06	129.59	422.34	17.34
11/27	42.29	31.90	758.46	130.79	422.42	17.42
12/27	36.25	26.17	768.54	131.96	422.49	17.49
Year Number:	28				Year Number:	28
1/28	32.71	23.95	777.29	132.97	422.55	17.55
2/28	42.50	32.72	787.07	134.10	422.62	17.62
3/28	27.29	45.67	768.70	131.98	422.49	17.49
4/28	59.17	53.26	774.60	132.66	422.53	17.53
5/28	71.88	62.61	783.87	133.73	422.60	17.60
6/28	60.42	72.17	772.12	132.37	422.51	17.51
7/28	36.46	77.56	731.01	127.61	422.22	17.22
8/28	48.75	70.85	708.91	125.05	422.06	17.06
9/28	71.25	52.98	727.18	127.17	422.19	17.19
10/28	57.50	43.94	740.74	128.74	422.29	17.29
11/28	42.29	31.69	751.34	129.97	422.36	17.36
12/28	36.25	26.00	761.59	131.15	422.44	17.44
Year Number:	29				Year Number:	29
1/29	32.71	23.81	770.48	132.18	422.50	17.50
2/29	42.50	32.53	780.46	133.34	422.57	17.57
3/29	27.29	45.41	762.34	131.24	422.44	17.44
4/29	59.17	52.97	768.53	131.96	422.49	17.49
5/29	71.88	62.29	778.12	133.07	422.56	17.56
6/29	60.42	71.82	766.72	131.75	422.47	17.47
7/29	36.46	77.20	725.97	127.03	422.18	17.18
8/29	48.75	70.54	704.18	124.51	422.03	17.03
9/29	71.25	52.75	722.68	126.65	422.16	17.16
10/29	57.50	43.76	736.42	128.24	422.26	17.26
11/29	42.29	31.57	747.14	129.48	422.33	17.33
12/29	36.25	25.91	757.48	130.68	422.41	17.41

Results of Water Balance Calculations
(continued)

Period Ending mm/yy)	Water Volume Added (ac-ft)	Water Volume Removed (ac-ft)	Volume Water in Pond (ac-ft)	Pond Surface Area (acres)	Water Surface Elevation (feet)	Pond Water Depth (feet)
Year Number:	30				Year Number:	30
1/30	32.71	23.73	766.46	131.72	422.47	17.47
2/30	42.50	32.42	776.55	132.88	422.54	17.54
3/30	27.29	45.26	758.58	130.80	422.42	17.42
4/30	59.17	52.80	764.94	131.54	422.46	17.46
5/30	71.88	62.10	774.72	132.67	422.53	17.53
6/30	60.42	71.61	763.53	131.38	422.45	17.45
7/30	36.46	76.99	722.99	126.69	422.16	17.16
8/30	48.75	70.35	701.40	124.18	422.01	17.01
9/30	71.25	52.62	720.02	126.34	422.14	17.14
10/30	57.50	43.66	733.87	127.94	422.24	17.24
11/30	42.29	31.50	744.66	129.19	422.32	17.32
12/30	36.25	25.85	755.05	130.40	422.39	17.39
Year Number:	31				Year Number:	31
1/31	32.71	23.68	764.09	131.44	422.46	17.46
2/31	42.50	32.35	774.24	132.62	422.53	17.53
3/31	27.29	45.17	756.36	130.55	422.40	17.40
4/31	59.17	52.70	762.83	131.30	422.45	17.45
5/31	71.88	61.99	772.72	132.44	422.52	17.52
6/31	60.42	71.49	761.64	131.16	422.44	17.44
7/31	36.46	76.86	721.24	126.48	422.15	17.15
8/31	48.75	70.24	699.75	123.98	422.00	17.00
9/31	71.25	52.54	718.46	126.16	422.13	17.13
10/31	57.50	43.60	732.36	127.77	422.23	17.23
11/31	42.29	31.46	743.19	129.02	422.31	17.31
12/31	36.25	25.82	753.63	130.23	422.38	17.38
Year Number:	32				Year Number:	32
1/32	32.71	23.67	762.69	131.28	422.45	17.45
2/32	42.50	32.31	772.88	132.46	422.52	17.52
3/32	27.29	45.12	755.05	130.40	422.39	17.39
4/32	59.17	52.64	761.58	131.15	422.44	17.44
5/32	71.88	61.92	771.53	132.30	422.51	17.51
6/32	60.42	71.42	760.53	131.03	422.43	17.43
7/32	36.46	76.79	720.20	126.36	422.14	17.14
8/32	48.75	70.16	698.79	123.85	421.99	16.99
9/32	71.25	52.49	717.55	126.05	422.12	17.12
10/32	57.50	43.56	731.48	127.67	422.22	17.22
11/32	42.29	31.43	742.34	128.92	422.30	17.30
12/32	36.25	25.80	752.79	130.13	422.37	17.37

Results of Water Balance Calculations
(continued)

Period Ending mm/yy)	Water Volume Added (ac-ft)	Water Volume Removed (ac-ft)	Volume Water in Pond (ac-ft)	Pond Surface Area (acres)	Water Surface Elevation (feet)	Pond Water Depth (feet)
Year Number:	33				Year Number:	33
1/33	32.71	23.63	761.87	131.19	422.44	17.44
2/33	42.50	32.29	772.08	132.37	422.51	17.51
3/33	27.29	45.09	754.29	130.31	422.39	17.39
4/33	59.17	52.61	760.85	131.07	422.43	17.43
5/33	71.88	61.88	770.85	132.22	422.50	17.50
6/33	60.42	71.38	759.89	130.96	422.43	17.43
7/33	36.46	76.75	719.50	126.22	422.14	17.14
8/33	48.75	70.12	698.22	123.77	421.98	16.98
9/33	71.25	52.46	717.01	125.99	422.12	17.12
10/33	57.50	43.54	730.97	127.61	422.22	17.22
11/33	42.29	31.42	741.84	128.87	422.30	17.30
12/33	36.25	25.79	752.31	130.08	422.37	17.37
Year Number:	34				Year Number:	34
1/34	32.71	23.62	761.39	131.13	422.44	17.44
2/34	42.50	32.27	771.62	132.31	422.51	17.51
3/34	27.29	45.07	753.84	130.26	422.38	17.38
4/34	59.17	52.59	760.43	131.02	422.43	17.43
5/34	71.88	61.86	770.44	132.18	422.50	17.50
6/34	60.42	71.35	759.51	130.91	422.42	17.42
7/34	36.46	76.72	719.24	126.25	422.14	17.14
8/34	48.75	70.10	697.90	123.72	421.98	16.98
9/34	71.25	52.44	716.70	125.96	422.12	17.12
10/34	57.50	43.53	730.67	127.57	422.22	17.22
11/34	42.29	31.41	741.55	128.83	422.29	17.29
12/34	36.25	25.78	752.02	130.05	422.37	17.37
Year Number:	35				Year Number:	35
1/35	32.71	23.61	761.12	131.10	422.43	17.43
2/35	42.50	32.27	771.35	132.28	422.51	17.51
3/35	27.29	45.06	753.59	130.23	422.38	17.38
4/35	59.17	52.57	760.18	130.99	422.43	17.43
5/35	71.88	61.85	770.21	132.15	422.50	17.50
6/35	60.42	71.34	759.29	130.89	422.42	17.42
7/35	36.46	76.71	719.04	126.23	422.13	17.13
8/35	48.75	70.08	697.70	123.70	421.98	16.98
9/35	71.25	52.43	716.52	125.94	422.12	17.12
10/35	57.50	43.52	730.50	127.55	422.22	17.22
11/35	42.29	31.41	741.38	128.81	422.29	17.29
12/35	36.25	25.78	751.86	130.03	422.37	17.37

Results of Water Balance Calculations
(continued)

Period Ending mm/yy)	Water Volume Added (ac-ft)	Water Volume Removed (ac-ft)	Volume Water in Pond (ac-ft)	Pond Surface Area (acres)	Water Surface Elevation (feet)	Pond Water Depth (feet)
Year Number:	36				Year Number:	36
1/36	32.71	23.61	760.95	131.08	422.43	17.43
2/36	42.50	32.26	771.19	132.26	422.51	17.51
3/36	27.29	45.05	753.43	130.21	422.38	17.38
4/36	59.17	52.57	760.03	130.97	422.43	17.43
5/36	71.88	61.84	770.07	132.13	422.50	17.50
6/36	60.42	71.33	759.16	130.87	422.42	17.42
7/36	36.46	76.70	718.92	126.21	422.13	17.13
8/36	48.75	70.08	697.59	123.68	421.98	16.98
9/36	71.25	52.43	716.41	125.92	422.12	17.12
10/36	57.50	43.52	730.40	127.54	422.22	17.22
11/36	42.29	31.40	741.28	128.80	422.29	17.29
12/36	36.25	25.78	751.76	130.02	422.37	17.37
Year Number:	37				Year Number:	37
1/37	32.71	23.61	760.86	131.07	422.43	17.43
2/37	42.50	32.26	771.10	132.25	422.51	17.51
3/37	27.29	45.05	753.35	130.20	422.38	17.38
4/37	59.17	52.56	759.95	130.96	422.43	17.43
5/37	71.88	61.83	769.99	132.13	422.50	17.50
6/37	60.42	71.32	759.08	130.86	422.42	17.42
7/37	36.46	76.69	718.85	126.21	422.13	17.13
8/37	48.75	70.07	697.53	123.67	421.98	16.98
9/37	71.25	52.43	716.35	125.92	422.11	17.11
10/37	57.50	43.51	730.34	127.54	422.21	17.21
11/37	42.29	31.40	741.23	128.80	422.29	17.29
12/37	36.25	25.77	751.70	130.01	422.37	17.37
Year Number:	38				Year Number:	38
1/38	32.71	23.61	760.80	131.06	422.43	17.43
2/38	42.50	32.26	771.05	132.25	422.50	17.50
3/38	27.29	45.05	753.29	130.19	422.38	17.38
4/38	59.17	52.56	759.90	130.96	422.43	17.43
5/38	71.88	61.83	769.94	132.12	422.50	17.50
6/38	60.42	71.32	759.04	130.86	422.42	17.42
7/38	36.46	76.69	718.81	126.20	422.13	17.13
8/38	48.75	70.07	697.49	123.67	421.97	16.97
9/38	71.25	52.42	716.32	125.91	422.11	17.11
10/38	57.50	43.51	730.30	127.53	422.21	17.21
11/38	42.29	31.40	741.19	128.79	422.29	17.29
12/38	36.25	25.77	751.67	130.00	422.37	17.37

Results of Water Balance Calculations
(continued)

Period Ending mm/yy)	Water Volume Added (ac-ft)	Water Volume Removed (ac-ft)	Volume Water in Pond (ac-ft)	Pond Surface Area (acres)	Water Surface Elevation (feet)	Pond Water Depth (feet)
Year Number:	39				Year Number:	39
1/39	32.71	23.61	760.77	131.06	422.43	17.43
2/39	42.50	32.26	771.02	132.24	422.50	17.50
3/39	27.29	45.04	753.26	130.19	422.38	17.38
4/39	59.17	52.56	759.87	130.95	422.43	17.43
5/39	71.88	61.83	769.92	132.12	422.50	17.50
6/39	60.42	71.32	759.01	130.85	422.42	17.42
7/39	36.46	76.69	718.78	126.20	422.13	17.13
8/39	48.75	70.07	697.47	123.66	421.97	16.97
9/39	71.25	52.42	716.30	125.91	422.11	17.11
10/39	57.50	43.51	730.28	127.53	422.21	17.21
11/39	42.29	31.40	741.17	128.79	422.29	17.29
12/39	36.25	25.77	751.65	130.00	422.37	17.37
Year Number:	40				Year Number:	40
1/40	32.71	23.61	760.75	131.06	422.43	17.43
2/40	42.50	32.26	771.00	132.24	422.50	17.50
3/40	27.29	45.04	753.25	130.19	422.38	17.38
4/40	59.17	52.56	759.85	130.95	422.43	17.43
5/40	71.88	61.83	769.90	132.11	422.50	17.50
6/40	60.42	71.32	759.00	130.85	422.42	17.42
7/40	36.46	76.69	718.77	126.20	422.13	17.13
8/40	48.75	70.07	697.45	123.66	421.97	16.97
9/40	71.25	52.42	716.28	125.91	422.11	17.11
10/40	57.50	43.51	730.27	127.53	422.21	17.21
11/40	42.29	31.40	741.16	128.79	422.29	17.29
12/40	36.25	25.77	751.64	130.00	422.37	17.37

APPENDIX D

SUMP WATER QUALITY

TABLE D-1

SUMP 2: WATER ANALYSIS SUMMARY

	pH	Cond.	TDS	As mg/l	Mo mg/l	Se mg/l	U mg/l	Cl mg/l	SO_4 mg/l
3/31/81	6.7	10280	6661	<.01	<.1	<.01	.7	2366	1811
8/21/81	4.0	8020	5197	<.01	<.1	<.01	.3	1619	2543
6/01/82	6.8	12770	8275	<.01	<.1	<.01	.3	3739	1975
3/21/83	7.1	10760	6972	<.01	<.2	<.02	2.3	2970	2600
4/29/83	7.3	5260	3408	<.01	<.1	<.01	2.2	2060	1092
8/9/83	6.8	13280	8605	<.01	<.1	<.01	1.9	4933	1467
12/29/83	7.4	16900	10951	<.01	<.1	<.01	2.9	5110	1620
3/30/84	7.4	17140	-----	.009	<.1	<.001	2.4	5210	1600

mean 7.152
s.d 2.446

OVERSIZE
DOCUMENT
PAGE(S) PULLED

SEE APERTURE CARD FILES

APERTURE CARD/PAPER COPY AVAILABLE THROUGH NRC FILE C/

NUMBER OF OVERSIZE PAGES FILMED ON APERTURE CARD(S) 2

ACCESSION NUMBERS OF OVERSIZE PAGES:

9801060027-05

9801060027-06

DRF-08