3

PROGRAM MANAGER
RMA CONTAMINATION CLEANUP

U.S. ARMY
MATERIEL COMMAND

— COMMITTED TO PROTECTION OF THE ENVIRONMENT —

COMPREHENSIVE MONITORING PROGRAM

Contract Number DAAA15-87-0095

FINAL SURFACE WATER DATA ASSESSMENT REPORT FOR 1990

FEBRUARY 1992

Version 4.1

2472

Volume III

R.L. STOLLAR & ASSOCIATES, INC.

Harding Lawson Associates
Ebasco Services Incorporated
DataChem, Inc.
Enseco-Cal Lab
Midwest Research Institute

COMPREHENSIVE MONITORING PROGRAM

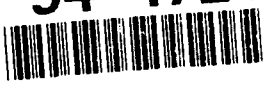
Contract Number DAAA15-87-0095

FINAL SURFACE WATER DATA ASSESSMENT REPORT FOR 1990

FEBRUARY 1992

Version 4.1

Volume III



Prepared by:

R. L. STOLLAR & ASSOCIATES INC.
HARDING LAWSON ASSOCIATES
EBASCO SERVICES INC.
DATACHEM LABORATORIES
ENVIRONMENTAL SCIENCE & ENGINEERING, INC.
RIVERSIDE TECHNOLOGY, INC.

Prepared for:

U. S. ARMY PROGRAM MANAGER FOR
ROCKY MOUNTAIN ARSENAL

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	02/00/92	

4. TITLE AND SUBTITLE
COMPREHENSIVE MONITORING PROGRAM, FINAL SURFACE WATER DATA ASSESSMENT REPORT FOR 1990, VERSION 4.1

5. FUNDING NUMBERS
DAAA15 87 0095

6. AUTHOR(S)

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
ROBERT L. STOLLAR AND ASSOCIATES
DENVER, CO

8. PERFORMING ORGANIZATION REPORT NUMBER
92093R05

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
HARDING LAWSON ASSOCIATES
DENVER, CO

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)
THE FISCAL YEAR 1990 SURFACE WATER REPORT IS DIVIDED INTO SIX SECTIONS AND TWO APPENDICES. SECTION 1 PROVIDES A BRIEF HISTORICAL REVIEW OF THE SURFACE WATER PROGRAM AT THE RMA. SECTION 2 PROVIDES THE GENERAL SETTING, THE DEFINED DRAINAGE BASIN AND SURFACE WATER FEATURES AT RMA. SECTION 3 PROVIDES A DETAILED DISCUSSION OF FY90 SURFACE WATER CMP STRATEGIES AND METHODOLOGIES. SECTION 4 PRESENTS THE WATER QUALITY AND QUANTITY DATA COLLECTED DURING FY90 IN THE MAJOR RMA DRAINAGE BASINS. SECTION 5 PROVIDES AN ASSESSMENT OF THE COLLECTED SURFACE WATER DATA. SECTION 6 PROVIDES CONCLUSIONS AND EXAMINES TRENDS OF FY90 DATA COMPARED TO PREVIOUS YEAR DATA. APPENDIX A INCLUDES INFORMATION RELATED TO SURFACE WATER QUANTITY AND APPENDIX B INCLUDES INFORMATION RELATED TO SURFACE WATER QUALITY.

14. SUBJECT TERMS	15. NUMBER OF PAGES
CONTAMINANTS, DRAINAGE BASINS, SAMPLING	16. PRICE CODE

17. SECURITY CLASSIFICATION	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED			

TABLE OF CONTENTS

VOLUME III

TABLE OF CONTENTS

APPENDIX A

SURFACE-WATER QUANTITY DATA FOR WATER YEAR 1990

APPENDIX A-1

SURFACE-WATER STATION SURVEY INFORMATION

APPENDIX A-1.1

MONITORING STATION SURVEY INFORMATION

Appendix A-1.1 Table A-1.1-1 Monitoring Station Survey Information

Station #	Location	Northing	Easting	Elevation/GH
SW01001	N. Uvalda Interceptor	175,588.02	2,187,896.41	5,260.55 = TBM 5,255.59 = 0.00 on SG
SW01003	South Plants Ditch	177,784.84	2,185,793.81	5,255.61 = TBM 5,248.78 = 0.00 on SG 5,253.13 = PZF on SW Weir 5,252.21 = PZF on S Weir
SW01004	Upper Derby Lake	176,932.23	2,187,034.25	5,255.77 = 8.00 on SG
SW01005	Lower Derby Lake	176,414.44	2,183,945.48	5,242.17 = 12.00 on SG
SW02001	Ladora Weir	176,311.48	2,183,662.77	5,235.49 = TBM 5,232.84 = 4.00 on SG
SW02003	Ladora Lake	177,726.61	2,179,691.86	5,219.11 = 12.00 on SG
SW02004	Lake Mary	177,378.84	2,178,434.27	5,203.39 = 1.00 on SG
SW08003	South First Creek	173,686.65	2,198,520.22	5,293.84 = TBM A 5,293.94 = TBM B 5,290.83 = PZF 5,290.82 = 0.00 on SG
SW11001	Peoria Interceptor	170,287.71	2,179,583.49	5,252.48 = TBM 5,248.15 = 1.00 on SG
SW11002	Havana Interceptor	170,992.86	2,178,854.75	5,261.49 = TBM 5,252.13 = PZF
SW11003	Havana Pond	172,696.42	2,180,121.78	5,253.97 = TBM 5,247.08 = 3.00 on SG
SW12005	South Uvalda Interceptor	170,445.36	2,186,746.06	5,272.37 = TBM 5,272.10 = 1.00 on SG
SW12007	Highline Lateral	175,292.77	2,188,725.83	5,275.15 = TBM 5,272.64 = 0.00 on SG 5,272.63 = PZF
SW24001	Sewage Treatment Effluent	194,147.34	2,186,376.17	5,154.56 = PVC

Appendix A-1.1 Table A-1.1-1 (cont'd.)

Station #	Location	Northing	Easting	Elevation/GH
SW24002	N. First Creek	195,311.93	2,187,575.26	5,146.52 = TBM A 5,146.01 = TBM B 5,141.75 = PZF 5,141.18 = 0.00 on SG
SW26001	Basin F	189,857.41	2,179,286.75	5,183.30 = PZF
SW36001	Basin A	180,985.85	2,184,525.97	5,253.51 = TBM A 5,253.50 = TBM B 5,252.11 = 0.00 on SG 5,252.19 = PZF
SW37001	First Creek Off-post	199,013.30	2,180,816.71	5,108.99 = TBM 5,106.91 = 0.00 on SG 5,107.43 = PZF Weir

SG = Staff Gage
TBM = Temporary Bench Mark
PZF = Point of Zero Flow

APPENDIX A-1.2

SURVEY INFORMATION FOR CONTROLS AT
SAND CREEK LATERAL NEAR HAVANA POND AND
LADORA LAKE SPILLWAY

Appendix A-1.2 Longitudinal Profile and Cross-Section Surveying

In order to develop an accurate water balance on RMA, it was recommended that additional gaging stations should be installed (RLSA, 1990b). RLSA recommended to the PMORMA the establishment of stations with control structures and continuous monitoring stage equipment downstream of Havana Pond in Sand Creek Lateral and downstream of the spillway leading from Ladora Lake. During Water Year 1990 preliminary surveying work was performed at these two sites. Longitudinal profiles, along with cross sections, were surveyed at these sites to determine the best location for an artificial control and gaging station, and to support future design considerations.

All longitudinal profiles were surveyed in a downstream direction, and all cross sections were surveyed from left to right looking in a downstream direction. Vertical elevations were measured to the nearest 0.005 feet. Horizontal stations were determined to the nearest 0.1 feet using stadia. Horizontal stationing and elevations in the longitudinal profile were determined for all slope breaks along the reach. Horizontal stationing and elevations for the cross-sections were determined for all slope breaks, left and right overbank reaches, left and right channel banks, as well as for the thalweg of each cross section.

The channel survey data were used to produce longitudinal and cross-section plots of these sites. This information can be used to subsequently determine:

- The appropriateness of each reach to accomodate station construction;
- The type of station control best suited to the channel characteristics and hydraulics; and
- The station sizing requirements and corresponding costs to construct.

Preliminary evaluation of these survey data indicate that a triangular-throated flume (similar to the new North First Creek Off-Post structure) is the most appropriate flow measuring structure for each site. The triangular-throated flume is recommended for the following reasons:

- A stage-discharge rating relationship can be determined with an error of less than 2 percent in the calculated discharge.
- The throat can be shaped in such a way that the complete range of low-flow to high-flow discharge can be measured accurately.
- The head loss over the flume required to have a unique relationship between the upstream sill-referenced head and the discharge is minimal; the head-loss consideration is extremely important since the surveyed reaches are relatively flat.
- This head-loss requirement can be estimated with sufficient accuracy.

- Because of the gradual converging transition, this structure has few problems with floating debris.
- Field observations have shown that the structure can be designed to pass sediment transported by channels with subcritical flow.
- Under similar hydraulic and other boundary conditions this flume is usually the most economical of all structures for accurately measuring flow.

Longitudinal Profiles and Cross-Section Information

Each longitudinal profile and cross-section is in feet mean sea level (MSL) and is tied to a vertical control (temporary bench mark - TBM) near each gage. All longitudinal profiles were surveyed in a downstream direction and all cross-sections were surveyed from left bank to right bank looking in a downstream direction. Horizontal and vertical scales for plotting were selected independently for each station reach based on best visual representation of plots to actual site conditions.

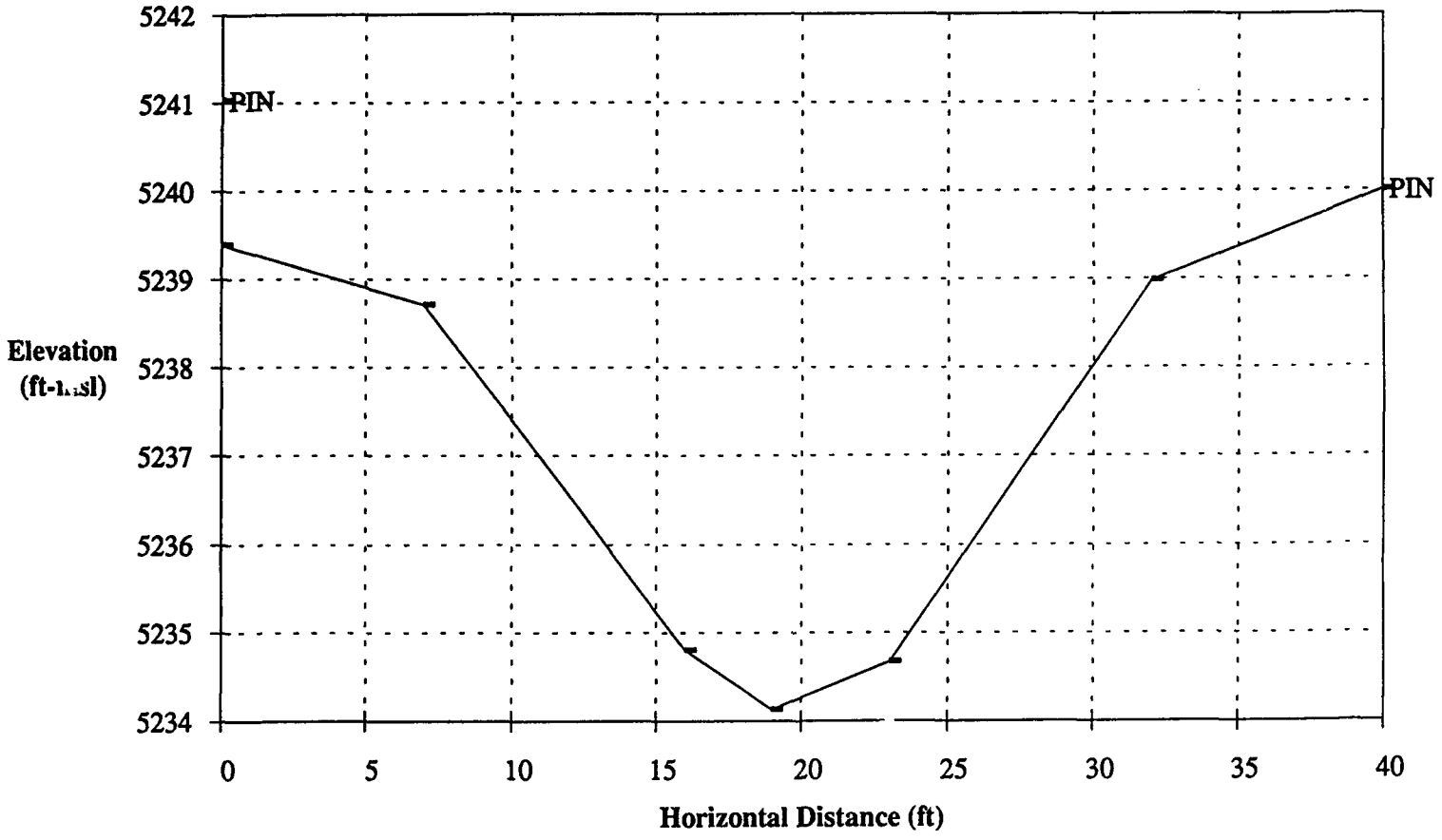
No comparisons were made at the following sites in Water Year 1990:

SW01003	South Plants Ditch
SW26001	Basin F
SW36001	Basin A

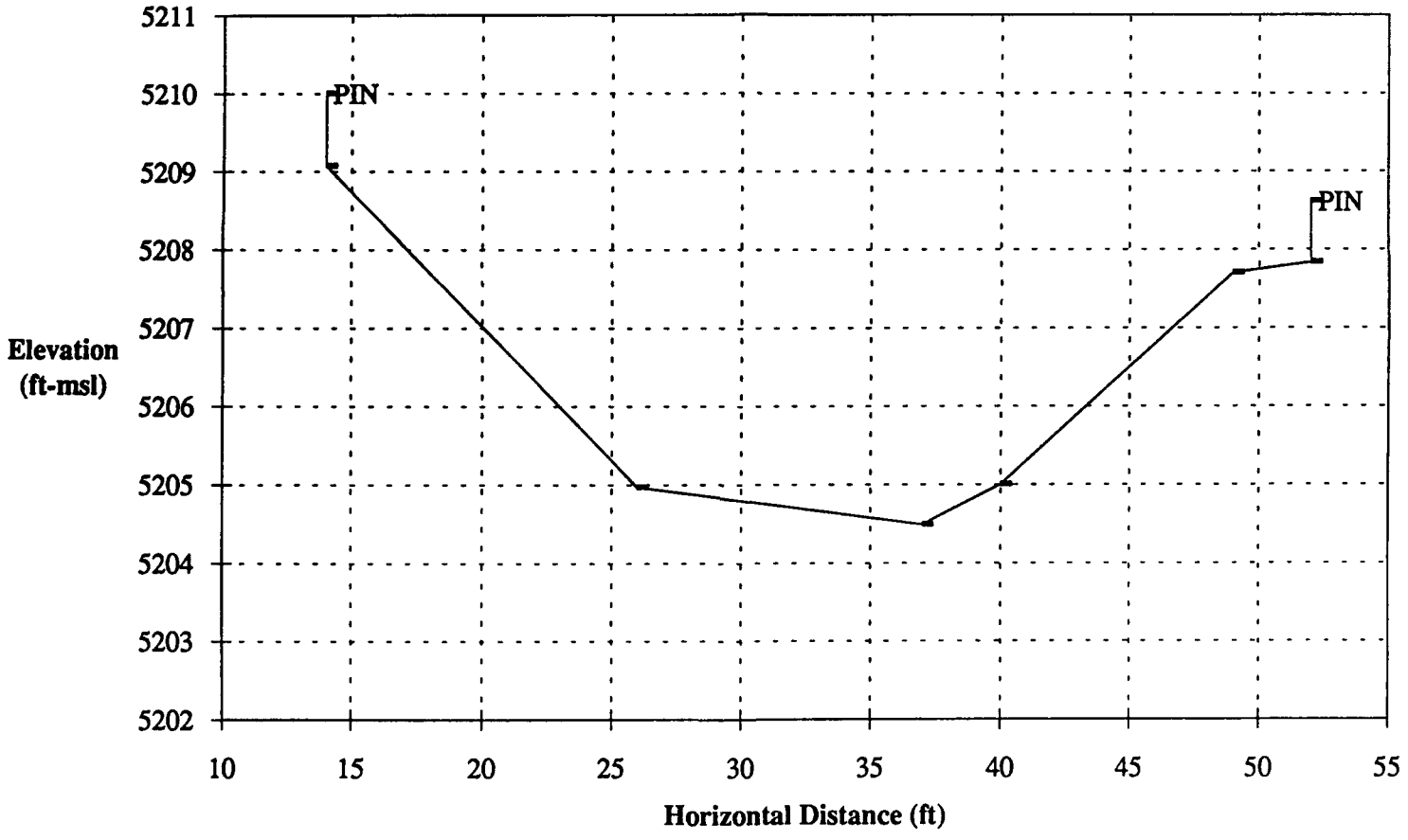
APPENDIX A-1.2.1

CROSS SECTION SURVEY PLOTS

SAND CREEK LATERAL
(REPRESENTATIVE CROSS SECTION)



LADORA LAKE SPILLWAY
(REPRESENTATIVE CROSS SECTION)



APPENDIX A-1.2.2

CROSS SECTION SURVEY DATA

Appendix A-1.2.2

Table A-1.2.2-1 Sand Creek Lateral Reach Survey Data

Horizontal Distance (ft)	Elevation (ft-msl)	Horizontal Distance (ft)	Elevation (ft-msl)
Longitudinal Profile		**Representative Cross Section**	
0	5241.20	0	5241.03
0	5239.70	0	5239.39
50	5235.66	7	5238.71
75	5235.64	16	5234.80
100	5235.03	19	5234.13
125	5234.54	23	5234.67
150	5234.43	32	5238.98
175	5234.06	40	5240.00
200	5234.13		
225	5234.49		
250	5234.46		
275	5235.05		
300	5234.79		
325	5234.86		
350	5235.47		
375	5235.26		
400	5234.96		
425	5234.61		
450	5234.64		
475	5234.18		
500	5234.79		
525	5234.76		
550	5234.45		
575	5234.47		
600	5234.52		

Appendix A-1.2.2

Table A-1.2.2-2 Ladora Lake Spillway Reach Survey Data

Horizontal Distance (ft)	Elevation (ft-msl)	Horizontal Distance (ft)	Elevation (ft-msl)
Longitudinal Profile		**Representative Cross Section**	
0	5205.17	14	5210.00
25	5204.74	14	5209.07
50	5204.27	26	5204.97
75	5204.02	37	5204.49
100	5203.82	40	5205.00
		49	5207.70
		52	5207.83
		52	5208.61

APPENDIX A-1.2.3

CHANNEL REACH SURVEYS AND LONGITUDINAL PROFILES

APPENDIX A-1.2.3 CHANNEL REACH SURVEYS

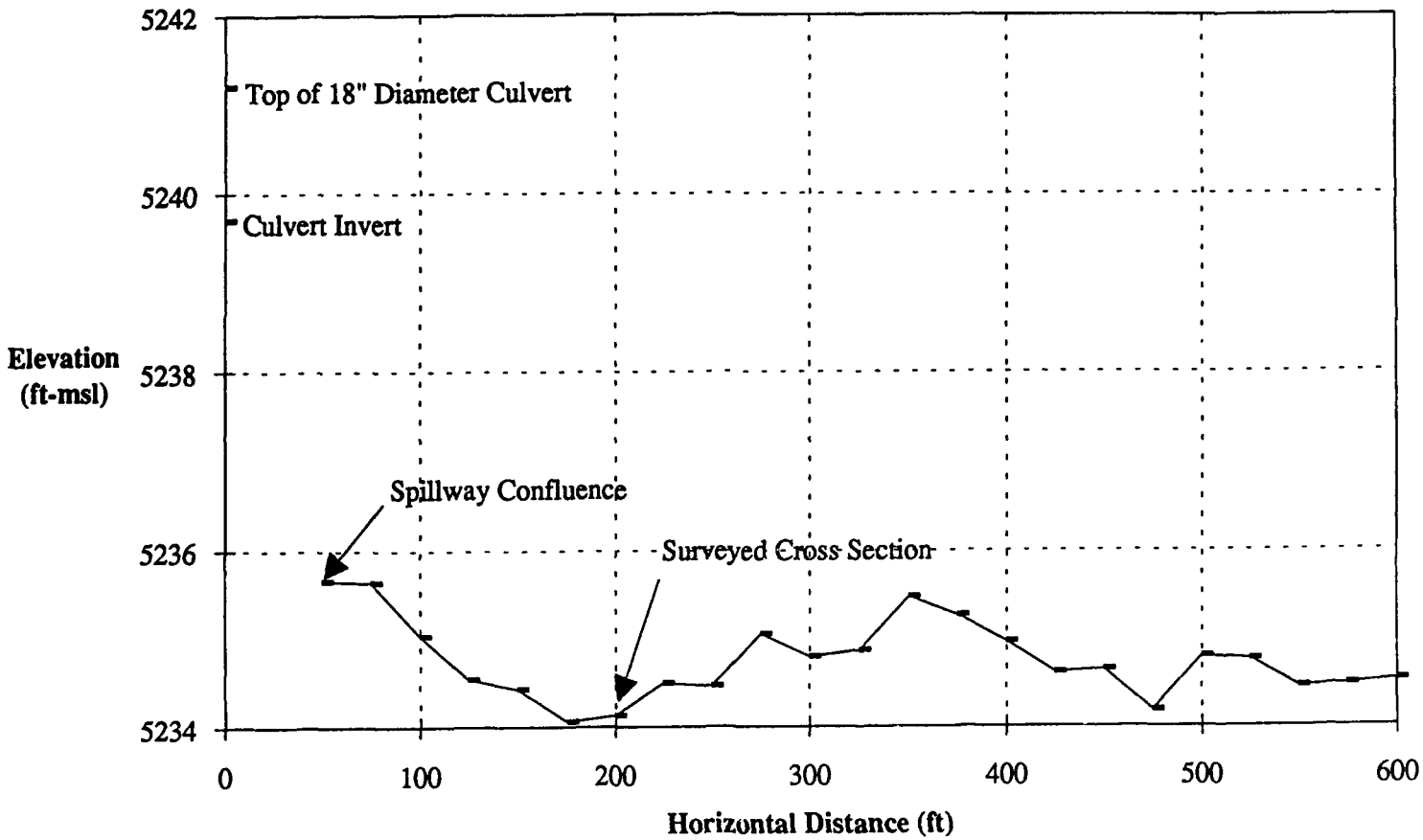
Vertical control was established by referencing to an existing temporary bench mark (TBM) located at or near each structure. Each TBM is permanently secured such that additional or future surveys can be referenced to the same elevation. The need to do additional surveying may arise as a result of flooding which could cause changes in channel geometry, from aggredation or degradation of the stream channel bottom as a result of increased or decrease sediment transport, and from modifications or changes in the control structure, staff location or staff elevation.

Each stream cross section was referenced either to the TBM or an established pin at the nearest upstream or downstream cross section to maintain vertical control. All rod readings were recorded to the nearest 0.005 feet. For each surveying instrument location, a backsight and foresight to established pins was recorded. All level loops were closed on the original TBM at each location, with an allowable vertical closure error not-to-exceed 0.01 feet. An end-to-end test or "peg test" was conducted on the surveying instrument each day prior to use to ensure instrument accuracy.

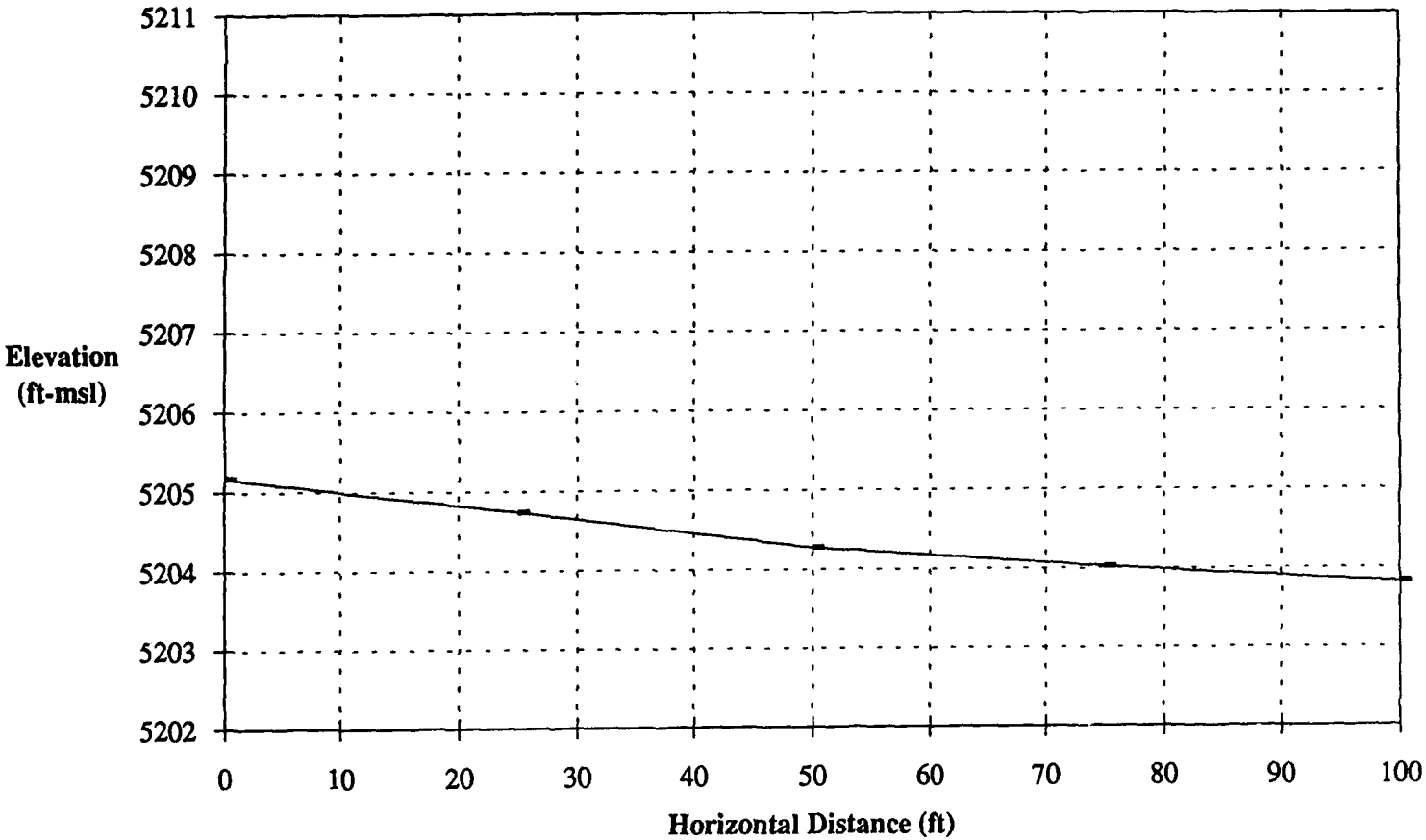
Horizontal control was established by driving 5/8-inch rebar stakes (pins) at the endpoints of each cross section. The pins serve as reference locations for each cross section and may be used for future surveys, if required. Each pin was tagged with aluminum tags etched with the station identification, pin identification and date. Pins were positioned on both sides of the stream channel perpendicular to flow lines in the stream. The location of the pins is high enough such that a wide range of high flows will be contained within the surveyed cross sections. Each pin was hammered into the ground approximately 1.5 feet. The remaining 0.5 feet was painted orange and tagged with orange surveyor's flagging for ease of locating in the future. For step-backwater modeling purposes, baseline and azimuth measurements were not required. Since all cross sections were staked and identified, horizontal control with reference to magnetic north can easily be obtained by additional surveys.

All cross sections were surveyed from left to right looking in a downstream direction. Horizontal stations were determined to the nearest 0.1 feet using a cloth tape stretched between the pins. Horizontal stationing was determined for all slope breaks along each cross section, for the left and right overbank reaches, left and right channel banks, left and right edge of water and for the thalweg of each cross section. Additionally, the water surface elevation at each cross section were determined to compute the energy grade of a particular reach.

SAND CREEK LATERAL
(LONGITUDINAL PROFILE)



LADORA LAKE SPILLWAY
(LONGITUDINAL PROFILE)



APPENDIX A-2

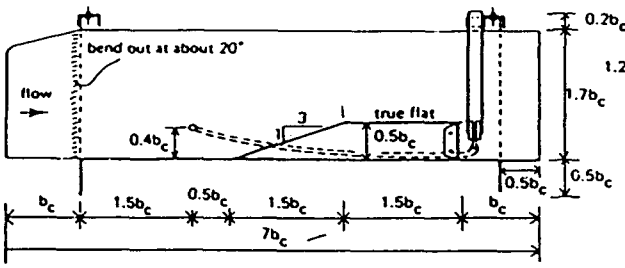
INSTANTANEOUS DISCHARGE MEASUREMENTS

APPENDIX A-2.1

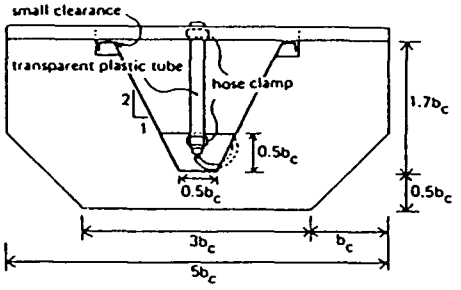
FLUME SPECIFICATIONS

VIEWS

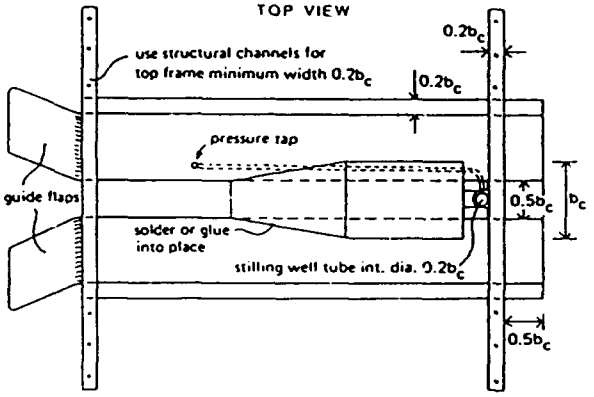
LONGITUDINAL SECTION



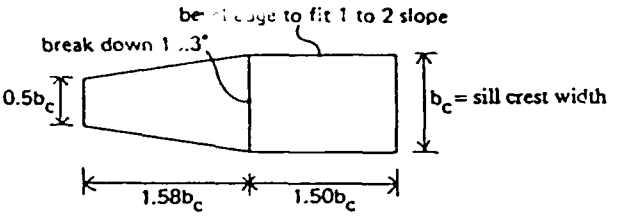
END VIEW



TOP VIEW



TOP VIEW SILL DETAIL



100 mm Flume	200 mm Flume
b_c = 100 mm = 3.94 in	b_c = 200 mm = 7.87 in

Prepared for :
U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

Prepared by :
R.L. Stollar & Associates, Inc.
Riverside Technology, Inc.

Figure. A-2.1-1
100mm and 200mm
Long-Throated Flume
Specifications
CMP SW FY 90

Appendix A-2.1

Table A-2.1-1 Head Discharge Relationship for 100 mm Portable Long-Throated Flume

h (ft)	Q (cfs)
0.04	0.0078
0.05	0.0113
0.06	0.0153
0.07	0.0198
0.08	0.0247
0.09	0.0301
0.10	0.0360
0.11	0.0424
0.12	0.0492
0.13	0.0565
0.14	0.0643
0.15	0.0726
0.16	0.0814
0.17	0.0907
0.18	0.1004
0.19	0.1107
0.20	0.1214
0.21	0.1327
0.22	0.1445
0.23	0.1568
0.24	0.1697
0.25	0.1831
0.26	0.1970
0.27	0.2114
0.28	0.2264
0.39	0.2420
0.30	0.2582
0.31	0.2748
0.32	0.2921
0.33	0.3099

(1) Design and ratings taken from "Flow Measuring Flumes for Open Channel Systems"; Marinus G. Bos, John A. Repogle, Albert J. Clemmens, 1984 by John Wiley & Sons, Inc.

(2) "h" is upstream sill - referenced head.

Appendix A-2.1

Table A-2.1-2 Head Discharge Relationship for Long-Throated Portable Flume with 0.66 ft (200 mm) wide sill (1)

h (ft)	Q (cfs)	h (ft)	Q (cfs)
0.07	0.0367	0.37	0.6008
0.08	0.0456	0.38	0.6303
0.09	0.0552	0.39	0.6606
0.10	0.0655	0.40	0.6915
0.11	0.0765	0.41	0.7232
0.12	0.0883	0.42	0.7557
0.13	0.1007	0.43	0.7887
0.14	0.1137	0.44	0.8226
0.15	0.1275	0.45	0.8572
0.16	0.1419	0.46	0.8927
0.17	0.1570	0.47	0.9288
0.18	0.1727	0.48	0.9656
0.19	0.1891	0.49	0.9656
0.20	0.2062	0.50	1.042
0.21	0.2240	0.51	1.081
0.22	0.2424	0.52	1.121
0.23	0.2615	0.53	1.161
0.24	0.2813	0.54	1.203
0.25	0.3017	0.55	1.245
0.26	0.3229	0.56	1.288
0.27	0.3447	0.57	1.332
0.28	0.3672	0.58	1.376
0.29	0.3903	0.59	1.422
0.30	0.4142	0.60	1.468
0.31	0.4387	0.61	1.515
0.32	0.4640	0.62	1.563
0.33	0.4900	0.63	1.611
0.34	0.5167	0.64	1.661
0.35	0.5440	0.65	1.711
0.36	0.5721	0.66	1.762

(1) Design and ratings taken from "Flow Measuring Flumes for Open Channel Systems"; Marinus G. Bos, John A. Repogle, Albert J. Clemmens, 1984 by John Wiley & Sons, Inc.

(2) "h" is upstream sill - referenced head.

APPENDIX A-2.2

DISCHARGE MEASUREMENT PROCEDURES

A-2.2 Marsh McBirney Meter and Long-Throated Flume Discharge Measurement Procedures

The Marsh-McBirney current meter is a factory calibrated electromagnetic-type meter and cannot be adjusted in the field. However, the battery, the electromagnetic sensor and internal electrical circuitry was checked. In addition to the above field inspection procedures, the manufacturer's suggested instructions for routine care and maintenance were followed.

The following procedures were implemented to measure and calculate current meter instantaneous discharge rates:

- A measuring tape was stretched across the stream at right angles to the direction of flow to determine the width of the stream and to be used in the measurement of each flow cell.

- The spacing of the subsections (flow cells) was generally made by dividing the total width of the stream into 20 subsections. Sections were usually chosen so that no section contained more than 10 percent of the total flow. Equal widths (subsections) across a cross section were used. For stream locations where 20 sections were not possible, a minimum distance of 0.3 feet between subsections was generally used.

- Recording stream stage from the staff gage and the recorder (if present). Identifying the starting point by either LEW or REW (left edge of water or right edge of water, respectively, when facing downstream). Recording the staff gage reading and time before, during and after discharge measurements in order to determine the mean gage height.

- Recording the distance from the initial measuring point to the edge of water and the depth at the edge of water.

- Stream depth measurements were made at 0.6 depth using a top setting wading rod. This rod is masked so as to automatically suspend the current meter at 0.6 depth by "setting" the total depth on the wading rod.

- After the meter was set at the proper depth, it was allowed to stabilize to the stream current. The wading rod was kept in a vertical position and the current meter was held parallel to

the direction of flow. The hydrologist stood in a position that least affected the velocity of the water passing the current meter by standing downstream and off to one side of the rod.

- The measuring and recording of flow velocity using the Marsh McBirney current meter was performed in accordance with the manufacturer's instructions. The minimum time for measuring velocity in each subsection was 20 seconds. Stream velocity meter measurements were obtained directly from the analog meter on the instrument.

- Upon completion of the measurement the time, stream stage and recorder readings were recorded on the discharge measurement sheet.

- The description of the stream bed, flow conditions, location of the measurement, weather and any other pertinent information which may have affected the accuracy of the measurement or the stage discharge relationship was recorded on the discharge measurement sheet.

- Each stream subsection area was calculated and multiplied by the corresponding stream velocity to determine subsection discharge. The subsection discharges were totalled to determine instantaneous discharge.

Long-Throated Flume Discharge Measurement Procedure

Instantaneous discharge measurements are taken using either the 100mm or 200mm long-throated flumes depending on stream stage and flow conditions. The 100mm flume is capable of measuring flows ranging from 0.0078 cfs to 0.3099 cfs, and the 200mm flume is capable of measuring flows ranging from 0.0367 cfs to 1.762 cfs.

Both flumes are custom built, galvanized sheetmetal rated structures. A water intake port in the flume channel is hydraulically connected to a clear plastic stilling well that is attached to the structure. The water level in the flume channel is measured as hydraulic head in the stilling well. The structures are mathematically rated, which enables a conversion of the measured hydraulic head to a corresponding discharge.

Procedures for obtaining instantaneous discharge measurements with either the 100mm or 200mm long-throated flumes are as follows:

- Select a site in the channel for the flume. This site should be in a reach of the channel that is straight both upstream and downstream of the flume site. The channel should be free of obstructions and have uniform flow.

- Record gage height (if available) and time in the log book and on the data sheet.

- Prepare the channel at the flume site by removing any rocks or debris which will interfere with leveling and sealing of the flume during installation.

- Install the flume in the channel making sure the flume is stable and level. Leveling of the cross-slope and longitudinal slope may be done with a carpenter's level.

- Seal the bottoms and sides of both the upstream and downstream faces of the wingwalls of the flume with soil. The flume must be completely sealed so that all flow is diverted through the flume for an accurate measurement.

- Allow the flow to stabilize over the sill of the flume. Check for leaks around the edges and bottom of the flume and seal if necessary.

- Obtain the sill-referenced head by measuring the distance from the top of the sill to the water level in the stilling well with a metal tape measure.

- For each of flume size, a rating table was prepared (see stage discharge relationship tables). Using the proper rating table, find the h value, in feet, and record the corresponding discharge value, in cfs. The head, discharge, time and gage height (if available) are recorded in the log book and on the data sheet. Generally, there are three discharge measurements taken at five minute intervals at each site.

APPENDIX A-2.3

WY90 INSTANTANEOUS DISCHARGE MEASUREMENTS SUMMARY

APPENDIX A-2.3 TABLE A-2.3-1
SUMMARY OF DISCHARGE MEASUREMENTS FOR MONITORING STATIONS AND SAMPLING LOCATIONS

SITE ID#	SITE NAME	DATE	INSTRUMENT TYPE	DISCHARGE (CFS)	STAFF GAGE HEIGHT (FT) START/STOP	COMMENTS
SW01001	NORTH UVALDA	04/17/90	FLUME-100MM	0.04	0.23/0.26	30 FT BELOW GAGE
		06/15/90	CURRENT METER	19.87	2.23/2.02	40 FT BELOW GAGE
		06/18/90	CURRENT METER	14.38	1.78/1.70	20 FT ABOVE GAGE
		06/19/90	CURRENT METER	9.20	1.29/1.25	25 FT ABOVE GAGE
		06/21/90	CURRENT METER	10.60	1.29/1.30	20 FT ABOVE GAGE
		06/22/90	CURRENT METER	12.55	1.42/1.42	20 FT ABOVE GAGE
		07/08/90	FLUME-100MM	0.14	0.24/0.24	120 FT BELOW GAGE
		07/09/90	FLUME-100MM	0.14	0.23/0.22	120 FT BELOW GAGE
		07/16/90	FLUME-100MM	0.02	0.19/0.19	80 FT BELOW GAGE
		08/28/90	FLUME-100MM	0.02	0.18/0.18	60 FT BELOW GAGE
		09/06/90	FLUME-100MM	0.07	0.23/0.23	60 FT BELOW GAGE
SW02001	LADORA WEIR	06/22/90	CURRENT METER	11.50	4.72/4.72	25 FT BELOW GAGE
		06/26/90	FLUME-100MM	0.09	4.16/4.16	40 FT BELOW GAGE
		07/03/90	FLUME-100MM	0.09	4.15/4.15	30 FT BELOW GAGE
		07/09/90	FLUME-100MM	0.09	4.15/4.15	30 FT BELOW GAGE
		09/05/90	FLUME-100MM	6.23	3.78/3.78	20 FT BELOW NEW GAGE
		09/05/90	FLUME-100MM	5.42	3.78/3.78	20 FT BELOW NEW GAGE
SW02006	STEAM PLANT EFFLUENT	10/04/89	FLUME-200MM	0.26	NA	80 FT NORTH OF ROAD
		04/19/90	FLUME-100MM	0.07	NA	80 FT NORTH OF ROAD
		09/04/90	FLUME-200MM	0.39	NA	80 FT NORTH OF ROAD
SW05001	SOUTH FIRST CREEK(OLD)	06/21/90	FLUME-200MM	0.89	0.65/0.65	5 FT ABOVE GAGE
		06/27/90	FLUME-200MM	0.17	0.49/0.49	10 FT ABOVE GAGE
SW05002		04/23/90	FLUME-200MM	1.04	NA	600 FT ABOVE F ST.
SW06001		04/23/90	FLUME-200MM	1.04	NA	300 FT ABOVE CULVERT
SW06002	EAST UPPER DERBY DITCH	07/18/90	FLUME-200MM	0.26	NA	CONFLUENCE AT FIRST CREEK
		07/18/90	FLUME-200MM	0.17	NA	CONFLUENCE AT FIRST CREEK
		07/27/90	FLUME-200MM	0.60	NA	CONFLUENCE AT FIRST CREEK
SW06003		07/16/90	CURRENT METER	2.36	NA	20 FT BELOW LAKE OUTLET
		07/18/90	CURRENT METER	2.93	NA	20 FT BELOW LAKE OUTLET
		07/26/90	CURRENT METER	3.43	NA	20 FT BELOW LAKE OUTLET
		07/22/90	CURRENT METER	4.64	NA	20 FT BELOW LAKE OUTLET
SW08001	SOUTH FIRST CREEK BOUNDARY	04/23/90	FLUME-200MM	0.89	4.19/4.19	225 FT BELOW CULVERT
		05/21/90	FLUME-200MM	1.08	4.24/4.24	225 FT BELOW CULVERT
		06/27/90	FLUME-100MM	0.21	BG	225 FT BELOW CULVERT
		09/12/90	FLUME-200MM	0.54	BG	225 FT BELOW CULVERT

APPENDIX A-2.3 TABLE A-2.3-1
SUMMARY OF DISCHARGE MEASUREMENTS FOR MONITORING STATIONS AND SAMPLING LOCATIONS

SITE ID#	SITE NAME	DATE	INSTRUMENT TYPE	DISCHARGE (CFS)	STAFF GAGE HEIGHT (FT) START/STOP	COMMENTS
SW08003	SOUTH FIRST CREEK	10/03/89	FLUME-100MM	0.09	0.22/0.22	40 FT BELOW GAGE
		11/24/89	FLUME-200MM	0.63	0.46/0.46	40 FT BELOW GAGE
		01/09/90	FLUME-200MM	0.97	0.48/0.48	40 FT BELOW GAGE
		02/06/90	FLUME-200MM	0.79	0.47/0.47	20 FT BELOW WEIR
		03/09/90	CURRENT METER	2.36	0.76/0.76	25 FT BELOW WEIR
		04/18/90	FLUME-200MM	1.08	0.52/0.52	30 FT BELOW WEIR
		04/23/90	FLUME-200MM	0.97	0.50/0.50	40 FT BELOW GAGE
		05/08/90	FLUME-200MM	0.79	0.45/0.45	40 FT BELOW GAGE
		05/15/90	FLUME-200MM	0.76	0.45/0.45	35 FT BELOW GAGE
		05/22/90	CURRENT METER	0.75	0.45/0.45	25 FT BELOW WEIR
		05/29/90	FLUME-200MM	0.52	0.36/0.36	30 FT BELOW GAGE
		05/30/90	FLUME-200MM	2.66	0.79/0.78	40 FT BELOW GAGE
		06/21/90	FLUME-200MM	1.25	0.54/0.54	40 FT BELOW GAGE
		06/27/90	FLUME-200MM	0.24	0.27/0.26	40 FT BELOW GAGE
		07/09/90	FLUME-100MM	0.03	0.12/0.12	40 FT BELOW GAGE
		07/24/90	FLUME-100MM	0.24	0.26/0.26	20 FT BELOW WEIR
		08/14/90	FLUME-100MM	0.04	0.09/0.09	40 FT BELOW GAGE
		08/22/90	CURRENT METER	1.60	0.58/0.57	70 FT BELOW GAGE
		09/07/90	FLUME-100MM	0.17	0.21/0.21	100 FT BELOW GAGE
		09/12/90	FLUME-200MM	0.52	0.34/0.39	50 FT BELOW WEIR
		09/24/90	FLUME-200MM	0.69	0.51/0.50	100 FT BELOW GAGE
SW08004	FIRST CREEK RETENTION POND AREA	04/23/90	FLUME-200MM	1.08	NA	150 FT ABOVE POND
		06/21/90	FLUME-200MM	0.97	NA	150 FT ABOVE POND
		06/27/90	FLUME-200MM	0.17	NA	150 FT ABOVE POND
SW11001	PEORIA INTERCEPTOR	10/04/89	FLUME-100MM	0.02	0.43/0.43	75 FT BELOW GAGE, AND -0.20 STAFF GAGE OFFSET
		01/30/90*	1 LITER BOTTLE	0.09	0.44/0.46	V-NOTCH ON WEIR
		01/30/90*	FLUME-100MM	0.01	0.47/0.48	50 FT BELOW GAGE
		03/06/90*	CURRENT METER	5.29	1.12/1.35	50 FT ABOVE GAGE
		03/13/90*	CURRENT METER	6.58	1.12/1.26	20 FT ABOVE WEIR
		03/20/90*	FLUME-100MM	0.02	0.47/0.47	60 FT BELOW GAGE
		04/16/90*	FLUME-100MM	0.01	0.41/0.41	100 FT BELOW GAGE
		06/06/90*	CURRENT METER	0.45	0.48/0.48	100 FT BELOW GAGE
		06/12/90*	FLUME-100MM	0.03	0.53/0.52	100 FT BELOW GAGE
		06/19/90*	FLUME-100MM	0.10	0.58/0.56	30 FT BELOW GAGE
		06/22/90*	FLUME-100MM	0.03	0.53/0.53	30 FT BELOW GAGE
		06/26/90*	FLUME-100MM	0.05	0.54/0.53	30 FT BELOW GAGE
		07/17/90*	FLUME-200MM	0.08	0.57/0.57	40 FT BELOW GAGE
		09/04/90*	5 GALLON BUCKET	0.04	0.52/0.52	V-NOTCH ON WEIR, STAFF GAGE AT ORIGINAL POSITION

* STAFF GAGE HEIGHTS CALCULATED USING (CR-10 VALUE X 1.04) + 0.07
1.04 = REFERENCE DIFFERENTIAL
0.07 = SURVEYED DIFFERENCE BETWEEN BUBBLER ORIFICE AND 0.00 MARK ON ORIGINAL STAFF GAGE

APPENDIX A-2.3 TABLE A-2.3-1
SUMMARY OF DISCHARGE MEASUREMENTS FOR MONITORING STATIONS AND SAMPLING LOCATIONS

SITE ID#	SITE NAME	DATE	INSTRUMENT TYPE	DISCHARGE (CFS)	STAFF GAGE HEIGHT (FT) START/STOP	COMMENTS
SW11002	HAVANA INTERCEPTOR*	10/04/89	FLUME-200MM	0.30	0.21/0.20	500 FT BELOW GAGE
		01/23/90	FLUME-200MM	0.24	0.63/0.75	100 FT BELOW CONCRETE
		01/30/90	FLUME-100MM	0.05	0.12/0.16	100 FT BELOW CONCRETE
		03/06/90	CURRENT METER	14.30	0.75/0.56	1000 FT BELOW GAGE
		03/13/90	CURRENT METER	22.55	0.86/0.92	1000 FT BELOW GAGE
		04/16/90	FLUME-100MM	0.02	0.12/0.11	300 FT BELOW CONCRETE
		05/15/90	FLUME-200MM	0.49	0.26/0.24	150 FT BELOW CONCRETE
		06/06/90	CURRENT METER	0.80	0.16/0.15	50 FT BELOW CONCRETE
		06/12/90	CURRENT METER	0.52	0.15/0.15	200 FT BELOW CONCRETE
		06/19/90	FLUME-200MM	0.54	0.24/0.24	200 FT BELOW CONCRETE
		06/22/90	FLUME-200MM	0.30	0.22/0.21	60 FT BELOW CONCRETE
		06/26/90	FLUME-200MM	0.21	0.22/0.21	100 FT BELOW CONCRETE
		07/29/90	CURRENT METER	158.11	3.32/2.15	10 FT BELOW BUBBLER
		07/09/90	CURRENT METER	61.13	1.70/1.58	10 FT BELOW BUBBLER
		07/1[illegible]/90	FLUME-100MM	0.23	0.22/0.21	END OF CONCRETE
		08/14/90	FLUME-200MM	0.32	0.22/0.21	END OF CONCRETE
		0[illegible]/05/90	5 GALLON BUCKET	0.39	0.26/0.23	END OF CONCRETE
		* STAFF GAGE HEIGHT = CR-10 VALUE				
SW12001	UVALDA DITCH C	04/13/90	FLUME-200MM	0.69	NA	300 FT EAST OF UVALDA
		09/06/90	FLUME-200MM	0.26	NA	300 FT EAST OF UVALDA
SW12004	STORM SEWER	03/08/90	CURRENT METER	0.97	NA	50 FT BELOW CULVERT
SW12005	SOUTH UVALDA	10/04/90	FLUME-200MM	0.30	0.49/0.49	40 FT BELOW GAGE
		01/09/90	FLUME-200MM	0.52	0.54/0.56	40 FT BELOW GAGE
		02/06/90	FLUME-200MM	0.30	0.49/0.49	40 FT BELOW GAGE
		03/08/90	CURRENT METER	3.74	1.06*	25 FT BELOW GAGE
		03/13/90	CURRENT METER	3.52	1.02*	25 FT BELOW WEIR
		03/29/90	FLUME-200MM	0.44	0.57*	40 FT BELOW GAGE
		04/16/90	FLUME-200MM	0.39	0.53/0.52	50 FT BELOW WEIR
		05/15/90	FLUME-200MM	0.49	0.56/0.56	55 FT BELOW GAGE
		06/12/90	FLUME-200MM	0.34	0.52/0.50	40 FT BELOW GAGE
		06/22/90	FLUME-100MM	0.31	0.51/0.51	50 FT BELOW GAGE
		08/28/90	FLUME-100MM	0.29	0.54/0.55	50 FT BELOW GAGE
		09/06/90	FLUME-200MM	0.44	0.55/0.55	80 FT BELOW GAGE
		* STAFF GAGE HEIGHT ESTIMATED FROM CR-10 VALUE				
SW12006	ARMY RESERVE STORM SEWER	07/21/90	FLUME-100MM	0.16	NA	30 FT BELOW CULVERT

APPENDIX A-2.3 TABLE A-2.3-1
SUMMARY OF DISCHARGE MEASUREMENTS FOR MONITORING STATIONS AND SAMPLING LOCATIONS

SITE ID#	SITE NAME	DATE	INSTRUMENT TYPE	DISCHARGE (CFS)	STAFF GAGE HEIGHT (FT) START/STOP	COMMENTS
SW12007	HIGHLINE LATERAL	05/15/90*	CURRENT METER	7.95	0.43/0.43	15 FT ABOVE GAGE
		05/15/90*	CURRENT METER	7.63	0.44/0.44	15 FT ABOVE GAGE
		05/16/90*	CURRENT METER	8.16	0.50/0.51	20 FT ABOVE GAGE
		06/06/90*	CURRENT METER	14.58	0.64/0.63	15 FT ABOVE GAGE
		06/11/90	CURRENT METER	15.70	0.65/0.67	15 FT ABOVE GAGE
		06/11/90	CURRENT METER	15.66	0.67/0.65	15 FT ABOVE GAGE
		06/13/90	CURRENT METER	17.23	0.72/0.70	10 FT ABOVE GAGE
		06/13/90	CURRENT METER	19.21	0.79/0.73	10 FT ABOVE GAGE
		06/14/90	CURRENT METER	15.35	0.63/0.61	10 FT ABOVE GAGE
		06/15/90	CURRENT METER	21.24	0.75/0.73	15 FT ABOVE GAGE
		06/18/90	CURRENT METER	15.99	0.69/0.65	15 FT ABOVE GAGE
		06/19/90	CURRENT METER	6.30	0.40/0.36	15 FT ABOVE GAGE
		06/21/90	CURRENT METER	9.98	0.50/0.50	10 FT ABOVE GAGE
		06/22/90	CURRENT METER	12.66	0.57/0.56	15 FT ABOVE GAGE
		07/16/90	CURRENT METER	14.49	0.61/0.63	15 FT ABOVE GAGE
		07/17/90	CURRENT METER	10.80	0.54/0.52	15 FT ABOVE GAGE
		07/18/90	FLUME-200MM	0.05	BELOW GAGE	30 FT ABOVE GAGE
		07/26/90	CURRENT METER	16.40	0.64/0.66	20 FT ABOVE GAGE
		07/27/90	CURRENT METER	13.62	0.60/0.60	20 FT ABOVE GAGE
		08/22/90	CURRENT METER	13.41	0.60/0.60	17 FT ABOVE GAGE
		* STAFF GAGE HEIGHT CALCULATED WITH -0.85 OFFSET TO CORRECT TO NEW STAFF GAGE				
SW24001	SEWAGE TREATMENT PLANT	04/17/90	FLOOR METER	22.2	NA	VARIABLE FLOW
		09/06/90	FLOOR METER	0.04	NA	VARIABLE FLOW
SW24002	NORTH FIRST CREEK	01/16/90	FLUME-100MM	0.02	0.62/0.62	50 FT BELOW GAGE
		02/20/90	FLUME-100MM	0.17	0.77/0.77	40 FT BELOW GAGE
		03/09/90	CURRENT METER	4.07	1.50/1.48	30 FT BELOW GAGE
		03/20/90	CURRENT METER	1.63	1.21/1.20	50 FT BELOW GAGE
		03/27/90	FLUME-200MM	1.29	1.17/1.17	30 FT BELOW GAGE
		04/18/90	FLUME-200MM	1.12	1.12/1.12	30 FT BELOW WEIR
		04/23/90	FLUME-200MM	1.08	1.13/1.12	50 FT BELOW GAGE
		05/08/90	FLUME-200MM	0.66	1.01/1.02	30 FT BELOW GAGE
		05/15/90	FLUME-200MM	0.72	1.04/1.03	50 FT BELOW GAGE
		05/29/90	FLUME-200MM	0.19	0.81/0.81	40 FT BELOW GAGE
		05/30/90	CURRENT METER	1.04	1.10/1.11	27 FT BELOW GAGE
		08/22/90	CURRENT METER	1.80	1.32/1.32	55 FT BELOW GAGE
		09/24/90	FLUME-200MM	1.04	1.12/1.12	80 FT BELOW GAGE
SW24004	NORTH FIRST CREEK BOUNDARY	04/23/90	CURRENT METER	1.34	NA	25 FT BELOW CULVERT
SW26001	BASIN F	03/13/90	FLUME-200MM	0.03	4.43/4.43	NEXT TO GAGE
		08/19/90	FLUME-200MM	0.57	4.74/4.76	NEXT TO GAGE

APPENDIX A-2.3 TABLE A-2.3-1
SUMMARY OF DISCHARGE MEASUREMENTS FOR MONITORING STATIONS AND SAMPLING LOCATIONS

SITE ID#	SITE NAME	DATE	INSTRUMENT TYPE	DISCHARGE (CFS)	STAFF GAGE HEIGHT (FT) START/STOP	COMMENTS
SW30002	NORTH PLANT DITCH CONFLUENCE	04/23/90	FLUME-200MM	1.20	NA	2 FT BELOW CONF.
		06/28/90	FLUME-100MM	0.03	NA	3 FT BELOW CONF.
SW31001	TOXIC STORAGE YARD DITCH	04/23/90	FLUME-200MM	1.20	NA	20 FT BELOW CONF.
SW36001	BASIN A	04/19/90	FLUME-100MM	0.01	BG	30 FT BELOW CULVERT
		06/22/90	FLUME-100MM	0.09	0.16/0.14	15 FT BELOW GAGE
		06/26/90	FLUME-100MM	0.04	0.15/0.15	15 FT BELOW GAGE
		07/18/90	FLUME-100MM	0.02	NA	80 FT ABOVE GAGE
		08/01/90	FLUME-100MM	0.02	NA	30 FT BELOW CULVERT
		08/28/90	FLUME-100MM	0.02	NA	40 FT BELOW CULVERT
		09/05/90	FLUME-100MM	0.03	NA	45 FT BELOW CULVERT
SW37001	FIRST CREEK OFF-POST	11/07/89	FLUME-100MM	0.02	0.60/0.60	15 FT BELOW GAGE
		11/14/89	FLUME-100MM	0.02	0.60/0.60	15 FT BELOW GAGE
		11/24/89	FLUME-100MM	0.02	0.61/0.61	25 FT BELOW GAGE
		11/28/89	FLUME-100MM	0.05	0.64/0.64	25 FT BELOW GAGE
		03/09/90	CURRENT METER	4.49	1.35/1.36	20 FT ABOVE FLUME
		04/18/90	FLUME-200MM	0.97	0.97/0.97	30 FT BELOW GAGE
		04/23/90	FLUME-200MM	0.97	0.98/0.98	25 FT BELOW GAGE
		06/06/90	CURRENT METER	0.32	0.70/0.70	8 FT BELOW WEIR
		06/19/90	FLUME-100MM	0.02	0.67/0.67	100 FT ABOVE GAGE
		06/26/90	FLUME-100MM	0.02	0.63/0.63	150 FT ABOVE GAGE
		06/28/90	FLUME-100MM	0.01	0.62/0.62	60 FT ABOVE GAGE
		08/22/90	CURRENT METER	3.99	1.26/1.26	10 FT ABOVE FLUME
		09/07/90	FLUME-100MM	0.05	0.65/0.65	120 FT ABOVE GAGE
		09/25/90	FLUME-100MM	0.04	0.68/0.68	80 FT ABOVE GAGE
SW37010	OFF-POST FIRST CREEK	06/28/90	FLUME-100MM	0.02	NA	1300 FT ABOVE SW37001
SW37011	OFF-POST FIRST CREEK	06/28/90	FLUME-100MM	0.10	NA	2600 FT ABOVE SW37001
SW37012	OFF-POST FIRST CREEK	06/28/90	FLUME-100MM	0.17	NA	3900 FT ABOVE SW37001

APPENDIX A-3

RATING CURVES

APPENDIX A-3.1

RATING CURVE DEVELOPMENT PROCEDURES

Appendix A-3.1 Rating Curve Development Procedures

The development of rating curves at RMA is based on the relationship of stage to discharge, is usually controlled by a section or reach of channel known as a station control and is located immediately downstream from a gage. Station controls at RMA are divided into three types: channel control, section control, and compound control. Channel control exists when the physical features of a long reach of channel are the elements that control the stage-discharge relationship. Section control can be artificial or natural but must have physical features such as a weir, flume, or rock ledge outcrop, within a single cross section that maintains a stable relationship between stage and discharge. A compound control is a situation where no single control is effective for the entire range of experienced stages. Compound controls typically exhibit section control at lower stages and channel control at medium to high stages as section control features become submerged (Rantz, 1982).

Two different criteria were used to confirm the permanence and/or follow shifts in the rating curve. These criteria are as follows:

- Instantaneous discharge measurements made during the 1989 water year must be within ± 5 percent of the rating curve discharge corresponding to the same gage height in order to confirm the permanence of the rating curve.

- For low-flow measurements, the ± 5 percent criteria may be too stringent because of station control insensitivity; therefore, departures greater than ± 5 percent are acceptable and confirm the permanence of the rating curve if the indicated shift in stage does not exceed 0.02 feet.

A detailed analysis of each instantaneous discharge measurement made during the 1990 water year is presented in Appendix A-5.

The types of station control found at respective RMA gaging stations include:

- Channel Control
  -Havana Interceptor - concrete-lined channel

- Section Control
  -Highline Lateral - Cipolletti weir
  -Ladora Weir - standard suppressed rectangular weir

-Basin A - 90° V-notch weir

-First Creek Off-Post - concrete triangular-throated flume

-South Plants Ditch - 90° V-notch weir

-South First Creek - concrete V-notch weir

-North First Creek - concrete V-notch weir

-Basin F - 200 mm long-throated flume

- Compound Control

  -South Uvalda - compound V-notch weir

  -North Uvalda - compound V-notch weir

  -Peoria Interceptor - compound weir with a 90° V-notch and standard contracted rectangular weir

Channel Control Rating Development. The development of the rating curve for a channel control station would normally use a graphical analysis of discharge measurements plotted on logarithmic graph paper. Upon review of the discharge measurements made prior to the 1990 Water Year for the only channel control station, Havana Interceptor, all were rejected as unreliable for rating curve development. Therefore, the following analysis was previously performed to derive a rating curve for Havana Interceptor:

- A normal depth hydraulic analysis was performed using HEC-2 to predict gage height and corresponding discharges from channel geometry.

- The predicted discharges and gage heights were plotted on logarithmic paper. The discharge was on the ordinate and the gage height was on the abscissa.

- A curve of connected, straight line segments was visually fitted through the plotted points.

- Endpoint coordinates of each straight line segment were determined from the rating curve plot. A rating equation was derived in the form of a power curve (Rantz 1982).

The rating equation was of the form

$$Q = p(G - e)^N$$

where

Q = discharge in cubic feet per second (cfs);

G - e = head or depth of water on the control in feet;

G = the gage height of the water surface in feet;

e = gage height in feet of zero flow for a section control of regular shape; or the gage height of effective zero flow for a channel control or a section control of irregular shape;

p = regression coefficient (dimensionless); and

N = regression coefficient (dimensionless), generally not equal to p.

Section Control Rating Development. Laboratory-rated discharge-measurement structures have been installed at seven RMA stations (Highline Lateral, Ladora Weir, Basin A, South First Creek, North First Creek, First Creek Off-Post, and South Plants Ditch). These structures provide section control for the complete range of stages falling within the capacity of each structure. Each artificial control stabilizes and constricts the channel at a section and thereby simplifies the procedure for obtaining accurate records of discharge. Although these structures have been built in conformance with the dimensions of laboratory-rated weirs or flumes (the relationship of stage to discharge has been carefully measured under controlled conditions) differences between the model and prototype invariably exist, if only in approach-channel conditions (Rantz 1982). Therefore, instantaneous discharge measurements were made at artificial section-control stations to verify the rating curves prepared for the respective model structures.

It should be emphasized that the primary purpose of the artificial control structures was to measure flows within their capacities. Therefore, no attempt was made to determine the relationship of stage to discharge for stages and flows exceeding the capacity of the artificial section controls.

The laboratory rating for each structure was plotted along with the discharge measurements to verify that a correlation exists. These laboratory ratings are based on depth of water above the zero-reference of the structure. Since the field-measured staff gage heights do not generally equal the water depths above the zero-reference of the structures, an offset was subtracted from each staff gage height to obtain the plotted depth value. This offset (*e*) is the gage height (in feet) corresponding to zero flow for the existing control. The empirical curve was used if the discharge measurements consistently plotted on the empirical rating curve. For stations at RMA requiring modification of the empirical ratings, the verified stage-discharge measurements were plotted, and connected, straight line segments were fit to the plotted points. Regression analysis to fit a power curve was performed as previously described (Channel Control Rating Development) to obtain a calibrated rating curve and rating equations for the existing conditions of each structure. For the stations where zero on the staff gage does not correspond to zero flow, the rating equation will be of the form previously described in Channel Control Rating Development.

The datum plane at North First Creek was originally referenced to zero on the staff gage. To eliminate the possibility of minus values of gage height, the datum selected was changed to an elevation of zero flow over the artificial control. A permanent datum was selected so that only one datum for the gage-height record will be used for the remainder of the life of the station.

Compound Control Rating Development. The development of rating curves for the compound control stations (South Uvalda, North Uvalda, and Peoria Interceptor) utilized a procedure that was a combination of the procedures delineated in the previous two station control sections (Section Control Rating Development and Channel Control Rating Development). Additional considerations include the following:

- Discharge measurements were evaluated to determine if the measured discharges and corresponding staff readings could occur theoretically. This evaluation was conducted using HEC-2 to simulate the channel hydraulics. Discharge measurements that appeared invalid based upon the HEC-2 analysis were not used in the rating curve development.

- The rating curves required extrapolation beyond the range defined by discharge measurements for high flows. An analysis was performed using HEC-2 to determine if the transition from section control to channel control had occurred at the highest recorded stage. In all cases, this transition had not occurred. Further analysis demonstrated that it was inappropriate to use HEC-2 for the high-flow extrapolation.

  A hydraulic analysis using HEC-2 was attempted to predict the higher flows. (Note, however, that these higher flows are section controlled.) This was done by assuming critical depth at the control section and that normal depth would then occur at the gage section. The present stations were constructed such that there is insufficient distance between the gage section and the control section. The result is that normal depth occurs upstream of the gage section, therefore, yielding an unrealistic result.

- The high-flow extrapolation was done using the Manning equation:

$$Q = \frac{1.486}{n} AR^{2/3} S^{1/2}$$

where

Q = discharge (cfs);

n = Manning's channel roughness coefficient (dimensionless);

A = cross-sectional area (ft^2);

R = hydraulic radius = A/P;

P = wetted perimeter (ft); and

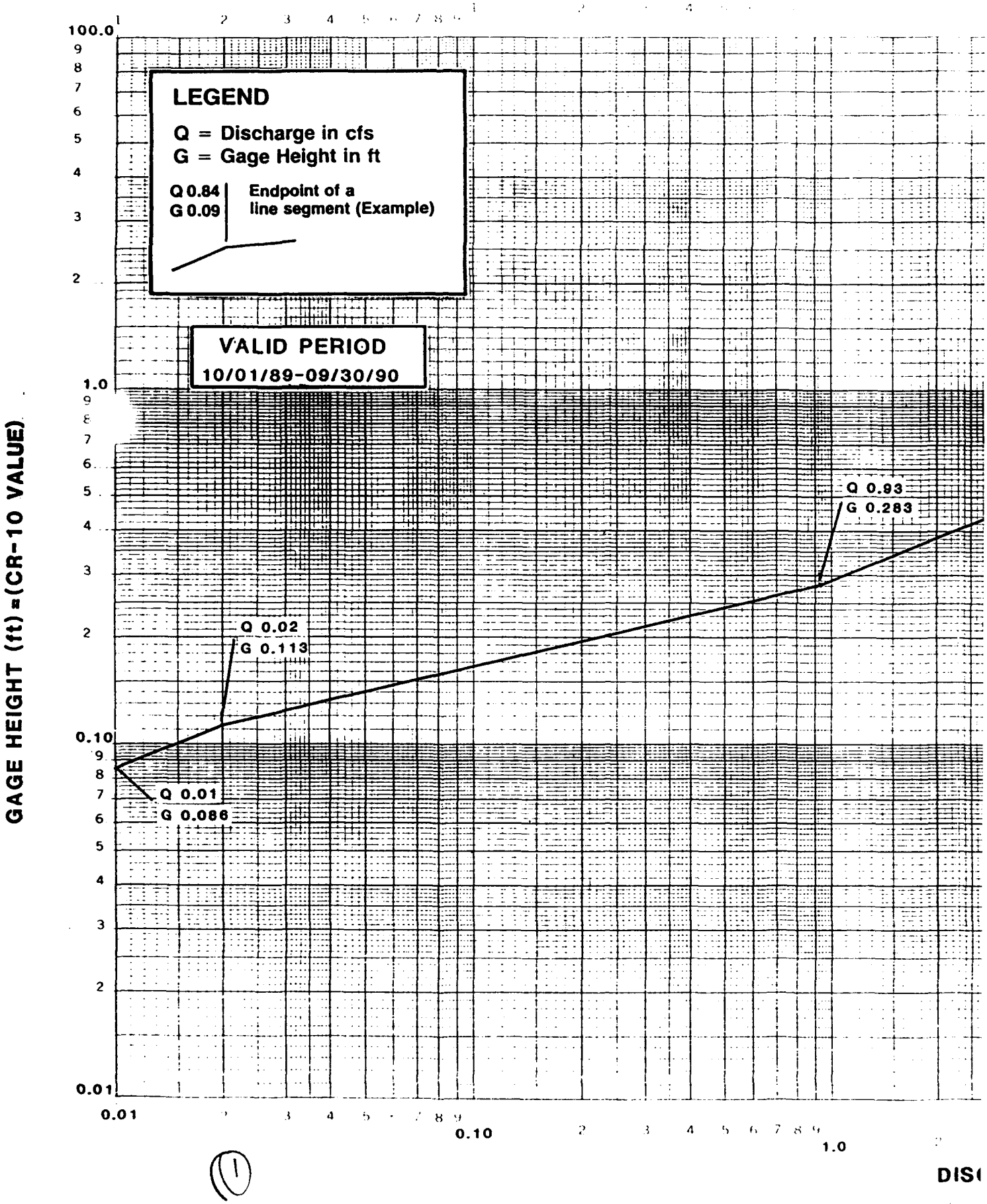
S = slope (ft/ft).

The channel cross-section geometry corresponding to the maximum recorded gage height was plotted from reach survey data to determine the cross-sectional area and wetted perimeter at the location of the staff gage. The slope of the corresponding stream surface energy gradient was not available. Since average streambed slope typically approaches the energy gradient at the higher stages (Rantz 1982), the average streambed slope was computed from contour maps or reach survey data for input to Manning's equation. The channel roughness coefficient, *n*, was determined from stage-discharge measurements and field observations of streambed and bank cover conditions. The calculated discharge was plotted on logarithmic paper, and regression analysis was performed on this line segment as previously described.

The datum plane for Peoria Interceptor was originally referenced to zero on the staff gage. To eliminate the possibility of minus values of gage height the datum selected was changed to an elevation of zero flow over the artificial control. A permanent datum was selected so that only one datum for the gage-height record will be used for the remainder of the life of the station.

APPENDIX A-3.2

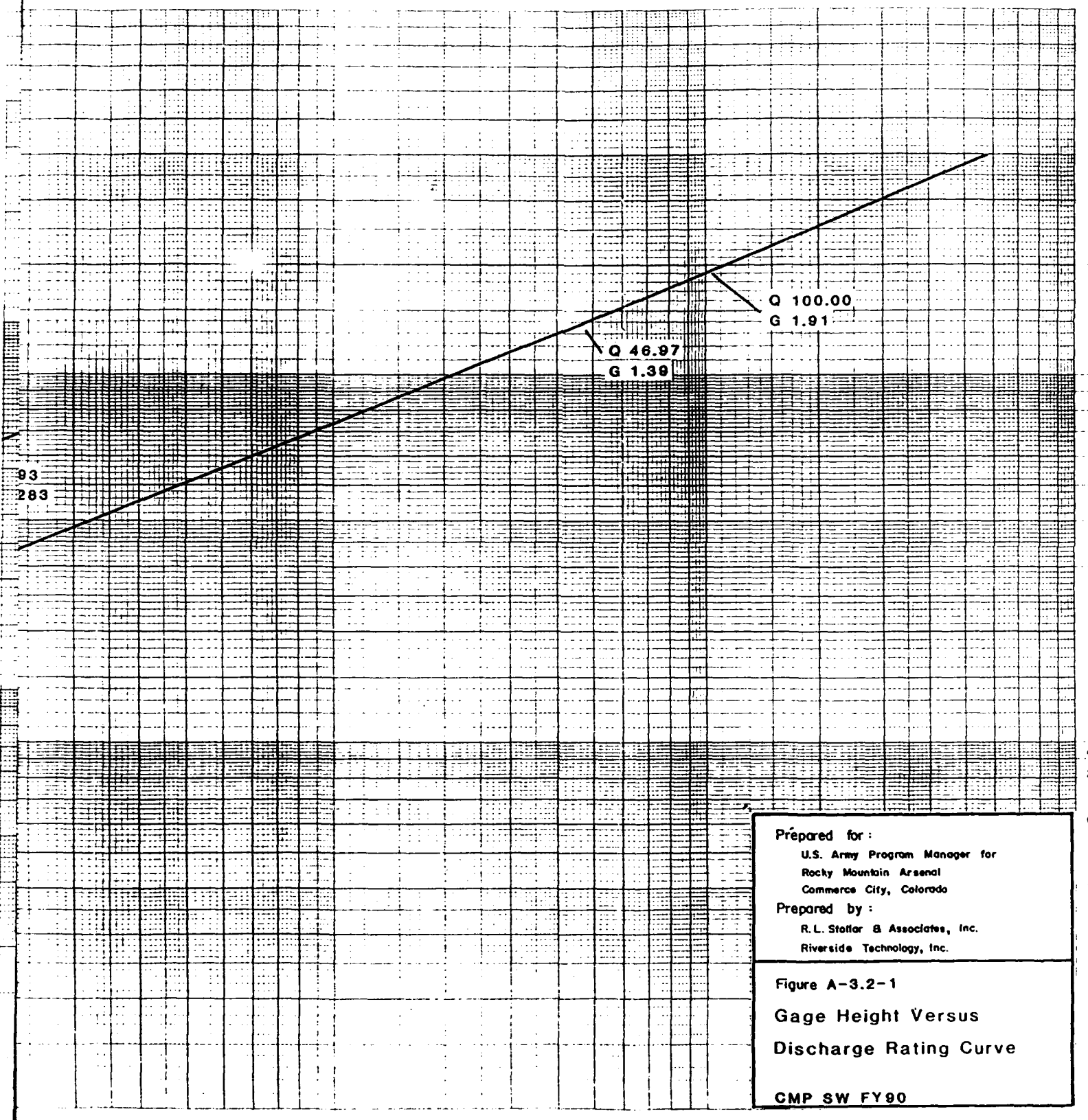
WATER YEAR 1990 RATING CURVES


LEGEND
Q = Discharge in cfs
G = Gage Height in ft
Q 0.84
G 0.09
Endpoint of a line segment (Example)
VALID PERIOD
10/01/89-09/30/90
Q 0.93
G 0.283
Q 0.02
G 0.113
Q 0.01
G 0.086
GAGE HEIGHT (ft) =(CR-10 VALUE)
100.0
1.0
0.10
0.01
0.01
0.10
1.0

(1)

DISC

NA INTERCEPTOR (SW11002)

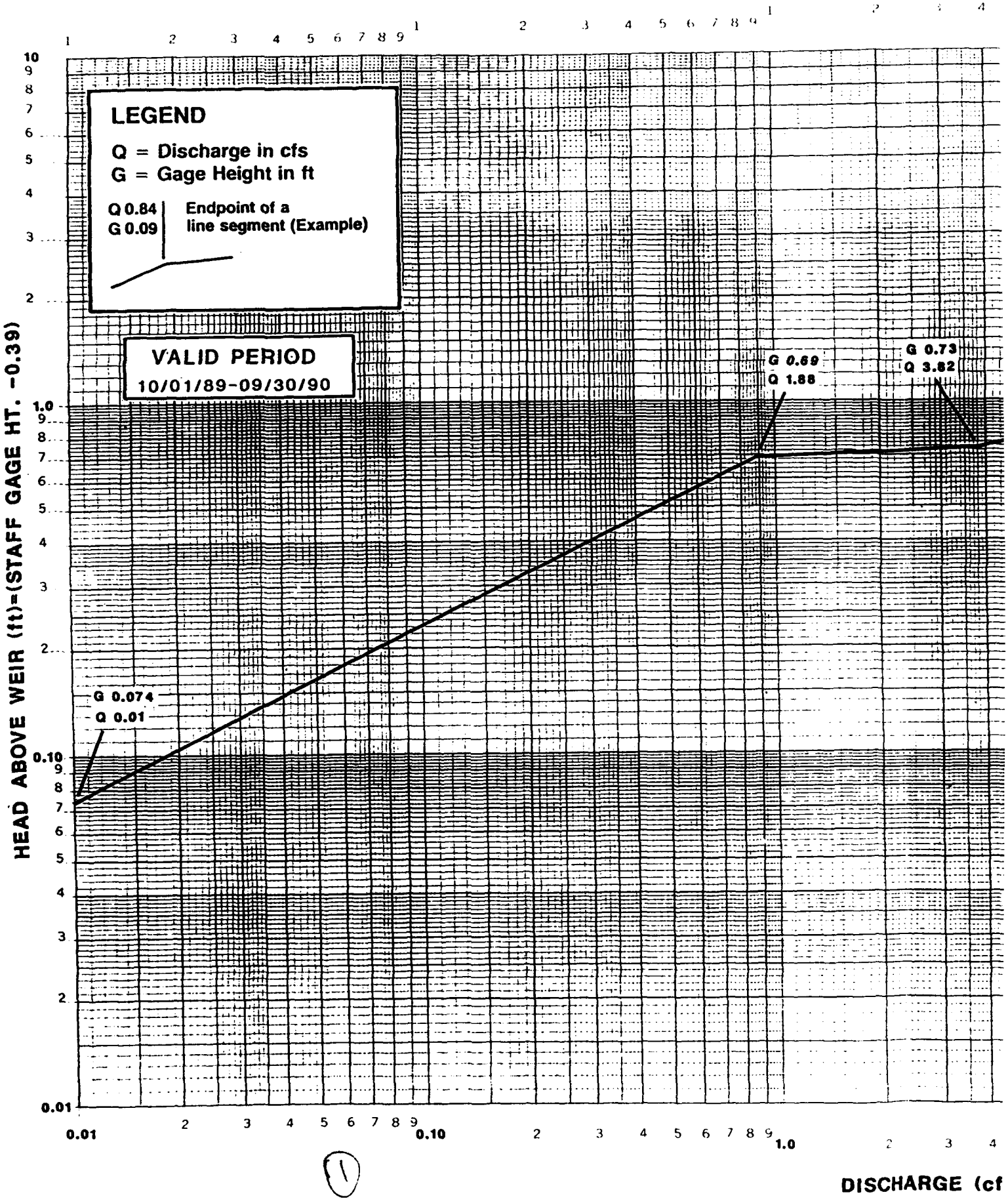


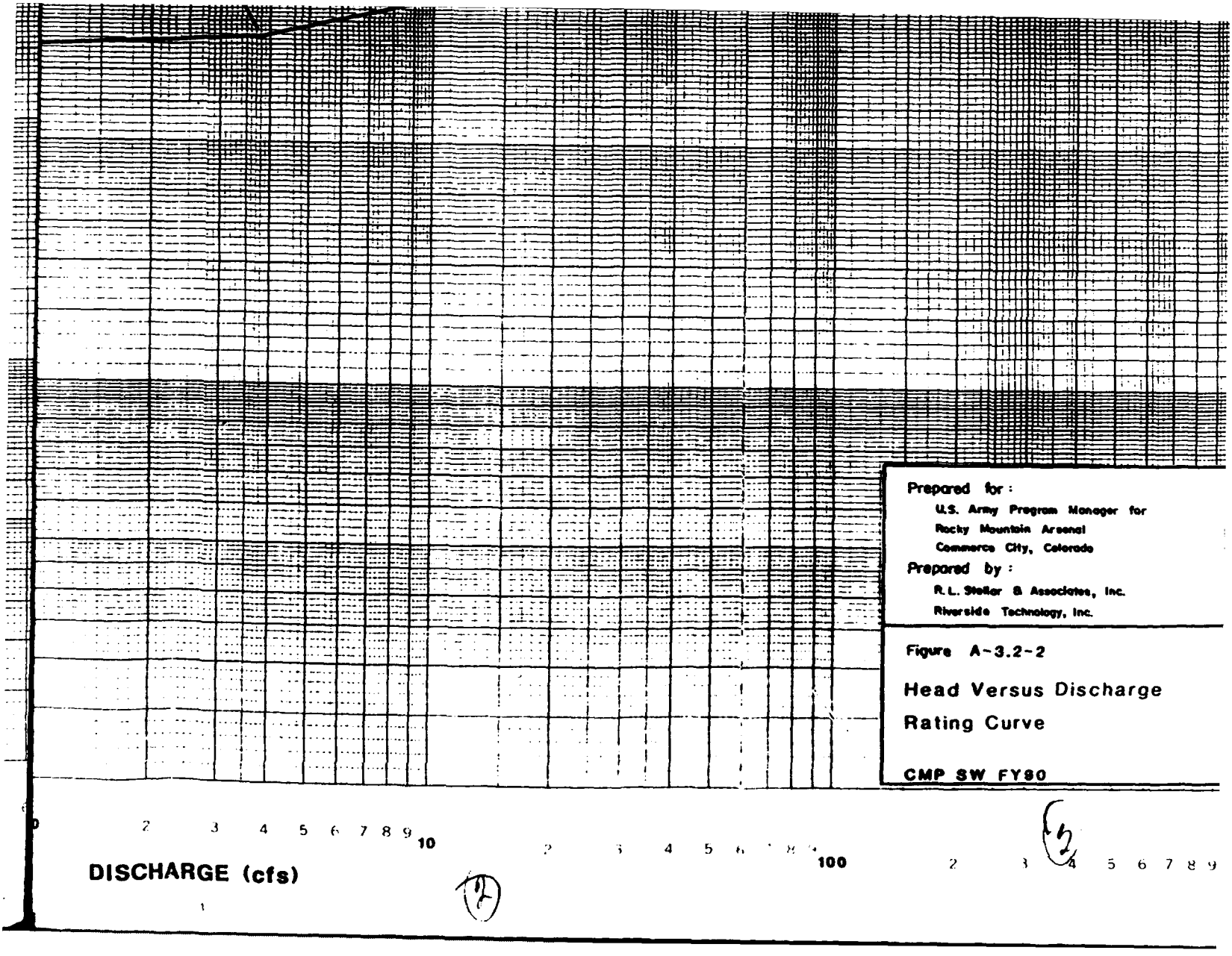
Prepared for :
U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by :
R.L. Stollar & Associates, Inc.
Riverside Technology, Inc.

Figure A-3.2-1
Gage Height Versus
Discharge Rating Curve

CMP SW FY90

PEORIA INTERCEPTOR (SW





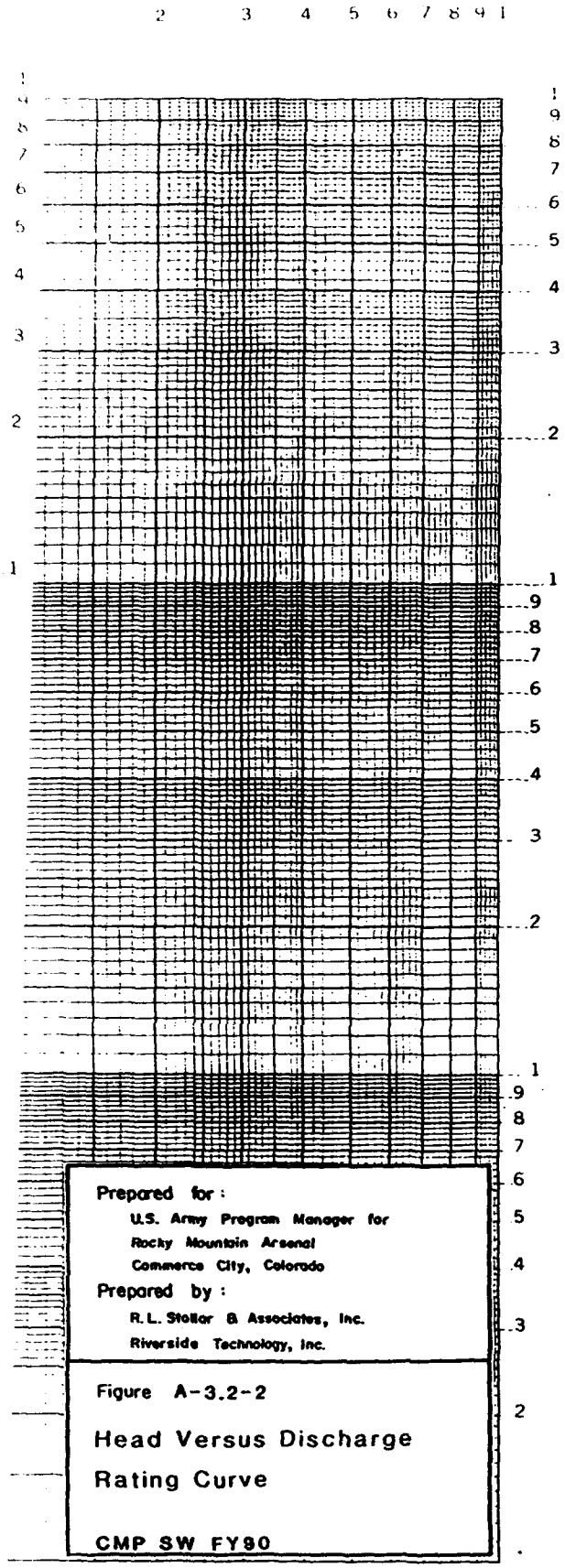
Prepared for :
U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

Prepared by :
R.L. Stollar & Associates, Inc.
Riverside Technology, Inc.

Figure A-3.2-2

Head Versus Discharge
Rating Curve

CMP SW FY90

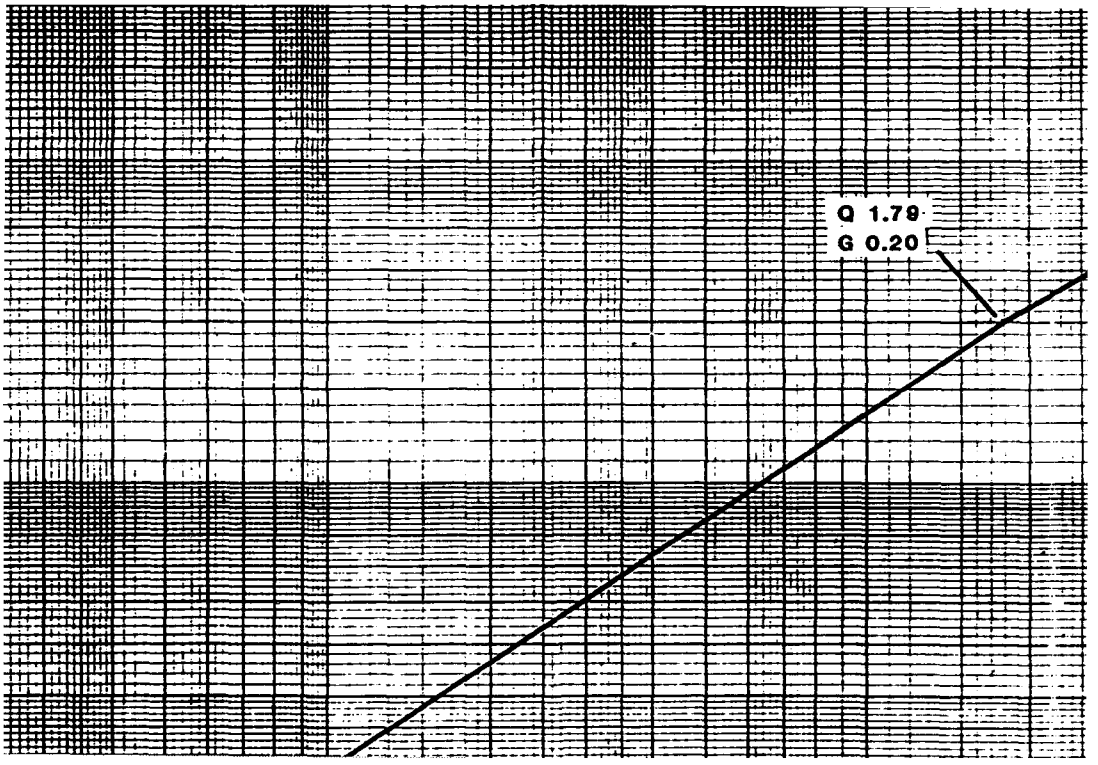


Prepared for :
U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by :
R. L. Stollar & Associates, Inc.
Riverside Technology, Inc.

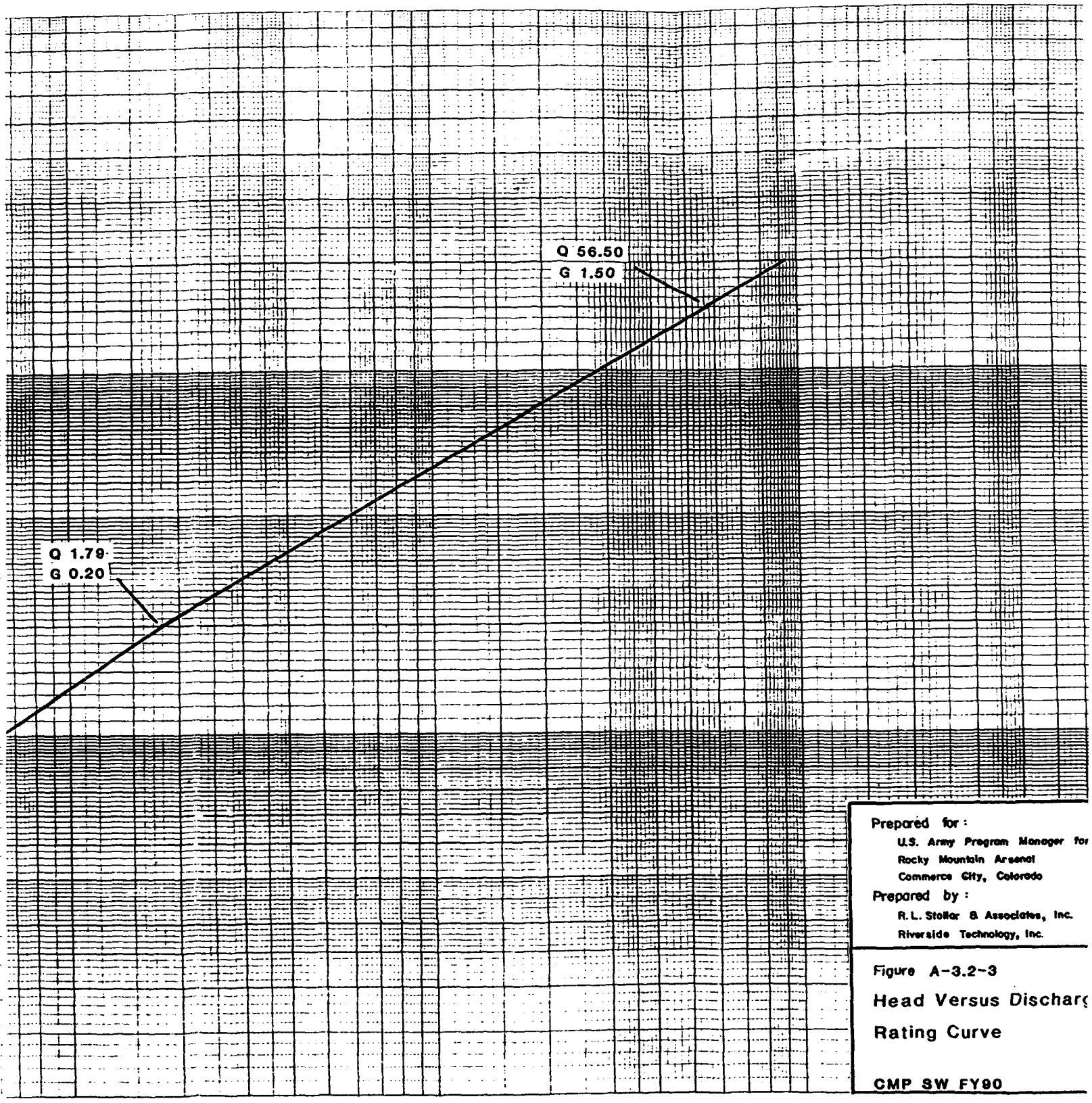
Figure A-3.2-2

Head Versus Discharge
Rating Curve

CMP SW FY90


Q 1.79
G 0.20

LADORA WEIR (SW02001)



1.0 2 3 4 5 6 7 8 9 10 2 3 4 5 6 7 8 9 100 2 3 4 5

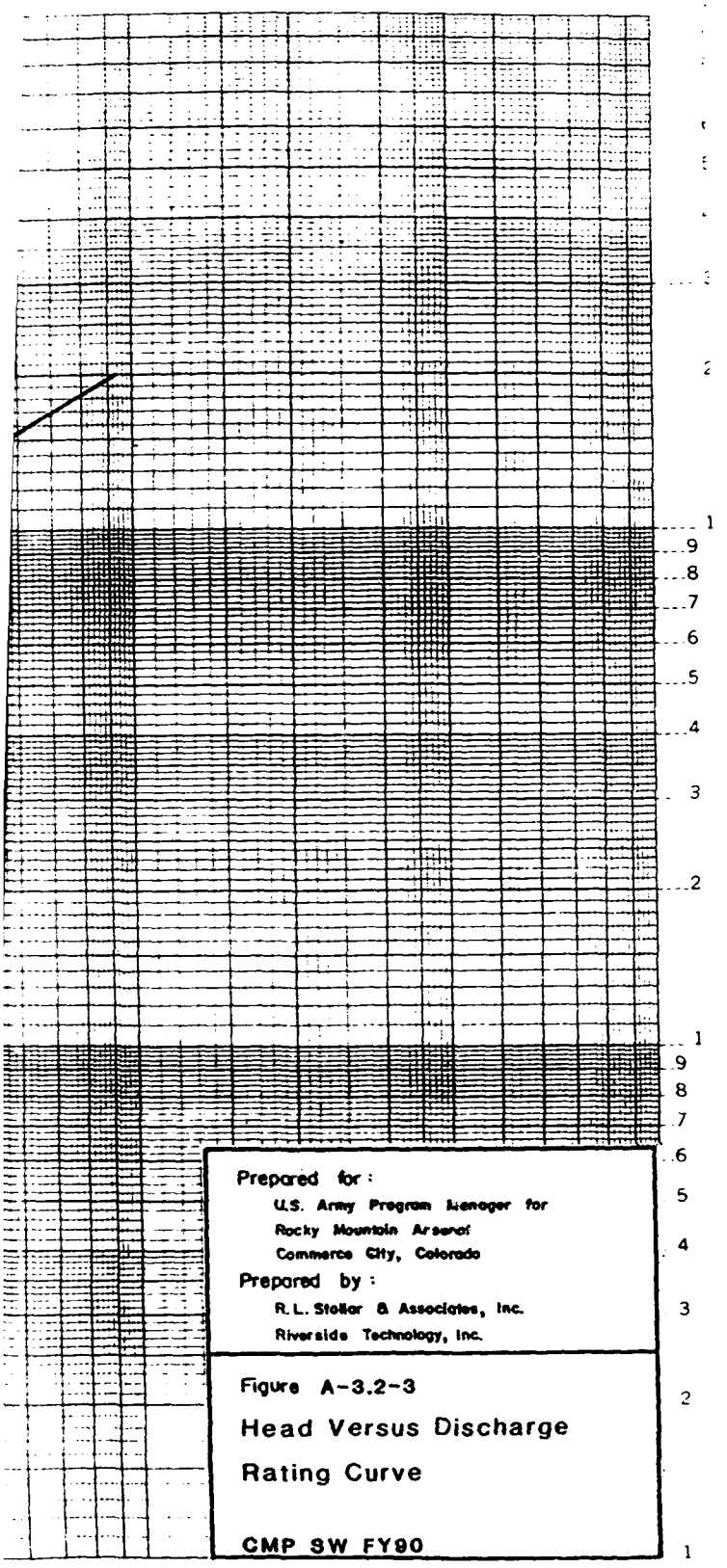
DISCHARGE (cfs)

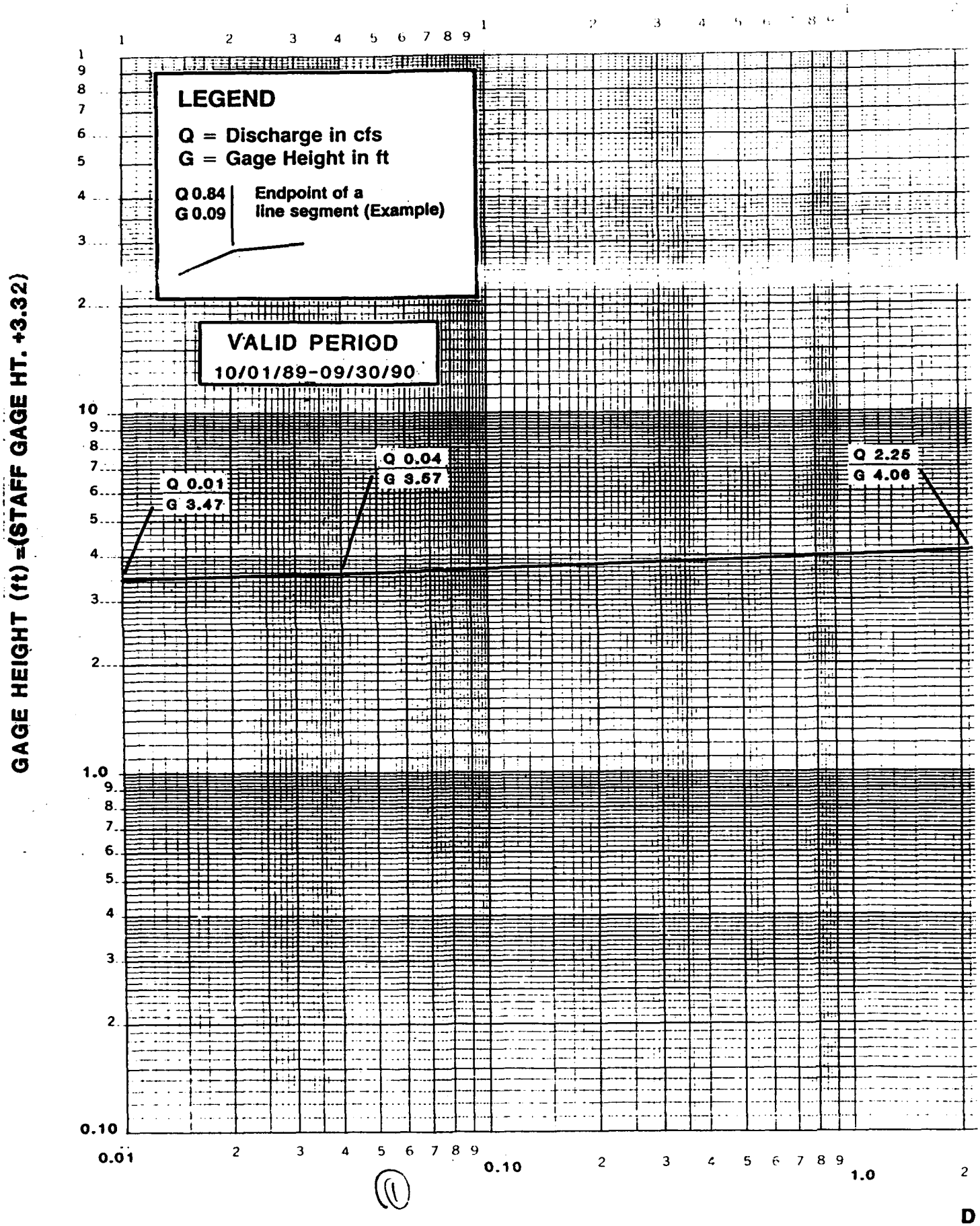
Prepared for :
U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

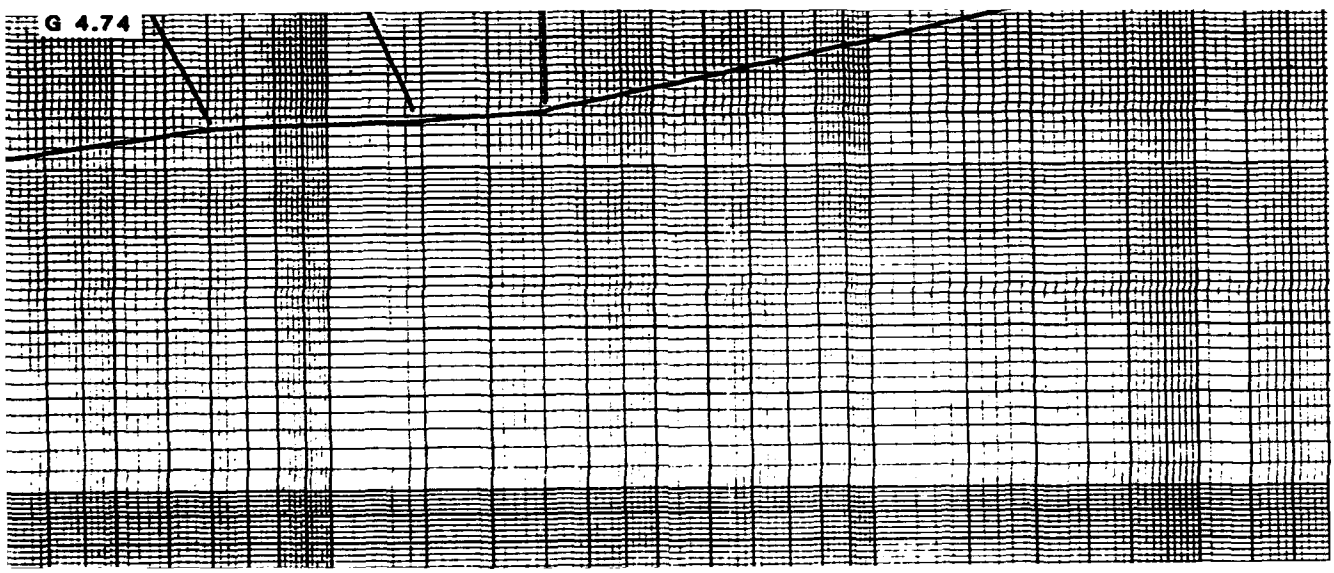
Prepared by :
R. L. Stollar & Associates, Inc.
Riverside Technology, Inc.

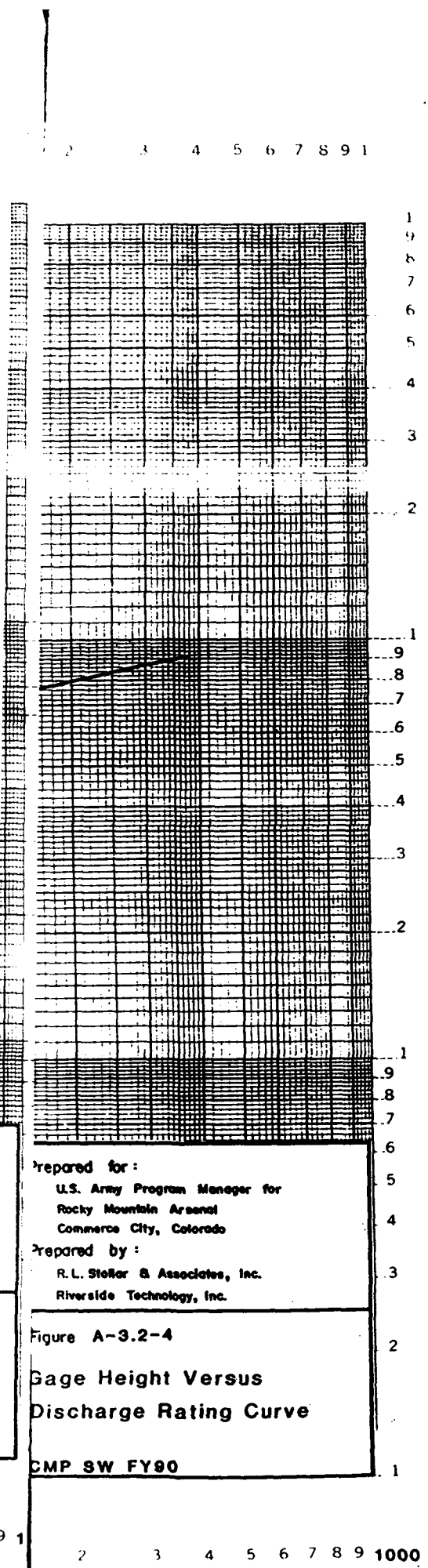
Figure A-3.2-3
Head Versus Discharg
Rating Curve

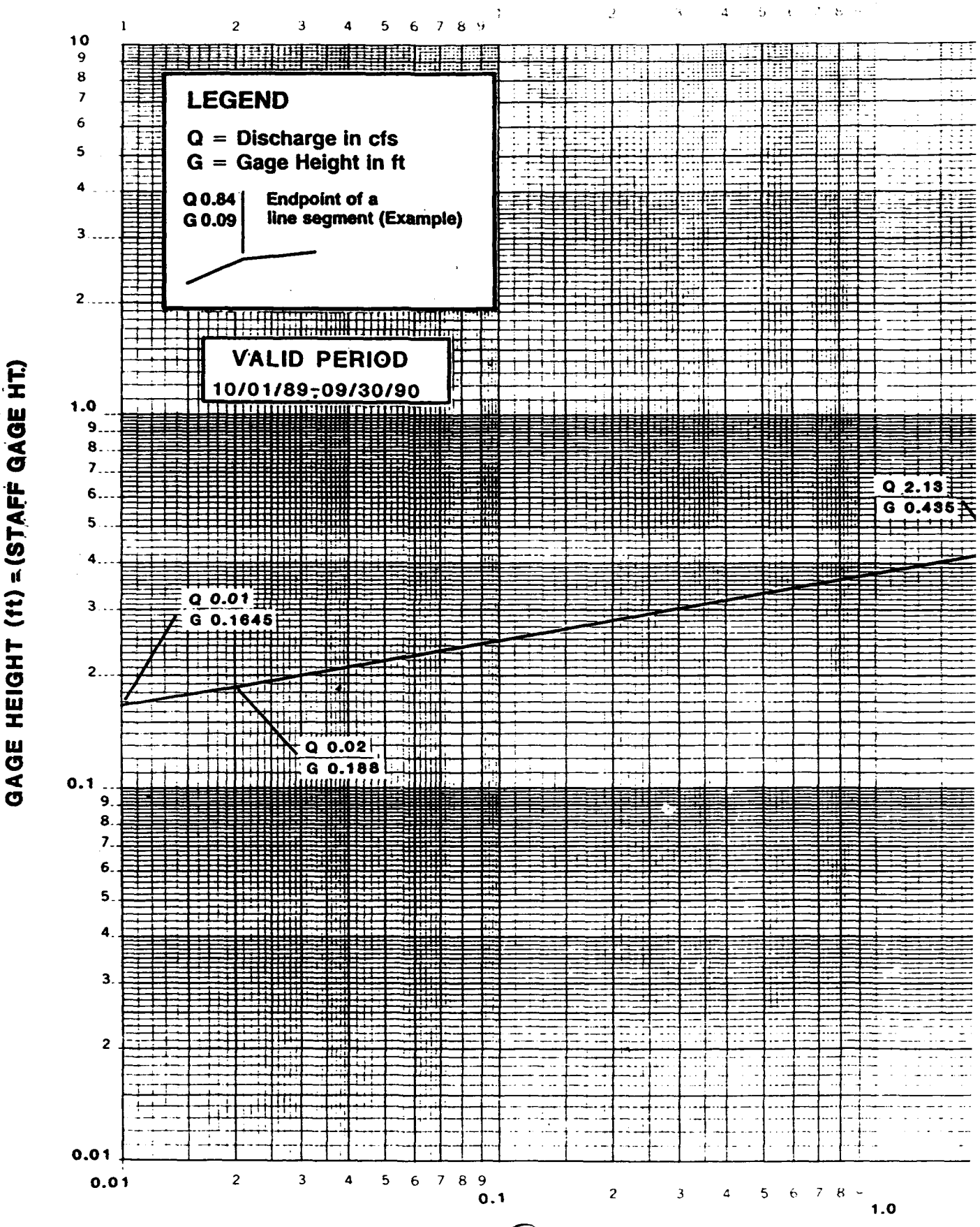
CMP SW FY90


Prepared for :
U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by :
R.L. Stollar & Associates, Inc.
Riverside Technology, Inc.
Figure A-3.2-3
Head Versus Discharge
Rating Curve
CMP SW FY90


LEGEND
Q = Discharge in cfs
G = Gage Height in ft
Q 0.84
G 0.09
Endpoint of a line segment (Example)
VALID PERIOD
10/01/89-09/30/90
Q 0.01
G 3.47
Q 0.04
G 3.57
Q 2.25
G 4.06
GAGE HEIGHT (ft) =(STAFF GAGE HT. +3.32)
0.01
0.10
1.0

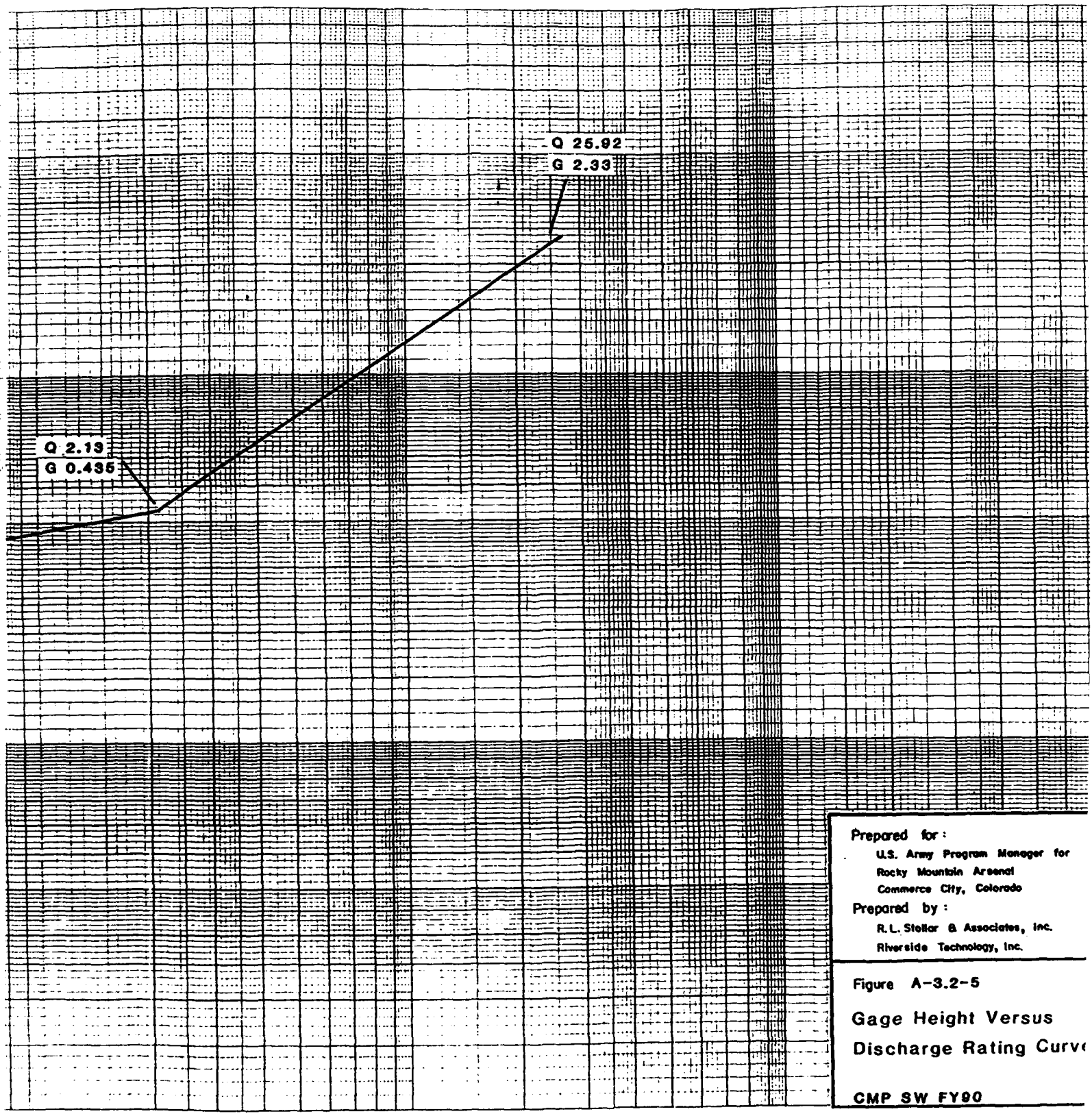

G 4.74


2 3 4 5 6 7 8 9 1
1
9
8
7
6
5
4
3
2
1
9
8
7
6
5
4
3
2
1
9
8
7
6
5
4
3
2
1
Prepared for :
U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by :
R. L. Stollar & Associates, Inc.
Riverside Technology, Inc.
Figure A-3.2-4
Gage Height Versus
Discharge Rating Curve
CMP SW FY90
2 3 4 5 6 7 8 9 1000


LEGEND
Q = Discharge in cfs
G = Gage Height in ft
Q 0.84
G 0.09
Endpoint of a line segment (Example)
VALID PERIOD
10/01/89-09/30/90
Q 2.13
G 0.435
Q 0.01
G 0.1645
Q 0.02
G 0.188
GAGE HEIGHT (ft) = (STAFF GAGE HT.)
0.01
0.1
1.0

LD

NORTH UVALDA (SW01001)



Prepared for :
U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

Prepared by :
R.L. Stollar & Associates, Inc.
Riverside Technology, Inc.

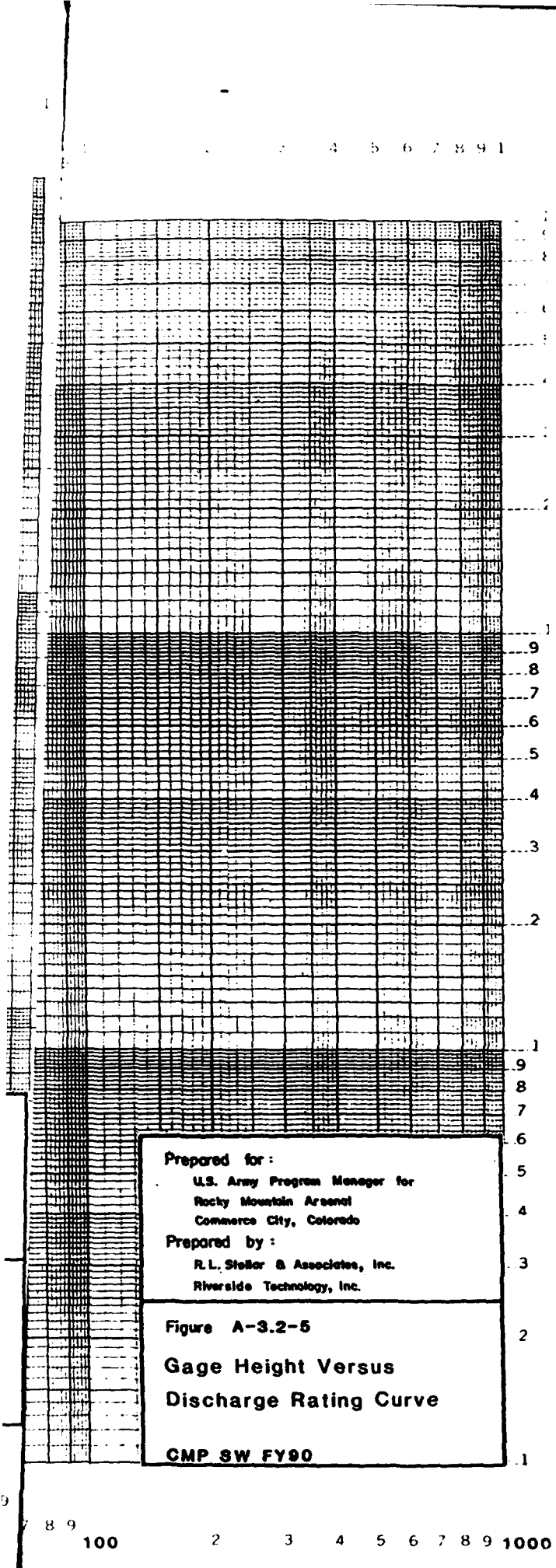
Figure A-3.2-5

Gage Height Versus
Discharge Rating Curve

CMP SW FY90

1.0 2 3 4 5 6 7 8 9 10 2 3 4 5 6 7 8 9 100 2 3 4 5 6

DISCHARGE (cfs)



Prepared for :

U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

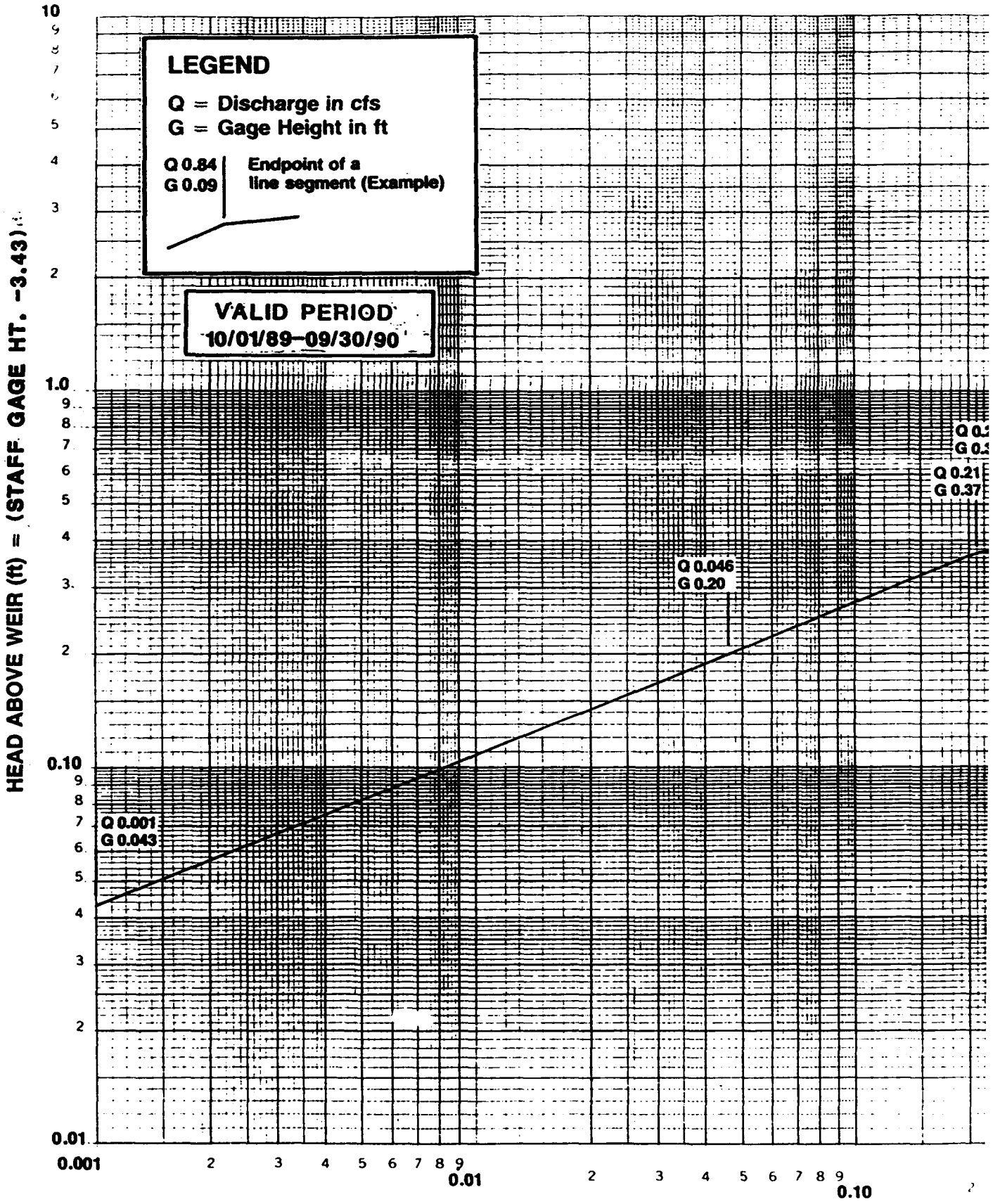
Prepared by :

R.L. Stollar & Associates, Inc.
Riverside Technology, Inc.

Figure A-3.2-5

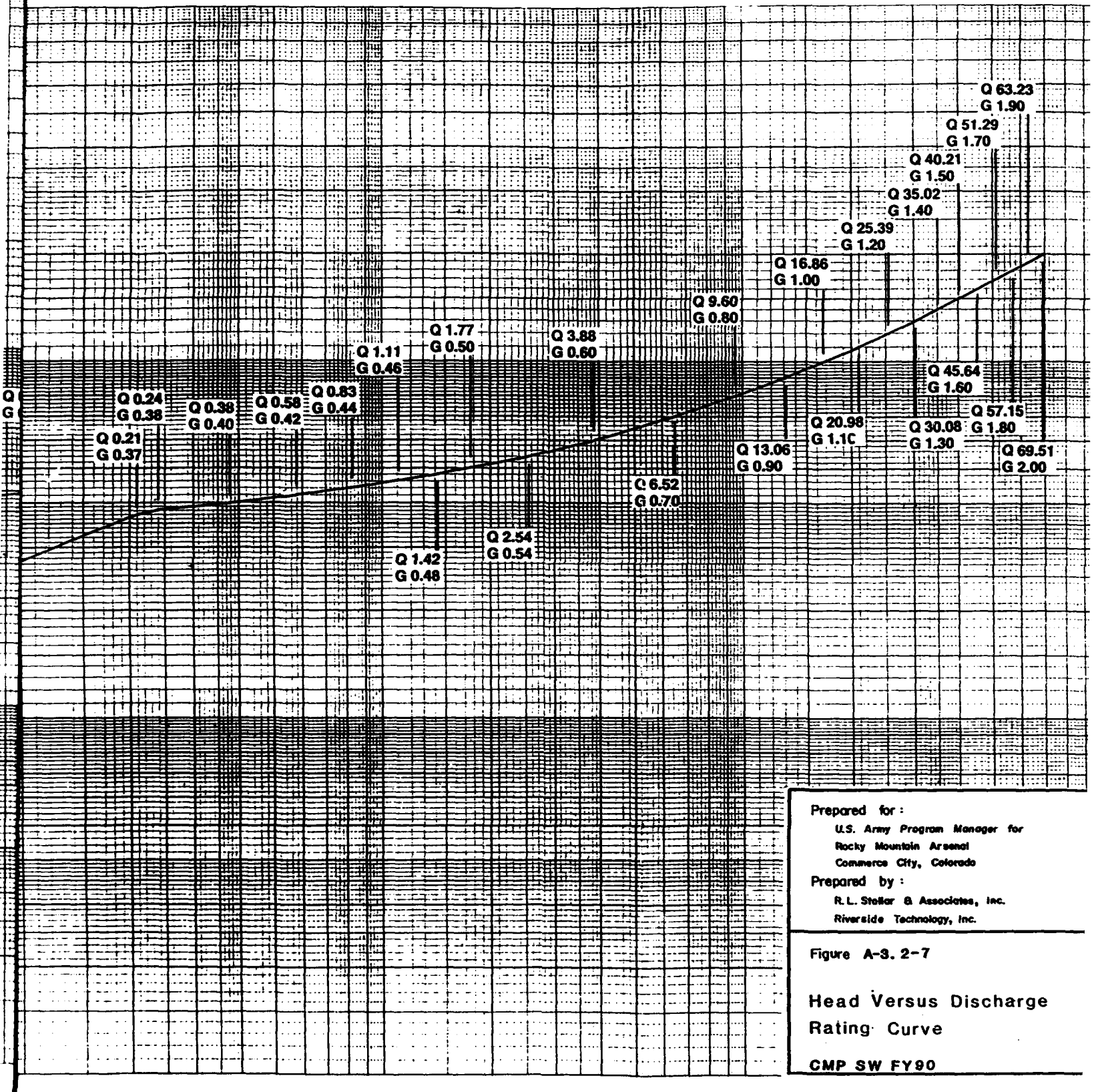
Gage Height Versus Discharge Rating Curve

CMP SW FY90


LEGEND
Q = Discharge in cfs
G = Gage Height in ft
Q 0.84
G 0.09
Endpoint of a line segment (Example)
VALID PERIOD
10/01/89–09/30/90
HEAD ABOVE WEIR (ft) = (STAFF GAGE HT. -3.43)
Q 0.001
G 0.043
Q 0.046
G 0.20
Q 0.21
G 0.37
10
9
8
7
6
5
4
3
2
1.0
0.10
0.01
0.001
0.01
0.10

DIS

PLANTS DITCH (SW01003)



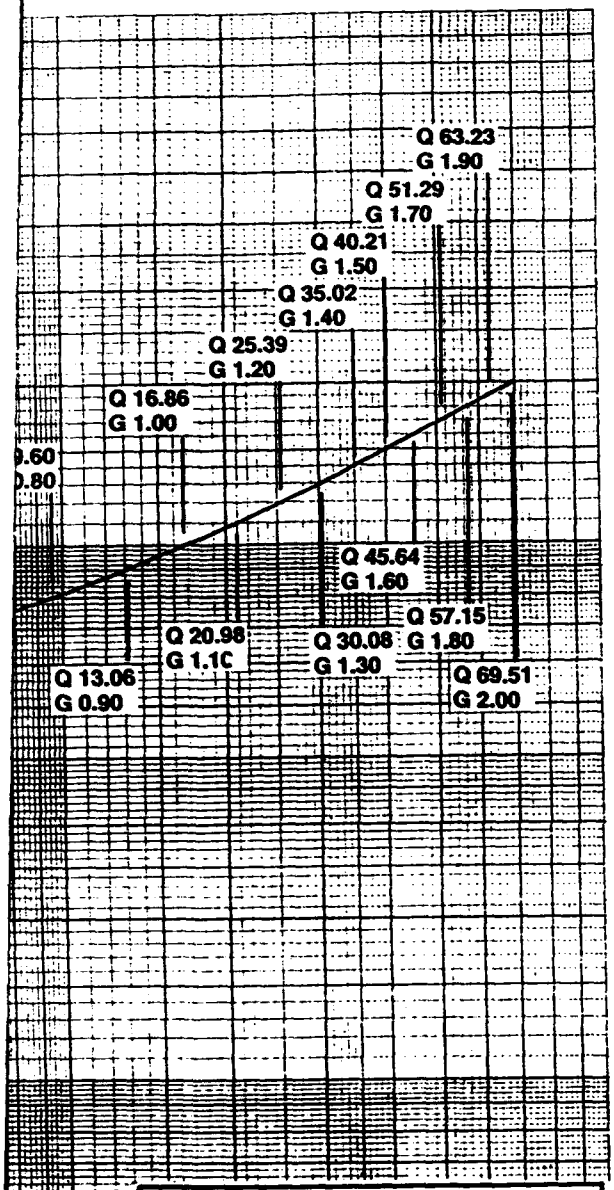
Prepared for :
U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by :
R.L. Stollar & Associates, Inc.
Riverside Technology, Inc.

Figure A-3. 2-7

Head Versus Discharge Rating Curve

CMP SW FY90

AL



Prepared for :

U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

Prepared by :

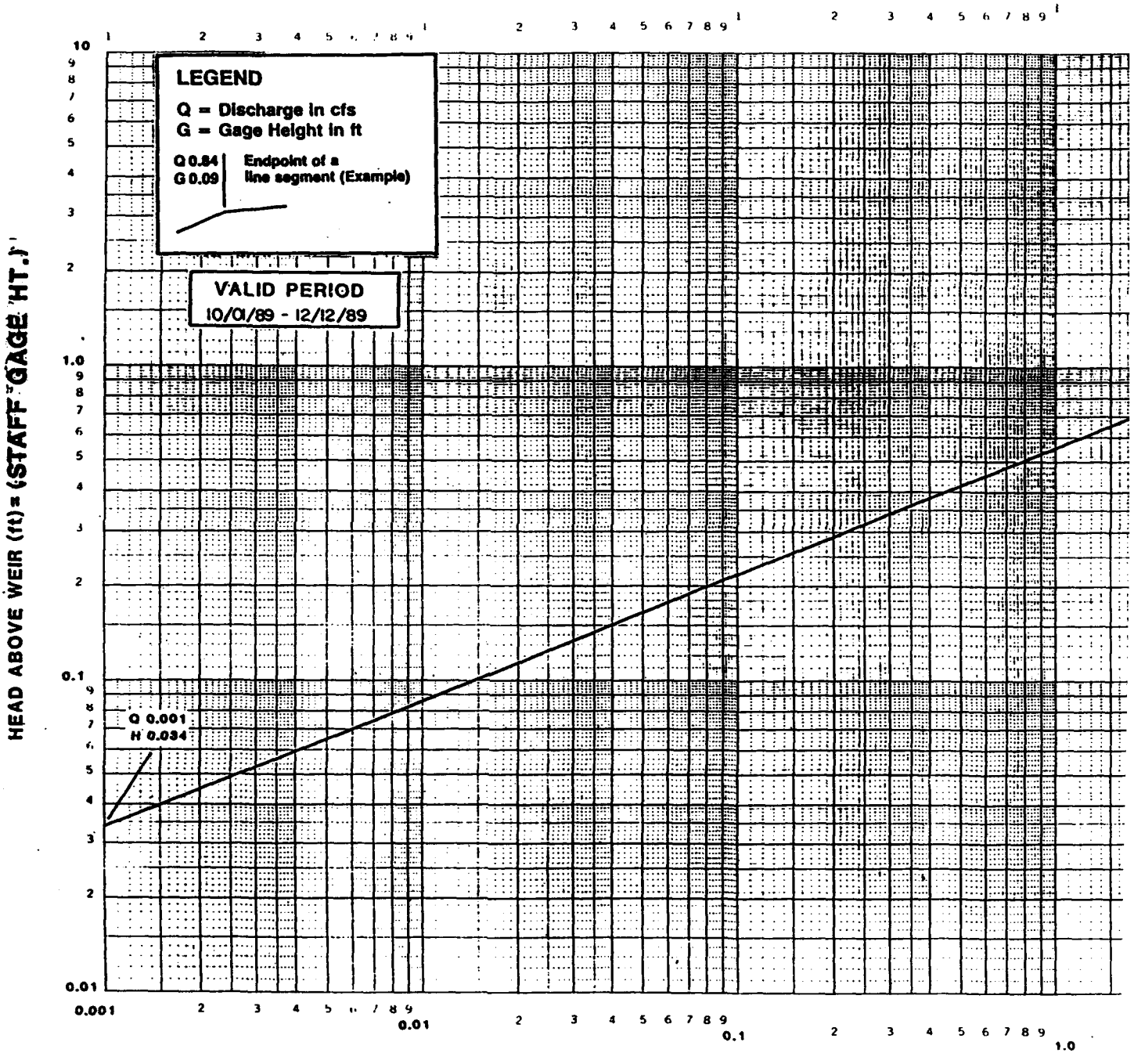
R. L. Stollar & Associates, Inc.
Riverside Technology, Inc.

Figure A-3. 2-7

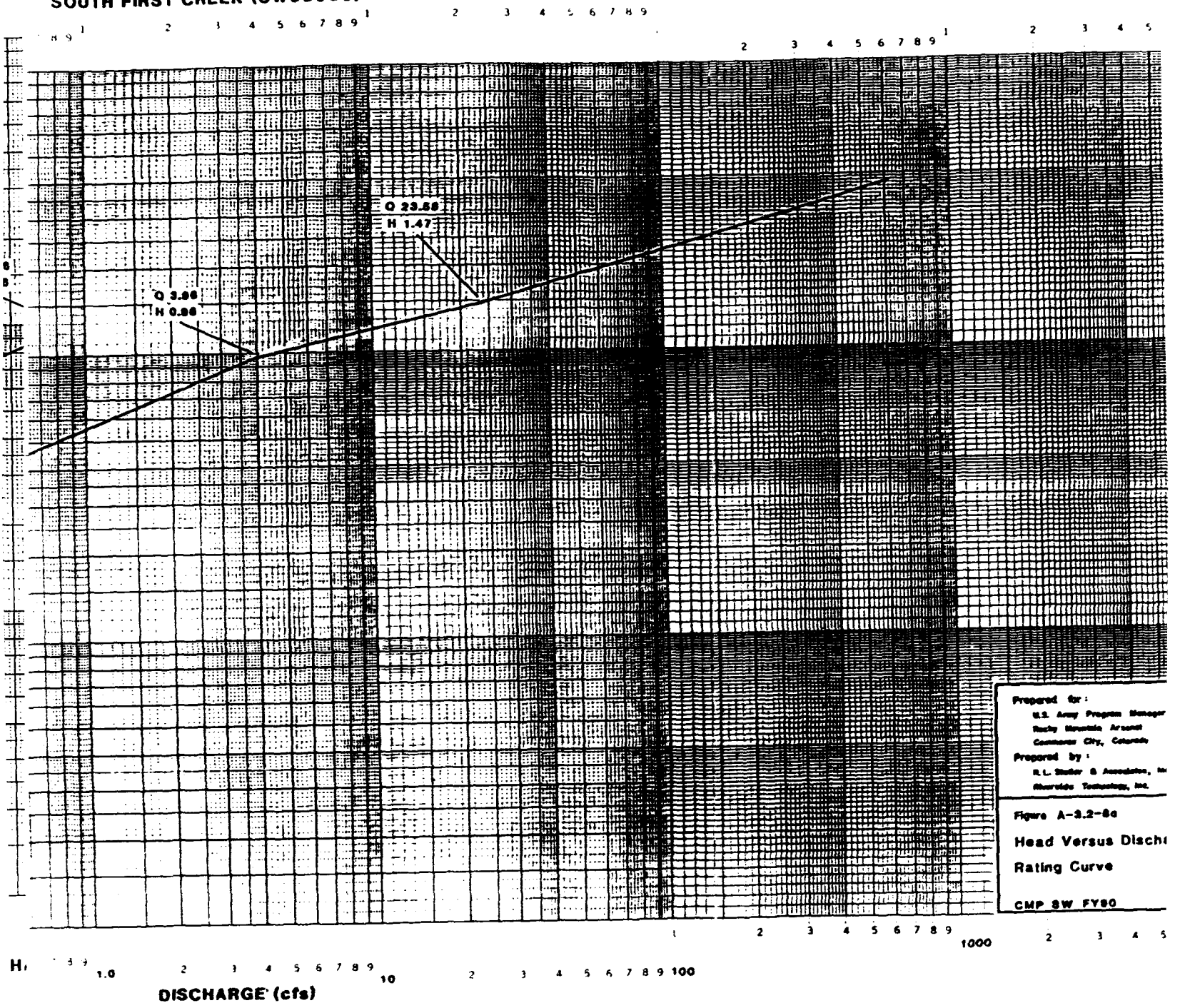
Head Versus Discharge
Rating Curve

CMP SW FY90

SOUTH FIR


LEGEND
Q = Discharge in cfs
G = Gage Height in ft
Q 0.84
G 0.09
Endpoint of a line segment (Example)
VALID PERIOD
10/01/89 - 12/12/89
HEAD ABOVE WEIR (ft) = (STAFF GAGE HT.)
Q 0.001
H 0.034
10
1.0
0.1
0.01
0.001
0.01
0.1
1.0

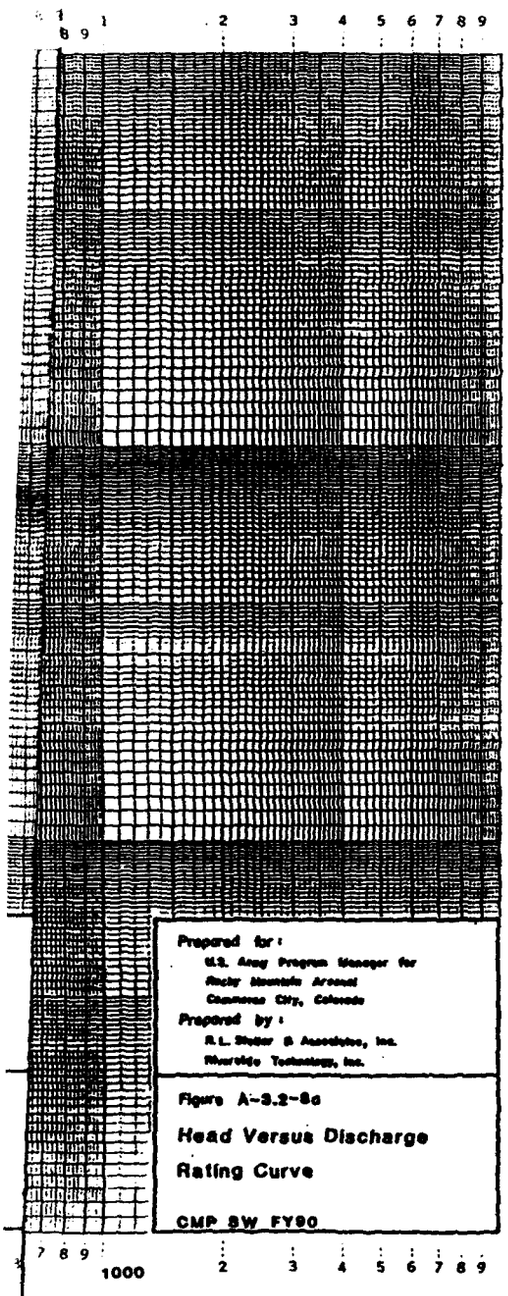
SOUTH FIRST CREEK (SW08003)



Prepared for :
U.S. Army Program Manager
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by :
R.L. Stoller & Associates, Inc
Riverside Technology, Inc.

Figure A-3.2-8a
Head Versus Discha
Rating Curve

CMP SW FY90



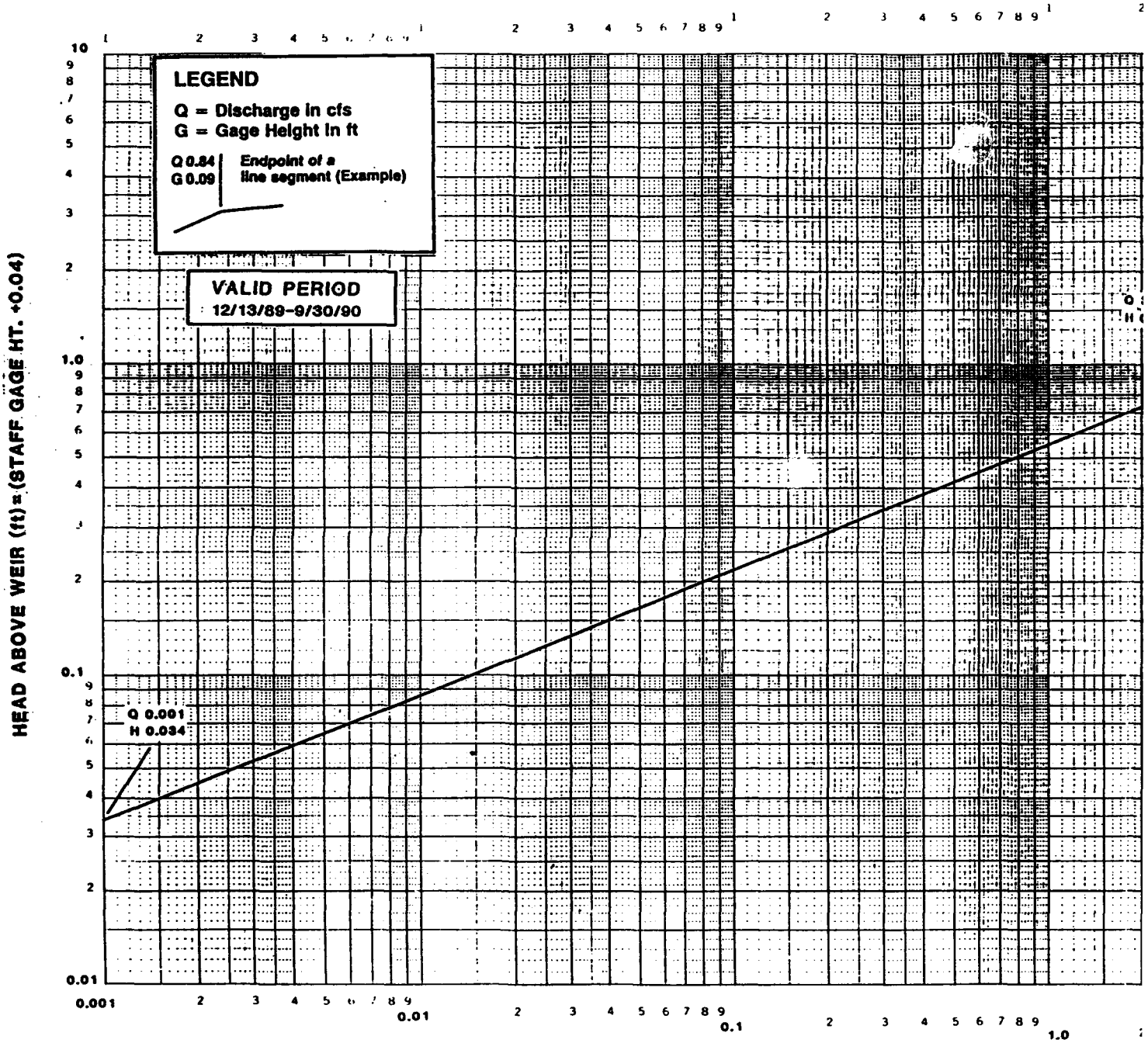
Prepared for:
U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by:
R.L. Stoller & Associates, Inc.
Riverside Technology, Inc.

Figure A-3.2-8a

Head Versus Discharge Rating Curve

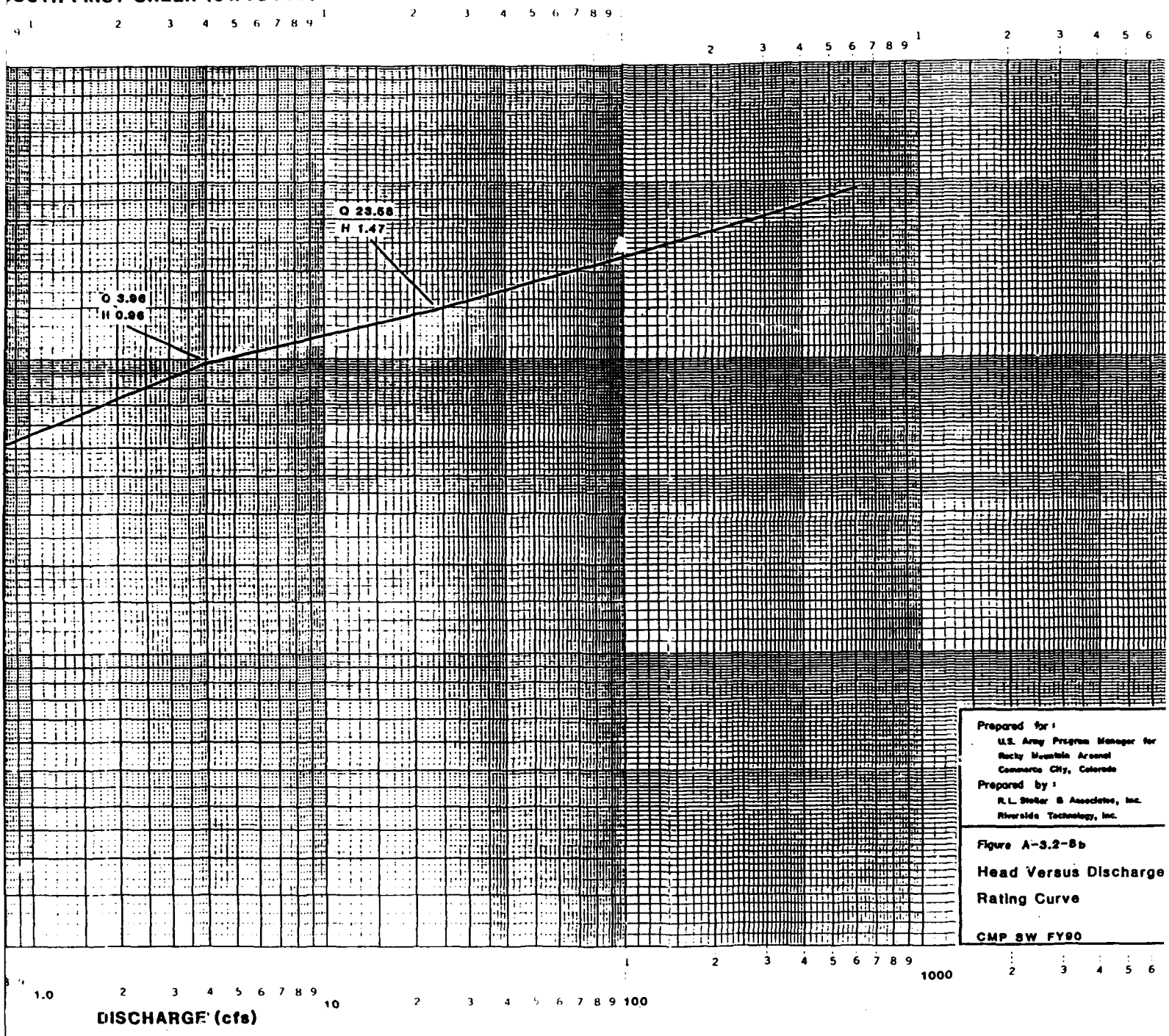
CMP SW FY90

SOUTH FIRST



DIS

SOUTH FIRST CREEK (SW08003)



Prepared for :
U.S. Army Program Manager for Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by :
R.L. Stoller & Associates, Inc.
Riverside Technology, Inc.

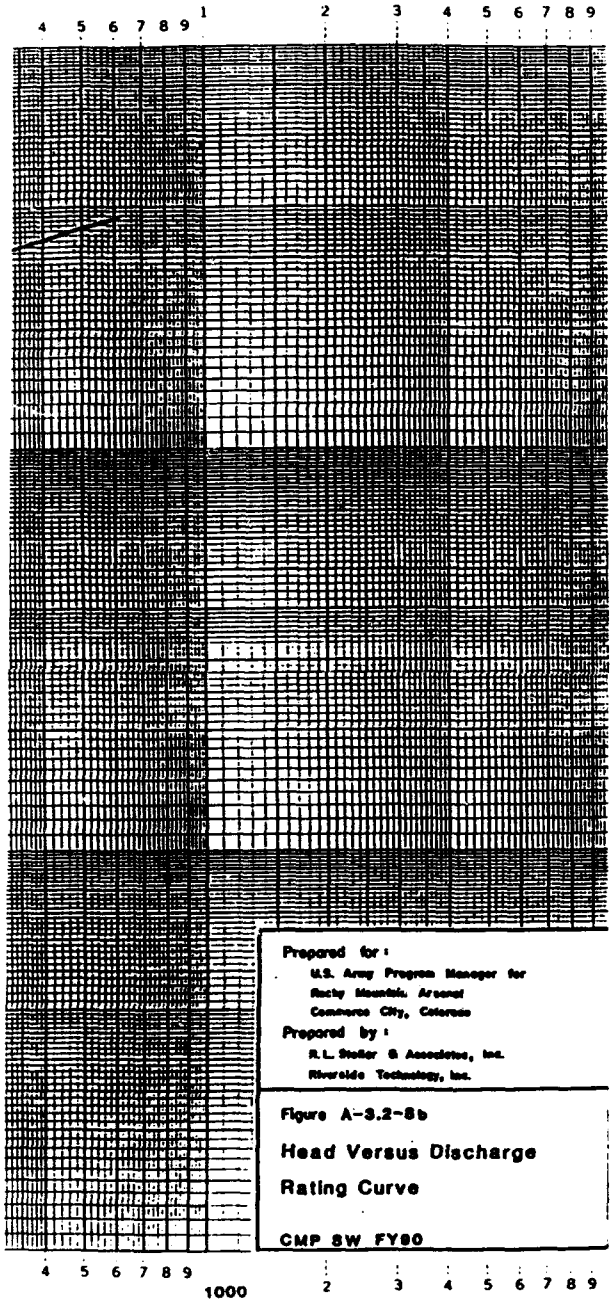
Figure A-3.2-8b

Head Versus Discharge Rating Curve

CMP SW FY90

(1)

1

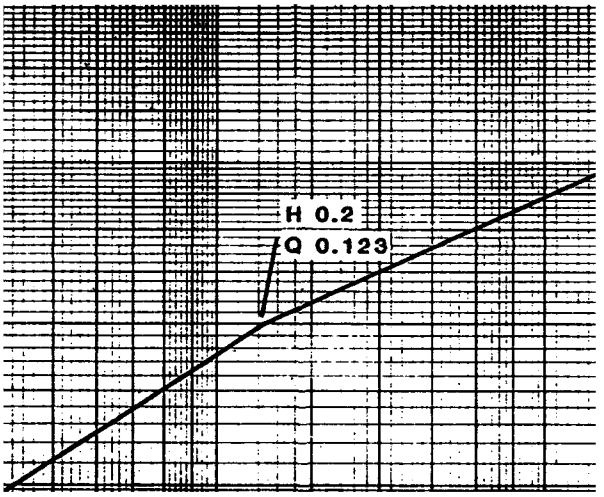


Prepared for :
U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by :
R.L. Stoller & Associates, Inc.
Riverside Technology, Inc.

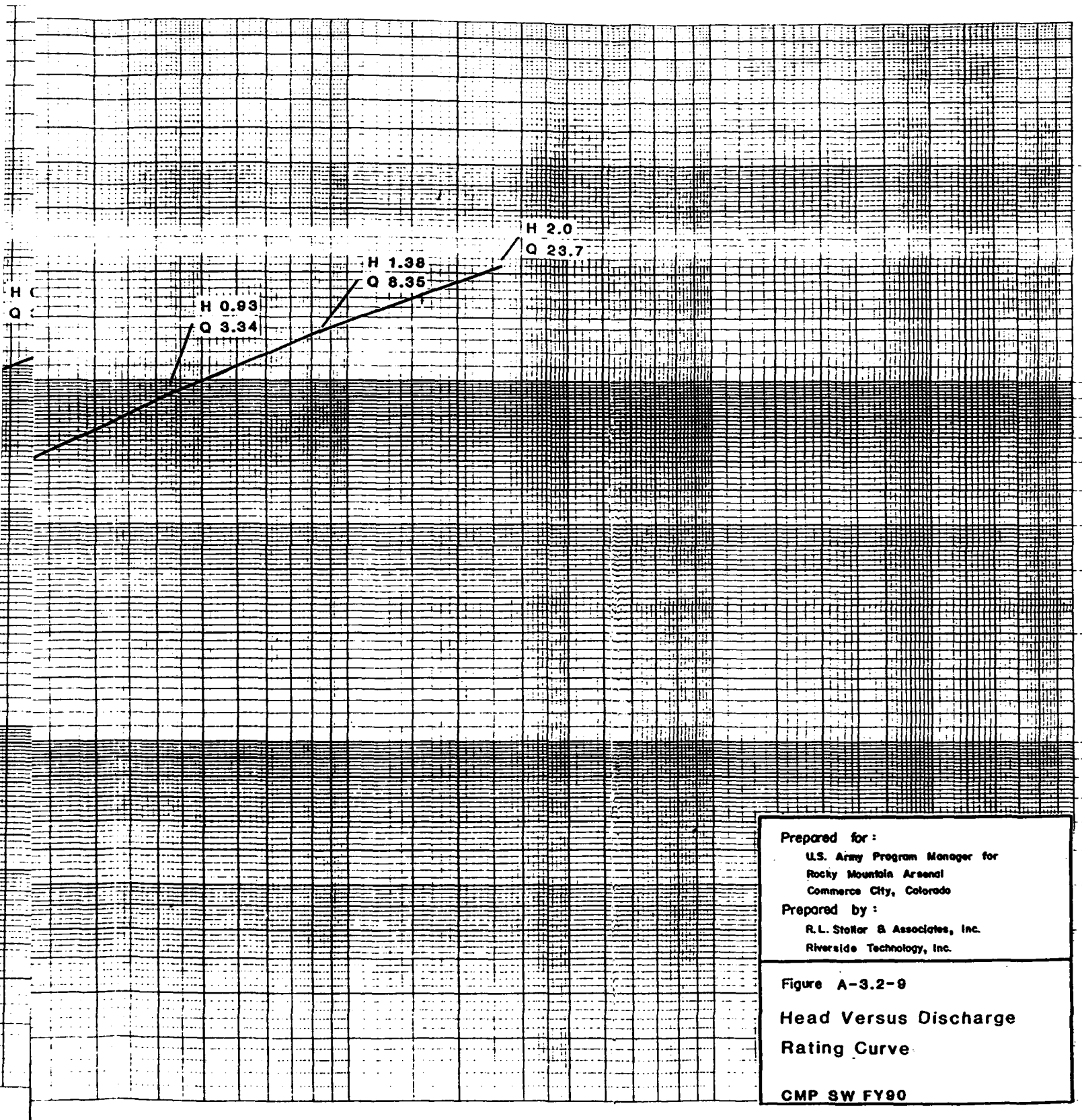
Figure A-3.2-8b

Head Versus Discharge Rating Curve

CMP SW FY80


H 0.2
Q 0.123

RTH FIRST CREEK (SW24002)

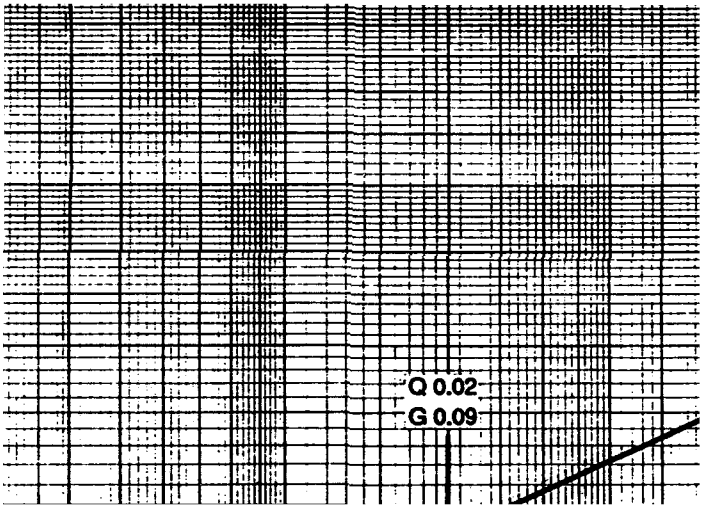


Prepared for:
U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by:
R.L. Stollar & Associates, Inc.
Riverside Technology, Inc.

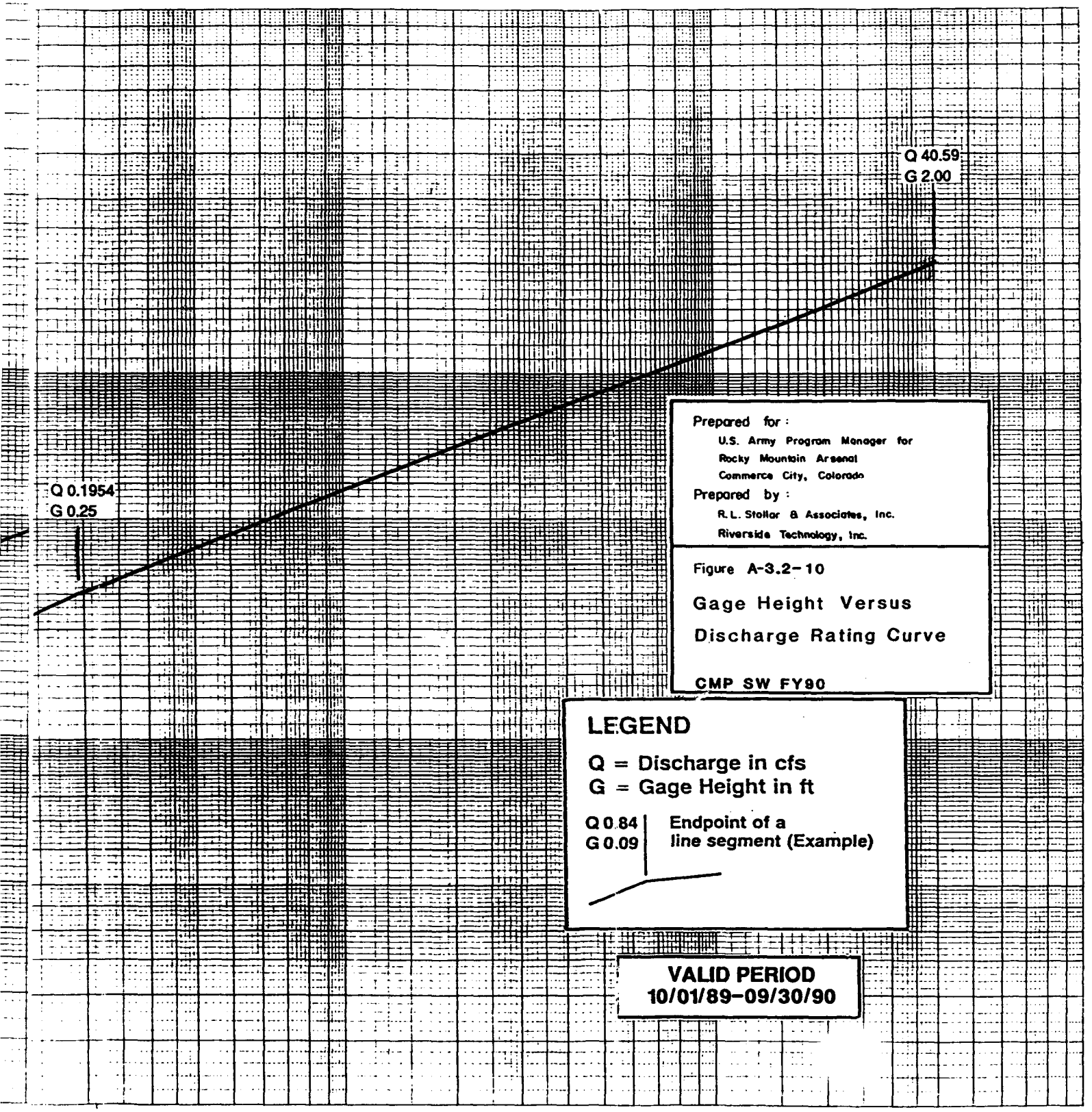
Figure A-3.2-9
Head Versus Discharge
Rating Curve

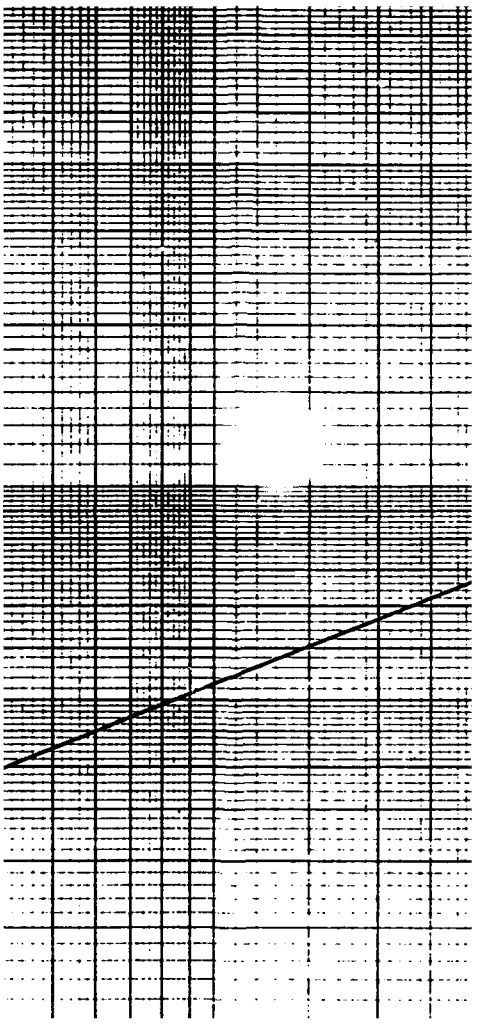
CMP SW FY90

DISCHARGE (cfs)

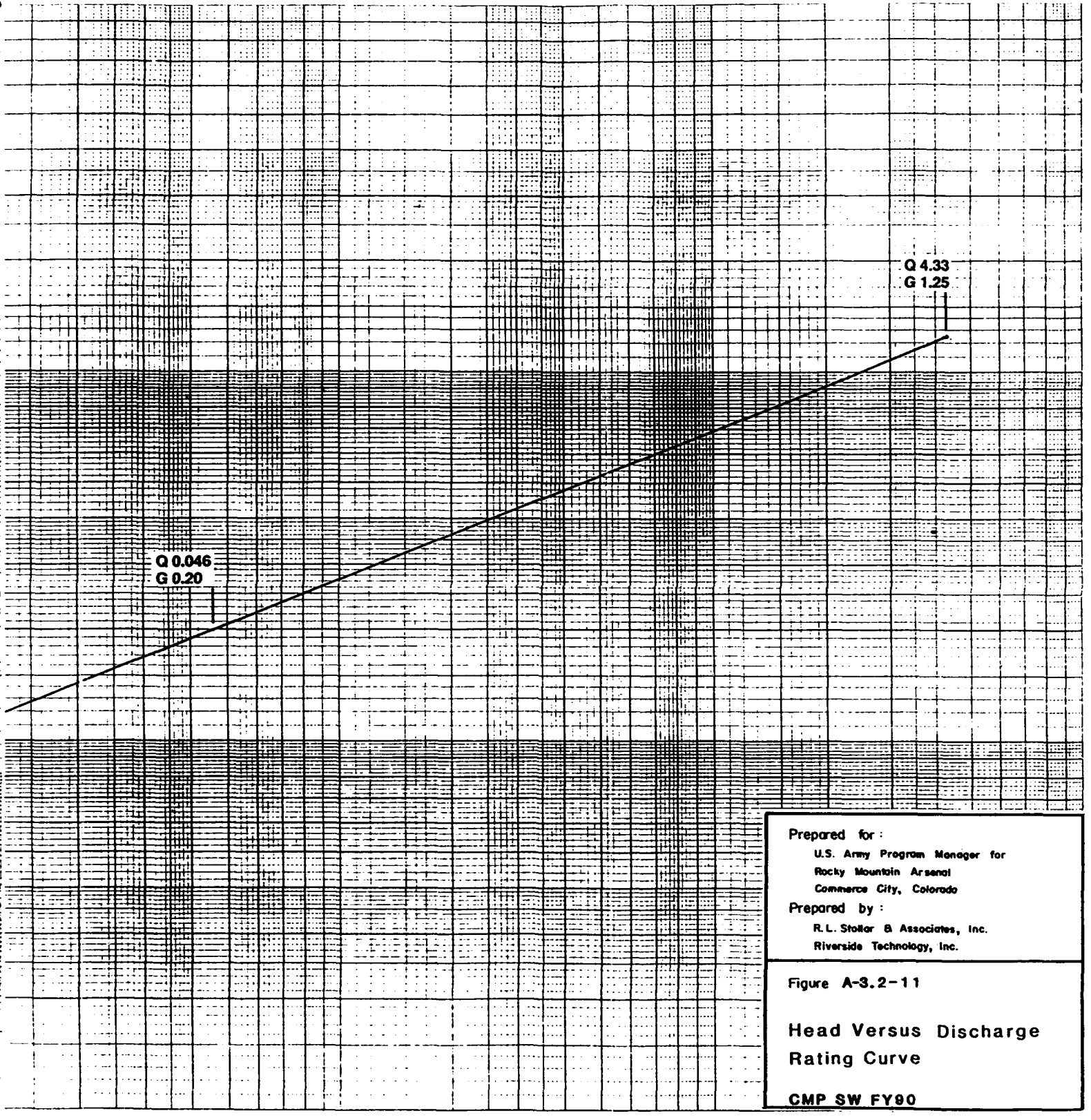

Q 0.02
G 0.09

DS CREEK OFF-POST (SW37001)

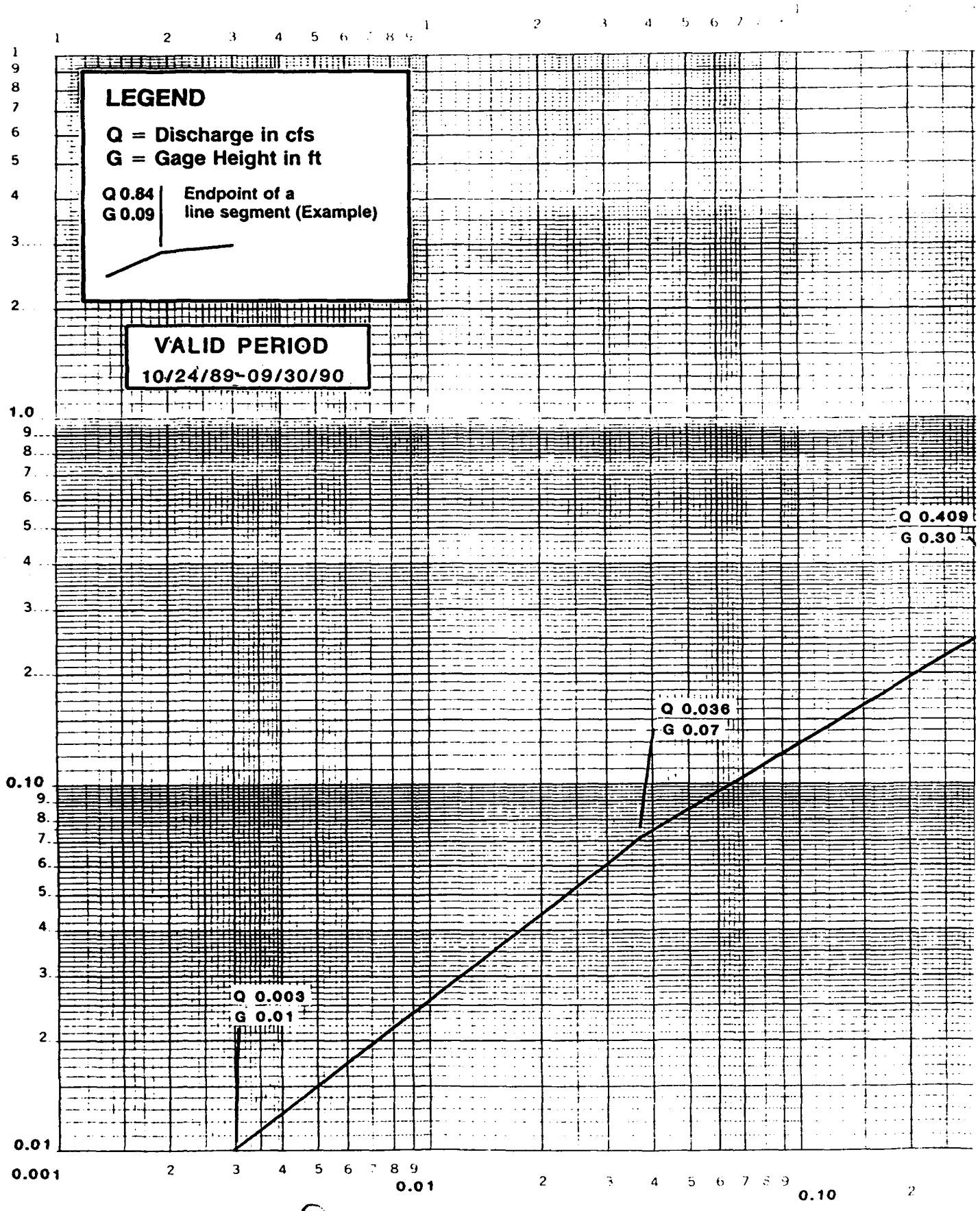




BASIN A (SW36001)

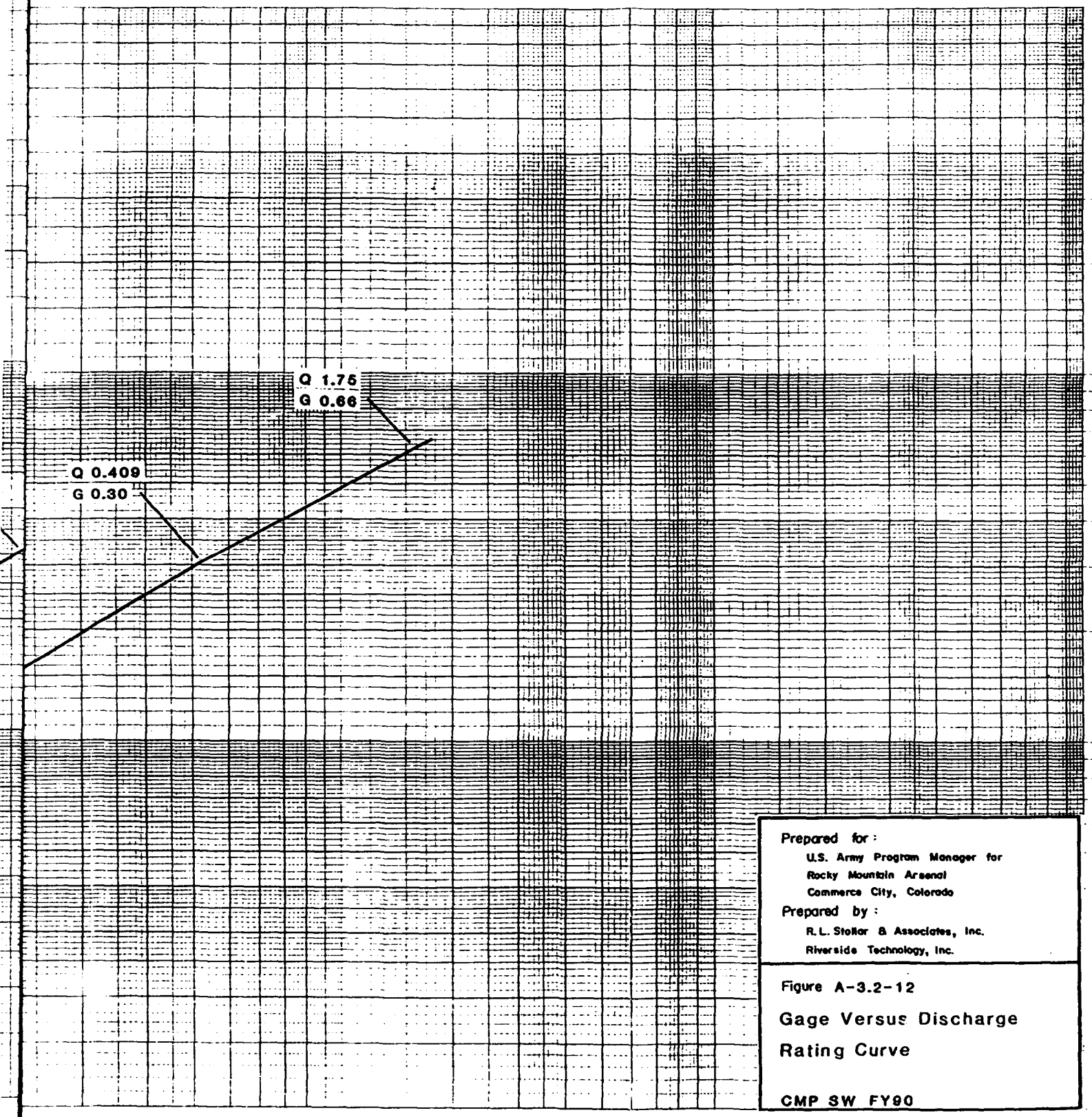


BASIN


LEGEND
Q = Discharge in cfs
G = Gage Height in ft
Q 0.84
G 0.09
Endpoint of a line segment (Example)
VALID PERIOD
10/24/89~09/30/90
GAGE HEIGHT (ft) =(H, of 200mm FLUME)
Q 0.409
G 0.30
Q 0.036
G 0.07
Q 0.003
G 0.01
0.001
0.01
0.10

DISCH

BASIN F (SW26001)



Prepared for :
U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado

Prepared by :
R.L. Stollar & Associates, Inc.
Riverside Technology, Inc.

Figure A-3.2-12

Gage Versus Discharge Rating Curve

CMP SW FY90

1.0 10

DISCHARGE (cfs)

APPENDIX A-4

RATING EQUATIONS

STAGE-DISCHARGE RATING EQUATIONS

STATION: SW36001, BASIN A

DESCRIPTION: 90 DEGREE V-NOTCH WEIR PLATE

EQUATION FORM: $Q = p(G - e)^N$

where: Q = Discharge in cubic feet per second;
(G-e) = head or depth of water on the control in feet;
G = the gage height of the water surface in feet;
e = gage height in feet of zero flow for a section control of regular shape, or the gage height of effective zero flow for a channel control or a section control of irregular shape;
p = regression coefficient (dimensionless); and
N = regression coefficient (dimensionless), generally not equal to p.

Staff Gage Height, G, Range (ft)	p	N	e (ft)	Valid Period Begin Date	Valid Period End Date
0.07 - 0.26	(1)	(1)	0.07	10-01-88	09-30-90
0.27 - 1.32	2.488803337	2.481549685	0.07	10-01-88	09-30-90

For gage heights between 0.07 ft and 0.26 ft which corresponds to heads of 0.0 ft and 0.19 ft, use the given coefficients for the gage height range of 0.27 ft - 1.32 ft. Note that the flow can only be estimated in the low-flow range due to the fact that the nappe may not spring free of the crest when the head is less than 0.2 ft.

STAGE-DISCHARGE RATING EQUATIONS

STATION: SW26001, BASIN F

DESCRIPTION: 200mm RBC FLUME

EQUATION FORM: $Q = p(G - e)^N$

where: Q = Discharge in cubic feet per second;
(G-e) = head or depth of water on the control in feet;
G = the gage height of the water surface in feet;
e = gage height in feet of zero flow for a section control of regular shape, or the gage height of effective zero flow for a channel control or a section control of irregular shape;
p = regression coefficient (dimensionless); and
N = regression coefficient (dimensionless), generally not equal to p.

Staff Gage Height, G, Range (ft)	p	N	e (ft)	Valid Period Begin Date	Valid Period End Date
0.01 - 0.07	1.0742369	1.2769894	0.00	10-01-89	09-30-90
0.08 - 0.30	3.0540972	1.6699083	0.00	10-01-89	09-30-90
0.31 - 0.66	3.7647804	1.8436709	0.00	10-01-89	09-30-90

STAGE-DISCHARGE RATING EQUATIONS

STATION: SW37001, FIRST CREEK OFF-POST

DESCRIPTION: CONCRETE TRIANGULAR-THROATED FLUME

EQUATION FORM: $Q = p(G - e)^N$

where: Q = Discharge in cubic feet per second;
(G-e) = head or depth of water on the control in feet;
G = the gage height of the water surface in feet;
e = gage height in feet of zero flow for a section control of regular shape, or the gage height of effective zero flow for a channel control or a section control of irregular shape;
p = regression coefficient (dimensionless); and
N = regression coefficient (dimensionless), generally not equal to p.

Staff Gage Height, G, Range (ft)	p	N	e (ft)	Valid Period Begin Date	Valid Period End Date
0.50 - 0.54	0.124999989	0.999999979	0.50	10-01-89	09-30-90
0.55 - 0.59	1.226773025	1.709511275	0.50	10-01-89	09-30-90
0.60 - 0.75	4.306533142	2.231012279	0.50	10-01-89	09-30-90
0.76 - 2.50	6.853180828	2.566146561	0.50	10-01-89	09-30-90

STAGE-DISCHARGE RATING EQUATIONS

STATION: SW11002, HAVANA INTERCEPTOR

DESCRIPTION: CONCRETE-LINED TRAPEZOIDAL CHANNEL

EQUATION FORM: $Q = p(G - e)^N$

where: Q = Discharge in cubic feet per second;
(G-e) = head or depth of water on the control in feet;
G = the gage height of the water surface in feet;
e = gage height in feet of zero flow for a section control of regular shape, or the gage height of effective zero flow for a channel control or a section control of irregular shape;
p = regression coefficient (dimensionless); and
N = regression coefficient (dimensionless), generally not equal to p.

(1) Staff Gage Height, G, Range (ft)	p	N	e (ft)	Valid Period Begin Date	Valid Period End Date
0.086 - 0.113	5.06883068	2.53862410	0.00	10-01-89	09-30-90
0.114 - 0.283	182.4690690	4.18214079	0.00	10-01-89	09-30-90
0.284 - 1.39	20.86415818	2.46421834	0.00	10-01-89	09-30-90
1.391 - 4.00	21.46649374	2.37779196	0.00	10-01-89	09-30-90

(1) Staff gage height = CR-10 value

STAGE-DISCHARGE RATING EQUATIONS

STATION: SW12007, HIGHLINE LATERAL

DESCRIPTION: CIPPOLETTI WEIR

EQUATION FORM: $Q = p(G - e)^N$

where: Q = Discharge in cubic feet per second;
(G-e) = head or depth of water on the control in feet;
G = the gage height of the water surface in feet;
e = gage height in feet of zero flow for a section control of regular shape, or the gage height of effective zero flow for a channel control or a section control of irregular shape;
p = regression coefficient (dimensionless); and
N = regression coefficient (dimensionless), generally not equal to p.

Staff Gage Height, G, Range (ft)	p	N	e (ft)	Valid Period Begin Date	Valid Period End Date
0.01 - 0.04	5.99999983	0.99999999	0.00	10-01-89	09-30-90
0.05 - 0.09	11.77702045	1.20951125	0.00	10-01-89	09-30-90
0.10 - 0.20	15.97301939	1.33607175	0.00	10-01-89	09-30-90
0.21 - 0.33	30.47520000	1.73746171	0.00	10-01-89	09-30-90
0.34 - 1.07	35.00000002	1.86232821	0.00	10-01-89	09-30-90

STAGE-DISCHARGE RATING EQUATIONS

STATION: SW02001, LADORA WEIR

DESCRIPTION: 2-INCH-WIDE PLANKS FITTED ON TOP OF A CONCRETE WALL

EQUATION FORM: $Q = p(G - e)^N$

where: Q = Discharge in cubic feet per second;
(G-e) = head or depth of water on the control in feet;
G = the gage height of the water surface in feet;
e = gage height in feet of zero flow for a section control of regular shape, or the gage height of effective zero flow for a channel control or a section control of irregular shape;
p = regression coefficient (dimensionless); and
N = regression coefficient (dimensionless), generally not equal to p.

Staff Gage Height, G, Range (ft)	p	N	e (ft)	Valid Period Begin Date	Valid Period End Date
4.14 - 4.33(1)	19.98000000	1.50000000	4.13	10-01-89	07-12-90
4.34 - 6.13	28.20725079	1.71324624	4.13	10-01-89	07-12-90

(1) For staff gage heights between 4.13 ft and 4.33 ft, which corresponds to heads of 0.0 ft and 0.20 ft, use the given coefficients. Note that the flow can only be estimated in the low-flow range due to the fact that the nappe may not spring free of the crest when the head is less than 0.2 ft.

STAGE-DISCHARGE RATING EQUATIONS

STATION: SW01001, NORTH UVALDA

DESCRIPTION: BROAD-CRESTED CONCRETE WEIR

EQUATION FORM: $Q = p(G - e)^N$

where: Q = Discharge in cubic feet per second;
(G-e) = head or depth of water on the control in feet;
G = the gage height of the water surface in feet;
e = gage height in feet of zero flow for a section control of regular shape, or the gage height of effective zero flow for a channel control or a section control of irregular shape;
p = regression coefficient (dimensionless); and
N = regression coefficient (dimensionless), generally not equal to p.

Staff Gage Height, G, Range (ft)	p	N	e (ft)	Valid Period Begin Date	Valid Period End Date
0.165 - 0.188	117.1649533	5.190890513	0.00	10-01-89	09-30-90
0.189 - 0.435	218.7929949	5.56457547	0.00	10-01-89	09-30-90
0.436 - 2.36	7.35623634	1.48896286	0.00	10-01-89	09-30-90

STAGE-DISCHARGE RATING EQUATIONS

STATION: SW11001, PEORIA INTERCEPTOR

DESCRIPTION: FLAT-CRESTED WEIR WHICH CONSISTS OF A NARROW PLANK POSITIONED PERPENDICULAR TO FLOW. CHANGED TO A 90 DEGREE V-NOTCH WEIR ON APRIL 14, 1989.

EQUATION FORM: $Q = p(G - e)^N$

where: Q = Discharge in cubic feet per second;
(G-e) = head or depth of water on the control in feet;
G = the gage height of the water surface in feet;
e = gage height in feet of zero flow for a section control of regular shape, or the gage height of effective zero flow for a channel control or a section control of irregular shape;
p = regression coefficient (dimensionless); and
N = regression coefficient (dimensionless), generally not equal to p.

Staff Gage Height, G, Range (ft)	p	N	e (ft)	Valid Period Begin Date	Valid Period End Date
0.00 - 0.444	0.0000000	1.0000000	0.39	10-01-89	09-30-90
0.445 - 1.08	4.4887360	2.3454178	0.39	10-01-89	09-30-90
1.09 - 1.12	200.26455	12.581041	0.39	10-01-89	09-30-90
1.13 - 1.29	15.72101136	4.49539049	0.39	10-01-89	09-30-90
1.30 - 4.71	11.52103550	1.54529503	0.39	10-01-89	09-30-90

STAGE-DISCHARGE RATING EQUATIONS

STATION: SW08003, SOUTH FIRST CREEK

DESCRIPTION: CONCRETE COMPOUND WEIR

EQUATION FORM: $Q = p(G - e)^N$

where: Q = Discharge in cubic feet per second;
(G-e) = head or depth of water on the control in feet;
G = the gage height of the water surface in feet;
e = gage height in feet of zero flow for a section control of regular shape, or the gage height of effective zero flow for a channel control or a section control of irregular shape;
p = regression coefficient (dimensionless); and
N = regression coefficient (dimensionless), generally not equal to p.

Staff Gage Height, G, Range (ft)	p	N	e (ft)	Valid Period Begin Date	Valid Period End Date
0.00 - 0.92	4.38186739	2.47981406	-0.04	12-13-89	09-30-90
0.93 - 1.43	4.69819824	4.18732742	-0.04	12-13-89	09-30-90
1.44 - 3.73	8.25936147	2.72295354	-0.04	12-13-89	09-30-90
0.034 - 0.96	4.38186739	2.47981406	0.00	10-01-89	12-12-89
0.97 - 1.47	4.69819824	4.18732742	0.00	10-01-89	12-12-89

STAGE-DISCHARGE RATING EQUATIONS

STATION: SW01003, SOUTH PLANTS DITCH

DESCRIPTION: 90 DEGREE V-NOTCH WEIR PLATE

EQUATION FORM: $Q = p(G - e)^N$

where: Q = Discharge in cubic feet per second;
(G-e) = head or depth of water on the control in feet;
G = the gage height of the water surface in feet;
e = gage height in feet of zero flow for a section control of regular shape, or the gage height of effective zero flow for a channel control or a section control of irregular shape;
p = regression coefficient (dimensionless); and
N = regression coefficient (dimensionless), generally not equal to p.

Staff Gage Height, G, Range (ft)	p	N	e (ft)	Valid Period Begin Date	Valid Period End Date
3.43 - 3.62	(1)	(1)	3.43	10-01-89	09-30-90
3.63 - 3.80	2.488803337	2.481549685	3.43	10-01-89	09-30-90
3.80 - 5.43	(2) 33.30000000	1.500000000	3.80	10-01-89	09-30-90

(1) For gage heights between 3.43 ft and 3.62 ft which corresponds to heads of 0.00 ft and 0.19 ft. use the given coefficients for the gage height range of 3.63 ft - 3.80 ft. Note that the flow can only be estimated in the low-flow range due to the fact that the nappe may not spring free of the crest when the head is less than 0.2 ft.

(2) For gage heights above 3.80 ft use the coefficients given to compute a flow. To this add 0.21 cfs, the maximum flow through the V-notch. Note that the flow can only be estimated in this range above 3.80 ft.

STAGE-DISCHARGE RATING EQUATIONS

STATION: SW12005, SOUTH UVALDA

DESCRIPTION: V-NOTCH IN A 12-INCH-WIDE CONCRETE WEIR

EQUATION FORM: $Q = p(G - e)^N$

where: Q = Discharge in cubic feet per second;
(G-e) = head or depth of water on the control in feet;
G = the gage height of the water surface in feet;
e = gage height in feet of zero flow for a section control of regular shape, or the gage height of effective zero flow for a channel control or a section control of irregular shape;
p = regression coefficient (dimensionless); and
N = regression coefficient (dimensionless), generally not equal to p.

Staff Gage Height, G, Range (ft)	p	N	e (ft)	Valid Period Begin Date	Valid Period End Date
0.15 - 0.25	4.3152634E-29	48.79427888	-3.32	10-01-89	09-30-90
0.26 - 0.74	1.9319865E-19	31.33173826	-3.32	10-01-89	09-30-90
0.75 - 1.42	0.00027095	6.44063083	-3.32	10-01-89	09-30-90
1.43 - 1.60	3.9155296E-16	23.96131326	-3.32	10-01-89	09-30-90
1.61 - 1.78	6.6937503E-10	14.95383007	-3.32	10-01-89	09-30-90
1.79 - 5.80	0.01483656	4.57227707	-3.32	10-01-89	09-30-90

STAGE-DISCHARGE RATING EQUATIONS

STATION: SW24002, NORTH FIRST CREEK

DESCRIPTION: CONCRETE COMPOUND WEIR

EQUATION FORM: $Q = p(G - e)^N$

where: Q = Discharge in cubic feet per second;
(G-e) = head or depth of water on the control in feet;
G = the gage height of the water surface in feet;
e = gage height in feet of zero flow for a section control of regular shape, or the gage height of effective zero flow for a channel control or a section control of irregular shape;
p = regression coefficient (dimensionless); and
N = regression coefficient (dimensionless), generally not equal to p.

Staff Gage Height, G, Range (ft)	p	N	e (ft)	Valid Period Begin Date	Valid Period End Date
0.61 - 0.77	1.45522663	1.53515246	0.57	10-01-89	09-30-90
0.78 - 1.50	3.90348298	2.14822835	0.57	10-01-89	09-30-90
1.51 - 1.95	3.95295044	2.32175598	0.57	10-01-89	09-30-90
1.96 - 2.67	3.37620263	2.81141368	0.57	10-01-89	09-30-90

APPENDIX A-5

COMPARISON OF INSTANTANEOUS DISCHARGE VERSUS COMPUTED DISCHARGE

COMPARISON OF INSTANTANEOUS DISCHARGE VERSUS COMPUTED DISCHARGE
HAVANA INTERCEPTOR (SW11002)

(1)	(2)	(3)	* (4)	(5)	** (6)	*** (7) = 100X [(6)-(5)]/(6)	(8)	*** (9) = (4)-(8)	(10)	(11)
Measurement Number	Date	Start, Stop Time (hours)	Start, Stop Staff Gage Height (feet)	Instantaneous Discharge (cfs)	Computed Discharge (cfs)	Difference in Discharge (%)	Computed Staff Gage Height (feet)	Difference in Staff Gage Height (feet)	Measurement used for rating curve development and/or verification	Comments
1	10/04/89	0959, 1021	0.21, 0.20	0.30	0.22	-36.36	0.22	-0.02	x	RLSA, 200mm flume, downstream 500' below gage
2	01/23/90	1050, 1105	0.63, 0.75	0.24	10.27	97.66	0.16	0.59		RLSA, 200mm flume, downstream 200' below concrete channel, ice in channel
3	01/30/90	1335, 1403	0.12, 0.16	0.05	0.09	44.44	0.14	0.02		RLSA, 100mm flume, downstream 500' below gage, ice in channel
4	03/06/90	1300, 1340	0.75, 0.56	14.30	7.49	-90.92	0.86	-0.20		RLSA, Marsh McBirney, downstream 1000' below gage, ice in channel
5	03/13/90	1048, 1124	0.86, 0.92	22.55	15.66	-44.00	1.03	-0.14		RLSA, Marsh McBirney, downstream 1000' below gage, ice in channel
6	04/16/90	1440, 1534	0.12, 0.11	0.02	0.02	0.00	0.11	0.00	x	RLSA, 100mm flume, downstream 300' below concrete channel
7	05/15/90	1255, 1303	0.26, 0.24	0.49	0.47	-4.26	0.24	0.00	x	RLSA, 200mm flume
8	06/06/90	1331, 1400	0.16, 0.15	0.80	.09	-788.90	0.27	-0.11		RLSA, Marsh McBirney, downstream 50' below concrete channel
9	06/12/90	1328, 1407	0.15, 0.15	0.52	0.07	-612.33	0.25	-0.10		RLSA, Marsh McBirney, downstream 200' below concrete channel
10	06/19/90	0750, 0831	0.24, 0.24	0.54	0.47	-14.89	0.25	-0.01	x	RLSA, 200mm flume, downstream 200' below gage
11	06/22/90	1254, 1321	0.22, 0.21	0.30	0.27	-11.11	0.22	-0.01	x	RLSA, 200mm flume, downstream 60' below concrete channel
12	06/26/90	1212, 1240	0.22, 0.21	0.21	0.27	25.93	0.20	0.01	x	RLSA, 200mm flume, downstream 100' below concrete channel
13	07/09/90	1912, 1930	3.32, 2.15	158.11	235.85	32.96	2.32	0.42		RLSA, Marsh McBirney, downstream 10' below bubbler
14	07/09/90	1952, 2008	1.70, 1.58	61.13	69.60	12.17	1.56	0.08		RLSA, Marsh McBirney, downstream 10' below bubbler

COMPARISON OF INSTANTANEOUS DISCHARGE VERSUS COMPUTED DISCHARGE
HAVANA INTERCEPTOR (SW11002)

(1)	(2)	(3)	* (4)	(5)	** (6)	*** (7) = 100X [(6)-(5)]/(6)	(8)	*** (9) = (4)-(8)	(10)	(11)
Measurement Number	Date	Start, Stop Time (hours)	Start, Stop Staff Gage Height (feet)	Instantaneous Discharge (cfs)	Computed Discharge (cfs)	Difference in Discharge (%)	Computed Staff Gage Height (feet)	Difference in Staff Gage Height (feet)	Measurement used for rating curve development and/or verification	Comments
15	07/17/90	0947, 1026	0.22, 0.21	0.23	0.27	14.81	0.20	0.01	x	100mm flume, 5' above end of concrete channel
16	08/14/90	1058, 1230	.22, .21	0.32	0.27	-18.52	0.22	-0.01	x	RLSA, 200 mm flume, downstream at end of concrete channel
17	09/5/90	1400, 1416	.26, .23	0.39	0.55	4.88	0.23	0.02	x	RLSA, 5-gallon bucket, downstream at end of concrete channel

* Staff gage height = CR-10 value

** Discharges obtained with flumes are computed using the stop staff gage height. Discharges obtained with the Marsh McBirney are computed using the average of the start and stop staff gage heights.

*** Percent error in discharge is the curve value - the measured value
if "+", then the measurement lies above the curve.

if "-", then the measurement lies below the curve.

**** Stage error is the measured value- the curve value
if "+", then the measurement lies above the curve.

if "-", then the measurement lies below the curve.

COMPARISON OF INSTANTANEOUS DISCHARGE VERSUS COMPUTED DISCHARGE
PEORIA INTERCEPTOR (SW11001)

(1)	(2)	(3)	* (4)	(5)	** (6)	*** (7) = 100X [(6)-(5)]/(6)	(8)	**** (9) = (4)-(8)	(10)	(11)
Measurement Number	Date	Start, Stop Time (hours)	Start, Stop Staff Gage Height (feet)	Instantaneous Discharge (cfs)	Computed Discharge (cfs)	Difference in Discharge (%)	Computed Staff Gage Height (feet)	Difference in Staff Gage Height (feet)	Measurement used for rating curve development and/or verification	Comments
1	10/04/89	1200, 1257	0.43, 0.43	0.02	T	NA	0.53	-0.10		RLSA, 100mm flume, downstream 75' below weir
2	01/30/90	1424, 1436	0.44, 0.46	0.09	T	NA	0.50	-0.05		RLSA, 1-liter bottle, at V-notch on weir, ice in channel
3	01/30/90	1449, 1508	0.47, 0.48	0.01	T	NA	0.50	-0.02	X*****	RLSA, 100mm flume, downstream 50' below weir, ice in channel
4	03/06/90	1027, 1111	1.12, 1.35	5.29	7.57	30.12	1.17	0.07		RLSA, Marsh McBirney, upstream 50' above weir
5	03/13/90	0952, 1025	1.12, 1.26	6.58	5.77	-14.04	1.21	-0.02	X	RLSA, Marsh McBirney, upstream 20' above weir
6	03/20/90	1530, 1558	0.47, 0.47	0.02	T	NA	0.53	-0.06	X*****	RLSA, 100mm flume, downstream 60' below weir
7	04/16/90	1220, 1309	0.41, 0.41	0.01	T	NA	0.50	-0.09		RLSA, 100mm flume, downstream 100' below weir
8	06/06/90	1300, 1310	0.48, 0.48	0.45	T	NA	0.89	-0.41		RLSA, Marsh McBirney
9	06/12/90	1110, 1140	0.53, 0.52	0.03	0.02	-50.00	0.56	-0.04	X*****	RLSA, 100mm flume, downstream 100' below weir
10	06/19/90	0720, 0731	0.58, 0.56	0.10	0.03	-233.33	0.66	-0.10	X*****	RLSA, 100mm flume, downstream 30' below weir
11	06/22/90	1217, 1235	0.53, 0.53	0.03	0.02	-50.00	0.56	-0.03	X*****	RLSA, 100mm flume, downstream 30' below weir
12	06/26/90	1125, 1157	0.54, 0.53	0.05	0.02	-150.00	0.60	-0.07	X*****	RLSA, 100mm flume, downstream 30' below weir
13	07/17/90	0848, 0906	0.57, 0.57	0.08	0.04	-100.00	0.64	-0.07	X*****	RLSA, 200mm flume, downstream 40' below weir
14	09/04/90	0930, 0934	0.52, 0.52	0.04	0.02	-100.00	0.58	-0.06	X*****	RLSA, 5-gallon bucket, at V-notch on weir

Peoria Interceptor (SW11001) continued

* Starting and stopping staff gage heights are calculated using the (CR-10 value x 1.04) + 0.07 for measurements 2-13
1.04 = reference differential
0.07 = surveyed difference between bubbler orifice and 0.00 mark on originial staff gage.

** Discharges obtained with flumes are computed using the stop staff gage height. Discharges obtained with the Marsh McBirney are computed using the average of the start and stop staff gage heights.

*** Percent error in discharge is the curve value - the measured value
if "+", then the measurement lies above the curve.

if "-", then the measurement lies below the curve.

**** Stage error is the measured value - the curve value
if "+", then the measurement lies above the curve.

if "-", then the measurement lies below the curve.

***** Measurements used to redefine lower portion of rating using best fit analysis.

T = flow > 0.00 but < 0.005 cfs
NA = not applicable

COMPARISON OF INSTANTANEOUS DISCHARGE VERSUS COMPUTED DISCHARGE
LADORA WEIR (SW02001)

(1) Measurement Number	(2) Date	(3) Start, Stop Time (hours)	(4) Start, Stop Staff Gage Height (feet)	(5) Instantaneous Discharge (cfs)	(6) * Computed Discharge (cfs)	(7) = 100X [(6)-(5)]/(6) ** Difference in Discharge (%)	(8) Computed Staff Gage Height (feet)	(9) = (4)-(8) *** Difference in Staff Gage Height (feet)	(10) Measurement used for rating curve development and/or verification	(11) Comments
1	06/22/90	1006, 1032	4.72, 4.72	11.50	11.42	-0.70	4.72	0.00	x	RLSA, Marsh McBirney, downstream 25' below gage
2	06/26/90	1045, 1105	4.16, 4.16	0.09	0.10	10.00	4.16	0.00	x	RLSA, 100mm flume, downstream 40' below gage
3	07/03/90	1304, 1328	4.15, 4.15	0.09	0.06	-83.33	4.16	-0.01	x	RLSA, 100mm flume, downstream 30' below gage
4	07/09/90	1000, 1030	4.15, 4.15	0.09	0.06	-83.33	4.16	-0.01	x	RLSA, 100mm flume, downstream 30' below gage
5 ****	09/05/90	0950, 1000	3.78, 3.78	6.23	N/A	N/A	4.54	-0.76		RLSA, Marsh McBirney, downstream 20' below gage
6 ****	09/05/90	1005, 1012	3.78, 3.78	5.42	N/A	N/A	4.51	-0.73		RLSA, Marsh McBirney, downstream 20' below gage

* Discharges obtained with flumes are computed using the stop staff gage height. Discharges obtained with the Marsh McBirney are computed using the average of the start and stop staff gage heights.

** Percent error in discharge is the curve value - the measured value
if "+", then the measurement lies above the curve.

if "-", then the measurement lies below the curve.

*** Stage error is the measured value - the curve value
if "+", then the measurement lies above the curve.

if "-", then the measurement lies below the curve.

**** Measurements 5 and 6 were collected after weir structure was reconstructed, therefore, rating is not valid from 7/12/90 to end of WY90.

COMPARISON OF INSTANTANEOUS DISCHARGE VERSUS COMPUTED DISCHARGE
SOUTH UVALDA (SW12005)

(1)	(2)	(3)	(4)	(5)	(6)**	(7) = 100X [(6)-(5)]/(6)***	(8)	(9) = (4)-(8)****	(10)	(11)
Measurement Number	Date	Start, Stop Time (hours)	Start, Stop Staff Gage Height (feet)	Instantaneous Discharge (cfs)	Computed Discharge (cfs)	Difference in Discharge (%)	Computed Staff Gage Height (feet)	Difference in Staff Gage Height (feet)	Measurement used for rating curve development and/or verification	Comments
1	10/04/89	0828, 0852	0.49, 0.49	0.30	.31	3.23	0.49	0.00	x	RLSA, 200mm flume, downstream 40' below gage
2	01/09/90	1408, 1429	0.54, 0.56	0.52	.54	3.70	0.55	0.01	x	RLSA, 200mm flume
3	02/06/90	1348, 1358	0.49, 0.49	0.30	.31	3.23	0.49	0.00	x	RLSA, 200mm flume, downstream 240' below gage
4	03/08/90	1348, 1402	*1.06	3.74	3.67	-1.91	1.07	-0.01	x	RLSA, Marsh McBirney, downstream 25' below gage
5	03/13/90	1315, 1354	*1.02	3.52	3.46	-1.73	1.03	-0.01	x	RLSA, Marsh McBirney, downstream 25' below weir
6	03/28/90	1942, 1015	*0.57	0.44	.59	25.42	0.53	0.04		RLSA, 200mm flume, downstream 40' below gage
7	04/16/90	0916, 0947	0.53, 0.52	0.39	.39	0.00	0.52	0.00	x	RLSA, 200mm flume, downstream 50' below weir
8	05/15/90	0915, 0933	0.56, 0.56	0.49	0.54	9.26	0.55	0.01	x	RLSA, 200mm flume, downstream 55' below gage
9	06/12/90	1025, 1045	0.52, 0.50	0.34	0.33	-3.03	0.50	0.00	x	RLSA, 200mm flume, downstream 40' below gage
10	06/22/90	1347, 1408	0.51, 0.51	0.31	0.36	13.89	0.49	0.02	x	RLSA, 100mm flume, downstream 50' below gage
11	08/28/90	1309, 1332	0.54, 0.55	0.29	0.52	44.23	0.48	0.07		RLSA, 100mm flume, downstream 50' below gage
12	09/06/90	0747,08 05	0.55, 0.55	0.44	0.52	15.38	0.53	0.02	x	RLSA, 200mm flume, downstream 80' below gage

* Staff gage height estimated from CR-10 value

** Discharges obtained with flumes are computed using the stop staff gage height. Discharges obtained with the Marsh McBirney are computed using the average of the start and stop staff gage heights.

*** Percent error in discharge is the curve value - the measured value
if "+", then the measurement lies above the curve.
if "-", then the measurement lies below the curve.

**** Stage error is the measured value - the curve value
if "+", then the measurement lies above the curve.
if "-", then the measurement lies below the curve.

COMPARISON OF INSTANTANEOUS DISCHARGE VERSUS COMPUTED DISCHARGE
NORTH UVALDA (SW01001)

(1) Measurement Number	(2) Date	(3) Start, Stop Time (hours)	(4) Start, Stop Staff Gage Height (feet)	(5) Instantaneous Discharge (cfs)	* (6) Computed Discharge (cfs)	** (7) = 100X [(6)-(5)]/(6) Difference in Discharge (%)	(8) Computed Staff Gage Height (feet)	*** (9) = (4)-(8) Difference in Staff Gage Height (feet)	(10) Measurement used for rating curve development and/or verification	(11) Comments
1	04/17/90	1320, 1335	0.23, 0.26	0.04	0.12	66.67	0.21	0.05		RLSA, 100mm flume, downstream 30' below gage
2	06/15/90	1334, 1350	2.23, 2.02	19.87	22.68	12.39	1.95	0.18		RLSA, Marsh McBirney, downstream 40' below gage
3	06/18/90	1225, 1250	1.78, 1.70	14.38	16.78	14.30	1.57	0.17		RLSA, Marsh McBirney, upstream 20' above gage
4	06/19/90	1225, 1237	1.29, 1.25	9.20	10.50	12.38	1.16	0.11		RLSA, Marsh McBirney, upstream 25' above gage
5	06/21/90	1523, 1537	1.29, 1.30	10.60	10.87	2.48	1.28	0.02	x	RLSA, Marsh McBirney, upstream 20' above gage
6	06/22/90	0924, 0938	1.42, 1.42	12.55	12.40	-1.21	1.43	-0.01	x	RLSA, Marsh McBirney, upstream 20' above gage
7	07/08/90	0930, 0940	0.24, 0.24	0.14	0.08	-75.00	0.27	-0.03		RLSA, 100mm flume, downstream 120' below gage
8	07/09/90	0924, 0941	0.23, 0.22	0.14	0.05	-180.00	0.27	-0.05		RLSA, 100mm flume, downstream 120' below gage
9	07/16/90	1459, 1509	0.19, 0.19	0.02	0.02	0.00	0.19	0.00	x	RLSA, 100mm flume, downstream 80' below gage
10	08/28/90	1450, 1500	0.18, 0.18	0.02	0.02	0.00	0.19	-0.01	x	RLSA, 100mm flume, downstream 60' below gage
11	09/06/90	0928, 0955	0.23, 0.23	0.07	0.06	-16.67	0.24	-0.01	x	RLSA, 100mm flume, downstream 60' below gage

* Discharges obtained with flumes are computed using the stop staff gage height. Discharges obtained with the Marsh McBirney are computed using the average of the start and stop staff gage heights.

** Percent error in discharge is the curve value - the measured value
if "+", then the measurement lies above the curve.

if "-", then the measurement lies below the curve.

*** Stage error is the measured value - the curve value
if "+", then the measurement lies above the curve.

COMPARISON OF INSTANTANEOUS DISCHARGE VERSUS COMPUTED DISCHARGE
HIGHLINE LATERAL (SW12007)

(1) Measurement Number	(2) Date	(3) Start, Stop Time (hours)	(4) Start, Stop Staff Gage Height (feet)	(5) Instantaneous Discharge (cfs)	** (6) Computed Discharge (cfs)	*** (7) = 100 [(6)-(5)]/(6) Difference in Discharge (%)	(8) Computed Staff Gage Height (feet)	**** (9) = (4)-(8) Difference in Staff Gage Height (feet)	(10) Measurement used for rating curve development and/or verification	(11) Comments
1*	05/15/90	0948, 1054	0.43, 0.43	7.95	7.27	-9.35	0.45	-0.02	x	RLSA, Marsh McBirney
2*	05/15/90	1055, 1100	0.44, 0.44	7.63	7.60	-0.39	0.44	0.00	x	RLSA, Marsh McBirney, upstream 15' above gage
3*	05/16/90	0948, 0959	0.50, 0.51	8.16	9.99	18.31	0.46	0.05		RLSA, Marsh McBirney, upstream 20' above gage
4*	06/06/90	1215, 1220	0.64, 0.63	14.58	15.24	4.33	0.62	0.02	x	RLSA, Marsh McBirney, upstream 15' above gage
5	06/11/90	0847, 0916	0.65, 0.67	15.70	16.14	2.73	0.65	0.01	x	RLSA, Marsh McBirney, upstream 15' above gage
6	06/11/90	0917, 0939	0.67, 0.65	15.66	16.14	2.97	0.65	0.01	x	RLSA, Marsh McBirney, upstream 15' above gage
7	06/13/90	0743, 0758	0.72, 0.70	17.23	18.50	6.87	0.68	0.03		RLSA, Marsh McBirney, upstream 10' above gage
8	06/13/90	1330, 1340	0.79, 0.73	19.21	20.99	8.48	0.72	0.04		RLSA, Marsh McBirney, upstream 10' above gage
9	06/14/90	1605, 1610	0.63, 0.61	15.35	14.37	-6.82	0.64	-0.02	x	RLSA, Marsh McBirney, upstream 10' above gage
10	06/15/90	1402, 1415	0.75, 0.73	21.24	19.98	-6.31	0.76	-0.02	x	RLSA, Marsh McBirney, upstream 15' above gage
11	06/18/90	1305, 1325	0.69, 0.65	15.99	16.60	3.67	0.66	0.01	x	RLSA, Marsh McBirney, upstream 15' above gage
12	06/19/90	1317, 1325	0.40, 0.36	6.30	5.77	-9.19	0.40	-0.02	x	RLSA, Marsh McBirney, upstream 15' above gage
13	06/21/90	1459, 1518	0.50, 0.50	9.98	9.63	-3.63	0.51	-0.01	x	RLSA, Marsh McBirney, upstream 10' above gage
14	06/22/90	0853, 0910	0.57, 0.56	12.66	12.29	-3.01	0.58	-0.01	x	RLSA, Marsh McBirney, upstream 15' above gage
15	07/16/90	1425, 1436	0.61, 0.63	14.49	14.37	-0.84	0.62	0.00	x	RLSA, Marsh McBirney, upstream 15' above gage

COMPARISON OF INSTANTANEOUS DISCHARGE VERSUS COMPUTED DISCHARGE
HIGHLINE LATERAL (SW12007)

(1) Measurement Number	(2) Date	(3) Start, Stop Time (hours)	(4) Start, Stop Staff Gage Height (feet)	(5) Instantaneous Discharge (cfs)	** (6) Computed Discharge (cfs)	*** (7) = 100 [(6)-(5)]/(6) Difference in Discharge (%)	(8) Computed Staff Gage Height (feet)	**** (9) = (4)-(8) Difference in Staff Gage Height (feet)	(10) Measurement used for rating curve development and/or verification	(11) Comments
16	07/17/90	1133, 1145	0.54, 0.52	10.80	10.73	-0.65	0.53	0.00	x	RLSA, Marsh McBirney, upstream 15' above gage
17	07/18/90	0957, 1007	Below gage	0.05	NA	NA	0.03	NA		RLSA, 200mm flume
18	07/26/90	1325, 1340	0.64, 0.66	16.40	15.69	-4.53	0.67	-0.02	x	RLSA, Marsh McBirney, upstream 20' above gage
19	07/27/90	1150, 1157	0.60, 0.60	13.62	13.52	-0.74	0.60	0.00	x	RLSA, Marsh McBirney, upstream 20' above gage
20	08/22/90	1450, 1500	0.60, 0.60	13.41	13.52	0.81	0.60	0.00	x	RLSA, Marsh McBirney, upstream 17' above gage

* Reported staff gage heights from 5/15/90 to 6/06/90 were adjusted to the current staff gage by subtracting 0.85 from the observed gage height.

** Discharges obtained with flumes are computed using the stop staff gage height. Discharges obtained with the Marsh McBirney are computed using the average of the start and stop staff gage heights.

*** Percent error in discharge is the curve value - the measured value
if "+", then the measurement lies above the curve.

if "-", then the measurement lies below the curve.

**** Stage error is the measured value - the curve value
if "+", then the measurement lies above the curve.

if "-", then the measurement lies below the curve.

COMPARISON OF INSTANTANEOUS DISCHARGE VERSUS COMPUTED DISCHARGE
SOUTH FIRST CREEK (SW08003)

(1) Measurement Number	(2) Date	(3) Start, Stop Time (hours)	(4) Start, Stop Staff Gage Height (feet)	(5) Instantaneous Discharge (cfs)	* (6) Computed Discharge (cfs)	** (7) = 100X [(6)-(5)]/(6) Difference in Discharge (%)	(8) Computed Staff Gage Height (feet)	*** (9) = (4)-(8) Difference in Staff Gage Height (feet)	(10) Measurement used for rating curve development and/or verification	(11) Comments
1	10/03/89	0910, 0937	0.22, 0.22	0.09	0.10	12.62	0.21	0.01	x	RLSA, 100mm flume, downstream 40' below gage
2	11/24/89	1125, 1140	0.46, 0.46	0.63	0.64	1.41	0.46	0.00	x	RLSA, 200mm flume, downstream 40' below gage
3	01/09/90	1315, 1335	0.48, 0.48	0.97	0.87	-12.00	0.50	-0.02	x	RLSA, 200mm flume, downstream 40' below gage
4	02/06/90	1056, 1110	0.47, 0.47	0.79	0.83	4.24	0.46	0.01	x	RLSA, 200mm flume, downstream 20' below weir
5	03/09/90	1055, 1150	0.76, 0.76	2.36	2.52	6.35	0.74	0.02	x	RLSA, Marsh McBirney, downstream 25' below weir
6	04/18/90	1237, 1305	0.52, 0.52	1.08	1.04	-3.85	0.53	-0.01	x	RLSA, 200mm flume, downstream 30' below weir
7	04/23/90	1510, 1522	0.50, 0.50	0.97	0.95	-2.00	0.50	0.00	x	RLSA, 200mm flume, downstream 40' below gage
8	05/08/90	0949, 1005	0.45, 0.45	0.79	0.75	-5.76	0.46	-0.01	x	RLSA, 200mm flume, downstream 40' below gage
9	05/15/90	0834, 0843	0.45, 0.45	0.76	0.75	-1.74	0.45	0.00	x	RLSA, 200mm flume, downstream 35' below gage
10	05/22/90	1228, 1315	0.45, 0.45	0.75	0.75	-0.40	0.45	0.00	x	RLSA, Marsh McBirney, downstream 25' below weir
11	05/29/90	0944, 1016	0.36, 0.36	0.52	0.45	-15.04	0.38	-0.02	x	RLSA, 200mm flume, downstream 30' below gage
12	05/30/90	0735, 0754	0.79, 0.78	2.66	2.68	0.75	0.78	0.00	x	RLSA, 200mm flume, downstream 40' below gage
13	06/21/90	0823, 0857	0.54, 0.54	1.25	1.14	-10.13	0.56	-0.02	x	RLSA, 200mm flume, dowsntream 40' below gage
14	06/27/90	0733, 0756	0.27, 0.26	0.24	0.27	-8.60	0.27	-0.01	x	RLSA, 200mm flume, downstream 40' below gage

COMPARISON OF INSTANTANEOUS DISCHARGE VERSUS COMPUTED DISCHARGE
SOUTH FIRST CREEK (SW08003)

(1) Measurement Number	(2) Date	(3) Start, Stop Time (hours)	(4) Start, Stop Staff Gage Height (feet)	(5) Instantaneous Discharge (cfs)	* (6) Computed Discharge (cfs)	** (7) = 100X [(6)-(5)]/(6) Difference in Discharge (%)	(8) Computed Staff Gage Height (feet)	*** (9) = (4)-(8) Difference in Staff Gage Height (feet)	(10) Measurement used for rating curve development and/or verification	(11) Comments
15	07/09/90	0804, 0826	0.12, 0.12	0.03	0.05	36.17	0.09	0.03	x	RLSA, 100mm flume, downstream 40' below gage
16	07/24/90	0906, 0927	0.26, 0.26	0.24	0.22	-9.10	0.27	-0.01	x	RLSA, 100mm flume, downstream 20' below weir
17	08/14/90	1435, 1450	0.09, 0.09	0.04	0.03	-42.86	0.11	-0.02	x	RLSA, 100mm flume, downstream 25' below weir
18	08/22/90	1234, 1306	0.58, 0.57	1.60	1.34	-19.49	0.63	-0.05		RLSA, Marsh McBirney, downstream 55' below weir
19	09/07/90	0956, 1016	0.21, 0.21	0.17	0.14	-20.57	0.23	-0.02	x	RLSA, 100mm flume, downstream 100' below gage
20	09/12/90	0746, 0827	0.34, 0.39	0.52	0.54	3.70	0.38	0.01	x	RLSA, 200mm flume, downstream 50' below weir
21	09/24/90	1312, 1332	0.51, 0.50	0.69	0.95	27.37	0.43	0.07		RLSA, 200mm flume, downstream 100' below gage

* Discharges obtained with flumes are computed using the stop staff gage height. Discharges obtained with the Marsh McBirney are computed using the average of the start and stop staff gage heights.

** Percent error in discharge is the curve value - the measured value
if "+", then the measurement lies above the curve.

if "-", then the measurement lies below the curve.

*** Stage error is the measured value - the curve value
if "+", then the measurement lies above the curve.

if "-", then the measurement lies below the curve.

COMPARISON OF INSTANTANEOUS DISCHARGE VERSUS COMPUTED DISCHARGE
NORTH FIRST CREEK (SW24002)

(1) Measurement Number	(2) Date	(3) Start, Stop Time (hours)	(4) Start, Stop Staff Gage Height (feet)	(5) Instantaneous Discharge (cfs)	* (6) Computed Discharge (cfs)	** (7) = 100X [(6)-(5)]/(6) Difference in Discharge (%)	(8) Computed Staff Gage Height (feet)	*** (9) = (4)-(8) Difference in Staff Gage Height (feet)	(10) Measurement used for rating curve development and/or verification	(11) Comments
1	01/16/90	1346, 1402	.62, .62	0.02	0.02	0.00	.62	0.00	x	RLSA, 100mm flume, downstream 50' below gage
2	02/20/90	1545, 1607	.77, .77	0.17	0.12	-41.67	.80	-0.03		RLSA, 100mm flume, downstream 40' below gage, ice in channel
3	03/09/90	1015, 1030	1.50, 1.48	4.07	3.26	-24.85	1.59	-0.10		RLSA, Marsh McBirney, downstream 20' below weir
4	03/20/90	1110, 1140	1.21, 1.20	1.63	1.50	-8.67	1.24	-0.03		RLSA, Marsh McBirney, downstream 40' below weir
5	03/27/90	1110, 1135	1.17, 1.17	1.29	1.30	0.77	1.17	0.00	x	RLSA, 200mm flume, downstream 30' below gage
6	04/18/90	1113, 1140	1.12, 1.12	1.12	1.08	-3.70	1.13	-0.01	x	RLSA, 200mm flume, downstream 30' below weir
7	04/23/90	0915, 0945	1.13, 1.12	1.08	1.08	0.00	1.12	0.00	x	RLSA, 200mm flume, downstream 50' below gage
8	05/08/90	0823, 0833	1.01, 1.02	0.66	0.70	5.71	1.01	0.01	x	RLSA, 200mm flume, downstream 30' below gage
9	05/15/90	0708, 0727	1.04, 1.03	0.72	0.74	2.70	1.03	0.00	x	RLSA, 200mm flume, downstream 50' below gage
10	05/29/90	0815, 0902	0.81, 0.81	0.19	0.18	-5.56	.81	0.00	x	RLSA, 200mm flume, downstream 40' below gage
11	05/30/90	0907, 0914	1.10, 1.11	1.04	1.04	0.00	1.11	0.00	x	RLSA, Marsh McBirney, downstream 27' below gage
12	08/22/90	1400, 1417	1.32, 1.32	1.80	2.10	14.29	1.27	0.05		RLSA, Marsh McBirney, downstream 40' below weir
13	09/24/90	1416, 1445	1.12, 1.12	1.04	1.08	3.70	1.11	0.01	x	RLSA, 200mm flume, downstream 80' below gage

* Discharges obtained with flumes are computed using the stop staff gage height. Discharges obtained with the Marsh McBirney are computed using the average of start and stop staff gage heights.

** Percent error in discharge is the curve value - the measured value
if "+", then the measurement lies above the curve.
if "-", then the measurement lies below the curve.

*** Stage error is the measured value - the curve value
if "+", then the measurement lies above the curve.
if "-", then the measurement lies below the curve.

COMPARISON OF INSTANTANEOUS DISCHARGE VERSUS COMPUTED DISCHARGE
FIRST CREEK OFF-POST (SW37001)

(1)	(2)	(3)	(4)	(5)	* (6)	** (7) = 100X [(6)-(5)]/(6)	(8)	*** (9) = (4)-(8)	(10)	(11)
Measurement Number	Date	Start, Stop Time (hours)	Start, Stop Staff Gage Height (feet)	Instantaneous Discharge (cfs)	Computed Discharge (cfs)	Difference in Discharge (%)	Computed Staff Gage Height (feet)	Difference in Staff Gage Height (feet)	Measurement used for rating curve development and/or verification	Comments
1	11/07/89	1527, 1537	0.60, 0.60	0.02	0.03	33.33	0.59	0.01	x	RLSA, 100mm flume, downstream 15' below gage
2	11/14/89	1525, 1535	0.60, 0.60	0.02	0.03	33.33	0.59	0.01	x	RLSA, 100mm flume, downstream 15' below gage
3	11/24/89	1450, 1500	0.61, 0.61	0.02	0.03	33.33	0.59	0.02	x	RLSA, 100mm flume, downstream 25' below gage
4	11/28/89	1450, 1500	0.64, 0.64	0.05	0.05	0.00	0.64	0.00	x	RLSA, 100mm flume, downstream 25' below gage
5	03/09/90	1310, 1353	1.35, 1.36	4.49	4.65	3.44	1.35	0.01	x	RLSA, Marsh McBirney, upstream 20' above concrete flume
6	04/18/90	0825, 0850	0.97, 0.97	0.97	0.99	2.02	0.97	0.00	x	RLSA, 200mm flume, downstream 30' below gage
7	04/23/90	0730, 0753	0.98, 0.98	0.97	1.04	6.73	0.97	0.01	x	RLSA, 200mm flume, downstream 25' below gage
8****	06/06/90	1540, 1616	0.70, 0.70	0.32	0.12	-166.67	0.80	-0.10		RLSA, Marsh McBirney, downstream 8' below concrete flume
9****	06/19/90	0855, 0915	0.67, 0.67	0.02	0.08	75.00	0.59	0.08		RLSA, 100mm flume, upstream 100' above gage
10****	06/26/90	1407, 1435	0.63, 0.63	0.02	0.05	60.00	0.59	0.04		RLSA, 100mm flume, upstream 150' above gage
11****	06/28/90	1440, 1455	0.62, 0.62	0.01	0.04	75.00	0.56	0.06		RLSA, 100mm flume, upstream 60' above gage
12	08/22/90	0950, 1012	1.26, 1.26	3.99	3.39	-17.70	1.31	-0.05		RLSA, Marsh McBirney, upstream 10' above mouth of flume
13	09/07/90	1302, 1316	0.65, 0.65	0.05	0.06	16.66	0.64	0.01	x	RLSA, 100mm flume, upstream 120' above gage
14	09/25/90	0715, 0725	0.68, 0.68	0.04	0.09	55.55	0.62	0.06		RLSA, 100mm flume, upstream 80' above gage

First Creek Off Post (SW37001) continued

* Discharges obtained with flumes are computed using the stop staff gage height. Discharges obtained with the Marsh McBirney are computed using the average of start and stop staff gage heights.

** Percent error in discharge is the curve value - the measured value
if "+", then the measurement lies above the curve.

if "-", then the measurement lies below the curve.

*** Stage error is the measured value - the curve value
if "+", then the measurement lies above the curve.

if "-", then the measurement lies below the curve.

**** Observed staff gage values may be erroneous due to partially plugged intake pipes.

No comparisons were made at the following sites in Water Year 1990:

SW01003	South Plants Ditch
SW26001	Basin F
SW36001	Basin A

APPENDIX A-6

CONTINUOUS GAGE HEIGHT RECORDERS EQUIPMENT AND PROCEDURES

APPENDIX A-6.1

STEVENS TYPE F EQUIPMENT SPECIFICATIONS AND PROCEDURES

A-6.1 Stevens Type F Recorder Procedures

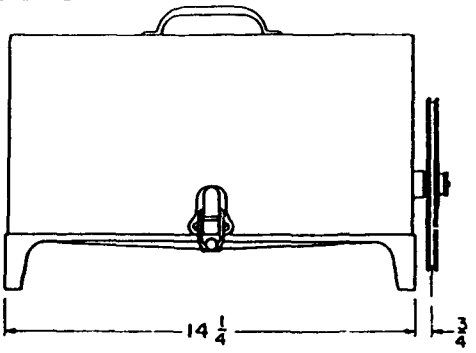
During Water Year 1990 there were twelve surface water stations equipped with Stevens Type F water level recorders. The Stevens Type F recorders currently in use are Model 68's equipped with quartz multispeed timers and either multiple D-cell batteries or a single mercury battery power source. The Stevens Type F recorder is attached to a float, beaded wire, and pulley. Changing water levels in the stilling well cause the float to rise and fall which turns the recorder's drum proportionally. The quartz multispeed timer moves a pen across the strip chart at a uniform speed. The resulting record produced is a graph of water level versus time.

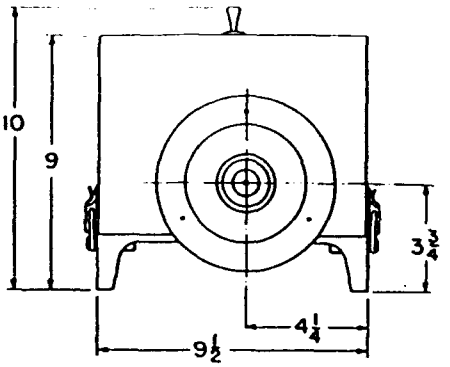
Weekly activities at the continuous monitoring stations included collecting and replacing strip charts, checking recorder operation, calibrating strip charts to the outside observed stage and initial time, and removing obstructions from stilling wells, channel sections and control structures. Freezing conditions prohibited the use of the recorders from late November 1989 through February 1990. Stage data is invalid during periods of freezing because the frozen water in the stilling well incapacitates the recorder's float and pulley system.

The strip chart analog stage data were reduced to a digitized format using the computer program CPSPC (Radian Corp., October 1987, Version 3.1) in conjunction with a digitizer. After a strip chart has been digitized, the software program transforms the digital file into units used by the analog record. In this case, the scale was correlated to Julian date and scientific hours for time and to 0.01 ft for gage height. The minimal digitized strip chart points chosen were 0.00, 12.00, and 24.00 for each record day. Other significant stage points selected for digitization were high flow events, when gage heights were digitized at a minimum of 15 minute intervals, and any stage points that exhibited 0.1+ ft of deflection within any 2 hour period. Finally, the digitized stage output was compared to the strip chart analog record and corrected to the observed staff gage settings.

STEVENS TYPE F Water-level Recorder

Specifications





GAGE SCALES ADAPT RECORDER TO WATER-LEVEL RANGE

The relationship between the rotation of the float pulley and the chart drum is set by gearing. Changes in the gearing, or the pulley circumference, thus affect the ratio between the chart *record* and *water-level* changes. This ratio is known as *gage scale*.

To make a field change from any scale listed in the Table, *below*, (except 1:20 and 1:24) to another, requires only the substitution of a pair of gears. The 1:20 and 1:24 scales are obtained by installing the 750 mm. or 36 *in.* circumference ring on the float pulley of a Recorder geared for the 1:10 or 1:12 scales, respectively.

Table 3

GAGE SCALES FOR STEVENS TYPE F RECORDER (obtained by gearing)

Gage Scale	*Water Level Change for 1 Rev. of Drum*	*Value of Smallest Chart Division*	*Float Pulley Required*
English Decimal System—		*F1/F2 F3 Chart*	
1:1	1.0 ft.	.01 ft. .1 in.	18 in. circ.
1:2	2.0 ft.	.02 ft. .2 in.	18 in. circ.
1:5	5.0 ft.	.05 ft. .5 in.	18 in. circ.
1:10	10.0 ft.	.10 ft. 1.0 in.	18 in. circ.
1:20	20.0 ft.	.20 ft. 2.0 in.	36 in. circ.
English Duo-Decimal System—		*F3 Chart*	
10:12	1.2 ft.	.01 ft.	18 in. circ.
5:12	2.4 ft.	.02 ft.	18 in. circ.
1:6	6.0 ft.	.05 ft.	18 in. circ.
1:12	12.0 ft.	.10 ft.	18 in. circ.
1:24	24.0 ft.	.20 ft.	36 in. circ.
Metric System—		*F4 Chart*	
1:1	0.3 m.	2 mm.	375 mm. circ.
1:2	0.6 m.	4 mm.	375 mm. circ.
1:5	1.5 m.	10 mm.	375 mm. circ.
1:10	3.0 m.	20 mm.	375 mm. circ.
1:20	6.0 m.	40 mm.	750 mm. circ.

NOTE: Range is unlimited since the chart drum may make any number of revolutions.

Leupold & Stevens, Inc.

P.O. Box 688 Tel. 503 646-9171

Beaverton, Oregon 97005 U.S.A. • Cable LEUSTEV, Beaverton.

Basic Type F Recorder Specifications

Float operated water level recorder with horizontal ball bearing chart drum; rectangular chart 12 inches (or 30 cm) x 9.6 inches; capillary pen with Lucite reservoir; 1 oz. black ink; 4 legged cast aluminum base for shelf or table mounting; metal cover without port.

APPLICATION OPTIONS:

Type of pen drive:

- ☐ 8 day spring driven clock
- ☐ 30 day weight driven clock
- ☐ synchronous motor for ___V, ___Hz
- ☐ battery driven clock, 1.5 VDC

Time scale:

_____ (refer to Table 1 for availability)

Gage scale:

_____ (refer to Table 3 for availability)

Chart:

- ☐ F1 ☐ F3 ☐ F7
- ☐ F2 ☐ F4 ☐ F8

Float Pulley:

- ☐ 18 in. or 375 mm circumference for
  - ☐ beaded float line ☐ perforated tape
- ☐ 36 in. or 750 mm pulley ring for 1:20 and 1:24 gage scales

Float line/tape:

- ☐ _____ feet stainless steel float line with set end hooks
- ☐ _____ feet stainless steel perforated and graduated float tape with set end hooks and index bracket

Float with counterweight:

- ☐ 2½ in. ☐ 5 in.
- ☐ 3 in. ☐ 6 in.
- ☐ 3½ in. ☐ 7 in.
- ☐ 4 in. ☐ 8 in.

Accessories:

- ☐ Scow float with adjustable anchor rod and counterweight
- ☐ Automatic clock starter (for 8 day clock only)
- ☐ Cover with viewing port
- ☐ Pencil stylus (in place of pen)

Note: See Price List for options available. Manufacturer reserves the right to make changes in design or materials for product improvement, without notice.

Litho in U.S.A.

10M-773-D&D

APPENDIX A-6.2

DATAPOD EQUIPMENT SPECIFICATIONS AND PROCEDURES

Appendix A-6.2 DP115 Datapod Procedures

The Omnidata International, Inc. model DP115 Datapod, equipped with a 10-turn potentiometer, operates in conjunction with the Stevens Type F recorder. Data collected by the DP115 is used to obtain digital stage measurements in conjunction with the Stevens recorder.

Proper setup of the DP115 Datapod requires that two recording functions are set:

- Resolution (stage change required to record a data point); and
- Sampling time interval.

The recording functions are set on the Datapod using the control switches located on the inside panel. Switches 1 and 2 control resolution, and switches 3 and 4 control sampling interval. A resolution of 0.01 ft and a sampling interval of 30 minutes is set on the Datapod. The Datapod will record a change in stage of 0.01 ft or greater at 30-minute intervals, however, if the stage change is less than 0.01 ft the Datapod does not record a data point. This function allows the Datapod to conserve space on the data storage module (DSM). A stage data point is also recorded when the unit is powered up and will record a data point at 24-hour intervals regardless of any change in stage.

The Datapod's DSM is changed monthly along with the units batteries. Data "short dumps" are acquired weekly and recorded in the log book. The following procedures are used to acquire the "short dump" and to change the DSM and batteries on the Datapod.

Procedure:

Note: ** indicates that a display has to be recorded in the log book.
[] indicates a display that will appear on the DP115.

1. **RECORD station number in the log book.
2. **RECORD the DP115 serial number on the log book.
3. **RECORD the display message [RUN] in the log book: Display.
4. Loosen the four screws on the face plate and separate the face plate from the case. (do not remove screws if only a short dump is being acquired.)

SHORT DUMP

Note: The DP115 will advance through the following sequence fairly quickly. If a display is missed, the sequence can be reinitiated by pressing the button on the outer case after the last display [RUN] is shown.

5. Push the button on the outer case -

[DLY] will be displayed, then -

[CHN1] will be displayed, then -

a number will be displayed indicating the current stream stage.

**RECORD the number with the label: CHN1

[ERR] will be displayed, then -

a number indicating the number of errors will be displayed.

**RECORD this number with the label: ERR

[TIME] will be displayed, then -

a number indicating the time (relative to startup) will be displayed.

**RECORD this number with the label: TIME

[DSM USED] will be displayed, then -

a number will be displayed indicating the amount of data storage modules space so far.

**RECORD this number with the label: DSM USED

[RUN] will be displayed indicating the DP115 is finished with the short dump.

Note: Continue procedures only if DSM and batteries are to removed.

Caution: There is a 24-hour clock in the DP115 that displays time to the nearest tenth hour.

Example: When the [TIME] display reads XXX.1, the DP115 has advanced 6 minutes into the hour.

The DP115 clock begins as soon as the last battery is inserted.

The DP115 is set to make a stream gage recording every 30 minutes. A 30-minute interval will be denoted on the [TIME] display as XXX.0 or XXX.5. If it is getting close to a recording interval such as XXX.4 or XXX.9, wait until after the reading has been make and then continue. (The LED will flash when a reading is being taken.)

6. Remove a battery from the battery pack to power down the DP115.
7. **RECORD the time of day with the label: Stop Time.
8. **RECORD the staff gage reading with the label: Staff Gage (ft).

Caution: **Be sure your fingers are clean and dry before touching the DSM. Care should be taken not to touch any of the pins on the DSM.**

9. Remove the DSM from the back of the face plate by gently pulling it straight up and place it in the protective container with the pins on the DSM inserted into the anti-static foam in the plastic storage container.

POWER UP

10. Replace the battery removed (or replace all batteries) to power up the DP115.
11. [DATAPOD 115] will appear in the display window, then -
12. [SAM] will appear in the display window, then -
    a number indicating the sample interval.
    **RECORD this number with the label: SAM.
13. [RES] will appear in the display window, then -
    a number indicating the deviation from straight-line resolution.
    **RECORD this number with the label: RES
14. [DLY] will appear in the display window, then -
15. [CHN1] will appear in the display window, then -
    a number indicating the sensor test for Channel 1.
    **RECORD this number with the label: CHN1.
16. Push in and hold the external button until [PLUG IN DSM PUSH] appears in the display window, then -
17. Insert a new DSM in the DP115.
    **RECORD the DSM number with the label: DSM#IN
    Note: **If either test fails, remove a battery, replace the DSM with another one and start the procedure again from "Power Up".**
23. If both tests pass:
    **RECORD the time of day with the label: Start Time.
    **RECORD the staff gage height with the label: Staff Gage (ft).
24. [RUN] should then be displayed in the display window.
    **RECORD RUN with the label: DISPLAY
25. Replace the face plate on the case and tighten the four screws.

The DSM containing data is read with an Omnidata Model 217 Reader. The DSM Reader transmits the data from the DSM to a computer file where it can be further reduced to a stream stage record.

DP115 DATAPOD SPECIFICATIONS

FUNCTION:
Single channel stream stage recorder.

TYPE OF SENSORS:
10-turn potentiometer. 5,000 to 100,000 Ohm resistance.

RESOLUTION:
0.01 foot in 10 feet of water.

RECORDING FUNCTIONS:
Records time of change and amount of change in water level.

SAMPLING INTERVALS:
User sets the time of day.

INPUT CONNECTOR:
3-pin environmentally sealed.

DATA STORAGE:
Medium: Non-volatile, interchangeable memory module.
Retrieval: Via built-in display or Model 217 Reader.

OPERATING CONTROLS AND DISPLAY:
Display: 4 1/2 digit LCD with low battery indicator.
Push Button: control data display and retrieval.

CLOCK ACCURACY:
+- 3 minutes per month (-10C to + 60C).

SELF TEST:
Performs self test functions on power-up.

OPERATING ENVIRONMENT:
-35 deg C to + 60 deg C, 0 to 100% RH, dust and water tight.

POWER:
8 alkaline AA penlight cells.

SIZE AND WEIGHT:
6.3" x 3.3" x 2.3", 1.2 lb.

APPENDIX A-6.3

DATA LOGGER EQUIPMENT SPECIFICATIONS AND PROCEDURES

Appendix A-6.3 Data Logger/Bubbler System Procedures

Five Campbell Scientific CR-10 data logger/bubbler systems were operating at RMA during WY90. The CR-10 data logger/bubbler system provides stream stage data throughout the year including periods of freezing conditions.

Customized software was developed to operate the data logger and associated bubbler system. The data logger/bubbler system software controls several functions:

- operating the system on a specified uniform time interval;
- performing the calibration calculations; and
- storing the data in the RAM pack storage module.

This software can be loaded either by the use of the hand-held display or by transferring the program from a PC compatible computer to the unit's RAM pack storage module, then down loading the program from the RAM pack into the data logger. The time interval between the start of each measurement cycle is user-selectable and may range from 20 seconds to 6554 seconds. The measurement cycle interval used during WY90 was 900 seconds (15 minutes). Calibration of the data logger/bubbler system is based on two different pressure measurements made at a known distance apart in a reference cylinder located in each station's gage house. The software residing in the data logger performs the calibration calculation prior to each measurement cycle. During the routine monthly maintenance, the calibration is checked using the station's staff gage reading as a reference point, so that the accuracy of each measurement can be verified.

Data are retrieved from the from the RAM pack storage module using either SMCOM or PC208 software. Both SMCOM and PC208 are available from Campbell Scientific, Inc. These communication software programs run on PC compatible computers, additionally, the PC208 software also serves as a simple data formatting and programming tool for the data logger.

Various field operating procedures were used during WY90 for proper and continual operation of CR-10 data logger/bubbler system stations. They are as follows:

1. Reading and Recording the Current Datalogger Output

This procedure is performed during each weekly station visit. Each CR-10 is equipped with a hand held keypad and display. The following key entries denote specific display readouts. Output from the

keypad's display is recorded in the field log book and a data sheet that is kept in the gage house. Additionally, nitrogen tank pressure, staff gage reading, and flow condition are recorded in the log book and data sheet.

- *5 - (Real Time)

  A - The Current Year

  A - The Julian Day

  A - The Time - Mountain Standard

- *6 - (Field Data)

  A

  #1 - Head above tube in stream.

  A

  #2 - Depth in reference tube above top line.

  A

  #3 - Ambient Temp. - °C

  A

  #4 - Reference differential - distance between lines in reference tube - (approx. 1 ft - 1.0).

  A

  #5 - Battery voltage - should be above 12 v.

  A

  #6 (with Isco sampler), 0.01 = sample taken, 0.00 = no sample.

  #20 and #21 - Time sample(s) taken.

  #20 - XXXX divide by 24 and add 1 = (day sample taken).

  #21 - minutes + #20 = (actual time sample taken).

2. Changing Batteries

The CR-10 data logger/bubbler system is powered by an industrial 12-volt, 15 amp-hour, sealed lead-acid battery. When the voltage falls below 12 volts, the battery is changed. The battery could be damaged if it is left in the field when the voltage drops below 12 volts. This is especially critical in the cold winter months.

The CR-10 has an internal battery pack consisting of eight alkaline D-cell batteries, that can be used as a back-up for the primary power supply. The following procedure is used to keep power applied to the unit while the external battery is being changed:

1. Insert the one D-cell battery back into the internal battery pack.
2. Disconnect the leads from the discharged external battery.
3. Connect a charged external battery.
4. Remove the D-cell battery from the internal battery pack.

3. Changing Nitrogen Tanks

Industrial nitrogen is supplied to the bubbler from a standard 2,200 psi nitrogen tank. The tank is equipped with a low pressure regulator to maintain a constant flow of 9 psi to the bubbler. The pressure to the bubbler can be changed by using the T-handle on the regulator. The regulator also has a gauge that indicates the pressure of nitrogen in the tank. When the tank pressure drops to approximately 500 psi, it is replaced with a full one. The following procedure is used to change the nitrogen tank:

1. With hand-held display, check *5 mode time to be sure that the instrument is not about to sample.
2. Close the valve on the top of the nitrogen tank.
3. With a 7/8" wrench, unscrew the flare nut on the regulator from the nitrogen tank orifice.
4. Unhook the safety chain and remove the empty tank from the shelter.
5. Place a full tank in the shelter and fasten the safety chain around it.
6. Place the regulator on the full tank and tighten the flare nut.
   Note: Slightly wiggling the regulator while tightening the flare nut will help ensure a tight fit to the mating fitting on tank.
7. Open the valve at the top of the bottle. The pressure to the bubbler should read 9 psi.
8. Check for leaks around the regulator flare nut and tank orifice. After the regulator is attached to the new tank, open the T-handle until 0 psi is read on low pressure gage. Observe the tank pressure gauge to determine if any pressure is lost (15 minutes should be adequate). If the pressure drops, there is a leak in the connection. If a leak is detected, close the valve on top of the tank and remove the regulator. Place the regulator in a different position on the orifice and retighten the flare nut. Repeat the procedure to check for leaks.

SPECIFICATIONS

The following electrical specifications are valid for an ambient temperature range of -25 °C to +50 °C unless otherwise specified

ANALOG INPUTS

NUMBER OF CHANNELS: 12 single ended or 6 differential with any combination, software selectable.

CHANNEL EXPANSION: Increments of 32 channels multiplexed through a single CR10 channel with the Model AM32 Relay Scanner. Maximum of 6 AM32's possible.

ACCURACY OF VOLTAGE MEASUREMENTS AND ANALOG OUTPUT VOLTAGES: 0.2% of FSR, 0.1% of FSR (0 to 40 °C).

RANGE AND RESOLUTION: Ranges are software selectable for any channel. Resolution for single ended measurements is twice the value shown.

Full Scale Range	Resolution
±2.50 volts	333. microvolts
±0.25 volts	33.3 microvolts
±25.0 millivolts	3.33 microvolts
± 7.5 millivolts	1.00 microvolts
± 2.5 millivolts	0.33 microvolts

INPUT SAMPLE RATES: The fast or slow A/D conversion on the four lowest input ranges uses a 250 us or 2.72 ms signal integration time, respectively. Two integrations, separated in time by ½ of an AC line cycle, are used with the 60 Hz or 50 Hz noise rejection option. Differential measurements include a second sampling with reversed input polarity to reduce thermal offset and common mode errors. Input sample rates are the time required to measure and convert the result to engineering units.

Fast single ended voltage:	2.6 ms
Fast differential voltage:	4.2 ms
Slow single ended voltage:	5.1 ms
Slow differential voltage:	9.2 ms
Diff. w/60 Hz rejection:	25.9 ms
Fast diff. thermocouple:	8.6 ms

INPUT NOISE VOLTAGE:

Fast differential	– 0.82 microvolts RMS
Slow differential	– 0.25 microvolts RMS
Diff. w/60 Hz rejection	– 0.18 microvolts RMS

COMMON MODE RANGE: ±2.5 volts.

DC COMMON MODE REJECTION: >140 dB.

NORMAL MODE REJECTION: 70 dB (60 Hz with slow differential measurement).

INPUT CURRENT: 3 nanoamps max.

INPUT RESISTANCE: 200 gigohms.

EXCITATION OUTPUTS

DESCRIPTION: The CR10 has 3 switched excitations, active only during measurement, with only one output active at any time. The off state is high impedance.

RANGE: ±2.5 volts

RESOLUTION: 0.67 millivolts.

ACCURACY: Same as voltage input.

OUTPUT CURRENT: 20 mA @ ± 2.5 V, 35 mA @ ± 2.0 V, 50 mA @ ± 1.5 V.

FREQUENCY SWEEP FUNCTION: A swept frequency square wave output between 0 and 2.5 volts is provided for vibrating wire transducers. Timing and frequency range are specified by the instruction.

PERIOD AVERAGING MEASUREMENTS

DEFINITION: The time period for a specified number of cycles of an input frequency is measured, then divided by the number of cycles to obtain the average period of a single cycle.

INPUTS: Any single ended analog channel; signal dividing or AC coupling is normally required.

INPUT FREQUENCY RANGE:

Range Code	Preamp Gain	Input Hysteresis	Maximum Frequency
4	1	10 mV	200 kHz
3	10	1 mV	50 kHz
2	33	300 uV	20 kHz
1	100	100 uV	8 kHz

REFERENCE ACCURACY: ±40 ppm.

RESOLUTION: ±100 nanoseconds divided by the number of cycles measured. Resolution is reduced by signal noise and for signals with a slow transition through the zero voltage threshold.

TIME REQUIRED FOR MEASUREMENT: Signal period times the number of cycles measured plus 1.5 cycles; minimum measurement time is 2 ms.

RESISTANCE AND CONDUCTIVITY MEASUREMENTS

ACCURACY: 0.015% of full scale bridge output, limited by the matching bridge resistors. The excitation voltage should be programmed so the bridge output matches the full scale input voltage range.

MEASUREMENT TYPES: 6 wire and 4 wire full bridge; 4 wire, 3 wire, and 2 wire half bridge. Bridge measurements are ratiometric and dual polarity to eliminate thermal emf's. AC resistance measurements use a dual polarity 750 us excitation pulse for ionic depolarization, with the signal integration occurring over the last 250 us.

PULSE COUNTERS

NUMBER OF PULSE COUNTER CHANNELS: 2 eight bit or 1 sixteen bit selectable.

MAXIMUM COUNT RATE: 2000 Hz, eight bit counters; 250 kHz, sixteen bit counters. Pulse counter channels scanned at 8 Hz.

MODES: Switch closure, high frequency pulse, and low level AC.

SWITCH CLOSURE MODE
Minimum Switch Closed Time: 5 ms
Minimum Switch Open Time: 6 ms
Maximum Bounce Time: 1 ms open without count

HIGH FREQUENCY PULSE MODE
Minimum Pulse Width: 2 us.
Maximum Input Frequency: 250 kHz.
Voltage Thresholds: Count upon transition from below 1.5 V to above 3.5 V.
Maximum Input Voltage: ±20 V.

LOW LEVEL AC MODE
(Typical of magnetic pulse flow sensors, selected anemometers, etc.)

Min. AC Input Voltage	6 mV RMS
Input Hysteresis	11 mV
Max. AC Input Voltage	20 V RMS

Frequency Range

AC Input (RMS)	Range
20 millivolts	1 Hz to 100 Hz
50 millivolts	0.5 Hz to 400 Hz
150 millivolts to 20 V	0.3 Hz to 1000 Hz

(Consult factory if higher frequencies are desired.)

DIGITAL I/O PORTS

8 ports, software selectable as binary inputs or control outputs.

OUTPUT VOLTAGES (no load): high – 5 V ± 0.1 V, low – < 0.1 V

OUTPUT RESISTANCE: 500 ohms

INPUT STATE: high – > 3 V, low – < 0.8 V

INPUT RESISTANCE: 100 kohms

TRANSIENT PROTECTION

All input and output connections to the CR10 module are protected using RC filters or transzorbs connected to a heavy copper bar between the circuit card and the case. The CR10WP Wiring Panel includes additional spark gap and transzorb protection.

CPU AND INTERFACE

PROCESSOR: Hitachi 6303

MEMORY: 32k ROM, 16k RAM expandable to 64k.

DISPLAY: 8 digit LCD (0.5" digits)

PERIPHERAL INTERFACE: 9 pin D-type connector for keyboard/display, storage module, cassette, modem, printer, and RS232 adapter. Baud rates selectable at 300, 1200, 9600, and 76,800.

CLOCK ACCURACY: ±1 minute per month

MAXIMUM PROGRAM EXECUTION RATE: System tasks initiated in sync with real-time up to 64 Hz. One measurement with tape transfer is possible at this rate without interruption.

SYSTEM POWER REQUIREMENTS

VOLTAGE: 9.6 to 16 volts

TYPICAL CURRENT DRAIN: 0.5 mA quiescent, 13 mA during processing, and 35 mA during analog measurement.

BATTERIES: 7.5 Ahr alkaline D-cells or 5 Ahr rechargeable lead acid batteries, standard.

PHYSICAL SPECIFICATIONS

SIZE: 7.8" x 3.5" x 1.5", 9" x 3.5" x 2.9" with CR10WP Wiring Panel. Input connectors extend length 0.15".

WEIGHT: 2 lbs.

WARRANTY

Two years against defects in materials and workmanship.

CAMPBELL SCIENTIFIC

P.O. Box 551
Logan, UT 84321
Phone (801) 753-2342
TLX 453058

9699 45th Avenue
Edmonton, Alberta T6E 5Z8
CANADA
Phone (403) 434-9421
TLX 037-2966 (EDM)

College Road/Sutton Bonington
Loughborough, LE12 5RA
ENGLAND
Phone 05097 2516
TLX 94016393 (CAMP G)

Reprinted January 1988

APPENDIX A-7

WY90 GAGE HEIGHT DATA
(on diskette)

The Surface-Water CMP data for Water Year 1990 has been archived (compressed) using the program PKARC. Several steps must be taken to access the data:

1. Create a subdirectory named ARC on your computer's C: drive;

2. Copy the files PKXARC.COM, PKARC.COM , PKARC.DOC and PKXARC.DOC from the supplied disk to the ARC subdirectory;

3. Insert the ARC subdirectory in the path statement of your computer's AUTOEXEC.BAT file in the following format;

   ;c:\arc;

4. Create another subdirectory on your computer's hard drive and copy the filename.arc file to the new directory;

5. Once the filename.arc file is copied, type

   PKXARC filename

   The PKXARC command unarchives the file so that it can be viewed;

6. To view the data use the DOS command;

   TYPE filename.ext

To re-archive the data, the following step is required:

1. at the DOS prompt type

   PKARC -M filename.ext

Documentation for the PKARC and PKXARC programs can be accessed at the DOS prompt by typing:

PKARC.DOC or PKXARC.DOC

A help screen can be accessed by typing:

PKARC/H

APPENDIX A-8

WY90 DISCHARGE RECORDS

ROCKY MOUNTAIN ARSENAL

SW11002, HAVANA INTERCEPTOR GAGING STATION

LOCATION: UTM ZONE 13 COORDINATES, NORTHING 170,992.86 FEET, EASTING 2,178,854.75 FEET, IN SW 1/4 SW 1/4 SEC. 11, T.3 S., R.67 E., IRONDALE GULCH DRAINAGE BASIN, ON THE ROCKY MOUNTAIN ARSENAL IN ADAMS COUNTY, COLORADO. THE STATION IS LOCATED IN THE CENTER OF THE CHANNEL APPROXIMATELY 1500 FEET EAST OF C STREET.

DRAINAGE AREA: 5.220 SQUARE MILES OF WHICH 2.6 SQUARE MILES IS STORM SEWER DRAINAGE FROM AN URBANIZED AREA.

EQUIPMENT USED: CAMPBELL SCIENTIFIC CR-10 DATA LOGGER.

DISCHARGE RECORDS WATER YEAR 1990

PERIOD OF RECORD FOR WATER YEAR 1990 : OCTOBER 1, 1989 TO SEPTEMBER 30, 1990.

GAGE: 0.00 FOOT MARK AND PZF EQUALS 5252.09 FT-MSL.

REMARKS: THE STATION RECEIVES STORM SEWER DRAINAGE FROM THE SOUTHERN PORTION OF MONTBELLO AND SURFACE RUNOFF FROM THE UNDEVELOPED AREA EAST OF MONTBELLO. THE DRAINAGE BASIN IS BOUNDED ON THE SOUTH BY HIGHWAY 70 AND ON THE WEST BY STAPLETON AIRPORT. THE ESTIMATED RECORDS DURING DECEMBER, JANUARY AND FEBRUARY WERE DUE TO ICE CONDITIONS IN THE CHANNEL. ESTIMATES DURING APRIL THROUGH AUGUST WERE DUE TO RECURRENT FAILURE OF MONITORING EQUIPMENT.

ESTIMATED RECORDS: DECEMBER 4,10,11,13-15,20-31, JANUARY 1-31, FEBRUARY 2-4,15-17, APRIL 1-14,16-30, MAY 1-31, JUNE 1-11,24-30, JULY 1-3,10-31, AUGUST 1,7-24.

RECORDS POOR.

EXTREMES FOR CURRENT YEAR: INST. MIN. DISCH., .00 CFS ON OCT 2. INST. MAX. DISCH., 464. CFS ON JUL 9.

TOTAL VOLUME MEASURED: 901.45 AC.FT. (2.94E8 GALLONS). T = FLOW AT >0.00 CFS BUT <0.005 CFS

DISCHARGE (CFS) WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.12	2.8	.00	.00	T	.03	.00	.07	.02	.66	.32	.85
2	.24	.54	.00	T	.20	.02	.00	.08	.04	.73	.41	.59
3	.17	.71	.00	.00	70	.05	.00	.12	.08	.79	.38	.60
4	.14	.05	.00	.00	50	.05	.00	.52	.30	.73	21.	.75
5	.10	.01	T	.00	.04	13.	2.6	.19	.29	.61	.48	1.7
6	.09	.15	.00	.00	01	24.	1.4	.22	.30	.60	.30	.54
7	.07	.45	.00	.00	02	28.	.50	.34	.25	.83	.35	.63
8	.11	.00	.00	T	.00	6.1	1.3	.49	.22	2.5	.01	.65
9	.11	.00	.00	T	.01	4.3	.88	.04	.15	24.	.00	.78
10	.22	.00	.00	T	.00	2.9	.02	.16	.88	4.6	.00	.87
11	.07	.00	.00	T	.00	1.2	.01	.30	.26	.41	.06	.80
12	.09	.00	.00	T	.00	.65	.02	.39	.36	.11	.20	.78
13	.10	.00	.00	T	.00	5.6	.03	.46	.27	.17	.21	.58
14	.13	.00	.00	T	.01	2.0	.02	.57	.32	1.4	.53	.70
15	.82	.00	.00	.00	.00	.55	.03	.89	.36	.64	6.6	.47
16	3.7	.00	.00	T	.00	.02	.02	4.9	.41	.73	1.9	.48
17	.94	.00	.00	T	.00	.00	.02	.40	.34	.55	4.3	.89
18	.62	.00	.00	.00	.02	.08	.02	.58	.45	.57	1.7	18.
19	.06	.00	.00	T	.01	.00	4.8	.82	3.2	2.6	13.	4.9
20	.04	.00	.00	T	.76	.00	.63	1.8	.63	5.2	5.4	2.7
21	.03	.00	.00	T	.04	.00	.06	.80	.29	3.6	.41	1.2
22	.04	.00	.00	T	.02	.00	.06	.95	.36	1.0	.50	.61
23	.04	.00	.00	T	.00	.00	.05	1.2	.46	3.1	.57	.50
24	.03	.00	.00	T	.00	.02	1.1	2.4	1.0	.76	.31	.71
25	.03	.00	.00	T	.00	.00	.09	5.7	.61	.32	.32	1.9
26	.03	.00	.00	T	.00	.00	.07	8.1	.47	.34	.36	1.2
27	.01	.00	.00	.00	.00	.48	.15	11.	.56	.48	.50	.70
28	.02	.00	.00	.00	.05	4.3	.17	15.	.81	.78	.64	.98
29	.02	.00	.00	T		2.2	1.4	48.	.93	23.	.57	.62
30	.01	.00	.00	T		1.7	1.2	4.0	.72	1.3	.62	.51
31	.24		.00	T		.01		.91		.54	5.5	
TOT DSF	8.44	4.71	T	T	2.39	97.26	16.65	111.40	15.34	83.65	67.45	47.19
MEAN	.27	.16	T	T	.09	3.1	.56	3.6	.51	2.7	2.2	1.6
MAX	3.7	2.8	T	T	.76	28.	4.8	48.	3.2	24.	21.	18.
MIN	.01	.00	.00	.00	.00	.00	.00	.04	.02	.11	.00	.47
AC.FT.	16.74	9.34	T	T	4.74	192.91	33.02	220.96	30.43	165.92	133.79	93.60
TOT GAL x(1,000,000)	5.45	3.04	T	T	1.54	62.86	10.76	72.00	9.91	54.06	43.59	30.50

AC.FT. = TOT DSF x 1.9835

ROCKY MOUNTAIN ARSENAL

SW11001, PEORIA INTERCEPTOR GAGING STATION

LOCATION: UTM ZONE 13 COORDINATES, NORTHING 170,287.71 FEET, EASTING 2,179,583.49 FEET, IN SE 1/4 SW 1/4 SEC. 11, T.3 S., R.67 E., IRONDALE GULCH DRAINAGE BASIN, ON THE ROCKY MOUNTAIN ARSENAL IN ADAMS COUNTY, COLORADO. THE STATION IS LOCATED ON THE LEFT BANK APPROXIMATELY 100 FEET DOWNSTREAM OF THE CULVERT UNDER 56TH STREET.

DRAINAGE AREA: 0.644 SQUARE MILES WHICH IS MOSTLY STORM SEWER DRAINAGE.

EQUIPMENT USED: STEVENS "TYPE F" RECORDER COUPLED WITH A OMNIDATA DP115 DATAPOD RECORDER (OCTOBER 1, 1990 TO DECEMBER 4, 1990) AND A CAMPBELL CR-10 DATA LOGGER (REMAINDER OF THE YEAR).

DISCHARGE RECORDS WATER YEAR 1990

PERIOD OF RECORD FOR WATER YEAR 1990: OCTOBER 1, 1989 TO SEPTEMBER 30, 1990.

GAGE: 1.00 FOOT MARK ON THE STAFF GAGE EQUALS 5248.15 FT-MSL.

REMARKS: THE STATION RECEIVES STORM SEWER DRAINAGE FROM THE INDUSTRIAL AREA SOUTH OF THE RMA. THE PRIMARY CONTROL STRUCTURE IS A METAL V-NOTCH WEIR BLADE WHICH IS ATTACHED TO A NARROW PLANK THAT IS POSITIONED PERPENDICULAR TO FLOW AND IS EMBEDDED INTO THE BANKS ON BOTH SIDES OF THE CHANNEL. RECORD FROM OCTOBER 1 TO DECEMBER 13 ACQUIRED WITH DP115 DATAPOD. RECORD FROM DECEMBER 14 TO SEPTEMBER 30 ACQUIRED WITH CR-10 DATA LOGGER.

ESTIMATED RECORDS: DECEMBER 21, FEBRUARY 15-18, JULY 30,31, AUGUST 1,4-7,16,18,20-23, SEPTEMBER 19-22.

RECORDS POOR.

EXTREMES FOR CURRENT YEAR: INST. MIN. DISCH., .00 CFS ON OCT 24. INST. MAX. DISCH., 72. CFS ON JUL 29.

TOTAL VOLUME MEASURED: 202.22 AC.FT. (6.59E7 GALLONS). T = FLOW AT >0.00 CFS BUT <0.005 CFS

DISCHARGE (CFS) WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.02	1.6	T	T	T	T	T	T	.14	.17	.08	.12
2	.02	.14	T	T	.08	T	T	T	.12	.20	.07	.06
3	.01	.64	T	T	.18	T	T	.01	.08	.16	.06	.06
4	.02	.06	T	T	.09	T	T	.06	.11	.21	3.3	.06
5	.01	T	T	T	T	2.8	1.6	.02	.06	.14	.13	.40
6	.01	T	.00	T	T	4.6	.17	.03	.06	.17	.08	.05
7	.01	T	.00	T	T	2.8	.04	.04	.05	.50	.08	.05
8	.01	T	.00	.10	T	3.9	.35	.08	.05	1.6	.11	.07
9	.01	T	T	.03	T	3.3	.09	.01	.04	3.1	.06	.07
10	T	T	.02	.01	.01	2.0	T	.03	.19	.41	.04	.04
11	.01	T	.01	T	T	.44	T	.02	.06	.22	.05	.02
12	T	T	.02	T	T	.04	T	.03	.07	.10	.09	.02
13	.01	T	.03	T	T	2.0	T	.03	.07	.10	.05	.03
14	.01	T	.12	T	T	.52	T	.03	.08	.51	.06	.04
15	.07	T	T	T	T	.57	T	.06	.11	.14	2.0	.08
16	.54	T	.00	.00	T	.05	T	1.4	.12	.13	.22	.06
17	.32	T	.00	.00	T	.03	T	.02	.09	.08	1.0	.07
18	.77	T	.00	.03	T	.09	T	.03	.08	.07	.21	5.1
19	.02	T	.00	T	T	T	1.9	.04	1.2	.92	4.7	2.2
20	T	T	.00	.08	.37	T	.08	.19	.19	1.4	1.5	1.4
21	T	T	.00	.25	.01	T	T	.04	.11	.90	.06	.34
22	T	T	.00	.34	T	T	T	.05	.10	.11	.05	.08
23	T	T	.02	.33	T	T	T	.05	.10	.76	.06	.06
24	T	.00	.15	.04	T	.06	.25	.09	.15	.07	.06	.03
25	.00	.00	.11	.08	T	T	T	.14	.09	.05	.03	.41
26	.00	.00	.26	.34	T	T	T	.15	.07	.07	.03	.04
27	.00	T	.15	T	.01	.40	.01	.19	.09	.08	.03	.04
28	T	T	.05	T	.04	1.6	.01	.23	.14	.12	.02	.13
29	T	T	.01	.08		.81	.21	6.5	.18	6.7	.03	.05
30	T	T	.01	.01		.65	.16	1.9	.16	.20	.04	.05
31	.11		.08	.01		T		.81		.08	1.0	
TOT DSF	1.98	2.44	1.04	1.73	.79	26.66	4.87	12.28	4.16	19.47	15.30	11.2
MEAN	.06	.08	.03	.06	.03	.86	.16	.40	.14	.63	.49	.3
MAX	.77	1.6	.26	.34	.37	4.6	1.9	6.5	1.2	6.7	4.7	5.1
MIN	.00	.00	.00	.00	T	T	T	T	.04	.05	.02	.0
AC.FT.	3.93	4.84	2.06	3.43	1.57	52.88	9.66	24.36	8.25	38.62	30.35	22.2
TOT GAL x(1,000,000)	1.28	1.58	.67	1.12	.51	17.23	3.15	7.94	2.69	12.58	9.89	7.2

AC.FT. = TOT DSF x 1.9835

ROCKY MOUNTAIN ARSENAL

SW02001, LADORA WEIR GAGING STATION

LOCATION: UTM ZONE 13 COORDINATES, NORTHING 175,721.40 FEET, EASTING 2,182,686.29 FEET, IN SW 1/4 SW 1/4 SEC. 2, T.3 S., R.67 E., IRONDALE GULCH DRAINAGE BASIN, ON THE ROCKY MOUNTAIN ARSENAL IN ADAMS COUNTY, COLORADO. THE STATION IS LOCATED IN THE CENTER OF THE CHANNEL APPROXIMATELY 25 FEET DOWNSTREAM FROM D STREET.

DRAINAGE AREA: CONTROLLED FLOW FROM LOWER DERBY LAKE.

EQUIPMENT USED: STEVENS "TYPE F" RECORDER, OMNIDATA DP115 DATAPOD.

DISCHARGE RECORDS WATER YEAR 1990

PERIOD OF RECORD: OCTOBER 1, 1989 TO SEPTEMBER 30, 1990.

GAGE: 4.0 FOOT MARK ON THE STAFF GAGE EQUALS 5232.84 FT-MSL.

REMARKS: THE STATION MONITORS FLOW COMING OUT OF LOWER DERBY LAKE AND GOING INTO LADORA LAKE OR SAND CREEK LATERAL. THE PRIMARY CONTROL IS A SUPRESSED RECTANGULAR WEIR. LADORA WEIR UNDERWENT CONSTRUCTION DURING JULY AND AUGUST 1990 THAT CHANGED THE POINT OF ZERO FLOW OVER THE WEIR CREST, THEREFORE, ALL PERIODS OF FLOW OCCURRING AFTER JULY 12, 1990 ARE ESTIMATED.

ESTIMATED RECORDS: AUGUST 30,31, SEPTEMBER 1-10.

RECORDS POOR.

EXTREMES FOR CURRENT YEAR: INST. MIN. DISCH., .00 CFS ON OCT 1. INST. MAX. DISCH., 21. CFS ON JUN 15.

TOTAL VOLUME MEASURED: 440.00 AC.FT. (1.43E8 GALLONS).

DISCHARGE (CFS) WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.06	.00	11.
2	.00	.00	.00	.00	.00	.00	.00	.00	.00	.06	.00	11.
3	.00	.00	.00	.00	.00	.00	.00	.00	.00	.06	.00	9.7
4	.00	.00	.00	.00	.00	.00	.00	.00	.00	.06	.00	9.2
5	.00	.00	.00	.00	.00	.00	.00	.00	.00	.06	.00	9.5
6	.00	.00	.00	.00	.00	.00	.00	.00	.00	.06	.00	9.4
7	.00	.00	.00	.00	.00	.00	.00	.00	.00	.06	.00	9.6
8	.00	.00	.00	.00	.00	.00	.00	.00	.00	.06	.00	9.8
9	.00	.00	.00	.00	.00	.00	.00	.00	.00	.06	.00	9.9
10	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00	3.0
11	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
12	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
13	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
14	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
15	.00	.00	.00	.00	.00	.00	.00	.00	13.	.00	.00	.00
16	.00	.00	.00	.00	.00	.00	.00	.00	19.	.00	.00	.00
17	.00	.00	.00	.00	.00	.00	.00	.00	19.	.00	.00	.00
18	.00	.00	.00	.00	.00	.00	.00	.00	18.	.00	.00	.00
19	.00	.00	.00	.00	.00	.00	.00	.00	7.9	.00	.00	.00
20	.00	.00	.00	.00	.00	.00	.00	.00	3.8	.00	.00	.00
21	.00	.00	.00	.00	.00	.00	.00	.00	10.	.00	.00	.00
22	.00	.00	.00	.00	.00	.00	.00	.00	11.	.00	.00	.00
23	.00	.00	.00	.00	.00	.00	.00	.00	11.	.00	.00	.00
24	.00	.00	.00	.00	.00	.00	.00	.00	.19	.00	.00	.00
25	.00	.00	.00	.00	.00	.00	.00	.00	.06	.00	.00	.00
26	.00	.00	.00	.00	.00	.00	.00	.00	.08	.00	.00	.00
27	.00	.00	.00	.00	.00	.00	.00	.00	.06	.00	.00	.00
28	.00	.00	.00	.00	.00	.00	.00	.00	.06	.00	.00	.00
29	.00	.00	.00	.00		.00	.00	.00	.06	.00	.00	.00
30	.00	.00	.00	.00		.00	.00	.00	.06	.00	5.9	.00
31	.00		.00	.00		.00		.00		.00	10.	
TOT DSF	.00	.00	.00	.00	.00	.00	.00	.00	113.27	.56	15.90	92.10
MEAN	.00	.00	.00	.00	.00	.00	.00	.00	3.8	.02	.51	3.1
MAX	.00	.00	.00	.00	.00	.00	.00	.00	19.	.06	10.	11.
MIN	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AC.FT.	.00	.00	.00	.00	.00	.00	.00	.00	224.67	1.11	31.54	182.68
TOT GAL x(1,000,000)	.00	.00	.00	.00	.00	.00	.00	.00	73.20	.36	10.28	59.52

AC.FT. = TOT DSF x 1.9835

ROCKY MOUNTAIN ARSENAL

SW12005, SOUTH UVALDA GAGING STATION

LOCATION: UTM ZONE 13 COORDINATES, NORTHING 170,445.36 FEET, EASTING 2,186,746.06 FEET, IN SW 1/4 SE 1/4 SEC. 12, T.3 S., R.67 E., IRONDALE GULCH DRAINAGE BASIN, ON THE ROCKY MOUNTAIN ARSENAL IN ADAMS COUNTY, COLORADO. THE STATION IS LOCATED ON THE LEFT BANK APROXIMATELY 3000 FEET DOWNSTREAM FROM 56TH STREET.

DRAINAGE AREA: 7.723 SQUARE MILES OF WHICH 4.118 SQUARE MILES IS STORM SEWER DRAINAGE FROM AN URBANIZED AREA.

EQUIPMENT USED: STEVENS "TYPE F" RECORDER, CAMPBELL SCIENTIFIC CR-10 DATA LOGGER.

DISCHARGE RECORDS WATER YEAR 1990

GAGE: 0.00 FOOT MARK ON THE STAFF GAGE IS 5271.07 FT-MSL.

PERIOD OF RECORD FOR WATER YEAR 1990: OCTOBER 1, 1989 TO SEPTEMBER 30, 1990.

REMARKS: THE STATION RECEIVES STORM SEWER DRAINAGE FROM THE NORTHERN PORTION OF MONTBELLO AND SURFACE RUNOFF FROM THE UNDEVELOPED AREA EAST OF MONTBELLO. THE PRIMARY CONTROL STRUCTURE IS A BROAD-CRESTED WEIR WITH A V-NOTCH.

ESTIMATED RECORDS: DECEMBER 19-22, FEBRUARY 14-16, APRIL 3-5, JUNE 20-22.

RECORDS GOOD.

EXTREMES FOR CURRENT YEAR: INST. MIN. DISCH., .15 CFS ON APR 10. INST. MAX. DISCH., 364. CFS ON AUG 4.

TOTAL VOLUME MEASURED: 688.72 AC.FT. (2.24E8 GALLONS).

DISCHARGE (CFS) WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.43	1.2	.36	.37	.32	.33	.61	.40	1.0	.61	.39	.89
2	.48	.34	.34	.35	.51	.33	.59	.43	.88	.63	.46	.50
3	.38	.35	.36	.31	.69	.34	.54	.41	.73	.66	.46	.67
4	.45	.32	.37	.32	.45	.35	.58	.56	.75	.54	19.	.58
5	.41	.31	.38	.31	.32	8.2	.87	.49	.71	.54	.62	1.7
6	.42	.31	.35	.32	.33	12.	1.2	.55	.82	.57	.52	.61
7	.41	.31	.36	.34	.37	7.1	1.3	.50	.91	.90	.49	.56
8	.39	.31	.38	.74	.32	2.4	1.3	.67	.89	1.6	.43	.51
9	.45	.32	.36	.45	.33	1.4	.54	.65	.72	14.	.50	.49
10	.41	.33	.34	.37	.36	1.1	.28	.72	1.0	1.1	.55	.53
11	.35	.35	.37	.53	.37	.58	.33	.71	.76	.70	.53	.51
12	.28	.37	.41	.33	.37	.45	.39	.45	.47	.53	.46	.50
13	.27	.35	.40	.32	.33	2.6	.50	.46	.52	.61	.54	.58
14	.26	.34	.71	.32	.35	.82	.66	.54	.60	.76	.51	.55
15	.62	.34	.38	.31	.36	.70	1.1	.44	.50	.53	19.	.52
16	1.8	.35	.35	.30	.36	.76	.75	1.4	.43	.57	1.1	.45
17	.37	.36	.41	.29	.81	.67	.37	.45	.41	.63	2.5	.90
18	.32	.37	.44	.35	.32	.64	.39	.64	.52	.70	.83	7.8
19	.28	.38	.36	.31	.30	.55	3.6	.70	2.9	3.2	11.	2.3
20	.29	.39	.31	.34	.94	.51	.46	1.9	.56	2.2	1.1	1.0
21	.30	.39	.32	.80	.32	.45	.38	.61	.49	1.2	.73	.67
22	.29	.37	.32	.92	.31	.45	.38	.65	.42	.34	.72	.50
23	.30	.38	1.2	1.2	.31	.47	.36	.74	.77	.81	.72	.50
24	.29	.40	.33	.47	.33	.51	.64	1.4	.78	.42	.68	.58
25	.28	.37	.55	.70	.33	.54	.34	1.4	.75	.43	.56	1.0
26	.28	.38	.91	.85	.32	.83	.40	1.3	.91	.44	.53	.68
27	.27	.37	.73	.34	.33	1.4	.50	1.3	.88	.44	.59	.58
28	.30	.36	.41	.34	.38	2.6	.69	1.7	.75	.40	.58	.81
29	.29	.37	.33	.36		1.7	.93	15.	.75	7.6	.65	.52
30	.29	.37	.32	.35		1.3	.44	4.5	.75	.47	.73	.42
31	.55		.41	.35		.63		1.6		.36	3.5	
TOT DSF	12.51	11.46	13.55	13.96	11.14	52.71	21.42	43.27	23.33	44.49	70.98	28.41
MEAN	.40	.38	.44	.45	.40	1.7	.71	1.4	.78	1.4	2.3	.95
MAX	1.8	1.2	1.2	1.2	.94	12.	3.6	15.	2.9	14.	19.	7.8
MIN	.26	.31	.31	.29	.30	.33	.28	.40	.41	.34	.39	.42
AC.FT.	24.81	22.73	26.88	27.69	22.10	104.55	42.49	85.82	46.27	88.24	140.79	56.35
TOT GAL x(1,000,000)	8.08	7.41	8.76	9.02	7.20	34.07	13.84	27.96	15.08	28.75	45.87	18.36

AC.FT. = TOT DSF x 1.9835

ROCKY MOUNTAIN ARSENAL

SW01001, NORTH UVALDA GAGING STATION

LOCATION: UTM ZONE 13 COORDINATES, NORTHING 175,588.02 FEET, EASTING 2,187,896.41 FEET, IN SE 1/4 SE 1/4 SEC. 1, T.3 S., R.67 E., IRONDALE GULCH DRAINAGE BASIN, ON THE ROCKY MOUNTAIN ARSENAL IN ADAMS COUNTY, COLORADO. THE STATION IS LOCATED ON THE LEFT BANK APPROXIMATELY 150 FEET DOWNSTREAM FROM 6TH AVENUE.

DRAINAGE AREA: CONTROLLED FLOW FROM THE UVALDA INTERCEPTOR AND/OR THE HIGHLINE LATERAL CANAL.

EQUIPMENT USED: STEVENS "TYPE F" RECORDER, OMNIDATA DP115 DATAPOD.

DISCHARGE RECORDS WATER YEAR 1990

PERIOD OF RECORD FOR WATER YEAR 1990: OCTOBER 1, 1989 TO SEPTEMBER 30, 1990.

GAGE: 0.00 FOOT MARK ON THE STAFF GAGE EQUALS 5255.59 FT-MSL.

REMARKS: THE STATION RECEIVES STREAMFLOW FROM THE UVALDA INTERCEPTOR AND/OR THE HIGHLINE LATERAL CANAL. THE PRIMARY CONTROL IS A BROAD-CRESTED CONCRETE WEIR.

ESTIMATED RECORDS: APRIL 17, MAY 18.

RECORDS GOOD.

EXTREMES FOR CURRENT YEAR: INST. MIN. DISCH., .00 CFS ON OCT 11. INST. MAX. DISCH., 26. CFS ON JUN 15.

TOTAL VOLUME MEASURED: 406.21 AC.FT. (1.32E8 GALLONS). T = FLOW AT >0.00 CFS BUT <0.005 CFS

DISCHARGE (CFS) WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.03	.06
2	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.05	.06
3	.01	.00	.00	.00	.00	.00	.00	.00	.00	.00	.05	.08
4	.02	.00	.00	.00	.00	.00	.00	.00	.00	.00	.04	.08
5	.03	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.08
6	.05	.00	.00	.00	.00	.00	.00	.00	.00	.79	.00	.07
7	.04	.00	.00	.00	.00	.00	.00	.00	.00	.14	.00	.06
8	T	.00	.00	.00	.00	.00	.00	.00	.00	.10	.00	.06
9	T	.00	.00	.00	.00	.00	.00	.00	.00	.08	.00	.07
10	T	.00	.00	.00	.00	.00	.00	.00	1.5	.02	.00	.06
11	.00	.00	.00	.00	.00	.00	.00	.00	4.6	.00	.00	.05
12	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.04
13	.00	.00	.00	.00	.00	.00	.00	.00	.00	.01	T	.02
14	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.02	.02
15	.00	.00	.00	.00	.00	.00	.00	.00	18.	.02	.03	.01
16	.00	.00	.00	.00	.00	.00	.00	1.7	17.	.02	.00	T
17	.01	.00	.00	.00	.00	.00	.03	1.2	17.	.02	.00	T
18	.00	.00	.00	.00	.00	.00	.00	.00	16.	.04	.00	T
19	.00	.00	.00	.00	.00	.00	.00	.00	12.	.06	.00	T
20	.00	.00	.00	.00	.00	.00	.00	.00	13.	.05	.00	.00
21	.00	.00	.00	.00	.00	.00	.00	.00	13.	.05	.00	.00
22	.00	.00	.00	.00	.00	.00	.00	.00	14.	.04	13.	.00
23	.00	.00	.00	.00	.00	.00	.00	.00	10.	.03	8.8	.00
24	.00	.00	.00	.00	.00	.00	.00	.00	.39	.02	.11	.00
25	1.0	.00	.00	.00	.00	.00	.00	.00	.01	.00	.03	.00
26	.87	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00
27	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.02	.00
28	.00	.00	.00	.00	.00	.00	.00	.00	.00	T	.02	6.6
29	.00	.00	.00	.00		.00	.00	.00	.00	T	.03	18.
30	.00	.00	.00	.00		.00	.00	.00	.00	T	.05	14.
31	.00		.00	.00		.00		.00		.01	.06	
TOT DSF	2.07	.00	.00	.00	.00	.00	.03	2.90	136.50	1.52	22.36	39.42
MEAN	.07	.00	.00	.00	.00	.00	T	.09	4.6	.05	.72	1.3
MAX	1.0	.00	.00	.00	.00	.00	.03	1.7	18.	.79	13.	18.
MIN	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AC.FT.	4.11	.00	.00	.00	.00	.00	.06	5.75	270.74	3.01	44.35	78.19
TOT GAL x(1,000,000)	1.34	.00	.00	.00	.00	.00	.02	1.87	88.21	.98	14.45	25.48

AC.FT. = TOT DSF x 1.9835

ROCKY MOUNTAIN ARSENAL

SW12007, HIGHLINE LATERAL GAGING STATION

LOCATION: UTM ZONE 13 COORDINATES, NORTHING 194,147.34 FEET, EASTING 2,186,376.17 FEET, IN NE 1/4 NE 1/4 SEC. 12, T.3 S., R.67 E., IRONDALE GULCH DRAINAGE BASIN, ON THE ROCKY MOUNTAIN ARSENAL IN ADAMS COUNTY, COLORADO. THE STATION IS LOCATED ON THE RIGHT BANK APPROXIMATELY 25 FEET UPSTREAM FROM 6TH AVENUE.

DRAINAGE AREA: CONTROLLED FLOW FROM THE SOUTH PLATTE RIVER. AVERAGE WIDTH OF THE CHANNEL BOTTOM IS 8 FEET. AVERAGE CHANNEL DEPTH IS 4 FEET. THE LENGTH IS APPROXIMATELY 71 MILES.

DISCHARGE RECORDS WATER YEAR 1990

PERIOD OF RECORD FOR WATER YEAR 1990: BASED ON WEEKLY STAFF GAGE OBSERVATIONS FROM OCTOBER 3, 1989 TO APRIL 24, 1990, AND WITH A STEVENS "TYPE F" RECORDER FROM APRIL 25, 1990 TO SEPTEMBER 30, 1990.

GAGE: PZF EQUALS 5272.63 FT-MSL. 3.33 MARK ON STAFF EQUALS 5275.10 FT-MSL.

REMARKS: THE STATION IS LOCATED ALONG THE HIGHLINE LATERAL IRRIGATION DITCH WHICH IS USED TO DELIVER THE ARMY-OWNED SHARES OF IRRIGATION WATER ORIGINATING FROM THE SOUTH PLATTE RIVER. THE PRIMARY CONTROL STRUCTURE AT THE STATION IS A CIPOLETTI WEIR.

ESTIMATED RECORDS: NONE.

RECORDS GOOD.

EXTREMES FOR CURRENT YEAR: INST. MIN. DISCH., .00 CFS ON OCT 1. INST. MAX. DISCH., 30.03 CFS ON JUN 15.

TOTAL VOLUME MEASURED: 2003.21 AC.FT. (6.53E8 GALLONS).

DISCHARGE (CFS) WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.00	.00	.00	.00	.00	.00	.00	.00	.34	.00	.00	.00
2	.00	.00	.00	.00	.00	.00	.00	.00	.03	.00	.00	.00
3	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
5	.00	.00	.00	.00	.00	.00	.00	.00	6.2	.00	.00	.00
6	.00	.00	.00	.00	.00	.00	.00	.00	15.	.00	.00	.00
7	.00	.00	.00	.00	.00	.00	.00	.00	15.	.00	.00	.00
8	.00	.00	.00	.00	.00	.00	.00	1.2	15.	.00	.00	.0C
9	.00	.00	.00	.00	.00	.00	.00	6.7	10.	.03	.00	1.7
10	.00	.00	.00	.00	.00	.00	.00	13.	12.	3.1	.00	12.
11	.00	.00	.00	.00	.00	.00	.00	18.	17.	15.	.00	13.
12	.00	.00	.00	.00	.00	.00	.00	19.	17.	14.	.00	12.
13	.00	.00	.00	.00	.00	.00	.00	11.	17.	13.	.00	14.
14	.00	.00	.00	.00	.00	.00	.00	9.8	19.	16.	.00	13.
15	.00	.00	.00	.00	.00	.00	.00	6.7	21.	16.	.00	12.
16	.00	.00	.00	.00	.00	.00	.00	11.	22.	16.	.00	12.
17	.00	.00	.00	.00	.00	.00	.00	24.	21.	8.6	.00	11.
18	.00	.00	.00	.00	.00	.00	.00	1.1	18.	.00	.00	13.
19	.00	.00	.00	.00	.00	.00	.00	.20	6.0	.00	.00	16.
20	.00	.00	.00	.00	.00	.00	.00	.00	3.2	.00	8.3	11.
21	.00	.00	.00	.00	.00	.00	.00	.00	12.	.00	7.7	11.
22	.00	.00	.00	.00	.00	.00	.00	.00	12.	.00	12.	15.
23	.00	.00	.00	.00	.00	.00	.00	.00	15.	.00	12.	16.
24	.00	.00	.00	.00	.00	.00	.00	.00	21.	4.9	14.	16.
25	.00	.00	.00	.00	.00	.00	.00	.00	18.	15.	19.	15.
26	.00	.00	.00	.00	.00	.00	.00	.00	.35	14.	18.	16.
27	.00	.00	.00	.00	.00	.00	.00	.00	.00	9.0	18.	16.
28	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	12.	16.
29	.00	.00	.00	.00		.00	.00	.00	.00	.00	11.	17.
30	.00	.00	.00	.00		.00	.00	.00	.00	.00	3.8	16.
31	.00		.00	.00		.00		.00		.00	.00	
TOT DSF	.00	.00	.00	.00	.00	.00	.00	121.70	313.12	144.63	135.80	294.70
MEAN	.00	.00	.00	.00	.00	.00	.00	3.9	10.	4.7	4.4	9.8
MAX	.00	.00	.00	.00	.00	.00	.00	24.	22.	16.	19.	17.
MIN	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AC.FT.	.00	.00	.00	.00	.00	.00	.00	241.39	621.06	286.87	269.36	584.53
TOT GAL x(1,000,000)	.00	.00	.00	.00	.00	.00	.00	78.65	202.36	93.47	87.77	190.46

AC.FT. = TOT DSF x 1.9835

ROCKY MOUNTAIN ARSENAL

SW01003, SOUTH PLANTS DITCH GAGING STATION

LOCATION: UTM ZONE 13 COORDINATES, NORTHING 177,784.84 FEET, EASTING 2,185,743.81 FEET, IN SE 1/4 NW 1/4 SEC. 1, T.3 S., R.67 E., IRONDALE GULCH DRAINAGE BASIN, ON THE ROCKY MOUNTAIN ARSENAL IN ADAMS COUNTY, COLORADO. THE STATION IS LOCATED ON THE RIGHT BANK APPROXIMATELY 2000 NORTH OF THE SOUTH PLANTS SERVICE ROAD.

DRAINAGE AREA: 0.055 SQUARE MILE WATERSHED BETWEEN LOWER DERBY LAKE AND THE SOUTH PLANTS AREA.

EQUIPMENT USED: STEVENS "TYPE F" RECORDER.

DISCHARGE RECORDS WATER YEAR 1990

PERIOD OF RECORD FOR WATER YEAR 1990: BASED ON WEEKLY OBSEVATIONS OF THE STATION FROM OCTOBER 1, 1989 TO APRIL 3, 1990, AND WITH A STEVENS RECORDER FROM APRIL 4, 1990 TO SEPTEMBER 30, 1990.

GAGE: PZF EQUALS 5253.13 FT-MSL ON SW WEIR, PZF EQUALS 5252.21 ON S WEIR, AND 0.00 MARK ON STAFF EQUALS 5248.78 FT-MSL.

REMARKS: THE STATION CONSISTS OF A DIVERSION STRUCTURE WHICH DIVERTS FLOW TO EITHER THE EAST OR WEST END OF LOWER DERBY LAKE. THE PRIMARY CONTROL STRUCTURES CONSIST OF TWO SEPARATE SHARP-CRESTED, V-NOTCH WEIRS WHICH ARE MOUNTED TO THE OVERFLOW SIDES OF THE DIVERSION STRUCTURE.

ESTIMATED RECORDS: NONE.

RECORDS EXCELLENT.

EXTREMES FOR CURRENT YEAR: INST. MIN. DISCH., .00 CFS ON OCT 1. INST. MAX. DISCH., 0.0 CFS ON OCT 1.

TOTAL VOLUME MEASURED: 0.00 AC.FT. (0.00 GALLONS).

DISCHARGE (CFS) WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
5	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
6	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
7	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
8	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
9	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
10	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
11	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
12	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
13	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
14	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
15	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
16	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
17	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
18	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
19	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
20	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
21	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
22	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
23	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
24	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
25	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
26	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
27	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
28	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
29	.00	.00	.00	.00		.00	.00	.00	.00	.00	.00	.00
30	.00	.00	.00	.00		.00	.00	.00	.00	.00	.00	.00
31	.00		.00	.00		.00		.00		.00	.00	
TOT DSF	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
MEAN	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
MAX	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
MIN	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AC.FT.	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
TOT GAL	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

AC.FT. = TOT DSF x 1.9835

ROCKY MOUNTAIN ARSENAL

SW08003, SOUTH FIRST CREEK GAGING STATION

LOCATION: UTM ZONE 13 COORDINATES, NORTHING 173,686.65 FEET, EASTING 2,198,520.22 FEET, IN NE 1/4 SE 1/4 SEC.8, T.3 S., R.67 E., FIRST CREEK DRAINAGE BASIN, ON THE ROCKY MOUNTAIN ARSENAL IN ADAMS COUNTY, COLORADO. THE STATION IS LOCATED ON THE RIGHT BANK APPROXIMATELY 1500 FEET UPSTREAM FROM 6TH AVENUE.

DRAINAGE AREA: SURFACE DRAINAGE AREA IS 26.38 SQUARE MILES OF WHICH 0.197 SQUARE MILES IS STORM SEWER DRAINAGE FROM AN URBANIZED AREA.

EQUIPMENT USED: STEVENS "TYPE F" RECORDER, CAMPBELL SCIENTIFIC CR-10 DATA LOGGER.

DISCHARGE RECORDS WATER YEAR 1990

PERIOD OF RECORD FOR WATER YEAR 1990: OCTOBER 1, 1989 TO SEPTEMBER 30, 1990.

GAGE: PZF EQUALS 5290.83 FT-MSL. 3.0 MARK ON STAFF EQUALS 5290.82 FT-MSL.

REMARKS: THE PRIMARY CONTROL STRUCTURE IS A V-NOTCHED CONCRETE WEIR.

ESTIMATED RECORDS: DECEMBER 18-22, FEBRUARY 14-16.

RECORDS GOOD.

EXTREMES FOR CURRENT YEAR: INST. MIN. DISCH., .00 CFS ON JUL 1. INST. MAX. DISCH., 307. CFS ON AUG 19.

TOTAL VOLUME MEASURED: 729.11 AC.FT. (2.38E8 GALLONS).

DISCHARGE (CFS) WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.06	.46	.67	.81	1.0	.84	1.4	.91	.54	.03	.15	.32
2	.07	.53	.65	.82	1.0	.82	1.3	.91	.40	.01	.11	.20
3	.10	.59	.70	.77	.91	.85	1.3	.87	.38	.00	.07	.14
4	.13	.56	.75	.64	.92	.87	1.2	.84	.39	.01	.62	.12
5	.14	.52	.73	.61	.90	1.2	1.4	.82	.54	.01	2.0	.13
6	.15	.49	.67	.59	.94	11.	1.6	.82	.47	.02	.43	.15
7	.16	.49	.63	.60	1.1	4.2	1.4	.78	.43	.01	.25	.12
8	.17	.49	.60	.70	1.2	3.1	1.3	1.5	.35	.01	.14	.08
9	.17	.50	.67	.90	1.0	2.6	1.3	1.4	.34	.53	.07	.06
10	.18	.50	.64	1.0	1.0	2.3	1.2	.99	.35	.19	.05	.11
11	.17	.55	.59	1.1	1.1	2.0	1.2	.85	.30	.44	.03	.18
12	.17	.56	.55	.89	1.2	1.7	1.2	.82	.20	1.7	.05	.53
13	.19	.60	.75	.90	1.1	1.9	1.2	.93	.19	1.3	.05	.24
14	.20	.62	.81	.91	.80	2.0	1.1	.76	.19	1.1	.03	.17
15	.21	.57	.72	.89	.79	1.9	1.1	.75	.18	1.5	.40	.13
16	.33	.55	.63	.84	.74	1.5	1.1	.95	.16	1.2	.22	.06
17	.38	.60	.63	.80	.74	1.4	1.1	.88	.12	.88	.11	.11
18	.37	.61	.56	.78	.86	1.4	1.0	3.1	.10	.55	.41	.30
19	.37	.60	.53	.76	.83	1.3	1.2	2.0	.11	.21	68.	.46
20	.37	.58	.48	.78	.83	1.3	1.7	1.1	.65	.78	17.	.56
21	.38	.57	.43	.80	.91	1.2	1.1	.99	1.3	.58	3.7	.56
22	.37	.57	.39	.86	.88	1.2	1.0	.74	1.4	.41	1.7	.38
23	.36	.59	.39	.88	.84	1.1	.95	.65	.92	.27	1.7	.69
24	.37	.71	.40	.88	.84	1.2	.92	.62	.51	.19	.97	.82
25	.38	.75	.47	.86	.83	1.2	.92	.55	.70	.42	.82	.79
26	.39	.67	.58	.91	.81	1.2	.93	.52	.51	1.8	.91	.80
27	.37	.82	.73	.95	.77	1.2	.91	.51	.18	1.8	.85	.67
28	.38	.78	.78	.84	.75	2.0	.92	.48	.08	1.0	.69	.66
29	.38	.70	.83	.88		2.1	.83	1.3	.04	.45	.44	.78
30	.39	.68	.77	.89		2.1	.89	2.3	.03	.42	.36	.77
31	.42		.73	.99		1.7		.94		.25	.37	
TOT DSF	8.28	17.81	19.46	25.83	25.59	60.38	34.67	31.58	12.06	18.07	102.70	11.09
MEAN	.27	.59	.63	.83	.91	2.0	1.2	1.0	.40	.58	3.3	.37
MAX	.42	.82	.83	1.1	1.2	11.	1.7	3.1	1.4	1.8	68.	.82
MIN	.06	.46	.39	.59	.74	.82	.83	.48	.03	.00	.03	.06
AC.FT.	16.42	35.33	38.74	51.23	50.76	119.76	68.77	62.64	23.92	35.84	203.70	22.00
TOT GAL x(1,000,000)	5.35	11.51	12.62	16.69	16.54	39.02	22.41	20.41	7.79	11.68	66.37	7.17

AC.FT. = TOT DSF x 1.9835

ROCKY MOUNTAIN ARSENAL

SW24002, NORTH FIRST CREEK GAGING STATION

LOCATION: UTM ZONE 13 COORDINATES, NORTHING 195,311.93 EASTING 2,187,575.26, IN NW 1/4, SE 1/4, SEC. 14, T.2S., R.67 E., FIRST CREEK DRAINAGE BASIN, ON THE ROCKY MOUNTAIN ARSENAL IN ADAMS COUNTY, COLORADO. THE STATION IS LOCATED ON THE RIGHT BANK APPROXIMATELY 1500 FEET UPSTREAM FROM 96TH AVE.

DRAINAGE AREA: 36.70 SQUARE MILES.

EQUIPMENT USED: STEVENS "TYPE F" RECORDER, CAMPBELL SCIENTIFIC CR-10 DATA LOGGER.

DISCHARGE RECORDS WATER YEAR 1990

PERIOD OF RECORD FOR WATER YEAR 1990: OCTOBER 1, 1989 TO SEPTEMBER 30, 1990.

GAGE: PZF EQUALS 5141.75 FT-MSL. 0.00 MARK ON STAFF EQUALS 5142.18 FT-MSL.

REMARKS: THE PRIMARY CONTROL STRUCTURE IS A V-NOTCHED CONCRETE WEIR.

ESTIMATED RECORDS: JANUARY 19,20, FEBRUARY 15-17.

RECORDS GOOD.

EXTREMES FOR CURRENT YEAR: INST. MIN. DISCH., .00 CFS ON OCT 1. INST. MAX. DISCH., 27. CFS ON MAR 7.

TOTAL VOLUME MEASURED: 399.94 AC.FT. (1.30E8 GALLONS).

DISCHARGE (CFS) WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.00	.00	.00	.00	.00	.40	1.8	.82	.84	.00	.00	1.6
2	.00	.00	.00	.00	.00	.44	1.5	.86	.51	.00	.00	1.2
3	.00	.00	.00	.00	.00	.44	1.4	.82	.28	.00	.00	.73
4	.00	.00	.00	.00	.00	.48	1.4	.78	.17	.00	.00	.22
5	.00	.00	.00	.00	.00	.57	1.4	.78	.10	.00	.00	.04
6	.00	.00	.00	.00	.00	4.9	1.5	.77	.04	.00	.00	.02
7	.00	.00	.00	.00	.00	18.	1.6	.76	.02	.00	.00	.01
8	.00	.00	.00	.00	.00	8.2	1.4	.73	.01	.00	.00	.00
9	.00	.00	.00	.00	.02	3.3	1.3	.96	.00	.00	.00	.00
10	.00	.00	.00	.00	.08	3.2	1.2	1.2	.00	.00	.00	.00
11	.00	.00	.00	.00	.15	3.0	1.2	.98	.00	.00	.00	.00
12	.00	.00	.00	.00	.34	2.5	1.2	.87	.00	.00	.00	.00
13	.00	.00	.00	.00	.41	2.2	1.2	.83	.00	.00	.00	.00
14	.00	.00	.00	.00	.26	2.2	1.1	.80	.00	.00	.00	.00
15	.00	.00	.00	.00	.09	2.4	1.1	.75	.00	.00	.00	.00
16	.00	.00	.00	.01	.03	2.1	1.1	.78	.00	.00	.00	.00
17	.00	.00	.00	.00	.09	1.8	1.0	.76	.00	.00	.00	.00
18	.00	.00	.00	.00	.03	1.7	1.0	.77	.00	.00	.00	.00
19	.00	.00	.00	.00	.06	1.6	.93	1.5	.00	.00	8.9	.00
20	.00	.00	.00	.00	.13	1.5	1.2	1.4	.00	.00	9.0	.00
21	.00	.00	.00	.42	.18	1.5	1.4	1.0	.00	.00	5.4	.00
22	.00	.00	.00	.11	.26	1.4	1.3	.79	.00	.00	2.2	.00
23	.00	.00	.00	.00	.37	1.3	1.1	.64	.00	.00	1.3	.07
24	.00	.00	.00	.00	.38	1.2	1.1	.47	.00	.00	1.1	.92
25	.00	.00	.00	.00	.42	1.2	1.0	.34	.00	.00	.82	1.6
26	.00	.00	.00	.34	.46	1.3	.96	.25	.00	.00	1.2	2.0
27	.00	.00	.00	.00	.38	1.3	.93	.22	.00	.00	1.6	2.3
28	.00	.00	.00	.00	.35	1.5	.93	.20	.00	.00	1.9	2.6
29	.00	.00	.00	.00		2.0	.84	.36	.00	.00	1.9	2.8
30	.00	.00	.00	.00		2.0	.85	1.1	.00	.00	1.9	1.2
31	.00		.00	.00		1.9		1.3		.00	1.7	
TOT DSF	.00	.00	.00	.88	4.49	77.53	35.94	24.59	1.97	.00	38.92	17.31
MEAN	.00	.00	.00	.03	.16	2.5	1.2	.79	.07	.00	1.3	.58
MAX	.00	.00	.00	.42	.46	18.	1.8	1.5	.84	.00	9.0	2.8
MIN	.00	.00	.00	.00	.00	.40	.84	.20	.00	.00	.00	.00
AC.FT.	.00	.00	.00	1.75	8.91	153.78	71.29	48.77	3.91	.00	77.20	34.33
TOT GAL	.00	.00	.00	.57	2.90	50.11	23.23	15.89	1.27	.00	25.15	11.19

AC.FT. = TOT DSF x 1.9835

ROCKY MOUNTAIN ARSENAL

SW37001, FIRST CREEK OFF-POST GAGING STATION

LOCATION: UTM ZONE 13 COORDINATES, NORTHING 199,013.30 FEET, EASTING 2,180,816.71 FEET, IN NW 1/4 SE 1/4 SEC. 14, T.2 S., R.67 E., FIRST CREEK DRAINAGE BASIN, ON THE ROCKY MOUNTAIN ARSENAL IN ADAMS COUNTY, COLORADO. THE STATION IS LOCATED ON THE LEFT BANK APPROXIMATELY 50 FEET UPSTREAM OF HIGHWAY 2.

DRAINAGE AREA: 37.32 SQUARE MILES.

EQUIPMENT USED: STEVENS "TYPE F" RECORDER COUPLED WITH A OMNIDATA DP115 DATAPOD RECORDER.

DISCHARGE RECORDS WATER YEAR 1990

PERIOD OF RECORD FOR WATER YEAR 1990: OCTOBER 1, 1989 TO SEPTEMBER 30, 1990.

GAGE: PZF EQUALS 5107.43 FT-MSL. 1.0 MARK ON STAFF EQUALS 5107.91 FT-MSL.

REMARKS: THE CONTROL STRUCTURE IS A CONCRETE TRIANGULAR FLUME. THE STATION RECEIVES STREAM FLOW THAT EXITS THE NORTH BOUNDARY OF THE RMA AT 96th AVENUE.

ESTIMATED RECORDS: OCTOBER 11-31, NOVEMBER 1-6, DECEMBER 16-19, FEBRUARY 7-26, JUNE 6-28.

RECORDS GOOD.

EXTREMES FOR CURRENT YEAR: INST. MIN. DISCH., .00 CFS ON OCT 1. INST. MAX. DISCH., 18. CFS ON AUG 20.

TOTAL VOLUME MEASURED: 329.00 AC.FT. (1.07E8 GALLONS).

DISCHARGE (CFS) WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	.00	.02	.05	.00	.00	.17	2.0	.76	.92	.00	.00	1.4
2	.00	.02	.07	.00	.00	.18	1.5	.76	.49	.00	.00	1.1
3	.00	.02	.06	.00	.00	.18	1.4	.74	.29	.01	.00	.64
4	.00	.02	.05	.00	.00	.18	1.4	.80	.18	.03	.00	.27
5	.00	.02	.04	.00	.00	.22	1.4	.76	.13	.03	.00	.11
6	.00	.02	.04	.00	.00	.26	1.4	.72	.12	.02	.00	.08
7	.00	.03	.04	.00	.00	.90	1.5	.62	.12	.00	.00	.08
8	.00	.03	.04	.00	.00	6.3	1.5	.62	.11	.02	.00	.07
9	.00	.03	.04	.00	.00	4.7	1.4	.61	.12	.04	.00	.06
10	.00	.03	.03	.00	.00	3.7	1.2	.95	.12	.03	.00	.06
11	.00	.03	.04	.00	.00	3.6	1.2	.95	.10	.02	.00	.06
12	.00	.03	.04	.00	.00	3.1	1.2	.81	.09	.02	.00	.06
13	.00	.03	.07	.00	.01	2.6	1.2	.62	.09	.02	.00	.06
14	.00	.03	.05	.00	.01	2.3	1.0	.53	.09	.01	.00	.06
15	.00	.03	.09	.00	.01	2.5	.99	.52	.10	.01	.02	.06
16	.00	.03	.07	.00	.01	2.3	.96	.55	.09	.00	.00	.06
17	.01	.03	.05	.00	.01	2.0	.97	.51	.10	.00	.00	.07
18	.01	.03	.03	.00	.01	1.8	.99	.52	.08	.00	.00	.09
19	.01	.03	.00	.00	.01	1.6	1.0	.69	.08	.00	1.4	.08
20	.01	.03	.00	.00	.01	1.5	1.1	1.2	.08	.00	14.	.08
21	.01	.03	.00	.00	.01	1.3	1.3	.91	.08	.02	8.9	.08
22	.01	.03	.00	.00	.01	1.3	1.2	.66	.07	.02	3.3	.09
23	.01	.04	.00	.00	.01	1.1	1.1	.52	.06	.02	1.3	.09
24	.02	.03	.00	.00	.01	1.1	1.1	.37	.06	.00	.87	.10
25	.02	.04	.00	.00	.01	1.1	1.1	.24	.06	.00	.49	.09
26	.02	.04	.00	.00	.01	1.1	.99	.14	.04	.00	.37	.10
27	.02	.04	.00	.00	.15	1.1	.89	.12	.04	.00	.68	1.1
28	.02	.04	.00	.00	.14	1.4	.85	.11	.04	.00	1.1	1.8
29	.02	.04	.00	.00		2.1	.82	.17	.01	.05	1.2	2.1
30	.02	.05	.00	.00		2.3	.79	.79	.00	.02	1.3	1.4
31	.02		.00	.00		2.2		1.4		.01	1.3	
TOT DSF	.23	.92	.90	.00	.43	56.19	35.45	19.67	3.96	.40	36.23	11.50
MEAN	.01	.03	.03	.00	.02	1.8	1.2	.63	.13	.01	1.2	.38
MAX	.02	.05	.09	.00	.15	6.3	2.0	1.4	.92	.05	14.	2.1
MIN	.00	.02	.00	.00	.00	.17	.79	.11	.00	.00	.00	.06
AC.FT.	.46	1.82	1.79	.00	.85	111.45	70.31	39.01	7.85	.79	71.86	22.81
TOT GAL x(1,000,000)	.15	.59	.58	.00	.28	36.31	22.91	12.71	2.56	.26	23.41	7.43

AC.FT. = TOT DSF x 1.9835

ROCKY MOUNTAIN ARSENAL

SW36001, BASIN A GAGING STATION

LOCATION: UTM ZONE 13 COORDINATES, NORTHING 180,985.8 FEET, EASTING 2,182,686.29 FEET, IN SW 1/4 SW 1/4 SEC. 36, T.2 S., R.67 E., SOUTH PLATTE DRAINAGE BASIN, ON THE ROCKY MOUNTAIN ARSENAL IN ADAMS COUNTY, COLORADO. THE STATION IS LOCATED ON THE LEFT BANK APPROXIMATELY 200 FEET NORTH OF 7TH AVENUE AND 500 FEET EAST OF D STREET.

DRAINAGE AREA: 0.055 SQUARE MILES OF STORM SEWER DRAINAGE FROM THE SOUTH PLANTS AREA.

EQUIPMENT USED: STEVENS "TYPE F" RECORDER, OMNIDATA DP115 DATAPOD.

DISCHARGE RECORDS WATER YEAR 1990

PERIOD OF RECORD: OCTOBER 1, 1989 TO NOVEMBER 1, 1989 AND JUNE 21, 1990 TO JULY 9, 1990.

GAGE: PZF EQUALS 5252.19 FT-MSL. 0.00 MARK ON STAFF EQUALS 5252.11 FT-MSL.

REMARKS: THE STATION RECEIVES STORM SEWER DRAINAGE AND BASEFLOW FROM THE NORTH WEST SIDE OF THE SOUTH PLANTS AREA. THE PRIMARY CONTROL STRUCTURE IS A 15 INCH, 90 DEGREE V-NOTCH WEIR. NOTE- ON NOVEMBER 1, 1989 A SECTION OF THE CONCRETE CHANNEL UPSTREAM OF THE STATION COLLAPSED CAUSING FLOW TO BE DIVERTED AWAY FROM THE RECORDER UNTIL JUNE 20, 1990. THE CHANNEL WAS REPAIRED JUNE 21, 1990 BUT COLLAPSED AGAIN JULY 9, 1990 AND FLOW WAS DIVERTED THE REMAINDER OF WATER YEAR 1990.

ESTIMATED RECORDS: NONE.

RECORDS POOR (DUE TO POOR RATING AT LOW FLOWS).

EXTREMES FOR CURRENT YEAR: NOT APPLICABLE DUE TO INCOMPLETE RECORD.

TOTAL VOLUME MEASURED: NOT APPLICABLE DUE TO INCOMPLETE RECORD. T = FLOW AT >0.00 CFS BUT <0.005 CFS.

DISCHARGE (CFS) WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	T	T								T		
2	T									T		
3	T									T		
4	T									.01		
5	T									.01		
6	T									.01		
7	T									.01		
8	T									.01		
9	T									.02		
10	T											
11	T											
12	T											
13	T											
14	T											
15	T											
16	T											
17	T											
18	T											
19	T											
20	T											
21	T								T			
22	T								T			
23	T								T			
24	T								T			
25	T								T			
26	T								T			
27	T								.01			
28	T								.02			
29	T								.02			
30	T								.02			
31	T											
TOT DSF	T	T							.07	.07		
MEAN	T	T							T	T		
MAX	T	T							.02	.02		
MIN	T	T							T	T		
AC.FT.	T	T							.14	.14		
TOT GAL x(10,000)	T	T							4.6	4.6		

AC.FT. = TOT DSF x 1.9835

ROCKY MOUNTAIN ARSENAL

SW26001, BASIN F GAGING STATION

LOCATION: UTM ZONE 13 COORDINATES, NORTHING 189857.41 FEET, EASTING 2179286.75 FEET, IN NW 1/4 SW 1/4 SEC. 26, T.2 S., R.67 E., SOUTH PLATTE DRAINAGE BASIN, ON THE ROCKY MOUNTAIN ARSENAL IN ADAMS COUNTY, COLORADO. THE STATION IS LOCATED ON THE LEFT BANK APPROXIMATELY 1300 FEET SOUTH OF 9TH AVENUE AND 1000 FEET EAST OF C STREET.

DRAINAGE AREA: NA

EQUIPMENT USED: STEVENS "TYPE F" RECORDER.

DISCHARGE RECORDS WATER YEAR 1990

PERIOD OF RECORD: OCTOBER 24, 1989 TO SEPTEMBER 30, 1990.

GAGE: PZF EQUALS 5183.30 FT-MSL.

REMARKS: THE STATION WAS CONSTRUCTED ON OCTOBER 24, 1989. THE PRIMARY CONTROL STRUCTURE IS A 200MM LONG-THROATED FLUME.

ESTIMATED RECORDS: MARCH 9, 1990.

RECORDS GOOD EXCEPT FOR ESTIMATED DAY WHICH IS FAIR.

EXTREMES FOR CURRENT YEAR: INST. MIN. DISCH., .00 CFS ON OCT 24. INST. MAX. DISCH., 2.4 CFS ON AUG 19.

TOTAL VOLUME MEASURED: 1.41 AC.FT. (4.59E5 GALLONS). T = FLOW AT >0.00 CFS BUT <0.005 CFS

DISCHARGE (CFS) WATER YEAR OCTOBER 1989 TO SEPTEMBER 1990
MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
3		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
4		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
5		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
6		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
7		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
8		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
9		.00	.00	.00	.00	.13	.00	.00	.00	.00	.00	.00
10		.00	.00	.00	.00	.26	.00	.00	.00	.00	.00	.00
11		.00	.00	.00	.00	.20	.00	.00	.00	.00	.00	.00
12		.00	.00	.00	.00	.01	.00	.00	.00	.00	.00	.00
13		.00	.00	.00	.00	.01	.00	.00	.00	.00	.00	.00
14		.00	.00	.00	.00	.04	.00	.00	.00	.00	.00	.00
15		.00	.00	.00	.00	.01	.00	.00	.00	.00	.00	.00
16		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
17		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
18		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
19		.00	.00	.00	.00	.00	.00	.00	.00	.00	.04	.00
20		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
21		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
22		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
23		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
24	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
25	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
26	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
27	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
28	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
29	.00	.00	.00	.00		.00	.00	.00	.00	.01	.00	.00
30	.00	.00	.00	.00		.00	.00	.00	.00	.00	.00	.00
31	.00		.00	.00		.00		.00		.00	.00	
TOT DSF	.00	.00	.00	.00	.00	.66	.00	.00	.00	.01	.04	.00
MEAN	.00	.00	.00	.00	.00	.02	.00	.00	.00	T	T	.00
MAX	.00	.00	.00	.00	.00	.26	.00	.00	.00	.01	.04	.00
MIN	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
AC.FT.	.00	.00	.00	.00	.00	1.31	.00	.00	.00	.02	.08	.00
TOT GAL x(100,000)	.00	.00	.00	.00	.00	4.27	.00	.00	.00	.07	.26	.00

AC.FT. = TOT DSF x 1.9835

APPENDIX A-9

LAKE VOLUME RECORDS

Appendix A-9 Table A-9-1 Lake Mary Water Level*, Water Year 1990

DATE	STAFF GAGE (feet)	ELEV. (ft-msl)
10/03/89	0.90	5203.29
10/10/89	0.72	5203.11
10/17/89	0.54	5202.93
10/24/89	0.74	5203.13
10/31/89	0.77	5203.16
11/07/89	0.60	5202.99
11/14/89	0.42	5202.81
11/21/89	0.61	5203.00
11/28/89	0.82	5203.21
12/05/89	0.66	5203.05
12/12/89	FRZ	-
12/19/89	FRZ	-
12/26/89	FRZ	-
01/02/90	FRZ	-
01/09/90	FRZ	-
01/16/90	FRZ	-
01/23/90	FRZ	-
01/30/90	FRZ	-
02/06/90	FRZ	-
02/13/90	0.16	5202.55
02/20/90	0.13	5202.52
02/27/90	0.08	5202.47
03/08/90	0.30	5202.69
03/14/90	0.34	5202.73
03/20/90	0.32	5202.71
03/27/90	0.28	5202.67
04/03/90	0.32	5202.71
04/10/90	0.31	5202.70
04/17/90	0.97	5203.36
04/24/90	0.92	5203.31
05/01/90	0.90	5203.29
05/08/90	0.91	5203.30
05/15/90	1.00	5203.39
05/22/90	0.76	5203.15
05/29/90	1.02	5203.41
06/05/90	0.81	5203.20
06/12/90	0.90	5203.29
06/20/90	0.85	5203.24
06/27/90	0.87	5203.26
07/03/90	0.79	5203.18
07/10/90	0.96	5203.35
07/17/90	1.02	5203.41
07/24/90	0.83	5203.22
07/31/90	0.91	5203.30

Appendix A-9 Table A-9-1 Lake Mary Water Level*, Water Year 1990 (Continued)

DATE	STAFF GAGE (feet)	ELEV. (ft-msl)
08/07/90	0.91	5203.30
08/14/90	0.90	5203.30
08/21/90	0.95	5203.29
08/28/90	0.84	5203.23
09/04/90	0.85	5203.24
09/11/90	0.92	5203.31
09/18/90	0.87	5203.26
09/25/90	0.82	5203.21

* Storage relationship has not been established
FRZ = Frozen

Appendix A-9 Table A-9-2 Ladora Lake Water Level and Storage Data, Water Year 1990

DATE	STAFF GAGE (feet)	ELEV. (ft-msl)	VOLUME* (ac-ft)	AREA* (ac)
10/03/89	11.10	5218.23	251.90	48.40
10/10/89	11.60	5218.73	277.00	51.90
10/17/89	11.90	5219.03	292.30	54.00
10/24/89	11.90	5219.03	292.30	54.00
10/31/89	11.80	5218.93	287.00	53.30
11/07/89	11.80	5218.93	287.00	53.30
11/14/89	11.80	5218.93	287.00	53.30
11/21/89	11.80	5218.93	287.00	53.30
11/28/89	11.80	5218.93	287.00	53.30
12/05/89	11.80	5218.93	287.00	53.30
12/12/89	FRZ	-	-	-
12/19/89	FRZ	-	-	-
12/26/89	FRZ	-	-	-
01/02/90	FRZ	-	-	-
01/09/90	FRZ	-	-	-
01/16/90	12.00	5219.13	298.10	54.70
01/23/90	12.10	5219.23	303.80	55.50
01/30/90	12.00	5219.13	298.10	54.70
02/06/90	12.00	5219.13	298.10	54.70
02/13/90	12.00	5219.13	298.10	54.70
02/20/90	FRZ	-	-	-
02/27/90	12.00	5219.13	298.10	54.70
03/08/90	12.30	5219.43	315.30	56.90
03/14/90	12.40	5219.53	321.00	57.70
03/20/90	12.40	5219.53	321.00	57.70
03/27/90	12.10	5219.23	303.80	55.50
04/03/90	12.30	5219.43	315.30	56.90
04/10/90	12.20	5219.33	309.50	56.20
04/17/90	12.00	5219.13	298.10	54.70
04/24/90	12.00	5219.13	298.10	54.70
05/01/90	11.90	5219.03	292.30	54.00
05/08/90	11.80	5218.93	287.00	53.30
05/15/90	11.65	5218.78	279.50	52.20
05/22/90	11.50	5218.63	271.90	51.20
05/29/90	11.40	5218.53	266.90	50.50
06/05/90	11.30	5218.43	261.90	49.80
06/12/90	11.00	5218.13	246.90	47.70
06/20/90	12.70	5219.83	338.20	59.90
06/26/90	13.00	5220.13	346.80	61.00
07/03/90	12.60	5219.73	332.50	59.20
07/10/90	12.50	5219.63	326.70	58.40
07/17/90	12.20	5219.33	309.50	56.20
07/24/90	12.00	5219.13	298.10	54.70
07/31/90	11.90	5219.03	292.30	54.00

Appendix A-9 Table A-9-2 Ladora Lake Water Level and Storage Data, Water Year 1990 (Continued)

DATE	STAFF GAGE (feet)	ELEV. (ft-msl)	VOLUME* (ac-ft)	AREA* (ac)
08/07/90	11.70	5218.83	282.00	52.60
08/14/90	11.50	5218.63	271.90	51.20
08/21/90	11.50	5218.63	271.90	51.20
08/28/90	11.20	5218.33	256.90	49.10
09/04/90	12.10	5219.23	303.80	55.50
09/11/90	12.90	5220.03	346.80	61.00
09/18/90	12.60	5219.73	332.50	59.20
09/25/90	12.55	5219.68	329.63	58.80

* Source: Ebasco, WRI Report, 1989, Appendix B
FRZ = Frozen

Appendix A-9 Table A-9-3 Lower Derby Lake Water Level and Storage Data, Water Year 1990

DATE	STAFF GAGE (feet)	ELEV. (ft-msl)	VOLUME* (ac-ft)	AREA* (ac)
10/03/89	12.50	5242.67	272.20	52.80
10/10/89	12.40	5242.57	267.00	52.20
10/17/89	12.30	5242.47	261.80	51.70
10/24/89	12.90	5243.07	293.30	55.00
10/31/89	12.70	5242.87	282.60	53.90
11/07/89	12.70	5242.87	282.60	53.90
11/14/89	12.60	5242.77	277.40	53.30
11/21/89	12.60	5242.77	277.40	53.30
11/28/89	12.60	5242.77	277.40	53.30
12/05/89	12.40	5242.57	267.00	52.20
12/12/89	FRZ	-	-	-
12/19/89	FRZ	-	-	-
12/26/89	FRZ	-	-	-
01/02/90	FRZ	-	-	-
01/09/90	FRZ	-	-	-
01/16/90	12.20	5242.37	256.60	51.10
01/23/90	12.20	5242.37	256.60	51.10
01/30/90	FRZ	-	-	-
02/06/90	12.00	5242.17	246.20	50.00
02/13/90	12.00	5242.17	246.20	50.00
02/20/90	12.00	5242.17	246.20	50.00
02/27/90	11.90	5242.07	241.00	49.50
03/08/90	12.10	5242.27	251.40	50.60
03/14/90	12.00	5242.17	246.20	50.00
03/20/90	12.10	5242.27	251.40	50.60
03/27/90	12.00	5242.17	246.20	50.00
04/03/90	12.00	5242.17	246.20	50.00
04/10/90	12.10	5242.27	251.40	50.60
04/17/90	12.00	5242.17	246.20	50.00
04/24/90	12.00	5242.17	246.20	50.00
05/01/90	11.90	5242.07	241.00	49.50
05/08/90	12.80	5242.97	287.80	54.40
05/15/90	11.70	5241.87	231.50	48.30
05/22/90	11.70	5241.87	231.50	48.30
05/29/90	11.70	5241.87	231.50	48.30
06/05/90	11.60	5241.77	226.80	47.80
06/12/90	11.70	5241.87	231.50	48.30
06/20/90	11.70	5241.87	231.50	48.30
06/26/90	11.90	5242.07	241.00	49.50
07/03/90	11.60	5241.77	226.80	47.80
07/10/90	11.70	5241.87	231.50	48.30
07/17/90	11.60	5241.77	226.80	47.80
07/24/90	11.60	5241.77	226.80	47.80
07/31/90	11.50	5241.67	222.20	47.20

Appendix A-9 Table A-9-3 Lower Derby Lake Water Level and Storage Data, Water Year 1990 (Continued)

DATE	STAFF GAGE (feet)	ELEV. (ft-msl)	VOLUME* (ac-ft)	AREA* (ac)
08/07/90	11.60	5241.77	226.80	47.80
08/14/90	11.50	5241.67	222.20	47.20
08/21/90	11.50	5241.67	222.20	47.20
08/28/90	11.90	5242.07	241.00	49.50
09/04/90	11.00	5241.17	199.00	44.40
09/11/90	11.00	5241.17	199.00	44.40
09/18/90	12.50	5242.67	272.20	52.80
09/25/90	12.40	5242.57	267.00	52.20

* Source: Ebasco, WRI Report, 1989, Appendix B
FRZ = Frozen

Appendix A-9 Table A-9-4 Upper Derby Lake Water Level and Storage Data, Water Year 1990

DATE	STAFF GAGE (feet)	ELEV. (ft-msl)	VOLUME* (ac-ft)	AREA* (ac)
10/03/89	3.60	5251.37	32.80	16.80
10/10/89	3.20	5250.97	26.00	14.50
10/17/89	3.30	5251.07	27.50	15.00
10/24/89	BG	-	-	-
10/31/89	BG	-	-	-
11/07/89	0.70	5248.47	3.70	4.40
11/14/89	BG	-	-	-
11/21/89	BG	-	-	-
11/28/89	BG	-	-	-
12/05/89	BG	-	-	-
12/12/89	BG	-	-	-
12/19/89	BG	-	-	-
12/26/89	BG	-	-	-
01/02/90	BG	-	-	-
01/09/90	DRY	-	-	-
01/16/90	DRY	-	-	-
01/23/90	FRZ	-	-	-
01/30/90	DRY	-	-	-
02/06/90	DRY	-	-	-
02/13/90	DRY	-	-	-
02/20/90	DRY	-	-	-
02/27/90	DRY	-	-	-
03/08/90	2.50	5250.27	17.40	11.10
03/14/90	2.50	5250.27	17.40	11.10
03/20/90	2.30	5250.07	14.90	10.10
03/27/90	2.10	5249.87	13.10	9.30
04/03/90	2.30	5250.07	14.90	10.10
04/10/90	2.30	5250.07	14.90	10.10
04/17/90	1.90	5249.67	11.50	8.60
04/24/90	2.00	5249.77	12.30	9.00
05/01/90	1.80	5249.57	10.70	8.20
05/08/90	1.60	5249.37	9.10	7.50
05/15/90	5.20	5252.97	67.90	28.30
05/22/90	6.40	5254.17	108.10	38.20
05/29/90	5.80	5253.57	87.20	33.30
06/05/90	6.90	5254.67	128.70	42.30
06/12/90	8.20	5255.97	189.80	52.80
06/20/90	8.60	5256.37	212.20	55.90
06/26/90	8.70	5256.47	217.90	56.70
07/03/90	7.90	5255.67	175.00	50.40
07/10/90	7.90	5255.67	175.00	50.40
07/17/90	9.60	5257.37	272.10	63.80
07/24/90	8.90	5256.67	212.20	55.90
07/31/90	9.30	5257.07	252.60	61.40

Appendix A-9 Table A-9-4 Upper Derby Lake Water Level and Storage Data, Water Year 1990 (continued)

DATE	STAFF GAGE (feet)	ELEV. (ft-msl)	VOLUME* (ac-ft)	AREA* (ac)
08/07/90	9.00	5256.77	235.10	59.10
08/14/90	8.50	5256.27	206.50	55.20
08/21/90	9.10	5256.87	240.80	59.80
08/28/90	9.80	5257.57	285.10	65.40
09/04/90	8.80	5256.57	223.70	57.50
09/11/90	7.80	5255.57	170.10	49.60
09/18/90	8.50	5256.27	206.50	55.20
09/25/90	9.90	5257.67	291.60	66.20

* Source: Ebasco, WRI Report, 1989, Appendix B
FRZ = Frozen
BG = Below Gage

Appendix A-9 Table A-9-5 Havana Pond Water Level and Storage Data, Water Year 1990

DATE	STAFF GAGE (feet)	ELEV. (ft-msl)	VOLUME* (ac-ft)	AREA* (ac)
10/03/89	1.86	5245.94	19.15	12.46
10/10/89	1.60	5245.68	16.19	11.23
10/17/89	2.27	5246.35	24.53	14.42
10/24/89	1.73	5245.81	17.34	11.72
10/31/89	1.30	5245.38	13.02	9.02
11/07/89	1.54	5245.62	15.09	10.79
11/14/89	1.16	5245.24	11.58	9.26
11/21/89	0.96	5245.04	9.81	8.39
11/28/89	0.76	5244.84	8.22	7.51
12/05/89	0.61	5244.69	7.15	6.86
12/12/89	FRZ	-	-	-
12/19/89	FRZ	-	-	-
12/26/89	FRZ	-	-	-
01/02/90	BG	-	-	-
01/09/90	FRZ	-	-	-
01/16/90	1.14	5245.22	11.22	9.04
01/23/90	FRZ	-	-	-
01/30/90	FRZ	-	-	-
02/06/90	1.32	5245.40	13.02	9.92
02/13/90	1.09	5245.17	10.68	8.82
02/20/90	1.24	5245.32	12.05	9.48
02/27/90	1.11	5245.19	11.12	9.04
03/08/90	4.00	5248.08	57.44	23.72
03/14/90	3.41	5247.49	44.67	20.08
03/20/90	2.30	5246.38	25.26	14.67
03/27/90	1.59	5245.67	15.63	11.01
04/03/90	2.41	5246.49	26.75	15.16
04/10/90	2.23	5246.31	23.81	14.18
04/17/90	1.61	5245.69	16.19	11.23
04/24/90	2.12	5246.20	22.42	13.69
05/01/90	1.85	5245.93	19.15	12.46
05/08/90	1.49	5245.57	14.55	10.57
05/15/90	1.57	5245.65	15.63	11.01
05/22/90	1.96	5246.04	20.42	12.95
05/29/90	3.51	5247.59	46.40	20.57
06/05/90	2.70	5246.78	31.52	16.64
06/12/90	2.15	5246.23	23.11	13.93
06/20/90	2.47	5246.55	27.51	15.41
06/27/90	2.05	5246.13	21.74	13.44
07/03/90	2.02	5246.10	21.08	13.20
07/10/90	3.68	5247.76	49.54	21.39
07/17/90	2.62	5246.70	29.88	16.15
07/24/90	3.11	5247.19	38.56	18.60
07/31/90	4.02	5248.10	57.44	23.72

Appendix A-9 Table A-9-5 Havana Pond Water Level and Storage Data, Water Year 1990 (Continued)

DATE	STAFF GAGE (feet)	ELEV. (ft-msl)	VOLUME* (ac-ft)	AREA* (ac)
08/07/90	3.92	5248.00	55.10	23.06
08/14/90	3.00	5247.08	36.73	18.11
08/21/90	4.27	5248.35	63.58	25.39
08/28/90	2.95	5247.03	35.83	17.87
09/04/90	2.97	5247.05	35.83	17.87
09/11/90	2.65	5246.73	30.69	16.39
09/18/90	2.45	5246.53	27.51	15.41
09/25/90	3.25	5247.33	41.41	19.34

* Source: Ebasco, WRI Report, 1989, Appendix B
FRZ = Frozen
BG = Below Gage

APPENDIX A-10

SEWAGE TREATMENT PLANT RECORDS

Appendix A-10

Table A-10-1 Sewage Treatment Plant Flow Summary, Water Year 1990

Date Week Ending	Meter Reading	Discharge (gals/week)	Cummulative (gals)
7OCT89	50562600	103200	103200
14OCT89	50677100	114500	217700
21OCT89	50810200	133100	350800
28OCT89	50929400	119200	470000
4NOV89	51052600	123200	593200
11NOV89	51153600	101000	694200
18NOV89	51281500	127900	822100
25NOV89	51361800	80300	902400
2DEC89	51441900	80100	982500
9DEC89	51515100	73200	1055700
16DEC89	51596900	81800	1137500
23DEC89	51672200	75300	1212800
30DEC89	51751800	79600	1292400
6JAN90	51875700	123900	1416300
13JAN90	51972300	96600	1512900
20JAN90	52069900	97600	1610500
27JAN90	52185300	115400	1725900
3FEB90	52268500	83200	1809100
10FEB90	52371700	103200	1912300
17FEB90	52441700	70000	1982300
24FEB90	52551500	109800	2092100
3MAR90	52617600	66100	2158200
10MAR90	52719500	101900	2260100
17MAR90	52843400	123900	2384000
24MAR90	53006700	163300	2547300
31MAR90	53162600	155900	2703200
7APR90	53313000	150400	2853600
14APR90	53455600	142600	2996200
21APR90	53590100	134500	3130700
28APR90	53695800	105700	3236400
5MAY90	53797400	101600	3338000
12MAY90	53908100	110700	3448700
19MAY90	54015300	107200	3555900
26MAY90	54096500	81200	3637100
2JUNE90	54218400	121900	3759000
9JUNE90	54364900	146500	3905500
16JUNE90	54495700	130800	4036300
23JUNE90	54642700	147000	4183300
30JUNE90	54796300	153600	4336900
7JULY90	54976900	180600	4517500

Table A-10-1 Sewage Treatment Plant Flow Summary, Water Year 1990 (Continued)

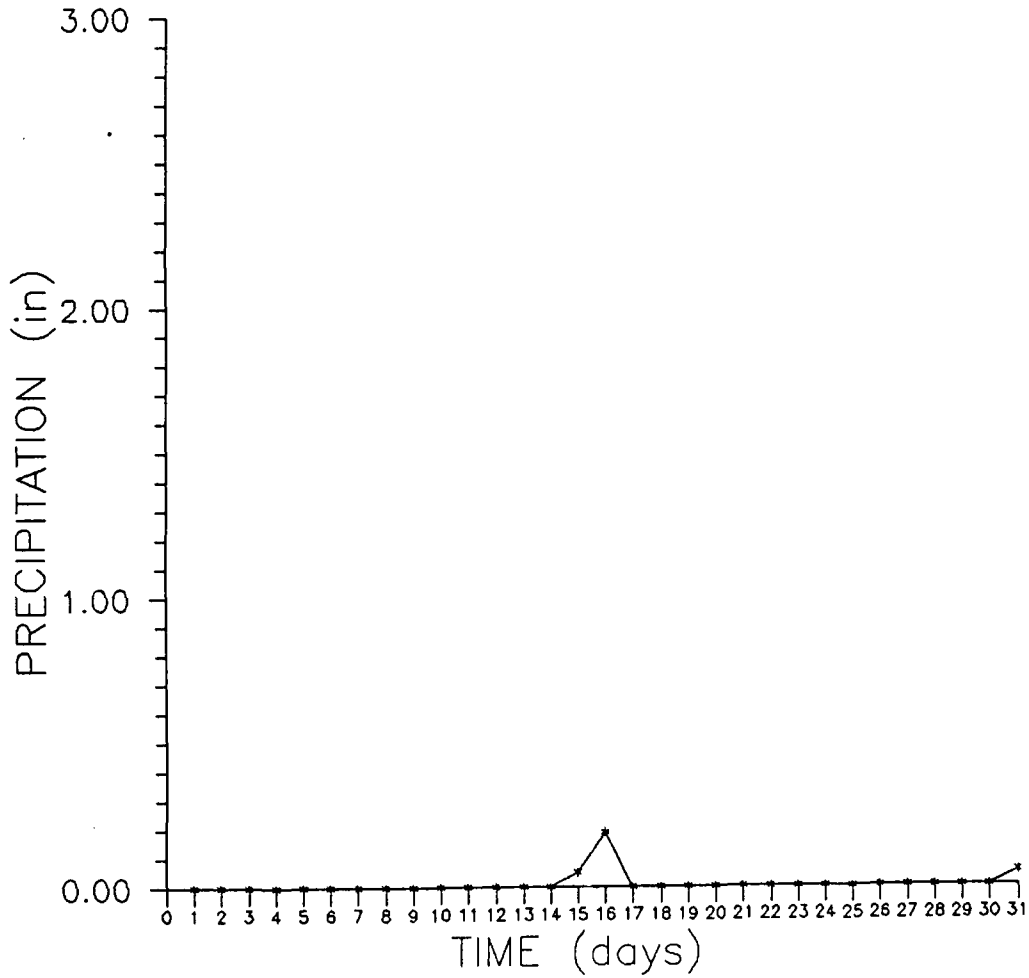
Date Week Ending	Meter Reading	Gallons Per Week	Commulating Gallons Per Year
14JULY90	55191600	214700	4732200
21JULY90	55387400	195800	4928000
28JULY90	55557200	169800	5097800
4AUG90	55732000	174800	5272600
11AUG90	55898200	166200	5438800
18AUG90	56066900	168700	5607500
25AUG90	56243200	176300	5783800
1SEP90	56385100	141900	5925700
8SEP90	56498300	113200	6038900
15SEP90	56638300	140000	6178900
22SEP90	56780600	142300	6321200
29SEP90	56920400	139800	6461000
1OCT90	56945100	24700	6485700

APPENDIX A-11

CLIMATIC CONDITIONS RECORDS

APPENDIX A-11.1

PRECIPITATION GRAPHS/PLOTS

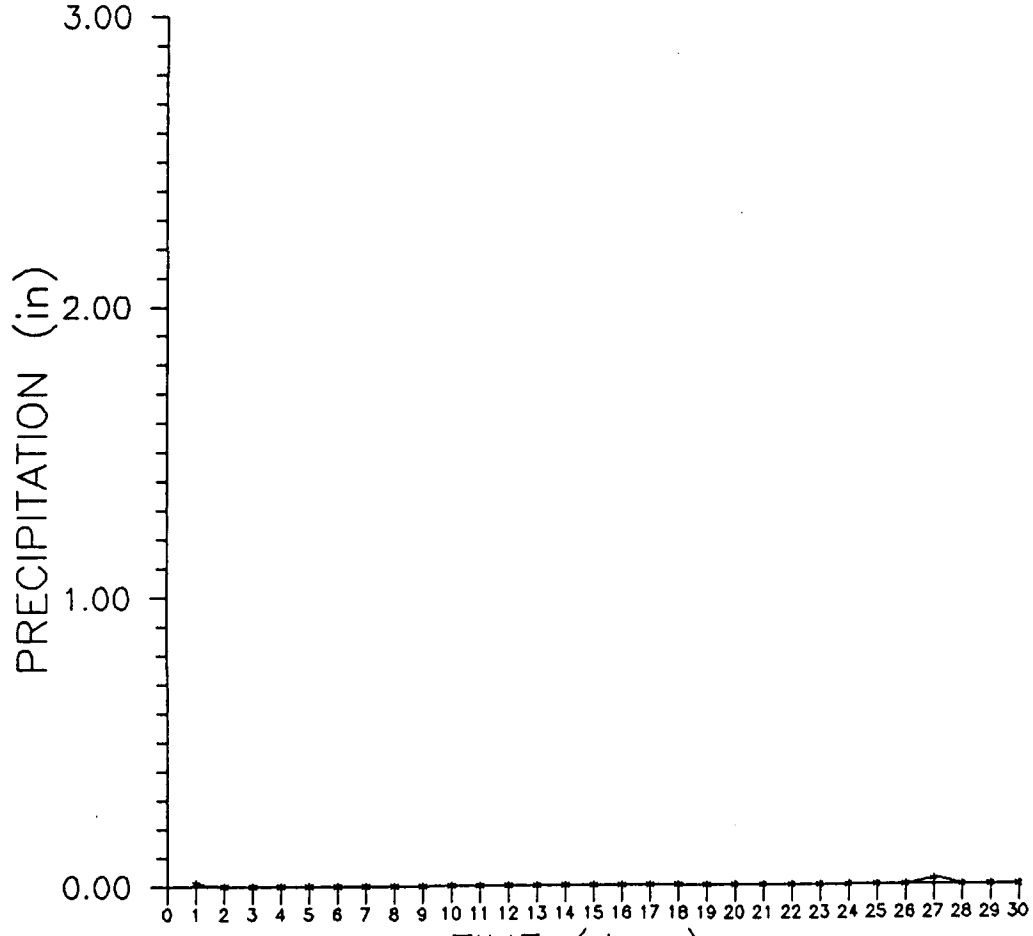


Prepared for :
U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by :
R.L. Stollar & Associates, Inc.

Figure A-11.1-1

Daily Precipitation
October 1989

CMP SW90

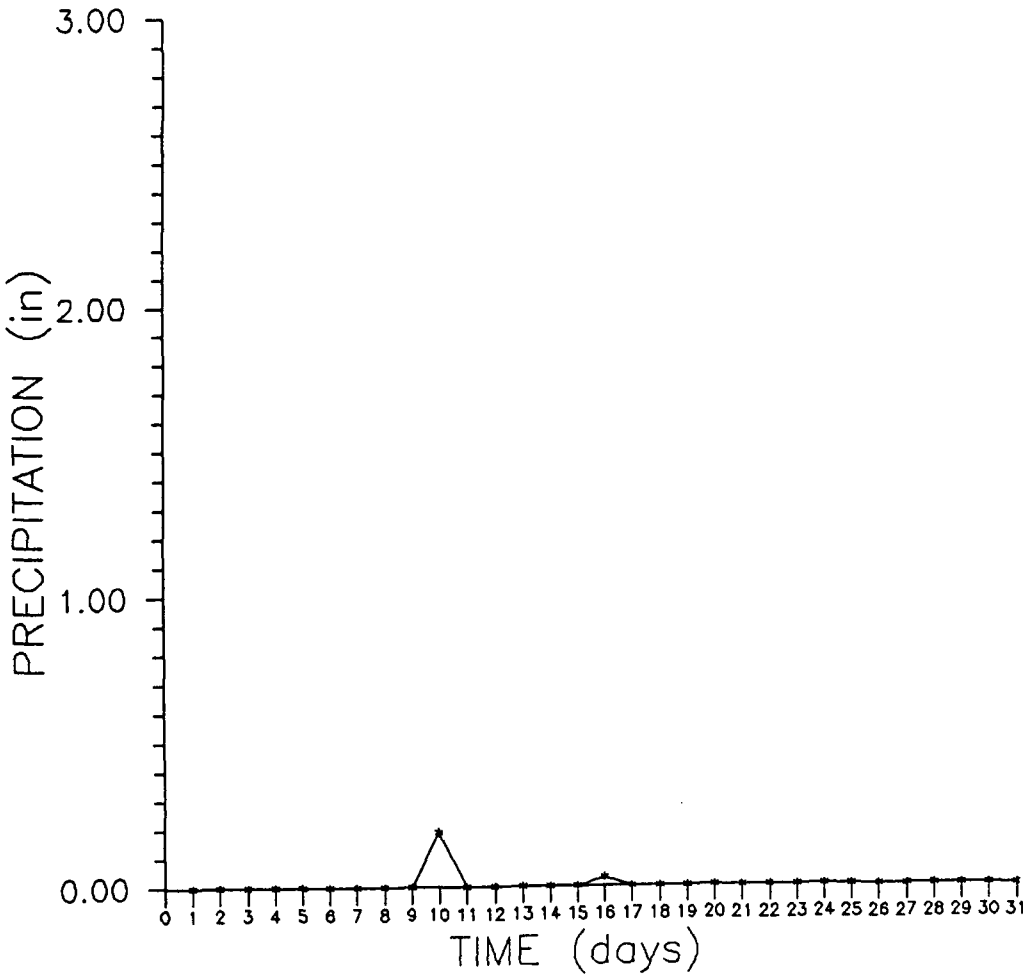


Prepared for :
U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by :
R.L. Stollar & Associates, Inc.

Figure A-11.1-2

Daily Precipitation
November 1989

CMP SW90

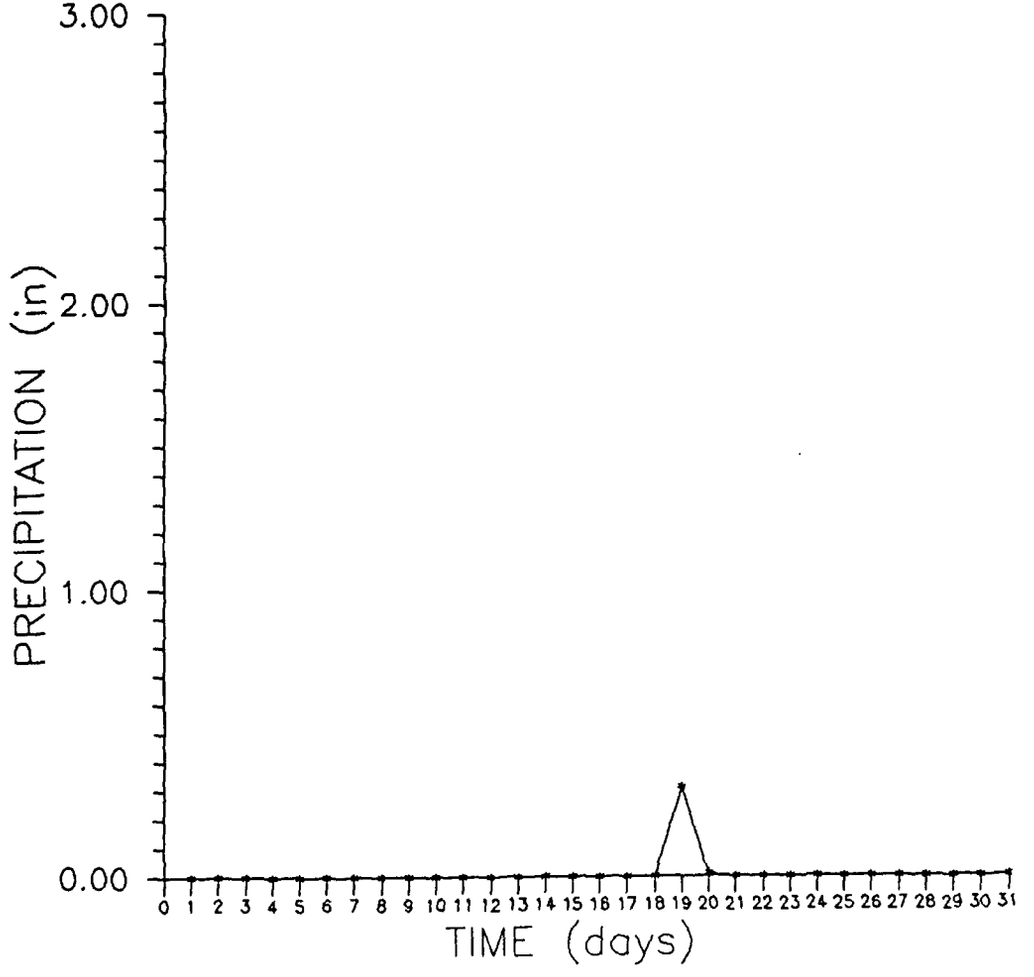


Prepared for :
U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by :
R.L. Stollar & Associates, Inc.

Figure A-11.1-3

Daily Precipitation
December 1989

CMP SW90

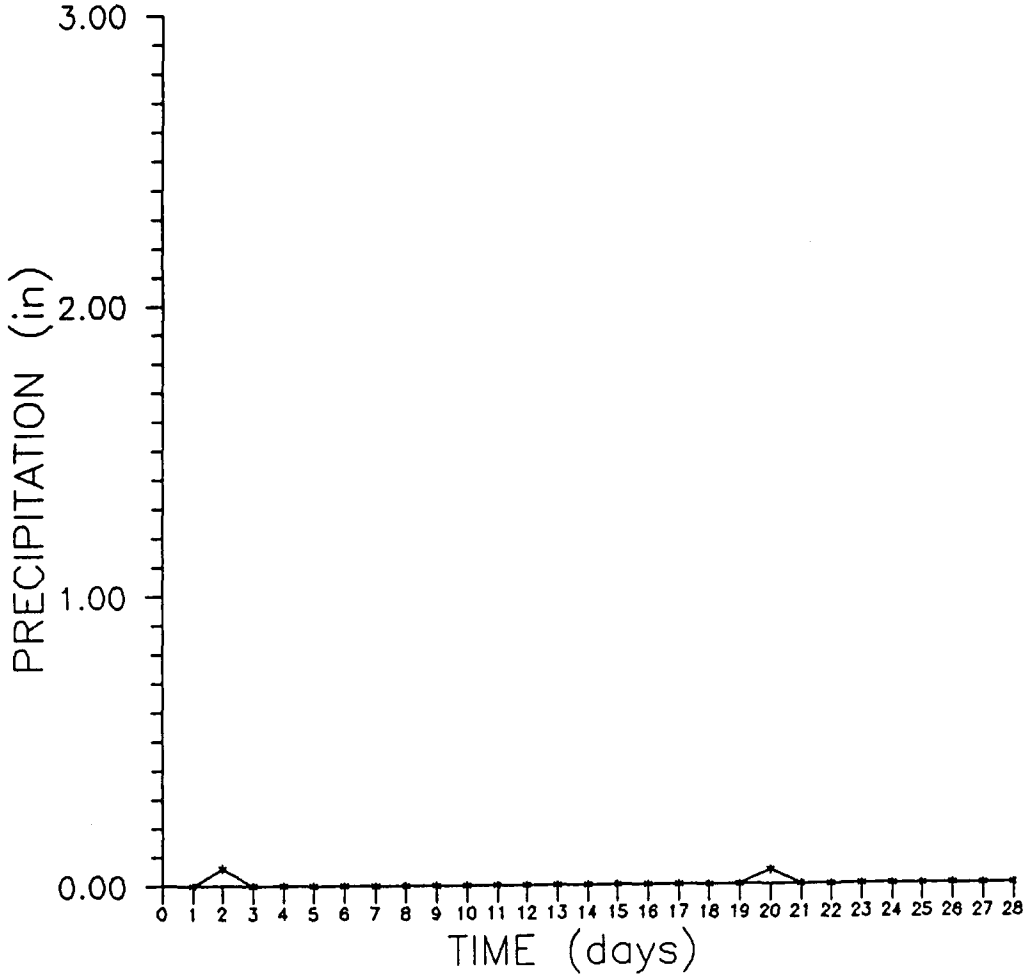


Prepared for :
U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by :
R.L. Stollar & Associates, Inc.

Figure A-11.1-4

Daily Precipitation
January 1990

CMP SW90

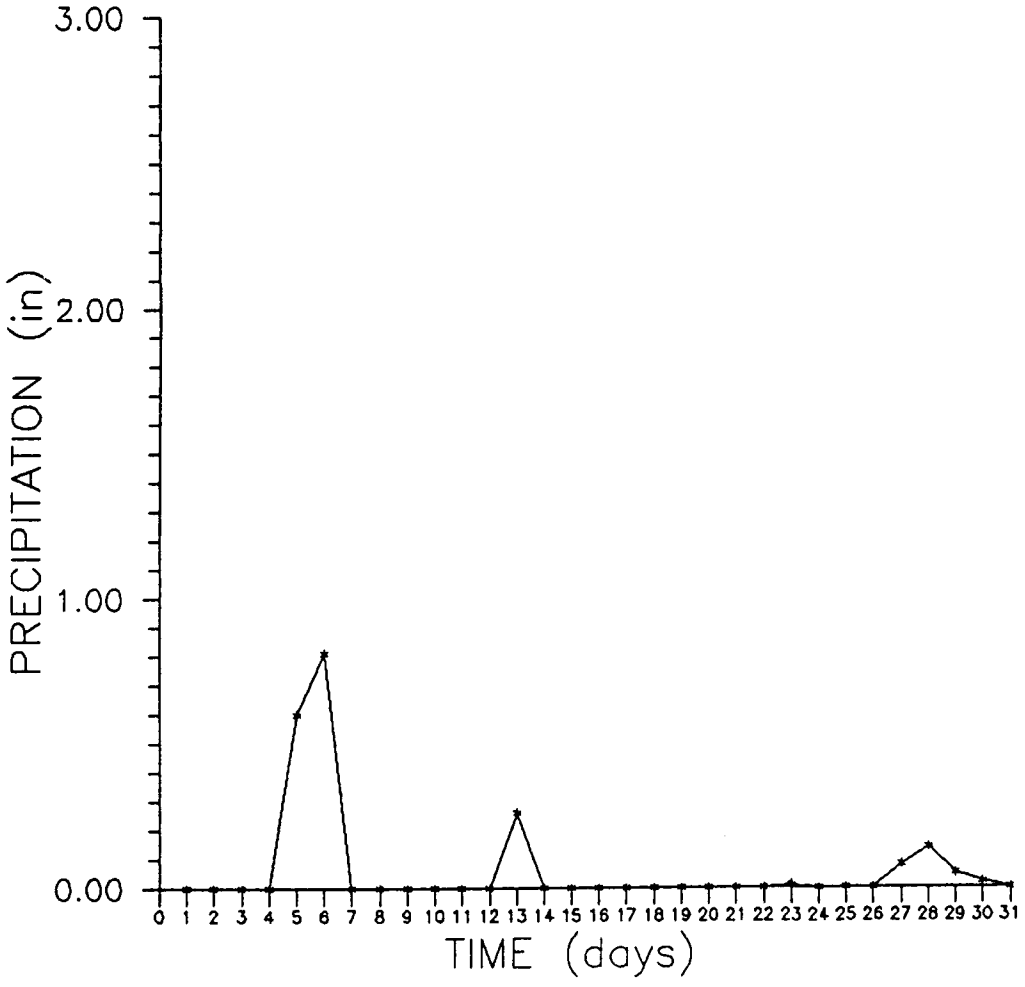


Prepared for :
U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by :
R.L. Stollar & Associates, Inc.

Figure A-11.1-5

Daily Precipitation
February 1990

CMP SW90

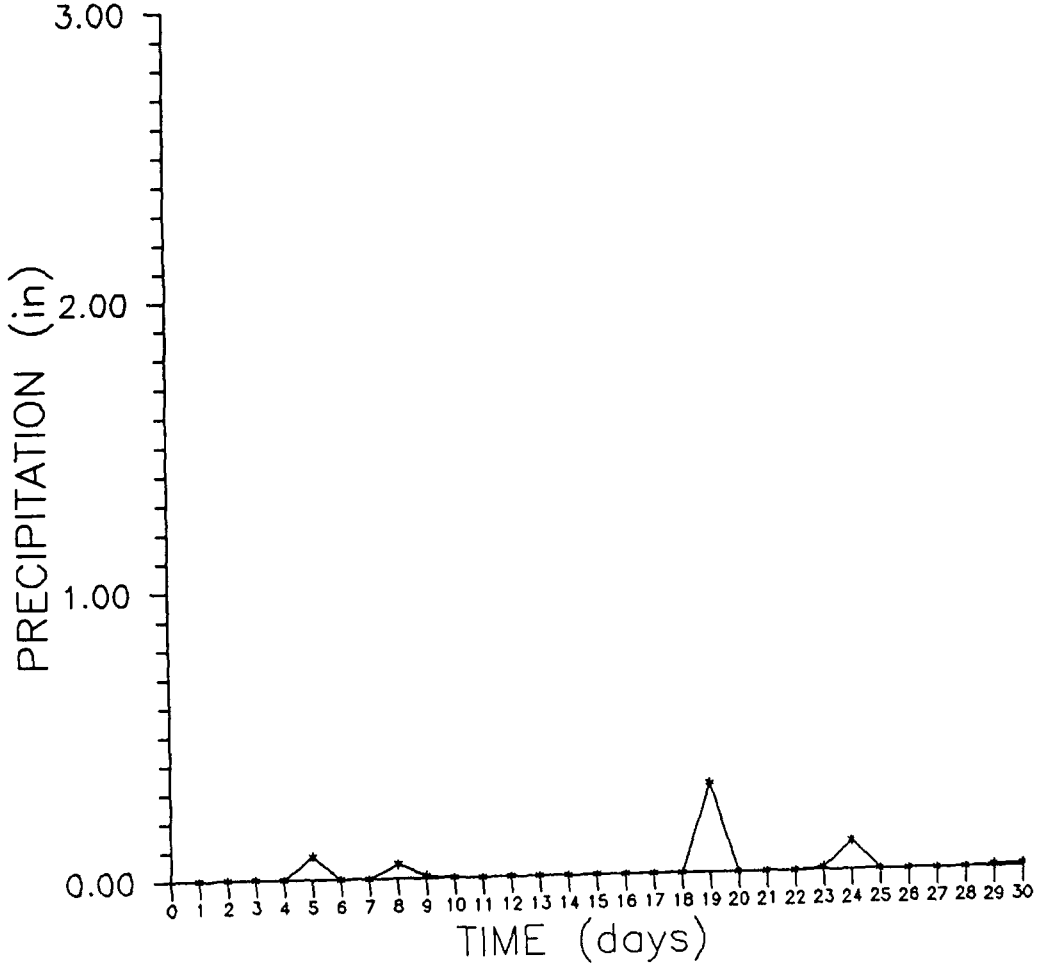


Prepared for:
U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by:
R.L. Stollar & Associates, Inc.

Figure A-11.1-6

Daily Precipitation
March 1990

CMP SW90

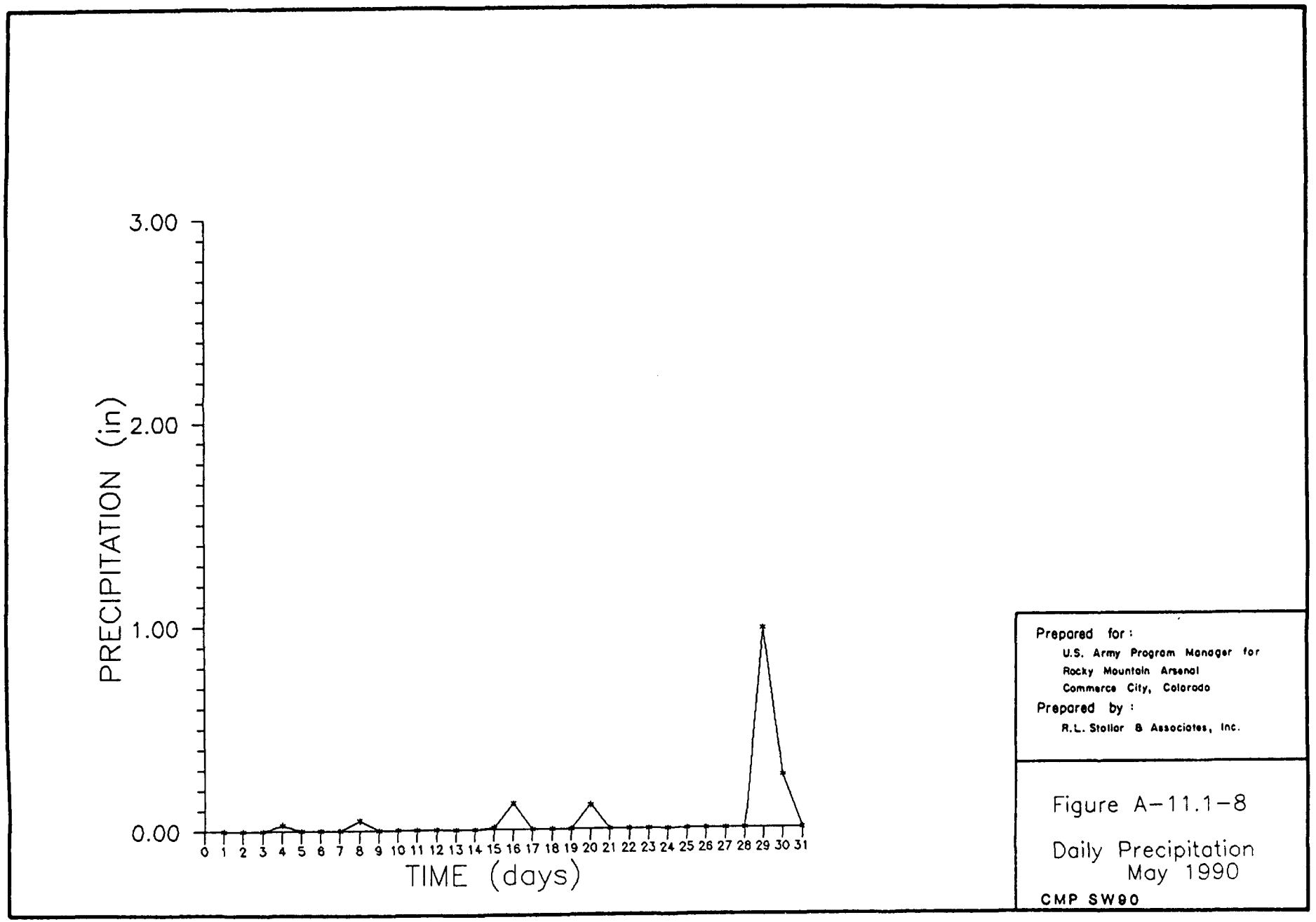


Prepared for :
U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by :
R.L. Stollar & Associates, Inc.

Figure A-11.1-7

Daily Precipitation
April 1990

CMP SW90

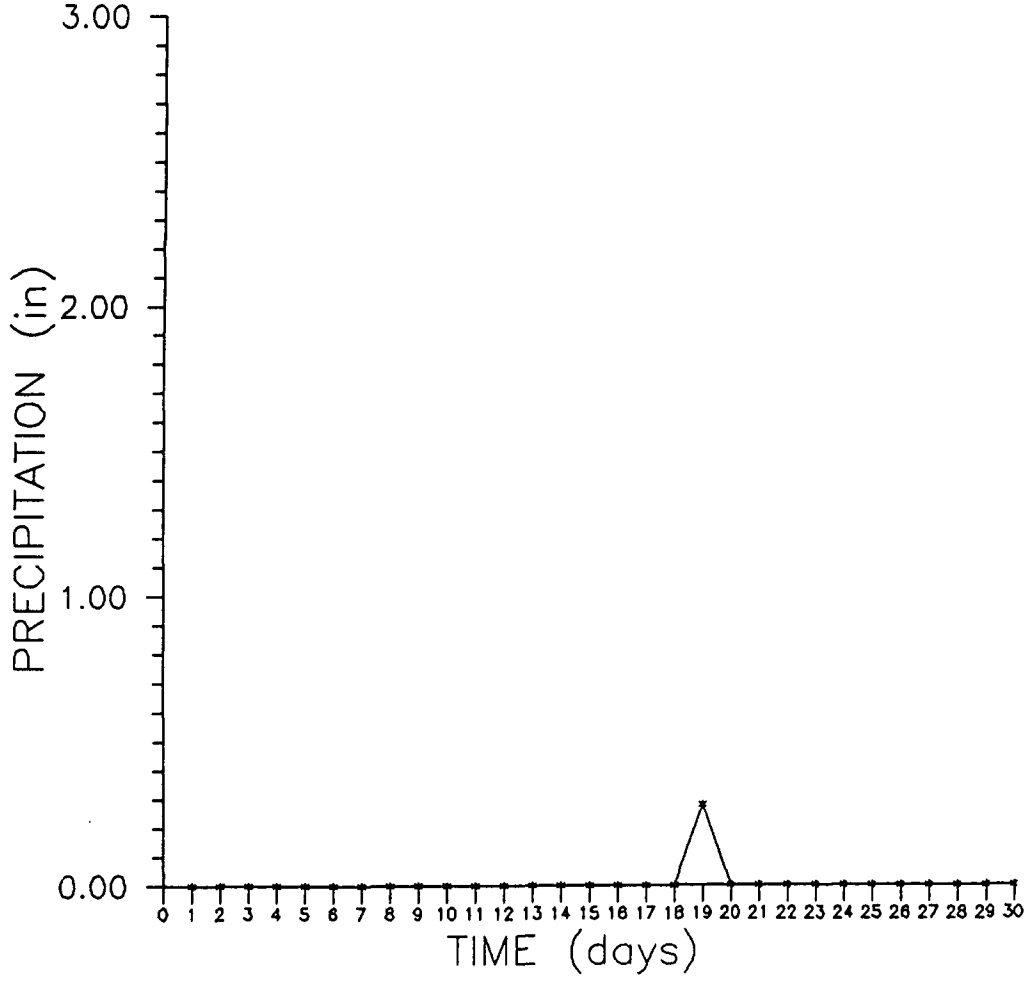


Prepared for :
U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by :
R.L. Stollar & Associates, Inc.

Figure A-11.1-8

Daily Precipitation
May 1990

CMP SW90

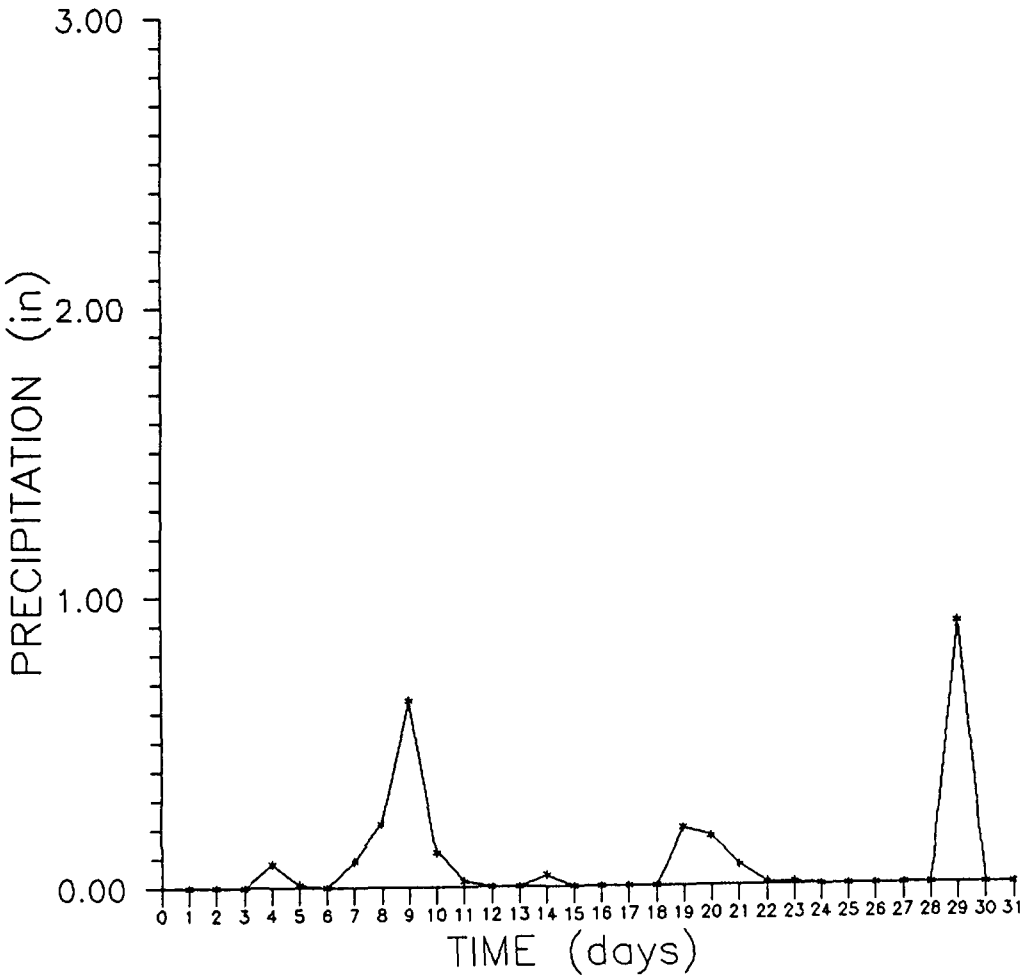


Prepared for :
U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by :
R.L. Stollar & Associates, Inc.

Figure A-11.1-9

Daily Precipitation
June 1990

CMP SW90

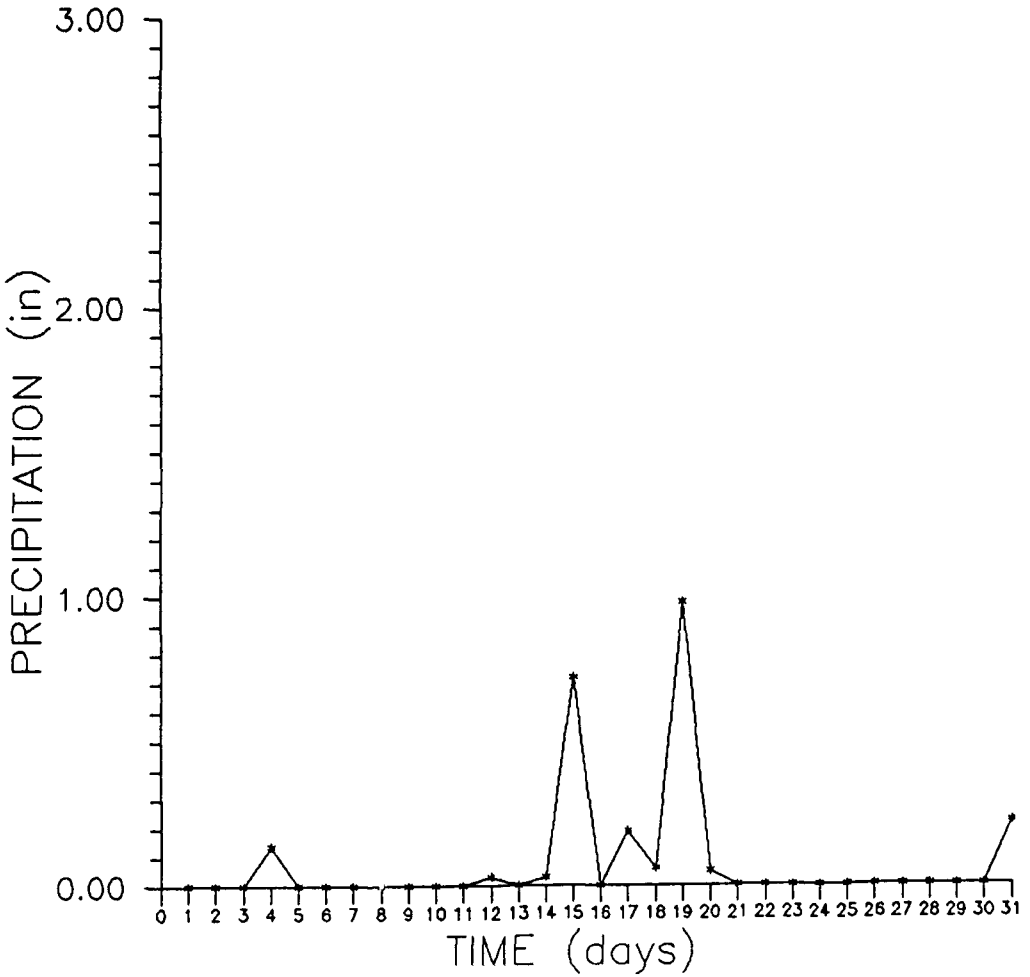


Prepared for :
U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by :
R.L. Stollar & Associates, Inc.

Figure A-11.1-10

Daily Precipitation
July 1990

CMP SW90

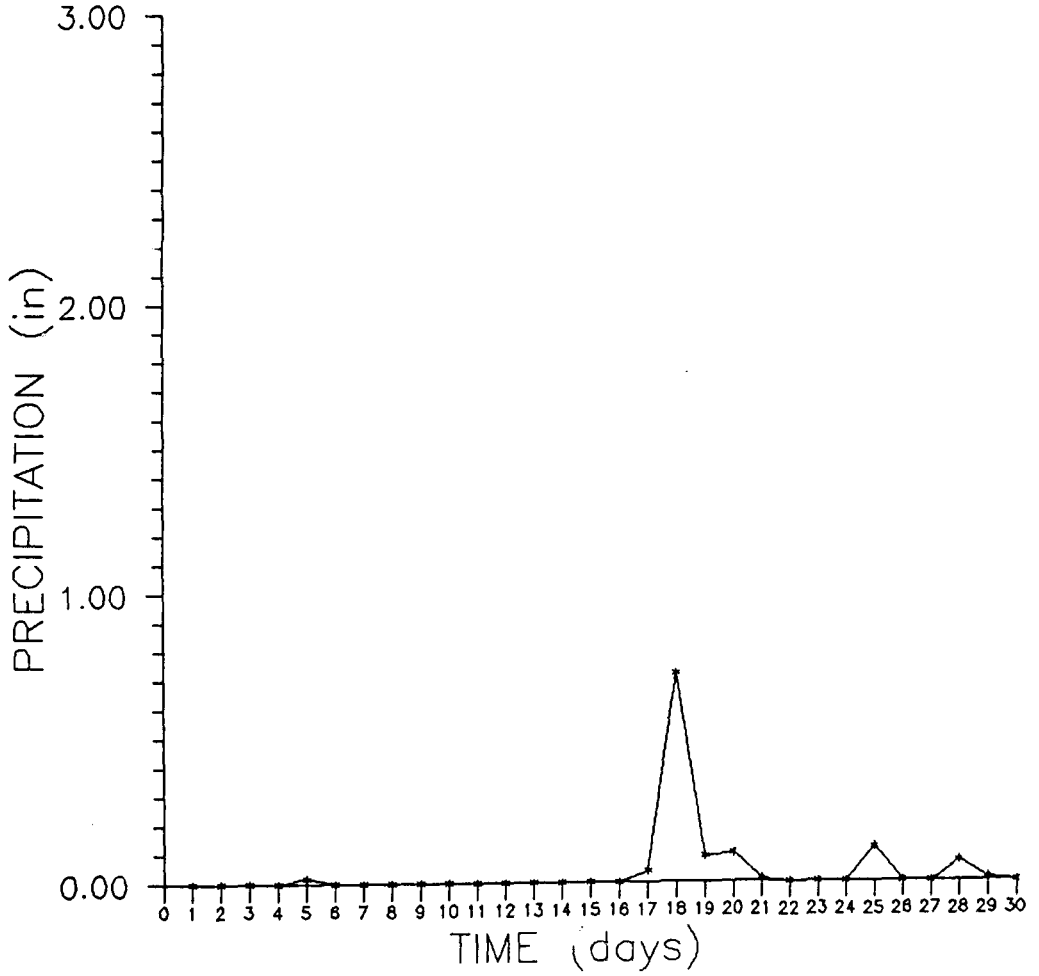


Prepared for :
U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by :
R.L. Stollar & Associates, Inc.

Figure A-11.1-11

Daily Precipitation
August 1990

CMP SW90



Prepared for:
U.S. Army Program Manager for
Rocky Mountain Arsenal
Commerce City, Colorado
Prepared by:
R.L. Stollar & Associates, Inc.

Figure A-11.1-12

Daily Precipitation
September 1990

CMP SW90

APPENDIX A-11.2

DAILY TEMPERATURE AND PRECIPITATION DATA

Appendix 11.2 Table A-11.2-1
Daily Temperature and Precipitation Data, WY 1990

OCTOBER 1989	CMP AIR ELEMENT*		STAPLETON AIRPORT**		SOUTH PLANTS RAIN GAGE
DAY	AVE TEMP (F)	TOTAL PRECIPITATION (INCHES)	AVE TEMP (F)	TOTAL PRECIPITATION (INCHES)	AVE PRECIPITATION (INCHES)
1	61	0.00	62	0.00	0.00
2	50	0.00	51	0.00	0.00
3	43	0.00	47	0.00	0.00
4	54	0.00	55	0.00	0.00
5	54	0.00	54	0.00	0.00
6	52	0.00	53	0.00	0.00
7	51	0.00	52	0.00	0.00
8	57	0.00	58	0.00	0.00
9	58	0.00	58	0.00	0.00
10	65	0.00	64	0.00	0.00
11	69	0.00	68	0.00	0.00
12	66	0.00	66	0.00	0.00
13	65	0.00	66	0.00	0.00
14	63	0.00	64	0.00	0.00
15	44	0.05	43	0.15	0.05
16	30	0.19	32	0.40	0.43
17	32	0.00	34	0.02	0.08
18	35	0.00	37	trace	0.01
19	42	0.00	44	0.00	0.00
20	54	0.00	52	0.00	0.00
21	57	0.00	56	0.00	0.00
22	58	0.00	57	0.00	0.00
23	56	0.00	55	0.00	0.00
24	57	0.00	56	0.00	0.00
25	55	0.00	57	0.00	0.00
26	52	0.00	49	0.00	0.00
27	48	0.00	49	0.00	0.00
28	44	0.00	46	trace	0.00
29	33	0.00	34	0.00	0.00
30	36	0.00	35	0.00	0.00
31	39	0.05	42	0.24	0.00
AVE/TOTAL	51.06	0.29	51.30	0.81	0.57

Sources:
* RMA Comprehensive Monitoring Program, Air Element Annual Report 1990.
** NOAA Monthly Summaries, Stapleton Airport Weather Station.

Appendix 11.2 Table A-11.2-1 (continued)
Daily Temperature and Precipitation Data, WY 1990

NOVEMBER 1989	CMP AIR ELEMENT*		STAPLETON AIRPORT**		SOUTH PLANTS RAIN GAGE
DAY	AVE TEMP (F)	TOTAL PRECIPITATION (INCHES)	AVE TEMP (F)	TOTAL PRECIPITATION (INCHES)	AVE PRECIPITATION (INCHES)
1	23	0.01	27	0.11	0.22
2	35	0.00	36	0.00	0.01
3	46	0.00	43	0.00	0.00
4	51	0.00	50	0.00	0.00
5	46	0.00	45	0.00	0.00
6	42	0.00	43	0.00	0.00
7	46	0.00	44	0.00	0.00
8	43	0.00	42	0.00	0.00
9	54	0.00	51	0.00	0.00
10	56	0.00	54	0.00	0.00
11	59	0.00	58	0.00	0.00
12	59	0.00	58	0.00	0.00
13	55	0.00	53	0.00	0.00
14	38	0.00	38	0.00	0.00
15	26	0.00	29	0.00	0.00
16	31	0.00	32	0.00	0.00
17	39	0.00	40	0.00	0.00
18	45	0.00	45	0.00	0.00
19	57	0.00	62	0.00	0.00
20	50	0.00	49	0.00	0.00
21	47	0.00	47	0.00	0.00
22	33	0.00	35	trace	0.00
23	38	0.00	40	0.00	0.00
24	51	0.00	50	0.00	0.00
25	40	0.00	43	trace	0.00
26	41	0.00	44	0.00	0.00
27	30	0.02	30	0.04	0.00
28	27	0.00	29	0.00	0.00
29	37	0.00	38	0.00	0.00
30	37	0.00	37	0.00	0.00
AVE/TOTAL	42.73	0.03	42.80	0.15	0.23

Sources:
* RMA Comprehensive Monitoring Program, Air Element Annual Report 1990.
** NOAA Monthly Summaries, Stapleton Airport Weather Station.

Appendix 11.2 Table A-11.2-1 (continued)
Daily Temperature and Precipitation Data, WY 1990

DECEMBER 1989	CMP AIR ELEMENT*		STAPLETON AIRPORT**		SOUTH PLANTS RAIN GAGE
DAY	AVE TEMP (F)	TOTAL PRECIPITATION (INCHES)	AVE TEMP (F)	TOTAL PRECIPITATION (INCHES)	AVE PRECIPITATION (INCHES)
1	36	0.00	36	0.00	0.00
2	33	0.00	35	0.00	0.00
3	46	0.00	44	0.00	0.00
4	51	0.00	49	0.00	0.00
5	53	0.00	53	0.00	0.00
6	36	0.00	37	0.00	0.00
7	30	0.00	30	trace	0.00
8	42	0.00	36	0.00	0.00
9	44	0.00	45	0.00	0.00
10	22	0.19	22	0.44	0.00
11	9	0.00	11	0.02	0.00
12	26	0.00	26	0.00	0.00
13	30	0.00	26	0.00	0.00
14	30	0.00	29	trace	0.02
15	11	0.00	15	0.03	0.00
16	15	0.03	14	0.06	0.00
17	12	0.00	12	0.03	0.05
18	4	0.00	5	0.11	0.05
19	7	0.00	11	0.00	0.00
20	25	0.00	26	trace	0.00
21	-3	0.00	-3	0.04	0.00
22	-4	0.00	-3	trace	0.00
23	32	0.00	27	0.00	0.01
24	35	0.00	33	0.00	0.00
25	34	0.00	34	0.00	0.00
26	44	0.00	40	0.00	0.00
27	37	0.00	41	0.00	0.00
28	40	0.00	41	0.00	0.00
29	27	0.00	28	0.00	0.00
30	24	0.00	25	0.08	0.01
31	29	0.00	28	0.00	0.02
AVE/TOTAL	27.68	0.22	27.30	0.81	0.16

Sources:
* RMA Comprehensive Monitoring Program, Air Element Annual Report 1990.
** NOAA Monthly Summaries, Stapleton Airport Weather Station.

Appendix 11.2 Table A-11.2-1 (continued)
Daily Temperature and Precipitation Data, WY 1990

JANUARY 1990 CMP AIR ELEMENT* STAPLETON AIRPORT** SOUTH PLANTS RAIN GAGE

DAY	AVE TEMP (F)	TOTAL PRECIPITATION (INCHES)	AVE TEMP (F)	TOTAL PRECIPITATION (INCHES)	AVE PRECIPITATION (INCHES)
1	38	0.00	41	0.00	0.00
2	41	0.00	42	0.00	0.00
3	26	0.00	26	trace	0.00
4	23	0.00	25	0.00	0.00
5	30	0.00	29	0.00	0.00
6	37	0.00	40	0.00	0.00
7	41	0.00	40	0.00	0.00
8	49	0.00	49	0.00	0.00
9	54	0.00	53	0.00	0.00
10	56	0.00	52	0.00	0.00
11	39	0.00	42	0.00	0.00
12	33	0.00	34	0.00	0.00
13	46	0.00	45	0.00	0.00
14	46	0.00	46	0.00	0.00
15	38	0.00	38	0.00	0.00
16	37	0.00	36	0.00	0.00
17	32	0.00	35	0.01	0.00
18	23	0.00	24	0.05	0.04
19	23	0.31	26	0.63	0.00
20	28	0.01	30	0.03	0.35
21	36	0.00	39	0.00	0.08
22	40	0.00	37	0.00	0.00
23	41	0.00	41	0.00	0.00
24	25	0.00	26	0.02	0.01
25	37	0.00	36	0.00	0.00
26	41	0.00	44	0.00	0.00
27	23	0.00	25	0.00	0.00
28	29	0.00	27	0.00	0.00
29	36	0.00	35	0.00	0.00
30	34	0.00	35	0.00	0.00
31	36	0.00	38	0.00	0.00
AVE/TOTAL	36.16	0.32	36.40	0.74	0.48

Sources:
* RMA Comprehensive Monitoring Program, Air Element Annual Report 1990.
** NOAA Monthly Summaries, Stapleton Airport Weather Station.

Appendix 11.2 Table A-11.2-1 (continued)
Daily Temperature and Precipitation Data, WY 1990

FEBRUARY 1990	CMP AIR ELEMENT*		STAPLETON AIRPORT**		SOUTH PLANTS RAIN GAGE
DAY	AVE TEMP (F)	TOTAL PRECIPITATION (INCHES)	AVE TEMP (F)	TOTAL PRECIPITATION (INCHES)	AVE PRECIPITATION (INCHES)
1	27	0.00	32	0.01	0.00
2	24	0.06	26	0.16	0.04
3	27	0.00	28	0.00	0.04
4	37	0.00	38	0.00	0.00
5	31	0.00	30	0.00	0.00
6	36	0.00	37	0.00	0.00
7	45	0.00	43	0.00	0.00
8	32	0.00	35	0.00	0.00
9	40	0.00	38	0.00	0.00
10	47	0.00	48	0.00	0.00
11	48	0.00	50	0.00	0.00
12	48	0.00	49	0.00	0.00
13	21	0.00	24	0.06	0.00
14	7	0.00	10	0.09	0.00
15	7	0.00	5	0.01	0.00
16	15	0.00	17	0.00	0.00
17	36	0.00	28	0.00	0.00
18	28	0.00	29	0.00	0.00
19	28	0.00	30	0.00	0.00
20	28	0.05	33	0.14	0.12
21	33	0.00	37	0.00	0.00
22	36	0.00	37	0.00	0.00
23	42	0.00	43	0.00	0.00
24	40	0.00	41	0.00	0.00
25	42	0.00	42	0.00	0.00
26	41	0.00	43	0.00	0.00
27	32	0.00	34	0.05	0.00
28	30	0.00	31	0.03	0.04
AVE/TOTAL	32.44	0.11	33.30	0.55	0.24

Sources:
* RMA Comprehensive Monitoring Program, Air Element Annual Report 1990.
** NOAA Monthly Summaries, Stapleton Airport Weather Station.

Appendix 11.2 Table A-11.2-1 (continued)
Daily Temperature and Precipitation Data, WY 1990

MARCH 1990	CMP AIR ELEMENT*		STAPLETON AIRPORT**		SOUTH PLANTS RAIN GAGE
DAY	AVE TEMP (F)	TOTAL PRECIPITATION (INCHES)	AVE TEMP (F)	TOTAL PRECIPITATION (INCHES)	AVE PRECIPITATION (INCHES)
1	37	0.00	41	0.00	0.00
2	41	0.00	39	0.00	0.00
3	46	0.00	46	trace	0.00
4	47	0.00	48	0.00	0.00
5	42	0.60	43	0.62	0.46
6	30	0.81	31	1.32	0.51
7	28	0.00	30	0.02	0.46
8	39	0.00	39	trace	0.00
9	45	0.00	45	0.00	0.00
10	48	0.00	47	0.00	0.00
11	47	0.00	47	0.00	0.00
12	44	0.00	45	0.00	0.00
13	28	0.26	29	0.36	0.17
14	30	0.00	29	0.00	0.06
15	36	0.00	38	0.00	0.00
16	40	0.00	42	0.00	0.00
17	42	0.00	44	0.00	0.00
18	35	0.00	37	0.05	0.03
19	44	0.00	44	0.00	0.00
20	54	0.00	52	0.00	0.00
21	54	0.00	54	0.00	0.00
22	43	0.00	48	0.02	0.00
23	23	0.01	25	0.02	0.00
24	18	0.00	20	0.02	0.03
25	30	0.00	35	trace	0.00
26	32	0.00	35	0.00	0.00
27	43	0.08	46	0.20	0.11
28	33	0.14	35	0.21	0.16
29	33	0.05	37	0.19	0.11
30	34	0.02	37	0.07	0.12
31	45	0.00	46	0.00	0.00
AVE/TOTAL	38.45	1.97	39.5	3.10	2.22

Sources:
* RMA Comprehensive Monitoring Program, Air Element Annual Report 1990.
** NOAA Monthly Summaries, Stapleton Airport Weather Station.

Appendix 11.2 Table A-11.2-1 (continued)
Daily Temperature and Precipitation Data, WY 1990

APRIL 1990	CMP AIR ELEMENT*		STAPLETON AIRPORT**		SOUTH PLANTS RAIN GAGE
DAY	AVE TEMP (F)	TOTAL PRECIPITATION (INCHES)	AVE TEMP (F)	TOTAL PRECIPITATION (INCHES)	AVE PRECIPITATION (INCHES)
1	46	0.00	48	0.00	0.00
2	52	0.00	51	0.00	0.00
3	56	0.00	57	0.00	0.00
4	50	0.00	50	0.02	0.00
5	29	0.08	33	0.26	0.16
6	37	0.00	40	0.00	0.05
7	46	0.00	46	0.00	0.00
8	50	0.05	52	0.10	0.12
9	42	0.01	43	0.03	0.02
10	34	0.00	33	0.00	0.00
11	39	0.00	43	0.00	0.00
12	48	0.00	52	trace	0.00
13	46	0.00	49	0.01	0.00
14	55	0.00	54	0.00	0.00
15	53	0.00	52	0.00	0.00
16	46	0.00	46	trace	0.00
17	39	0.00	42	trace	0.00
18	50	0.00	51	0.01	0.00
19	52	0.31	56	0.29	0.23
20	55	0.00	55	0.00	0.00
21	60	0.00	62	trace	0.00
22	64	0.00	64	trace	0.00
23	59	0.01	61	0.00	0.00
24	51	0.10	57	0.12	0.10
25	46	0.00	46	0.01	0.00
26	47	0.00	53	trace	0.00
27	47	0.00	47	0.00	0.00
28	57	0.00	61	0.00	0.00
29	34	0.01	37	0.16	0.00
30	37	0.01	40	trace	0.11
AVE/TOTAL	47.47	0.58	49.1	1.01	0.79

Sources:
* RMA Comprehensive Monitoring Program, Air Element Annual Report 1990.
** NOAA Monthly Summaries, Stapleton Airport Weather Station.

Appendix 11.2 Table A-11.2-1 (continued)
Daily Temperature and Precipitation Data, WY 1990

MAY 1990	CMP AIR ELEMENT*		STAPLETON AIRPORT**		SOUTH PLANTS RAIN GAGE
DAY	AVE TEMP (F)	TOTAL PRECIPITATION (INCHES)	AVE TEMP (F)	TOTAL PRECIPITATION (INCHES)	AVE PRECIPITATION (INCHES)
1	37	0.00	40	trace	0.00
2	45	0.00	46	0.00	0.00
3	43	0.00	47	0.00	0.00
4	46	0.03	48	0.06	0.04
5	51	0.00	50	0.00	0.00
6	62	0.00	63	0.00	0.00
7	63	0.00	65	trace	0.00
8	43	0.05	45	0.03	0.04
9	41	0.00	45	0.01	0.00
10	51	0.00	53	0.00	0.01
11	45	0.00	47	0.02	0.01
12	50	0.00	53	0.01	0.00
13	58	0.00	60	0.00	0.00
14	53	0.00	56	0.01	0.00
15	55	0.01	57	0.04	0.01
16	47	0.13	50	0.19	0.18
17	55	0.00	54	0.00	0.00
18	63	0.00	65	0.00	0.00
19	62	0.00	61	0.00	0.00
20	55	0.12	61	0.00	0.06
21	64	0.00	63	0.00	0.00
22	68	0.00	66	0.00	0.00
23	69	0.00	68	0.00	0.00
24	67	0.00	69	0.00	0.00
25	63	0.00	66	0.00	0.00
26	58	0.00	62	0.01	0.00
27	56	0.00	60	0.00	0.00
28	63	0.00	63	0.03	0.00
29	52	0.98	58	0.82	1.00
30	55	0.26	57	0.28	0.15
31	62	0.00	61	0.00	0.00
AVE/TOTAL	54.89	1.58	56.6	1.51	1.50

Sources:
* RMA Comprehensive Monitoring Program, Air Element Annual Report 1990.
** NOAA Monthly Summaries, Stapleton Airport Weather Station.

Appendix 11.2 Table A-11.2-1 (continued)
Daily Temperature and Precipitation Data, WY 1990

JUNE 1990	CMP AIR ELEMENT*		STAPLETON AIRPORT**		SOUTH PLANTS RAIN GAGE
DAY	AVE TEMP (F)	TOTAL PRECIPITATION (INCHES)	AVE TEMP (F)	TOTAL PRECIPITATION (INCHES)	AVE PRECIPITATION (INCHES)
1	60	0.00	65	0.00	0.00
2	59	0.00	61	0.00	0.00
3	63	0.00	62	0.00	0.00
4	75	0.00	74	0.00	0.00
5	70	0.00	71	0.00	0.00
6	68	0.00	72	0.00	0.00
7	71	0.00	73	0.00	0.00
8	71	0.00	71	0.00	0.00
9	69	0.00	70	trace	0.00
10	73	0.00	75	0.04	0.03
11	76	0.00	77	0.00	0.00
12	66	0.00	70	trace	0.00
13	65	0.00	65	0.00	0.00
14	69	0.00	72	0.00	0.00
15	71	0.00	74	0.00	0.00
16	66	0.00	69	0.00	0.00
17	70	0.00	68	0.00	0.00
18	79	0.00	77	0.00	0.00
19	66	0.28	69	0.17	0.26
20	69	0.00	69	0.00	0.00
21	61	0.00	65	0.00	0.00
22	65	0.00	66	0.00	0.00
23	77	0.00	77	0.00	0.00
24	82	0.00	80	0.00	0.00
25	81	0.00	83	trace	0.00
26	79	0.00	78	trace	0.00
27	84	0.00	86	trace	0.00
28	84	0.00	82	0.00	0.00
29	82	0.00	83	0.00	0.00
30	81	0.00	83	trace	0.00
AVE/TOTAL	71.78	0.28	72.60	0.21	0.29

Sources:
* RMA Comprehensive Monitoring Program, Air Element Annual Report 1990.
** NOAA Monthly Summaries, Stapleton Airport Weather Station.

Appendix 11.2 Table A-11.2-1 (continued)
Daily Temperature and Precipitation Data, WY 1990

JULY 1990	CMP AIR ELEMENT*		STAPLETON AIRPORT**		SOUTH PLANTS RAIN GAGE
DAY	AVE TEMP (F)	TOTAL PRECIPITATION (INCHES)	AVE TEMP (F)	TOTAL PRECIPITATION (INCHES)	AVE PRECIPITATION (INCHES)
1	84	0.00	83	trace	0.00
2	85	0.00	80	0.00	0.00
3	77	0.00	80	0.02	0.00
4	70	0.08	74	0.02	0.05
5	68	0.01	71	0.04	0.03
6	73	0.00	76	trace	0.00
7	74	0.09	79	0.06	0.11
8	64	0.22	67	0.11	0.20
9	65	0.64	70	1.34	0.71
10	68	0.12	70	trace	0.05
11	67	0.02	70	0.05	0.03
12	62	0.00	63	trace	0.00
13	63	0.00	65	0.00	0.00
14	63	0.04	67	0.08	0.07
15	67	0.00	68	0.00	0.00
16	72	0.00	75	0.00	0.00
17	78	0.00	76	0.00	0.00
18	78	0.00	79	trace	0.00
19	70	0.20	73	0.41	0.16
20	61	0.17	65	0.26	0.15
21	56	0.07	60	0.08	0.08
22	68	0.01	61	0.01	0.01
23	64	0.01	67	0.20	0.03
24	70	0.00	72	0.00	0.00
25	72	0.00	72	0.02	0.00
26	76	0.00	75	0.00	0.00
27	71	0.00	72	0.00	0.00
28	66	0.00	69	0.18	0.00
29	62	0.90	67	0.69	0.64
30	62	0.00	64	trace	0.00
31	68	0.00	69	0.00	0.00
AVE/TOTAL	68.87	2.58	70.80	3.57	2.32

Sources:
* RMA Comprehensive Monitoring Program, Air Element Annual Report 1990.
** NOAA Monthly Summaries, Stapleton Airport Weather Station.

Appendix 11.2 Table A-11.2-1 (continued)
Daily Temperature and Precipitation Data, WY 1990

AUGUST 1990	CMP AIR ELEMENT*		STAPLETON AIRPORT**		SOUTH PLANTS RAIN GAGE
DAY	AVE TEMP (F)	TOTAL PRECIPITATION (INCHES)	AVE TEMP (F)	TOTAL PRECIPITATION (INCHES)	AVE PRECIPITATION (INCHES)
1	71	0.00	72	0.00	0.00
2	68	0.00	70	trace	0.00
3	67	0.00	69	0.00	0.00
4	62	0.14	66	0.36	0.35
5	59	0.00	63	0.01	0.00
6	65	0.00	68	0.00	0.00
7	73	0.00	73	0.00	0.00
8	76	0.00	76	0.00	0.00
9	73	0.00	74	0.00	0.00
10	74	0.00	75	0.00	0.00
11	68	0.00	74	0.07	0.03
12	61	0.03	64	0.06	0.01
13	66	0.00	66	0.01	0.00
14	66	0.03	69	trace	0.01
15	63	0.72	69	0.43	0.21
16	70	0.00	70	0.00	0.00
17	66	0.19	73	0.30	0.19
18	67	0.06	68	0.02	0.03
19	69	0.98	72	0.36	0.19
20	69	0.05	70	0.02	0.00
21	71	0.00	74	0.00	0.00
22	69	0.00	70	0.02	0.00
23	67	0.00	69	trace	0.00
24	71	0.00	72	0.00	0.00
25	73	0.00	73	0.00	0.00
26	76	0.00	75	0.00	0.00
27	76	0.00	76	0.00	0.00
28	76	0.00	74	0.00	0.00
29	77	0.00	76	0.00	0.00
30	79	0.00	79	0.00	0.00
31	72	0.22	76	0.30	0.21
AVE/TOTAL	69.70	2.42	71.30	1.96	1.23

Sources:
* RMA Comprehensive Monitoring Program, Air Element Annual Report 1990.
** NOAA Monthly Summaries, Stapleton Airport Weather Station.

Appendix 11.2 Table A-11.2-1 (continued)
Daily Temperature and Precipitation Data, WY 1990

SEPTEMBER 1990	CMP AIR ELEMENT*		STAPLETON AIRPORT**		SOUTH PLANTS RAIN GAGE
DAY	AVE TEMP (F)	TOTAL PRECIPITATION (INCHES)	AVE TEMP (F)	TOTAL PRECIPITATION (INCHES)	AVE PRECIPITATION (INCHES)
1	71	0.00	75	0.00	0.00
2	73	0.00	76	0.00	0.00
3	75	0.00	76	0.00	0.00
4	73	0.00	74	0.00	0.00
5	71	0.02	76	0.10	0.10
6	69	0.00	72	0.00	0.00
7	71	0.00	72	0.00	0.00
8	70	0.00	71	trace	0.00
9	70	0.00	72	0.00	0.00
10	68	0.00	72	trace	0.00
11	70	0.00	71	0.00	0.00
12	74	0.00	72	0.00	0.00
13	76	0.00	77	0.00	0.00
14	66	0.00	67	0.00	0.00
15	72	0.00	72	0.00	0.00
16	62	0.00	64	trace	0.00
17	59	0.04	62	0.01	0.04
18	60	0.72	63	1.02	0.44
19	63	0.09	65	0.04	0.22
20	57	0.10	59	0.12	0.12
21	56	0.01	59	trace	0.00
22	56	0.00	57	0.00	0.00
23	59	0.00	60	0.00	0.00
24	67	0.00	66	0.00	0.00
25	67	0.12	70	0.11	0.11
26	67	0.00	68	0.00	0.00
27	59	0.00	60	0.01	0.03
28	53	0.07	55	0.02	0.06
29	50	0.01	52	0.03	0.00
30	59	0.00	60	0.00	0.00
AVE/TOTAL	65.44	1.18	66.90	1.46	1.01

Sources:
* RMA Comprehensive Monitoring Program, Air Element Annual Report 1990.
** NOAA Monthly Summaries, Stapleton Airport Weather Station.

APPENDIX A-12

WELL WATER LEVELS

R.L. STOLLAR AND ASSOCIATES, INC.
SW WATER LEVEL DATA SHEET
MONTH OF: FEBRUARY

COMPREHENSIVE MONITORING PROGRAM
ROCKY MOUNTAIN ARSENAL

SITE ID	SITE TYPE	ELEVATION MEAS. PT.	DEPTH TO WATER(ft)	WATER ELEV (ft-msl)	MEAS. DATE.	PERS. INIT.
01001	WELL	5277.32	28.54	5248.78	90044	DLA, BE
01024	WELL	5240.45	6.95	5233.50	90044	DLA, BE
01028	WELL	5261.70	19.74	5241.96	90044	DLA, BE
01044	WELL	5266.03	16.59	5249.44	90044	DLA, BE
01047	WELL	5257.28	10.47	5246.81	90044	DLA, BE
01049	WELL	5276.47	33.28	5243.19	90044	DLA, BE
01069	WELL	5271.10	23.06	5248.04	90044	DLA, BE
01070	WELL	5262.60	16.71	5245.89	90044	DLA, BE
01073	WELL	5253.55	8.56	5244.99	90044	DLA, BE
01074	WELL	5257.73	17.10	5240.63	90044	DLA, BE
01075	WELL	5258.77	17.28	5241.49	90044	DLA, BE
01076	WELL	5258.73	16.25	5242.48	90044	DLA, BE
02001	WELL	5231.10	10.03	5221.07	90044	DLA, BE
02008	WELL	5205.12	10.04	5195.08	90044	DLA, BE
02026	WELL	5231.06	9.14	5221.92	90044	DLA, BE
02034	WELL	5240.01	13.13	5226.88	90044	DLA, BE
02050	WELL	5215.60	9.05	5206.55	90044	DLA, BE
02052	WELL	5233.30	7.34	5225.96	90044	DLA, BE
02055	WELL	5223.69	12.44	5211.25	90044	DLA, BE
02056	WELL	5211.03	8.94	5202.09	90044	DLA, BE
02059	WELL	5238.68	15.23	5223.45	90044	DLA, BE
02060	WELL	5238.15	8.42	5229.73	90044	DLA, BE
11002	WELL	5252.65	20.50	5232.15	90044	DLA, BE
11007	WELL	5240.72	14.95	5225.77	90044	DLA, BE
SW01004	UP DERBY LK	5247.77	DRY		90044	DLA, BE
SW01005	LW DERBY LK	5230.17	12.00	5242.17	90044	DLA, BE
SW02003	LADORA LAKE	5207.13	12.10	5219.23	90044	DLA, BE
SW02004	LAKE MARY	5202.39	0.13	5202.52	90044	DLA, BE
SW11003	HAVANA POND	5244.08	1.24	5245.32	90044	DLA, BE

R.L. STOLLAR AND ASSOCIATES, INC. COMPREHENSIVE MONITORING PROGRAM
SW WATER LEVEL DATA SHEET ROCKY MOUNTAIN ARSENAL
MONTH OF: MARCH

SITE ID	SITE TYPE	ELEVATION MEAS. PT.	DEPTH TO WATER(ft)	ELEV. (ft-msl)	MEAS. DATE.	PERS. INIT.
01001	WELL	5277.32	27.85	5249.47	90082	GPP,LH
01024	WELL	5240.45	6.45	5234.00	90082	GPP,LH
01028	WELL	5261.70	19.24	5242.46	90082	GPP,LH
01044	WELL	5266.03	16.48	5249.55	90082	GPP,LH
01047	WELL	5257.28	9.57	5247.71	90082	GPP,LH
01049	WELL	5276.47	33.23	5243.24	90082	GPP,LH
01069	WELL	5271.10	21.92	5249.18	90082	GPP,LH
01070	WELL	5262.60	15.30	5247.30	90082	GPP,LH
01073	WELL	5253.55	6.81	5246.74	90082	GPP,LH
01074	WELL	5257.73	16.63	5241.10	90082	GPP,LH
01075	WELL	5258.77	16.93	5241.84	90082	GPP,LH
01076	WELL	5258.73	16.30	5242.43	90082	GPP,LH
02001	WELL	5231.10	9.62	5221.48	90082	GPP,LH
02008	WELL	5205.12	9.80	5195.32	90082	GPP,LH
02026	WELL	5231.06	8.82	5222.24	90082	GPP,LH
02034	WELL	5240.01	12.95	5227.06	90082	GPP,LH
02050	WELL	5215.60	8.42	5207.18	90082	GPP,LH
02052	WELL	5233.30	6.87	5226.43	90082	GPP,LH
02055	WELL	5223.69	11.26	5212.43	90082	GPP,LH
02056	WELL	5211.03	8.41	5202.62	90082	GPP,LH
02059	WELL	5238.68	14.96	5223.72	90082	GPP,LH
02060	WELL	5238.15	8.28	5229.87	90082	GPP,LH
11002	WELL	5252.65	15.89	5236.76	90082	GPP,LH
11007	WELL	5240.72	12.66	5228.06	90082	GPP,LH
SW01004	UP DERBY LK	5247.77	2.40	5250.17	90082	GPP,LH
SW01005	LW DERBY LK	5230.17	12.10	5242.27	90082	GPP,LH
SW02003	LADORA LAKE	5207.13	12.20	5219.33	90082	GPP,LH
SW02004	LAKE MARY	5202.39	0.30	5202.69	90082	GPP,LH
SW11003	HAVANA POND	5244.08	2.00	5246.08	90082	GPP,LH

R.L. STOLLAR AND ASSOCIATES, INC. COMPREHENSIVE MONITORING PROGRAM
SW WATER LEVEL DATA SHEET ROCKY MOUNTAIN ARSENAL
MONTH OF: APRIL

SITE ID	SITE TYPE	ELEVATION MEAS. PT.	DEPTH TO WATER(ft)	WATER ELEV (ft-msl)	MEAS. DATE.	PERS. INIT.
01001	WELL	5277.32	27.45	5249.87	90110	GPP,TS
01024	WELL	5240.45	6.49	5233.96	90110	GPP,TS
01028	WELL	5261.70	19.15	5242.55	90110	GPP,TS
01044	WELL	5266.03	16.21	5249.82	90110	GPP,TS
01047	WELL	5257.28	9.05	5248.23	90110	GPP,TS
01049	WELL	5276.47	33.15	5243.32	90110	GPP,TS
01069	WELL	5271.10	21.84	5249.26	90110	GPP,TS
01070	WELL	5262.60	15.35	5247.25	90110	GPP,TS
01073	WELL	5253.55	6.67	5246.88	90110	GPP,TS
01074	WELL	5257.73	16.67	5241.06	90110	GPP,TS
01075	WELL	5258.77	16.98	5241.79	90110	GPP,TS
01076	WELL	5258.73	16.27	5242.46	90110	GPP,TS
02001	WELL	5231.10	9.77	5221.33	90110	GPP,TS
02008	WELL	5205.12	9.66	5195.46	90110	GPP,TS
02026	WELL	5231.06	8.91	5222.15	90110	GPP,TS
02034	WELL	5240.01	12.78	5227.23	90110	GPP,TS
02050	WELL	5215.60	8.42	5207.18	90110	GPP,TS
02052	WELL	5233.30	7.07	5226.23	90110	GPP,TS
02055	WELL	5223.69	11.76	5211.93	90110	GPP,TS
02056	WELL	5211.03	8.34	5202.69	90110	GPP,TS
02059	WELL	5238.68	14.97	5223.71	90110	GPP,TS
02060	WELL	5238.15	8.25	5229.90	90110	GPP,TS
11002	WELL	5252.65	17.90	5236.76	90110	GPP,TS
11007	WELL	5240.72	13.55	5227.17	90110	GPP,TS
SW01004	UP DERBY LK	5247.77	2.20	5250.17	90110	GPP,TS
SW01005	LW DERBY LK	5230.17	12.00	5242.17	90110	GPP,TS
SW02003	LADORA LAKE	5207.13	12.00	5219.13	90110	GPP,TS
SW02004	LAKE MARY	5202.39	0.98	5203.37	90110	GPP,TS
SW11003	HAVANA POND	5244.08	2.67	5246.75	90110	GPP,TS

R.L. STOLLAR AND ASSOCIATES, INC. COMPREHENSIVE MONITORING PROGRAM
SW WATER LEVEL DATA SHEET ROCKY MOUNTAIN ARSENAL
MONTH OF: JUNE

SITE ID	SITE TYPE	ELEVATION MEAS. PT.	DEPTH TO WATER(ft)	WATER ELEV (ft-msl)	MEAS. DATE.	PERS. INIT.
01001	WELL	5277.32	24.34	5252.98	90171	TS,LH
01024	WELL	5240.45	7.21	5233.24	90171	TS,LH
01028	WELL	5261.70	19.14	5242.56	90171	TS,LH
01044	WELL	5266.03	14.55	5251.48	90171	TS,LH
01047	WELL	5257.28	9.70	5247.58	90171	TS,LH
01049	WELL	5276.47	33.55	5242.92	90171	TS,LH
01069	WELL	5271.10	15.30	5255.80	90171	TS,LH
01070	WELL	5262.60	15.35	5247.25	90171	TS,LH
01073	WELL	5253.55	6.25	5247.30	90171	TS,LH
01074	WELL	5257.73	17.26	5240.47	90171	TS,LH
01075	WELL	5258.77	18.07	5240.70	90171	TS,LH
01076	WELL	5258.73	16.97	5241.76	90171	TS,LH
02001	WELL	5231.10	10.18	5220.92	90171	TS,LH
02008	WELL	5205.12	9.80	5195.32	90171	TS,LH
02026	WELL	5231.06	9.16	5221.90	90171	TS,LH
02034	WELL	5240.01	12.83	5227.18	90171	TS,LH
02050	WELL	5215.60	8.45	5207.15	90171	TS,LH
02052	WELL	5233.30	8.21	5225.09	90171	TS,LH
02055	WELL	5223.69	12.11	5211.58	90171	TS,LH
02056	WELL	5211.03	8.60	5202.43	90171	TS,LH
02059	WELL	5238.68	15.68	5223.00	90171	TS,LH
02060	WELL	5238.15	8.73	5229.42	90171	TS,LH
11002	WELL	5252.65	18.09	5236.76	90171	TS,LH
11007	WELL	5240.72	13.78	5226.94	90171	TS,LH
SW01004	UP DERBY LK	5247.77	8.60	5250.17	90171	TS,LH
SW01005	LW DERBY LK	5230.17	11.70	5241.87	90171	TS,LH
SW02003	LADORA LAKE	5207.13	12.70	5219.83	90171	TS,LH
SW02004	LAKE MARY	5202.39	0.85	5203.24	90171	TS,LH
SW11003	HAVANA POND	5244.08	2.47	5246.55	90171	TS,LH

R.L. STOLLAR AND ASSOCIATES, INC. COMPREHENSIVE MONITORING PROGRAM
SW WATER LEVEL DATA SHEET ROCKY MOUNTAIN ARSENAL
MONTH OF: JULY

SITE ID	SITE TYPE	ELEVATION MEAS. PT.	DEPTH TO WATER(ft)	WATER ELEV (ft-msl)	MEAS. DATE.	PERS. INIT.
01001	WELL	5277.32	25.71	5252.98	90199	TS,LH
01024	WELL	5240.45	9.60	5230.85	90199	TS,LH
01028	WELL	5261.70	20.12	5241.58	90199	TS,LH
01044	WELL	5266.03	15.23	5250.80	90199	TS,LH
01047	WELL	5257.28	11.98	5245.30	90199	TS,LH
01049	WELL	5276.47	36.03	5240.44	90199	TS,LH
01069	WELL	5271.10	16.43	5254.67	90199	TS,LH
01070	WELL	5262.60	12.62	5249.98	90199	TS,LH
01073	WELL	5253.55	7.80	5245.75	90199	TS,L
01074	WELL	5257.73	19.47	5238.26	90199	TS,LH
01075	WELL	5258.77	20.10	5238.67	90199	TS,LH
01076	WELL	5258.73	19.34	5239.39	90199	TS,LH
02001	WELL	5231.10	12.22	5218.88	90199	TS,LH
02008	WELL	5205.12	11.37	5193.75	90199	TS,LH
02026	WELL	5231.06	12.77	5218.29	90199	TS,LH
02034	WELL	5240.01	15.22	5224.79	90199	TS,LH
02050	WELL	5215.60	12.95	5202.65	90199	TS,LH
02052	WELL	5233.30	10.76	5222.54	90199	TS,LH
02055	WELL	5223.69	13.83	5209.86	90199	TS,LH
02056	WELL	5211.03	10.29	5200.74	90199	TS,LH
02059	WELL	5238.68	17.90	5220.78	90199	TS,LH
02060	WELL	5238.15	9.09	5229.06	90199	TS,LH
11002	WELL	5252.65	18.37	5236.76	90199	TS,LH
11007	WELL	5240.72	15.34	5225.38	90199	TS,LH
SW01004	UP DERBY LK	5247.77	9.50	5250.17	90199	TS,LH
SW01005	LW DERBY LK	5230.17	11.60	5241.77	90199	TS,LH
SW02003	LADORA LAKE	5207.13	12.20	5219.33	90199	TS,LH
SW02004	LAKE MARY	5202.39	0.99	5203.38	90199	TS,LH
SW11003	HAVANA POND	5244.08	2.52	5246.60	90199	TS,LH

R.L. STOLLAR AND ASSOCIATES, INC. COMPREHENSIVE MONITORING PROGRAM
SW WATER LEVEL DATA SHEET ROCKY MOUNTAIN ARSENAL
MONTH OF: AUGUST

SITE ID	SITE TYPE	ELEVATION MEAS. PT.	DEPTH TO WATER(ft)	WATER ELEV (ft-msl)	MEAS. DATE.	PERS. INIT.
01001	WELL	5277.32	23.92	5252.98	90225	TAS,TAG
01024	WELL	5240.45	7.74	5232.71	90225	TAS,TAG
01028	WELL	5261.70	19.67	5242.03	90225	TAS,TAG
01044	WELL	5266.03	12.12	5253.91	90225	TAS,TAG
01047	WELL	5257.28	9.85	5247.43	90225	TAS,TAG
01049	WELL	5276.47	34.46	5242.01	90225	TAS,TAG
01069	WELL	5271.10	15.58	5255.52	90225	TAS,TAG
01070	WELL	5262.60	11.04	5251.56	90225	TAS,TAG
01073	WELL	5253.55	5.07	5248.48	90225	TAS,TAG
01074	WELL	5257.73	17.75	5239.98	90225	TAS,TAG
01075	WELL	5258.77	9.07	5249.70	90225	TAS,TAG
01076	WELL	5258.73	7.30	5251.43	90225	TAS,TAG
02001	WELL	5231.10	10.42	5220.68	90225	TAS,TAG
02008	WELL	5205.12	9.66	5195.46	90225	TAS,TAG
02026	WELL	5231.06	9.60	5221.46	90225	TAS,TAG
02034	WELL	5240.01	13.21	5226.80	90225	TAS,TAG
02050	WELL	5215.60	8.75	5206.85	90225	TAS,TAG
02052	WELL	5233.30	8.82	5224.48	90225	TAS,TAG
02055	WELL	5223.69	12.64	5211.05	90225	TAS,TAG
02056	WELL	5211.03	8.65	5202.38	90225	TAS,TAG
02059	WELL	5238.68	16.12	5222.56	90225	TAS,TAG
02060	WELL	5238.15	8.97	5229.18	90225	TAS,TAG
11002	WELL	5252.65	13.85	5236.76	90225	TAS,TAG
11007	WELL	5240.72	12.03	5228.69	90225	TAS,TAG
SW01004	UP DERBY LK	5247.77	8.50	5250.17	90225	TAS,TAG
SW01005	LW DERBY LK	5230.17	11.50	5241.67	90225	TAS,TAG
SW02003	LADORA LAKE	5207.13	11.50	5218.63	90225	TAS,TAG
SW02004	LAKE MARY	5202.39	0.93	5203.32	90225	TAS,TAG
SW11003	HAVANA POND	5244.08	3.07	5247.15	90225	TAS,TAG

APPENDIX B-1

SAMPLE LOCATION SURVEY INFORMATION

Appendix B-1

Table B-1-1 Quality Sampling Station Survey Information

Station #	Location	Northing	Easting	Elevation/GH
SW01002	S. Plants Water Tower Pond	179,009.85	2,185,296.48	5,267.75
SW02006	S. Plants Stream Effluent	179,121.05	2,182,840.84	5,257.90
SW04001	Motor Pool Area	177,930.13	2,172,520.89	5,191.96
SW06002	E. Upper Derby Ditch	180,077.52	2,193,707.54	5,246.20
SW07001	Uvalda Ditch A	170,230.73	2,191,183.13	5,295.71
SW07002	Uvalda Ditch B	170,191.43	2,189,198.96	5,291.33
SW08001	South First Creek Boundary	172,876.88	2,199,286.91	5,298.91
SW08004	First Creek Retention Pond Area	174,711.01	2,197,612.81	5,288.40
SW12001	Uvalda Ditch C	170,205.42	2,186,942.80	5,278.46
SW12002	Uvalda Ditch D	170,156.02	2,186,818.97	5,278.77
SW12004	Storm Sewer	170,129.44	2,184,947.15	5,276.22
SW12006	Army Reserve Storm Sewer	170,820.71	2,184,380.87	5,265.65
SW24003	North Bog	196,357.55	2,184,791.45	5,137.24
SW24004	First Creek North Boundary	194,187.48	2,186,164.37	5,152.52

APPENDIX B-2

WATER YEAR 1990 WATER QUALITY DATA
(on diskette)

The Surface-Water CMP data for Water Year 1990 has been archived (compressed) using the program PKARC. Several steps must be taken to access the data:

1. Create a subdirectory named ARC on your computer's C: drive;

2. Copy the files PKXARC.COM, PKARC.COM , PKARC.DOC and PKXARC.DOC from the supplied disk to the ARC subdirectory;

3. Insert the ARC subdirectory in the path statement of your computer's AUTOEXEC.BAT file in the following format;

   ;c:\arc;

4. Create another subdirectory on your computer's hard drive and copy the filename.arc file to the new directory;

5. Once the filename.arc file is copied, type

   PKXARC filename

   The PKXARC command unarchives the file so that it can be viewed;

6. To view the data use the DOS command;

   TYPE filename.ext

To re-archive the data, the following step is required:

1. at the DOS prompt type

   PKARC -M filename.ext

Documentation for the PKARC and PKXARC programs can be accessed at the DOS prompt by typing:

PKARC.DOC or PKXARC.DOC

A help screen can be accessed by typing:

PKARC/H

APPENDIX B-3

WATER YEAR 1990 REJECTED WATER QUALITY DATA

FY 1990 RMA CMP SURFACE WATER - REJECTED DATA

SITEID	DATE	LAB	METHOD	TESTNAME	VALUE	UNITS
Sediment Data						
SW11001B	04-Sep-90	ED	MK9	ALDRN	0.00259	UGG
SW11001B	16-Apr-90	ED	MK9	ALDRN	0.00259	UGG
SW11001B	04-Sep-90	ED	MK9	ALDRN	0.00259	UGG
SW11001B	16-Apr-90	ED	MK9	ALDRN	0.00518	UGG
SW12004B	04-Sep-90	ED	MK9	ALDRN	0.00259	UGG
SW12005B	16-Apr-90	ED	MK9	ALDRN	0.054	UGG
SW12005B	16-Apr-90	ED	MK9	ALDRN	0.0544	UGG
SW12005B	16-Apr-90	ED	QQ9	DBCP	0.005	UGG
SW12005B	16-Apr-90	ED	QQ9	DBCP	0.005	UGG
SW12005B	16-Apr-90	ED	QQ9	DBCP	0.005	UGG
SW12005B	16-Apr-90	ED	QQ9	DBCP	0.005	UGG
SW11001B	16-Apr-90	ED	MK9	PPDDT	0.00225	UGG
SW11001B	16-Apr-90	ED	MK9	PPDDT	0.0045	UGG
SW12005B	16-Apr-90	ED	MK9	PPDDT	0.0045	UGG
SW12005B	16-Apr-90	ED	MK9	PPDDT	0.00225	UGG
Water Data						
SW08003ST	09-Mar-90	UB	AV8	13DMB	1.32	UGL
SW11001ST	06-Mar-90	UB	AV8	13DMB	1.32	UGL
SW11002ST	06-Mar-90	UB	AV8	13DMB	1.32	UGL
SW12004ST	08-Mar-90	UB	AV8	13DMB	1.32	UGL
SW12005ST	08-Mar-90	UB	AV8	13DMB	1.32	UGL
SW24002ST	09-Mar-90	UB	AV8	13DMB	1.32	UGL
SW37001ST	09-Mar-90	UB	AV8	13DMB	1.32	UGL
SW06002	18-Jul-90	UB	KK8	ALDRN	0.05	UGL
SW08003ST2	30-May-90	UB	KK8	ALDRN	0.05	UGL
SW04001ST	09-Jul-90	UB	UH11	ATZ	12.9	UGL
SW08003ST3	09-Jul-90	UB	UH11	ATZ	5.46	UGL
SW11002ST	09-Jul-90	UB	UH11	ATZ	17.5	UGL
SW12006ST	21-Jul-90	UB	UH11	ATZ	9.4	UGL
SW06002ST1	27-Jul-90	UB	P8	BCHPD	5.9	UGL
SW12006ST	21-Jul-90	UB	P8	BCHPD	5.9	UGL
SW08003ST	09-Mar-90	UB	AV8	C6H6	1.05	UGL
SW11001ST	06-Mar-90	UB	AV8	C6H6	1.05	UGL
SW11002ST	06-Mar-90	UB	AV8	C6H6	1.05	UGL
SW12004ST	08-Mar-90	UB	AV8	C6H6	1.05	UGL
SW12005ST	08-Mar-90	UB	AV8	C6H6	1.05	UGL
SW24002ST	09-Mar-90	UB	AV8	C6H6	1.05	UGL
SW37001ST	09-Mar-90	UB	AV8	C6H6	1.05	UGL
SW01004	12-Apr-90	UB	SS12	CA	35100	UGL
SW01005	12-Apr-90	UB	SS12	CA	50900	UGL
SW01005	12-Apr-90	UB	SS12	CA	51400	UGL
SW02003	12-Apr-90	UB	SS12	CA	56500	UGL

FY 1990 RMA CMP SURFACE WATER - REJECTED DATA

SITEID	DATE	LAB	METHOD	TESTNAME	VALUE	UNITS
SW02004	12-Apr-90	UB	SS12	CA	39200	UGL
SW07001	13-Apr-90	UB	SS12	CA	75100	UGL
SW07002	13-Apr-90	UB	SS12	CA	67200	UGL
SW12001	13-Apr-90	UB	SS12	CA	79300	UGL
SW12004	13-Apr-90	UB	SS12	CA	48300	UGL
SW12005ST3	28-Mar-90	UB	SS12	CA	11900	UGL
SW06002	18-Jul-90	UB	KK8	CL6CP	0.048	UGL
SW04001ST	09-Jul-90	UB	TF20	CYN	5	UGL
SW06002	18-Jul-90	UB	TF20	CYN	5	UGL
SW08003ST3	09-Jul-90	UB	TF20	CYN	5	UGL
SW11002ST	09-Jul-90	UB	TF20	CYN	5	UGL
SW12006ST	21-Jul-90	UB	TF20	CYN	5	UGL
SW04001ST	09-Jul-90	UB	UH11	DDVP	0.384	UGL
SW08003ST3	09-Jul-90	UB	UH11	DDVP	0.384	UGL
SW11002ST	09-Jul-90	UB	UH11	DDVP	0.384	UGL
SW12006ST	21-Jul-90	UB	UH11	DDVP	0.384	UGL
SW06002	18-Jul-90	UB	AT8	DIMP	0.392	UGL
SW01001	06-Sep-90	ED	PP8A	DMDS	1.16	UGL
SW02001	05-Sep-90	ED	PP8A	DMDS	1.16	UGL
SW02006	04-Sep-90	ED	PP8A	DMDS	1.16	UGL
SW08003	07-Sep-90	ED	PP8A	DMDS	1.16	UGL
SW08003FB	07-Sep-90	ED	PP8A	DMDS	1.16	UGL
SW08003TB	07-Sep-90	ED	PP8A	DMDS	1.16	UGL
SW11001	04-Sep-90	ED	PP8A	DMDS	1.16	UGL
SW11001	04-Sep-90	ED	PP8A	DMDS	1.16	UGL
SW11002	05-Sep-90	ED	PP8A	DMDS	1.16	UGL
SW12001	06-Sep-90	ED	PP8A	DMDS	1.16	UGL
SW12004	04-Sep-90	ED	PP8A	DMDS	1.16	UGL
SW24001	06-Sep-90	ED	PP8A	DMDS	1.16	UGL
SW24002	07-Sep-90	ED	PP8A	DMDS	1.16	UGL
SW06002	18-Jul-90	UB	AT8	DMMP	0.188	UGL
SW08003ST	09-Mar-90	UB	AV8	ETC6H5	1.37	UGL
SW11001ST	06-Mar-90	UB	AV8	ETC6H5	1.37	UGL
SW11002ST	06-Mar-90	UB	AV8	ETC6H5	1.37	UGL
SW12004ST	08-Mar-90	UB	AV8	ETC6H5	1.37	UGL
SW12005ST	08-Mar-90	UB	AV8	ETC6H5	1.37	UGL
SW24002ST	09-Mar-90	UB	AV8	ETC6H5	1.37	UGL
SW37001ST	09-Mar-90	UB	AV8	ETC6H5	1.37	UGL
SW08003ST	09-Mar-90	UB	AV8	MEC6H5	1.47	UGL
SW11001ST	06-Mar-90	UB	AV8	MEC6H5	1.47	UGL
SW11002ST	06-Mar-90	UB	AV8	MEC6H5	1.47	UGL
SW12004ST	08-Mar-90	UB	AV8	MEC6H5	1.47	UGL
SW12005ST	08-Mar-90	UB	AV8	MEC6H5	1.47	UGL
SW24002ST	09-Mar-90	UB	AV8	MEC6H5	1.47	UGL
SW37001ST	09-Mar-90	UB	AV8	MEC6H5	1.47	UGL
SW04001ST	09-Jul-90	UB	UH11	MLTHN	0.373	UGL

FY 1990 RMA CMP SURFACE WATER - REJECTED DATA

SITEID	DATE	LAB	METHOD	TESTNAME	VALUE	UNITS
SW08003ST3	09-Jul-90	UB	UH11	MLTHN	0.373	UGL
SW11002ST	09-Jul-90	UB	UH11	MLTHN	0.579	UGL
SW12006ST	21-Jul-90	UB	UH11	MLTHN	0.373	UGL
SW04001ST	09-Jul-90	UB	UH11	PRTHN	0.647	UGL
SW08003ST3	09-Jul-90	UB	UH11	PRTHN	0.647	UGL
SW11002ST	09-Jul-90	UB	UH11	PRTHN	0.647	UGL
SW12006ST	21-Jul-90	UB	UH11	PRTHN	0.647	UGL
SW04001ST	09-Jul-90	UB	UH11	SUPONA	0.787	UGL
SW08003ST3	09-Jul-90	UB	UH11	SUPONA	0.787	UGL
SW11002ST	09-Jul-90	UB	UH11	SUPONA	0.787	UGL
SW12006ST	21-Jul-90	UB	UH11	SUPONA	0.787	UGL
SW08003ST	09-Mar-90	UB	AV8	XYLEN	1.36	UGL
SW11001ST	06-Mar-90	UB	AV8	XYLEN	1.36	UGL
SW11002ST	06-Mar-90	UB	AV8	XYLEN	1.36	UGL
SW12004ST	08-Mar-90	UB	AV8	XYLEN	1.36	UGL
SW12005ST	08-Mar-90	UB	AV8	XYLEN	1.36	UGL
SW24002ST	09-Mar-90	UB	AV8	XYLEN	1.36	UGL
SW37001ST	09-Mar-90	UB	AV8	XYLEN	1.36	UGL
SW12004	13-Apr-90	UB	SS12	ZN	179	UGL
SW12005ST3	28-Mar-90	UB	SS12	ZN	115	UGL

APPENDIX B-4

ION BALANCE CALCULATIONS

ION BALANCE CALCULATIONS

SITE/DATE : SW01001, 17-Apr-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	54.00	2.70	30.68
MG	25.50	2.11	23.94
K	4.53	0.12	1.32
NA	89.20	3.88	44.06
CATION TOTAL		8.80	100.00
SO4	123.00	2.56	27.89
CL	47.10	1.33	14.48
NO3 MG/L-N	2.91	0.21	2.26
FL	1.32	0.07	0.76
HCO3	306.00	5.02	54.60
CO3	0.00	0.00	0.00
ANION TOTAL		9.19	100.00

CHARGE-BALANCE ERROR (%) : 2.14
pH : 8.13

ION BALANCE CALCULATIONS

SITE/DATE : SW01001, 06-Sep-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	24.40	1.22	48.21
MG	5.58	0.46	18.22
K	5.34	0.14	5.40
NA	16.40	0.71	28.17
CATION TOTAL		2.53	100.00
SO4	27.20	0.57	18.01
CL	19.60	0.55	17.59
NO3 MG/L-N	1.93	0.14	4.38
FL	1.00	0.05	1.67
HCO3	112.00	1.84	58.35
CO3	0.00	0.00	0.00
ANION TOTAL		3.15	100.00

CHARGE-BALANCE ERROR (%) : 10.85
pH : 7.52

ION BALANCE CALCULATIONS

SITE/DATE : SW01002, 19-Apr-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	639.00	31.95	46.89
MG	202.00	16.69	24.50
K	53.30	1.36	2.00
NA	417.00	18.13	26.61
CATION TOTAL		68.14	100.00
SO4	2570.00	53.54	67.85
CL	667.00	18.84	23.88
NO3 MG/L-N	0.09	0.01	0.01
FL	4.96	0.26	0.33
HCO3	382.00	6.26	7.94
CO3	0.00	0.00	0.00
ANION TOTAL		78.91	100.00

CHARGE-BALANCE ERROR (%) : 7.33
pH : 7.65

ION BALANCE CALCULATIONS

SITE/DATE : SW02001, 05-Sep-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	44.70	2.24	38.51
MG	17.00	1.40	24.21
K	4.36	0.11	1.92
NA	47.20	2.05	35.36
CATION TOTAL		5.80	100.00
SO4	109.00	2.27	33.30
CL	63.40	1.79	26.26
NO3 MG/L-N	1.50	0.11	1.57
FL	1.00	0.05	0.77
HCO3	139.00	2.28	33.41
CO3	9.60	0.32	4.69
ANION TOTAL		6.82	100.00

CHARGE-BALANCE ERROR (%) : 8.05
pH : 8.51

ION BALANCE CALCULATIONS

SITE/DATE : SW02006, 19-Apr-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	45.60	2.28	24.87
MG	16.60	1.37	14.96
K	4.87	0.12	1.36
NA	124.00	5.39	58.81
CATION TOTAL		9.17	100.00
SO4	154.00	3.21	32.65
CL	85.60	2.42	24.61
NO3 MG/L-N	0.57	0.04	0.41
FL	1.86	0.10	1.00
HCO3	155.00	2.54	25.86
CO3	45.60	1.52	15.47
ANION TOTAL		9.83	100.00

CHARGE-BALANCE ERROR (%) : 3.46
pH : 9.35

ION BALANCE CALCULATIONS

SITE/DATE : SW02006, 04-Sep-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	22.30	1.12	19.60
MG	17.60	1.45	25.57
K	3.26	0.08	1.47
NA	69.80	3.03	53.36
CATION TOTAL		5.69	100.00
SO4	120.00	2.50	35.64
CL	85.60	2.42	34.47
NO3 MG/L-N	1.03	0.07	1.05
FL	5.00	0.26	3.75
HCO3	29.30	0.48	6.85
CO3	38.40	1.28	18.25
ANION TOTAL		7.02	100.00

CHARGE-BALANCE ERROR (%) : 10.45
pH : 8.88

ION BALANCE CALCULATIONS

SITE/DATE : SW06002, 18-Jul-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	41.90	2.10	46.47
MG	11.40	0.94	20.90
K	4.33	0.11	2.46
NA	31.30	1.36	30.18
CATION TOTAL		4.51	100.00
SO4	75.60	1.57	34.86
CL	29.40	0.83	18.38
NO3 MG/L-N	0.67	0.05	1.05
FL	0.93	0.05	1.08
HCO3	123.00	2.02	44.63
CO3	0.00	0.00	0.00
ANION TOTAL		4.52	100.00

CHARGE-BALANCE ERROR (%) : 0.11
pH : 7.94

ION BALANCE CALCULATIONS

SITE/DATE : SW06002, storm event, 27-Jul-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	37.50	1.88	48.54
MG	9.36	0.77	20.03
K	4.81	0.12	3.18
NA	25.10	1.09	28.25
CATION TOTAL		3.86	100.00
SO4	67.50	1.41	35.30
CL	24.50	0.69	17.38
NO3 MG/L-N	0.51	0.04	0.92
FL	0.86	0.05	1.13
HCO3	110.00	1.80	45.27
CO3	0.00	0.00	0.00
ANION TOTAL		3.98	100.00

CHARGE-BALANCE ERROR (%) : 1.53
pH : 7.53

ION BALANCE CALCULATIONS

SITE/DATE : SW08001, 18-Apr-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	85.80	4.29	48.61
MG	20.80	1.72	19.48
K	5.41	0.14	1.57
NA	61.60	2.68	30.35
CATION TOTAL		8.83	100.00
SO4	106.00	2.21	26.06
CL	39.10	1.10	13.03
NO3 MG/L-N	0.08	0.01	0.07
FL	1.11	0.06	0.69
HCO3	311.00	5.10	60.15
CO3	0.00	0.00	0.00
ANION TOTAL		8.48	100.00

CHARGE-BALANCE ERROR (%) : -2.02
pH : 6.64

ION BALANCE CALCULATIONS

SITE/DATE : SW08003, 18-Apr-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	90.70	4.54	48.78
MG	21.40	1.77	19.02
K	5.16	0.13	1.42
NA	65.80	2.86	30.77
CATION TOTAL		9.30	100.00
SO4	112.00	2.33	26.33
CL	40.90	1.16	13.04
NO3 MG/L-N	0.18	0.01	0.14
FL	1.04	0.05	0.62
HCO3	292.00	4.79	54.01
CO3	15.60	0.52	5.87
ANION TOTAL		8.86	100.00

CHARGE-BALANCE ERROR (%) : -2.39
pH : 8.55

ION BALANCE CALCULATIONS

SITE/DATE : SW08003, 07-Sep-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	99.00	4.95	52.33
MG	20.40	1.69	17.82
K	5.68	0.15	1.54
NA	61.60	2.68	28.31
CATION TOTAL		9.46	100.00
SO4	122.00	2.54	24.03
CL	65.50	1.85	17.49
NO3 MG/L-N	0.49	0.04	0.33
FL	1.00	0.05	0.50
HCO3	372.00	6.10	57.65
CO3	0.00	0.00	0.00
ANION TOTAL		10.58	100.00

CHARGE-BALANCE ERROR (%) : 5.58
pH : 7.86

ION BALANCE CALCULATIONS

SITE/DATE : SW08003, storm event, 09-Mar-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	76.50	3.83	44.04
MG	21.70	1.79	20.65
K	8.75	0.22	2.58
NA	65.40	2.84	32.74
CATION TOTAL		8.69	100.00
SO4	132.00	2.75	28.40
CL	52.20	1.47	15.23
NO3 MG/L-N	0.30	0.02	0.22
FL	1.12	0.06	0.61
HCO3	328.00	5.38	55.54
CO3	0.00	0.00	0.00
ANION TOTAL		9.68	100.00

CHARGE-BALANCE ERROR (%) : 5.42
pH : 8.18

ION BALANCE CALCULATIONS

SITE/DATE : SW08003, storm event, 30-May-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	51.90	2.60	49.22
MG	12.30	1.02	19.28
K	4.59	0.12	2.23
NA	35.50	1.54	29.27
CATION TOTAL		5.27	100.00
SO4	65.70	1.37	23.79
CL	30.40	0.86	14.92
NO3 MG/L-N	1.73	0.12	2.15
FL	0.80	0.04	0.74
HCO3	205.00	3.36	58.41
CO3	0.00	0.00	0.00
ANION TOTAL		5.75	100.00

CHARGE-BALANCE ERROR (%) : 4.37
pH : 8.06

ION BALANCE CALCULATIONS

SITE/DATE : SW08003, storm event, 10-Jul-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	50.50	2.53	47.62
MG	11.40	0.94	17.77
K	4.96	0.13	2.39
NA	39.30	1.71	32.22
CATION TOTAL		5.30	100.00
SO4	75.10	1.56	24.91
CL	30.20	0.85	13.58
NO3 MG/L-N	3.44	0.25	3.91
FL	1.13	0.06	0.95
HCO3	217.00	3.56	56.64
CO3	0.00	0.00	0.00
ANION TOTAL		6.28	100.00

CHARGE-BALANCE ERROR (%) : 8.44
pH : 8.18

ION BALANCE CALCULATIONS

SITE/DATE : SW11001, 16-Apr-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	41.00	2.05	39.77
MG	10.60	0.88	17.00
K	6.89	0.18	3.42
NA	47.20	2.05	39.81
CATION TOTAL		5.15	100.00
SO4	52.70	1.10	22.89
CL	43.00	1.21	25.32
NO3 MG/L-N	0.14	0.01	0.21
FL	0.92	0.05	1.00
HCO3	148.00	2.43	50.57
CO3	0.00	0.00	0.00
ANION TOTAL		4.80	100.00

CHARGE-BALANCE ERROR (%) : -3.59
pH : 8.25

ION BALANCE CALCULATIONS

SITE/DATE : SW11001, 04-Sep-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	22.30	1.12	56.19
MG	3.41	0.28	14.20
K	3.76	0.10	4.85
NA	11.30	0.49	24.76
CATION TOTAL		1.98	100.00
SO4	29.10	0.61	18.20
CL	15.10	0.43	12.81
NO3 MG/L-N	1.13	0.08	2.42
FL	3.00	0.16	4.74
HCO3	32.90	0.54	16.19
CO3	45.60	1.52	45.64
ANION TOTAL		3.33	100.00

CHARGE-BALANCE ERROR (%) : 25.33
pH : 8.51

ION BALANCE CALCULATIONS

SITE/DATE : SW11001, storm event, 06-Mar-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	3.11	0.16	25.72
MG	0.49	0.04	6.67
K	2.18	0.06	9.22
NA	8.12	0.35	58.39
CATION TOTAL		0.60	100.00
SO4	5.71	0.12	15.95
CL	8.48	0.24	32.12
NO3 MG/L-N	0.56	0.04	5.36
FL	0.15	0.01	1.08
HCO3	20.70	0.34	45.49
CO3	0.00	0.00	0.00
ANION TOTAL		0.75	100.00

CHARGE-BALANCE ERROR (%) : 10.46
pH : 7.89

ION BALANCE CALCULATIONS

SITE/DATE : SW11001, storm event, 13-Mar-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	6.69	0.33	20.37
MG	1.45	0.12	7.30
K	4.44	0.11	6.92
NA	24.70	1.07	65.41
CATION TOTAL		1.64	100.00
SO4	6.09	0.13	7.37
CL	37.50	1.06	61.50
NO3 MG/L-N	0.40	0.03	1.64
FL	0.15	0.01	0.47
HCO3	30.50	0.50	29.03
CO3	0.00	0.00	0.00
ANION TOTAL		1.72	100.00

CHARGE-BALANCE ERROR (%) : 2.40
pH : 7.42

ION BALANCE CALCULATIONS

SITE/DATE : SW11002, 16-Apr-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	69.00	3.45	25.25
MG	10.10	0.83	6.11
K	23.20	0.59	4.34
NA	202.00	8.78	64.29
CATION TOTAL		13.66	100.00
SO4	111.00	2.31	19.72
CL	200.00	5.65	48.17
NO3 MG/L-N	0.07	0.00	0.04
FL	1.52	0.08	0.68
HCO3	95.20	1.56	13.31
CO3	63.60	2.12	18.08
ANION TOTAL		11.73	100.00

CHARGE-BALANCE ERROR (%) : -7.61
pH : 9.77

ION BALANCE CALCULATIONS

SITE/DATE : SW11002, 05-Sep-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	36.50	1.83	59.59
MG	2.59	0.21	6.99
K	3.31	0.08	2.76
NA	21.60	0.94	30.66
CATION TOTAL		3.06	100.00
SO4	56.30	1.17	27.43
CL	42.30	1.19	27.95
NO3 MG/L-N	0.78	0.06	1.30
FL	1.00	0.05	1.23
HCO3	0.00	0.00	0.00
CO3	54.00	1.80	42.10
ANION TOTAL		4.28	100.00

CHARGE-BALANCE ERROR (%) : 16.53
pH : 10.48

ION BALANCE CALCULATIONS

SITE/DATE : SW11002, storm event, 06-Mar-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	4.22	0.21	31.24
MG	0.76	0.06	9.34
K	2.60	0.07	9.85
NA	7.70	0.33	49.57
CATION TOTAL		0.68	100.00
SO4	4.64	0.10	13.20
CL	9.31	0.26	35.92
NO3 MG/L-N	0.28	0.02	2.76
FL	0.15	0.01	1.10
HCO3	21.00	0.34	47.02
CO3	0.00	0.00	0.00
ANION TOTAL		0.73	100.00

CHARGE-BALANCE ERROR (%) : 4.04
pH : 6.90

ION BALANCE CALCULATIONS

SITE/DATE : SW11002, storm event, 13-Mar-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	5.56	0.28	19.28
MG	1.28	0.11	7.34
K	6.70	0.17	11.88
NA	20.40	0.89	61.50
CATION TOTAL		1.44	100.00
SO4	6.62	0.14	6.44
CL	30.30	0.86	39.97
NO3 MG/L-N	0.56	0.04	1.87
FL	0.15	0.01	0.38
HCO3	8.50	0.14	6.51
CO3	28.80	0.96	44.83
ANION TOTAL		2.14	100.00

CHARGE-BALANCE ERROR (%) : 19.51
pH : 9.18

ION BALANCE CALCULATIONS

SITE/DATE : SW11003, 17-Apr-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	8.13	0.41	18.75
MG	0.81	0.07	3.10
K	3.34	0.09	3.94
NA	37.00	1.61	74.21
CATION TOTAL		2.17	100.00
SO4	118.00	2.46	56.29
CL	43.10	1.22	27.88
NO3 MG/L-N	1.11	0.08	1.82
FL	0.23	0.01	0.28
HCO3	36.60	0.60	13.74
CO3	0.00	0.00	0.00
ANION TOTAL		4.37	100.00

CHARGE-BALANCE ERROR (%) : 33.66
pH : 7.76

ION BALANCE CALCULATIONS

SITE/DATE : SW12001, 06-Sep-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	63.50	3.18	44.14
MG	17.80	1.47	20.45
K	3.55	0.09	1.26
NA	56.50	2.46	34.15
CATION TOTAL		7.19	100.00
SO4	82.00	1.71	21.19
CL	51.40	1.45	18.01
NO3 MG/L-N	3.75	0.27	3.32
FL	3.00	0.16	1.96
HCO3	273.00	4.48	55.52
CO3	0.00	0.00	0.00
ANION TOTAL		8.06	100.00

CHARGE-BALANCE ERROR (%) : 5.69
pH : 8.21

ION BALANCE CALCULATIONS

SITE/DATE : SW12004, 04-Sep-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	24.40	1.22	54.70
MG	4.24	0.35	15.71
K	4.89	0.13	5.61
NA	12.30	0.53	23.98
CATION TOTAL		2.23	100.00
SO4	35.50	0.74	30.41
CL	21.20	0.60	24.62
NO3 MG/L-N	1.10	0.08	3.23
FL	0.91	0.05	1.97
HCO3	59.00	0.97	39.77
CO3	0.00	0.00	0.00
ANION TOTAL		2.43	100.00

CHARGE-BALANCE ERROR (%) : 4.33
pH : 8.11

ION BALANCE CALCULATIONS

SITE/DATE : SW12004, storm event, 08-Mar-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	4.09	0.20	14.18
MG	0.83	0.07	4.75
K	2.89	0.07	5.12
NA	25.20	1.10	75.95
CATION TOTAL		1.44	100.00
SO4	4.37	0.09	6.13
CL	37.00	1.05	70.39
NO3 MG/L-N	0.18	0.01	0.86
FL	0.15	0.01	0.54
HCO3	20.00	0.33	22.08
CO3	0.00	0.00	0.00
ANION TOTAL		1.48	100.00

CHARGE-BALANCE ERROR (%) : 1.44
pH : 7.06

ION BALANCE CALCULATIONS

SITE/DATE : SW12005, 06-Sep-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	54.30	2.72	44.33
MG	14.90	1.23	20.11
K	5.25	0.13	2.19
NA	47.00	2.04	33.37
CATION TOTAL		6.12	100.00
SO4	63.40	1.32	21.84
CL	27.80	0.79	12.99
NO3 MG/L-N	2.94	0.21	3.47
FL	1.11	0.06	0.97
HCO3	224.00	3.67	60.73
CO3	0.00	0.00	0.00
ANION TOTAL		6.05	100.00

CHARGE-BALANCE ERROR (%) : -0.64
pH : 7.88

ION BALANCE CALCULATIONS

SITE/DATE : SW12005, storm event, 08-Mar-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	9.87	0.49	25.73
MG	2.44	0.20	10.51
K	1.92	0.05	2.56
NA	27.00	1.17	61.20
CATION TOTAL		1.92	100.00
SO4	15.90	0.33	14.74
CL	36.40	1.03	45.74
NO3 MG/L-N	0.55	0.04	1.75
FL	0.25	0.01	0.57
HCO3	51.00	0.84	37.19
CO3	0.00	0.00	0.00
ANION TOTAL		2.25	100.00

CHARGE-BALANCE ERROR (%) : 7.91
pH : 7.86

ION BALANCE CALCULATIONS

SITE/DATE : SW12005, storm event, 13-Mar-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	15.30	0.77	33.97
MG	4.78	0.40	17.54
K	2.57	0.07	2.92
NA	23.60	1.03	45.57
CATION TOTAL		2.25	100.00
SO4	30.00	0.63	23.77
CL	20.50	0.58	22.02
NO3 MG/L-N	1.06	0.08	2.88
FL	0.42	0.02	0.84
HCO3	81.00	1.33	50.49
CO3	0.00	0.00	0.00
ANION TOTAL		2.63	100.00

CHARGE-BALANCE ERROR (%) : 7.74
pH : 7.98

ION BALANCE CALCULATIONS

SITE/DATE : SW12006, storm event, 21-Jul-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	5.27	0.26	46.89
MG	0.87	0.07	12.80
K	3.57	0.09	16.25
NA	3.11	0.14	24.06
CATION TOTAL		0.56	100.00
SO4	4.15	0.09	18.76
CL	1.39	0.04	8.52
NO3 MG/L-N	0.90	0.06	13.93
FL	0.17	0.01	1.88
HCO3	16.00	0.26	56.91
CO3	0.00	0.00	0.00
ANION TOTAL		0.46	100.00

CHARGE-BALANCE ERROR (%) : -9.87
pH : 7.65

ION BALANCE CALCULATIONS

SITE/DATE : SW24001, 17-Apr-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	51.00	2.55	31.42
MG	17.90	1.48	18.23
K	5.40	0.14	1.70
NA	90.80	3.95	48.65
CATION TOTAL		8.12	100.00
SO4	81.80	1.70	23.41
CL	68.70	1.94	26.66
NO3 MG/L-N	2.86	0.20	2.81
FL	1.61	0.08	1.16
HCO3	204.00	3.34	45.95
CO3	0.00	0.00	0.00
ANION TOTAL		7.28	100.00

CHARGE-BALANCE ERROR (%) : -5.44
pH : 7.38

ION BALANCE CALCULATIONS

SITE/DATE : SW24001, 06-Sep-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	29.40	1.47	30.85
MG	9.62	0.80	16.69
K	5.25	0.13	2.82
NA	54.40	2.37	49.64
CATION TOTAL		4.76	100.00
SO4	53.50	1.11	19.72
CL	60.40	1.71	30.18
NO3 MG/L-N	4.30	0.31	5.43
FL	1.57	0.08	1.46
HCO3	149.00	2.44	43.21
CO3	0.00	0.00	0.00
ANION TOTAL		5.65	100.00

CHARGE-BALANCE ERROR (%) : 8.53
pH : 7.44

ION BALANCE CALCULATIONS

SITE/DATE : SW24002, 18-Apr-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	108.00	5.40	39.69
MG	35.40	2.93	21.51
K	5.78	0.15	1.09
NA	118.00	5.13	37.71
CATION TOTAL		13.60	100.00
SO4	239.00	4.98	38.22
CL	61.00	1.72	13.23
NO3 MG/L-N	0.49	0.03	0.27
FL	1.46	0.08	0.59
HCO3	379.00	6.21	47.69
CO3	0.00	0.00	0.00
ANION TOTAL		13.03	100.00

CHARGE-BALANCE ERROR (%) : -2.17
pH : 8.24

ION BALANCE CALCULATIONS

SITE/DATE : SW24002, 07-Sep-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	477.00	23.85	38.29
MG	134.00	11.07	17.78
K	5.79	0.15	0.24
NA	626.00	27.22	43.69
CATION TOTAL		62.29	100.00
SO4	2000.00	41.67	65.72
CL	453.00	12.80	20.18
NO3 MG/L-N	0.28	0.02	0.03
FL	10.00	0.53	0.83
HCO3	512.00	8.39	13.24
CO3	0.00	0.00	0.00
ANION TOTAL		63.40	100.00

CHARGE-BALANCE ERROR (%) : 0.89
pH : 7.44

ION BALANCE CALCULATIONS

SITE/DATE : SW24002, storm event, 09-Mar-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	81.90	4.10	36.68
MG	28.00	2.31	20.73
K	10.80	0.28	2.47
NA	103.00	4.48	40.12
CATION TOTAL		11.16	100.00
SO4	200.00	4.17	34.50
CL	76.80	2.17	17.96
NO3 MG/L-N	0.51	0.04	0.30
FL	1.25	0.07	0.54
HCO3	344.00	5.64	46.69
CO3	0.00	0.00	0.00
ANION TOTAL		12.08	100.00

CHARGE-BALANCE ERROR (%) : 3.93
pH : 8.19

ION BALANCE CALCULATIONS

SITE/DATE : SW24003, 17-Apr-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	138.00	6.90	26.42
MG	88.70	7.33	28.07
K	5.87	0.15	0.57
NA	270.00	11.74	44.94
CATION TOTAL		26.12	100.00
SO4	486.00	10.13	43.70
CL	330.00	9.32	40.24
NO3 MG/L-N	0.07	0.00	0.02
FL	2.22	0.12	0.50
HCO3	0.00	0.00	0.00
CO3	108.00	3.60	15.54
ANION TOTAL		23.17	100.00

CHARGE-BALANCE ERROR (%) : -5.99
pH : 8.48

ION BALANCE CALCULATIONS

SITE/DATE : SW24004, 17-Apr-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	116.00	5.80	40.58
MG	36.60	3.02	21.16
K	6.36	0.16	1.14
NA	122.00	5.30	37.11
CATION TOTAL		14.29	100.00
SO4	245.00	5.10	37.77
CL	62.90	1.78	13.15
NO3 MG/L-N	0.47	0.03	0.25
FL	1.49	0.08	0.58
HCO3	349.00	5.72	42.34
CO3	24.00	0.80	5.92
ANION TOTAL		13.51	100.00

CHARGE-BALANCE ERROR (%) : -2.80
pH : 8.60

ION BALANCE CALCULATIONS

SITE/DATE : SW26001, storm event, 13-Mar-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	36.60	1.83	50.36
MG	10.30	0.85	23.42
K	13.80	0.35	9.71
NA	13.80	0.60	16.51
CATION TOTAL		3.63	100.00
SO4	34.20	0.71	16.61
CL	34.80	0.98	22.92
NO3 MG/L-N	1.40	0.10	2.33
FL	0.64	0.03	0.78
HCO3	147.60	2.42	56.42
CO3	1.20	0.04	0.93
ANION TOTAL		4.29	100.00

CHARGE-BALANCE ERROR (%) : 8.26
pH : 8.40

ION BALANCE CALCULATIONS

SITE/DATE : SW26001, storm event, 19-Aug-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	173.00	8.65	76.99
MG	24.50	2.02	18.02
K	19.20	0.49	4.37
NA	1.59	0.07	0.62
CATION TOTAL		11.23	100.00
SO4	1.52	0.03	0.80
CL	1.37	0.04	0.98
NO3 MG/L-N	2.45	0.18	4.42
FL	0.28	0.01	0.37
HCO3	62.20	1.02	25.75
CO3	80.40	2.68	67.68
ANION TOTAL		3.96	100.00

CHARGE-BALANCE ERROR (%) : -47.88
pH : 9.27

ION BALANCE CALCULATIONS

SITE/DATE : SW30002, 19-Apr-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	104.00	5.20	41.21
MG	31.60	2.61	20.70
K	6.05	0.15	1.23
NA	107.00	4.65	36.87
CATION TOTAL		12.62	100.00
SO4	223.00	4.65	35.47
CL	61.50	1.74	13.26
NO3 MG/L-N	0.75	0.05	0.41
FL	1.65	0.09	0.66
HCO3	401.00	6.57	50.19
CO3	0.00	0.00	0.00
ANION TOTAL		13.10	100.00

CHARGE-BALANCE ERROR (%) : 1.86
pH : 7.73

ION BALANCE CALCULATIONS

SITE/DATE : SW31001, 17-Apr-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	73.50	3.68	31.97
MG	36.10	2.98	25.95
K	5.56	0.14	1.24
NA	108.00	4.70	40.84
CATION TOTAL		11.50	100.00
SO4	157.00	3.27	27.58
CL	57.50	1.62	13.70
NO3 MG/L-N	6.42	0.46	3.87
FL	2.02	0.11	0.90
HCO3	361.00	5.92	49.91
CO3	14.40	0.48	4.05
ANION TOTAL		11.86	100.00

CHARGE-BALANCE ERROR (%) : 1.55
pH : 8.60

ION BALANCE CALCULATIONS

SITE/DATE : SW31002, 19-Apr-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	94.90	4.75	43.96
MG	25.50	2.11	19.53
K	7.03	0.18	1.67
NA	86.50	3.76	34.85
CATION TOTAL		10.79	100.00
SO4	180.00	3.75	28.97
CL	55.70	1.57	12.16
NO3 MG/L-N	0.03	0.00	0.02
FL	1.44	0.08	0.59
HCO3	460.00	7.54	58.27
CO3	0.00	0.00	0.00
ANION TOTAL		12.94	100.00

CHARGE-BALANCE ERROR (%) : 9.05
pH : 8.00

ION BALANCE CALCULATIONS

SITE/DATE : SW36001, 19-Apr-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	66.20	3.31	33.84
MG	25.20	2.08	21.29
K	5.53	0.14	1.45
NA	97.70	4.25	43.43
CATION TOTAL		9.78	100.00
SO4	133.00	2.77	28.73
CL	76.10	2.15	22.29
NO3 MG/L-N	0.52	0.04	0.39
FL	2.14	0.11	1.17
HCO3	279.00	4.57	47.43
CO3	0.00	0.00	0.00
ANION TOTAL		9.64	100.00

CHARGE-BALANCE ERROR (%) : -0.71
pH : 7.99

ION BALANCE CALCULATIONS

SITE/DATE : SW36001, 05-Sep-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	34.00	1.70	21.97
MG	22.00	1.82	23.50
K	4.33	0.11	1.43
NA	94.50	4.11	53.10
CATION TOTAL		7.74	100.00
SO4	137.00	2.85	38.15
CL	67.10	1.90	25.34
NO3 MG/L-N	1.12	0.08	1.07
FL	1.47	0.08	1.03
HCO3	157.00	2.57	34.41
CO3	0.00	0.00	0.00
ANION TOTAL		7.48	100.00

CHARGE-BALANCE ERROR (%) : -1.69
pH : 7.75

ION BALANCE CALCULATIONS

SITE/DATE : SW37001, 18-Apr-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	119.00	5.95	33.04
MG	47.10	3.89	21.61
K	6.57	0.17	0.93
NA	184.00	8.00	44.42
CATION TOTAL		18.01	100.00
SO4	333.00	6.94	38.94
CL	124.00	3.50	19.66
NO3 MG/L-N	2.55	0.18	1.02
FL	1.89	0.10	0.56
HCO3	318.00	5.21	29.26
CO3	56.40	1.88	10.55
ANION TOTAL		17.82	100.00

CHARGE-BALANCE ERROR (%) : -0.55
pH : 8.65

ION BALANCE CALCULATIONS

SITE/DATE : SW37001, 07-Sep-90

SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	107.00	5.35	26.76
MG	45.50	3.76	18.81
K	7.23	0.18	0.92
NA	246.00	10.70	53.50
CATION TOTAL		19.99	100.00
SO4	383.00	7.98	43.26
CL	162.00	4.58	24.81
NO3 MG/L-N	0.29	0.02	0.11
FL	2.51	0.13	0.72
HCO3	350.00	5.74	31.11
CO3	0.00	0.00	0.00
ANION TOTAL		18.45	100.00

CHARGE-BALANCE ERROR (%) : -4.02
pH : 7.98

ION BALANCE CALCULATIONS

SITE/DATE : SW37001, storm event, 09-Mar-90

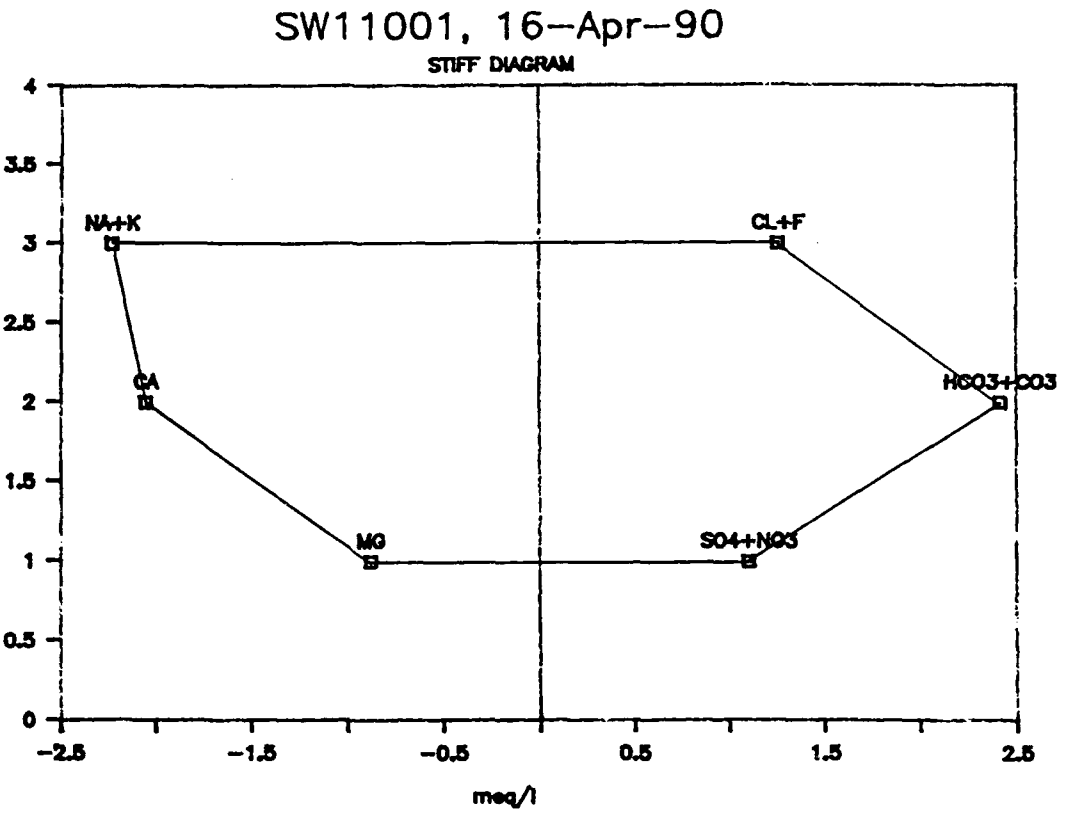
SPECIES	MG/L	MEQ/L	% TOTAL MEQ/L
CA	81.70	4.09	33.20
MG	32.20	2.66	21.63
K	11.60	0.30	2.41
NA	121.00	5.26	42.76
CATION TOTAL		12.30	100.00
SO4	255.00	5.31	42.07
CL	94.90	2.68	21.23
NO3 MG/L-N	0.42	0.03	0.24
FL	1.49	0.08	0.62
HCO3	276.00	4.52	35.83
CO3	0.00	0.00	0.00
ANION TOTAL		12.63	100.00

CHARGE-BALANCE ERROR (%) : 1.30
pH : 8.03

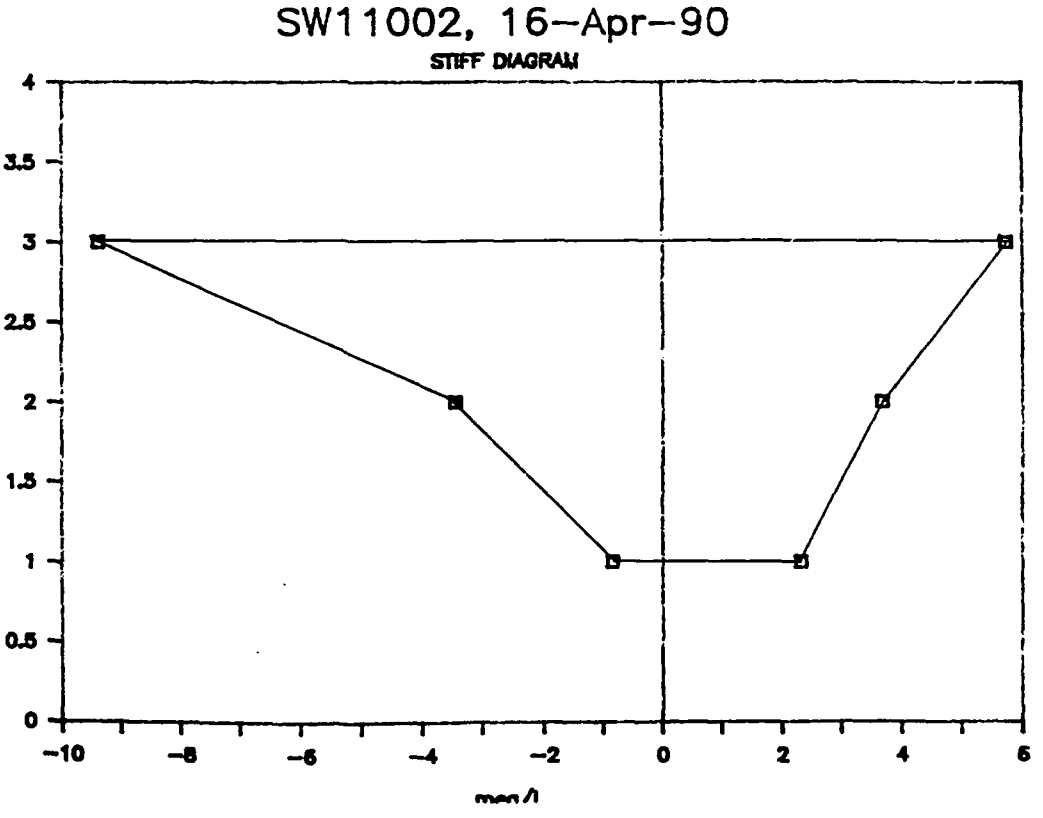
APPENDIX B-5

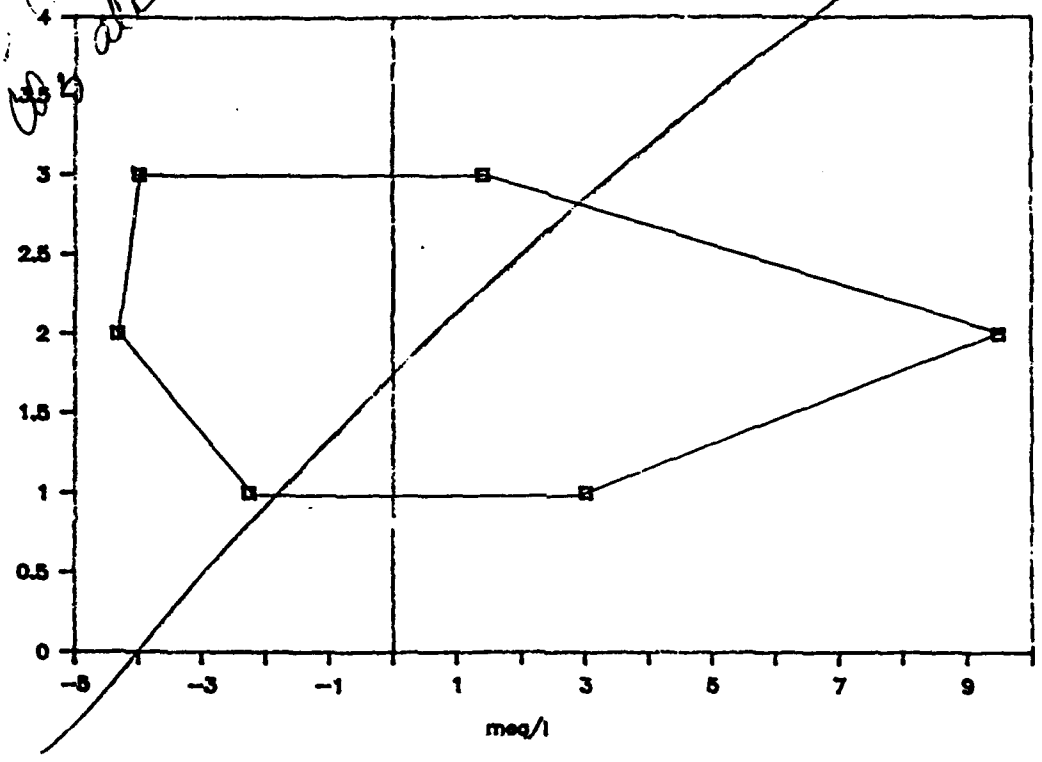
STIFF DIAGRAMS

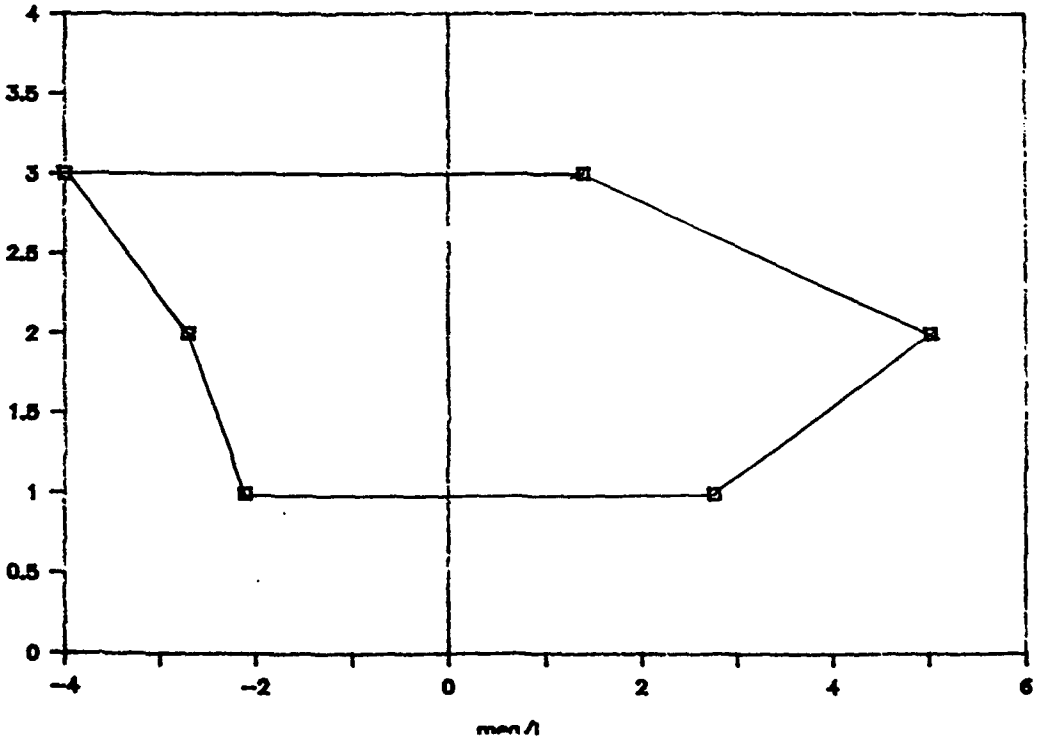
V. HCO_3 type water



N $\pm$ Cl water





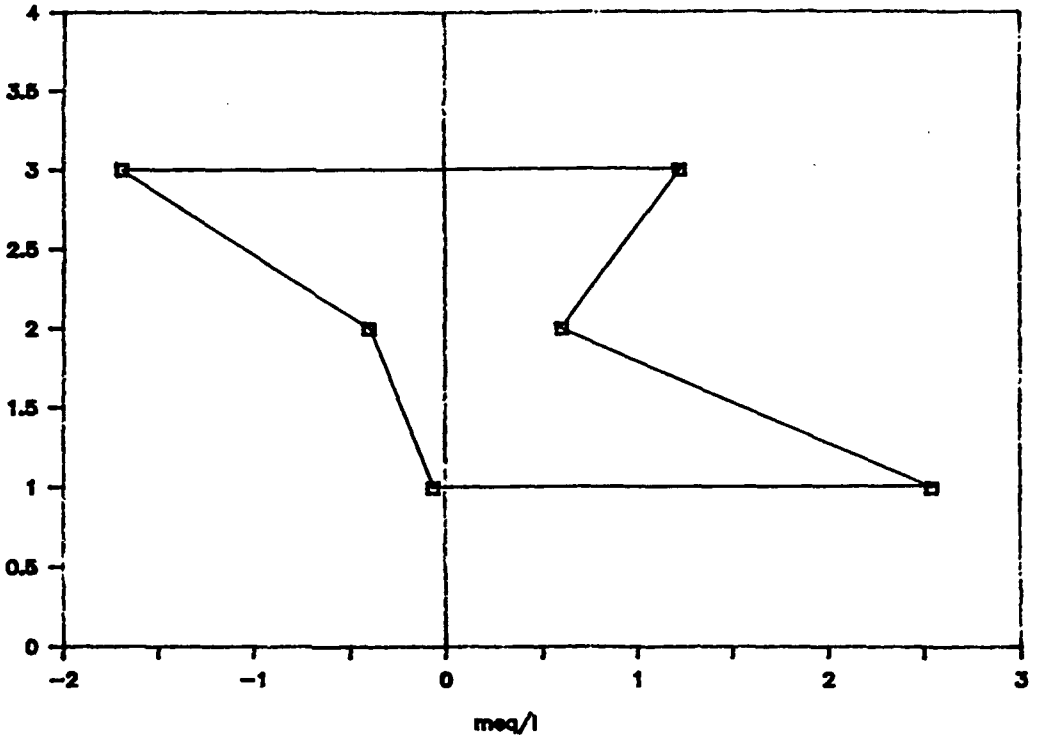


Na HCO_3 type water

SW11003, 17-Apr-90

5

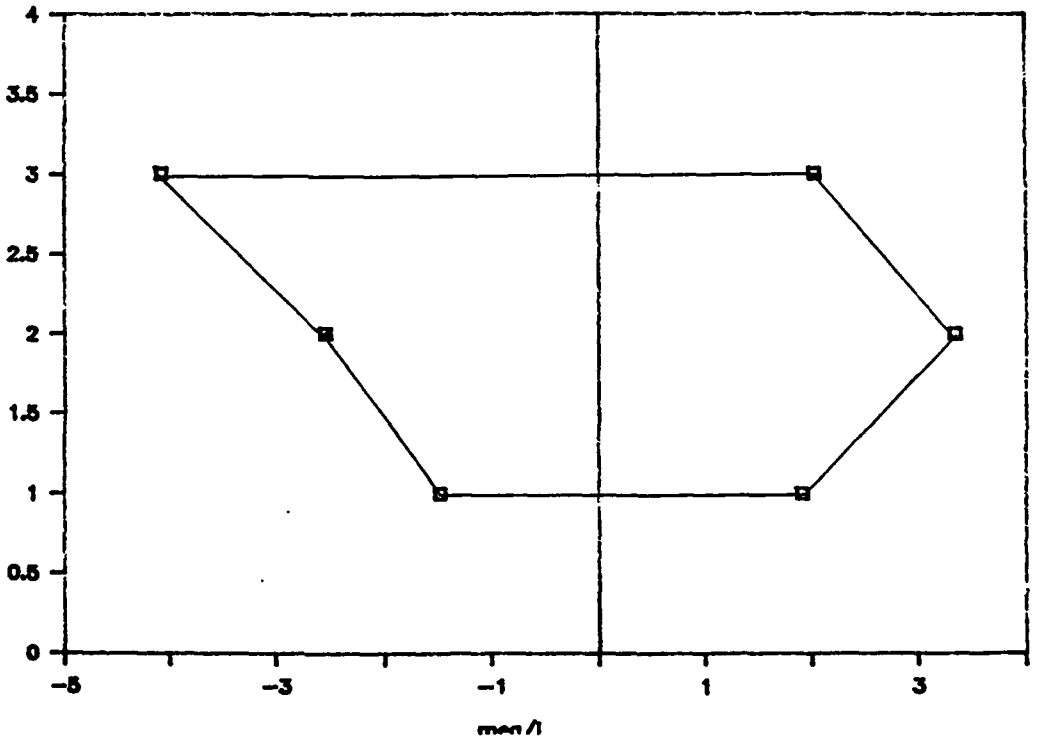
Ca SO4 type H2O



SW24001, 17-Apr-90

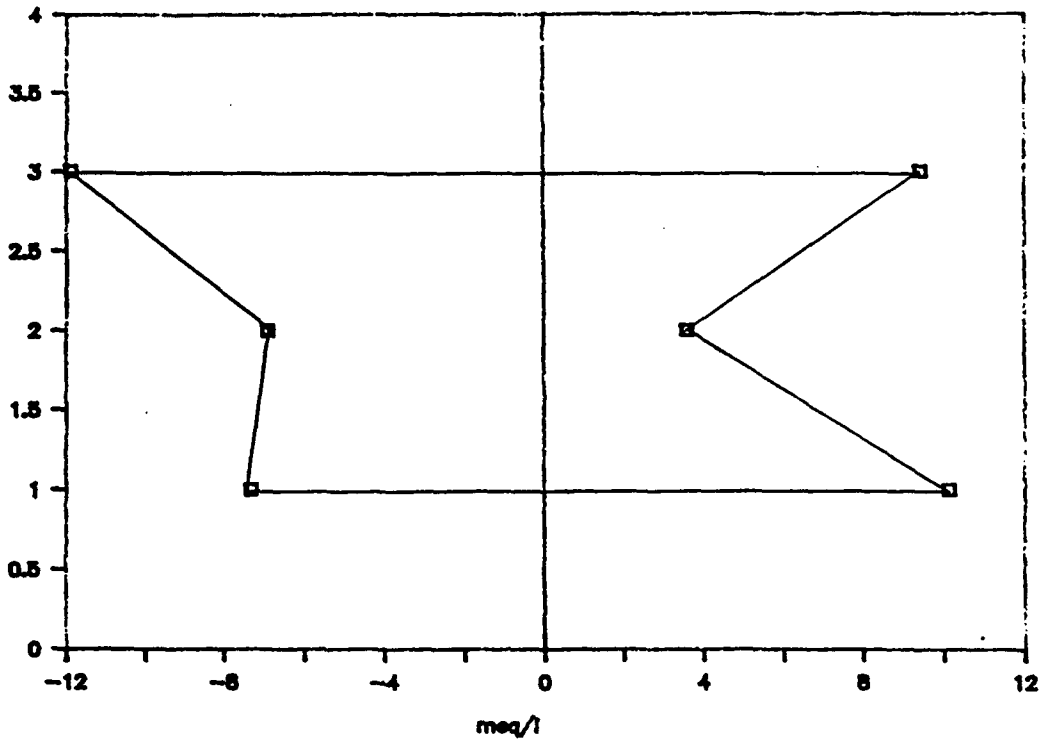
6

NaHCO3



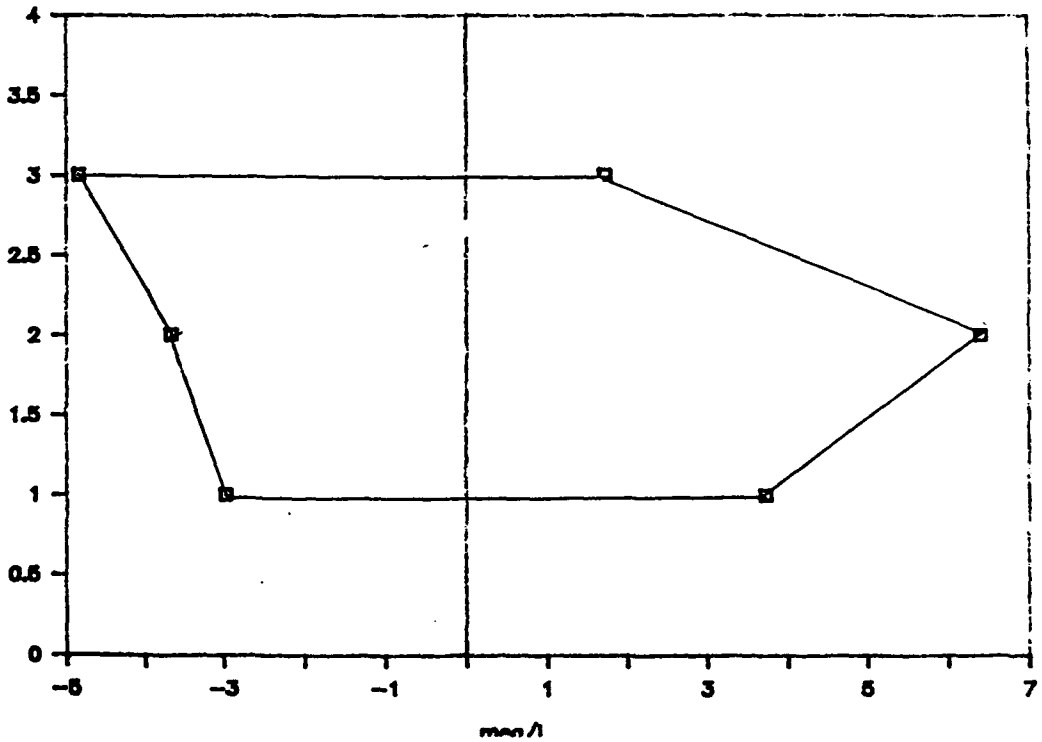
Na SO4

SW24003, 17-Apr-90



. a HCO3

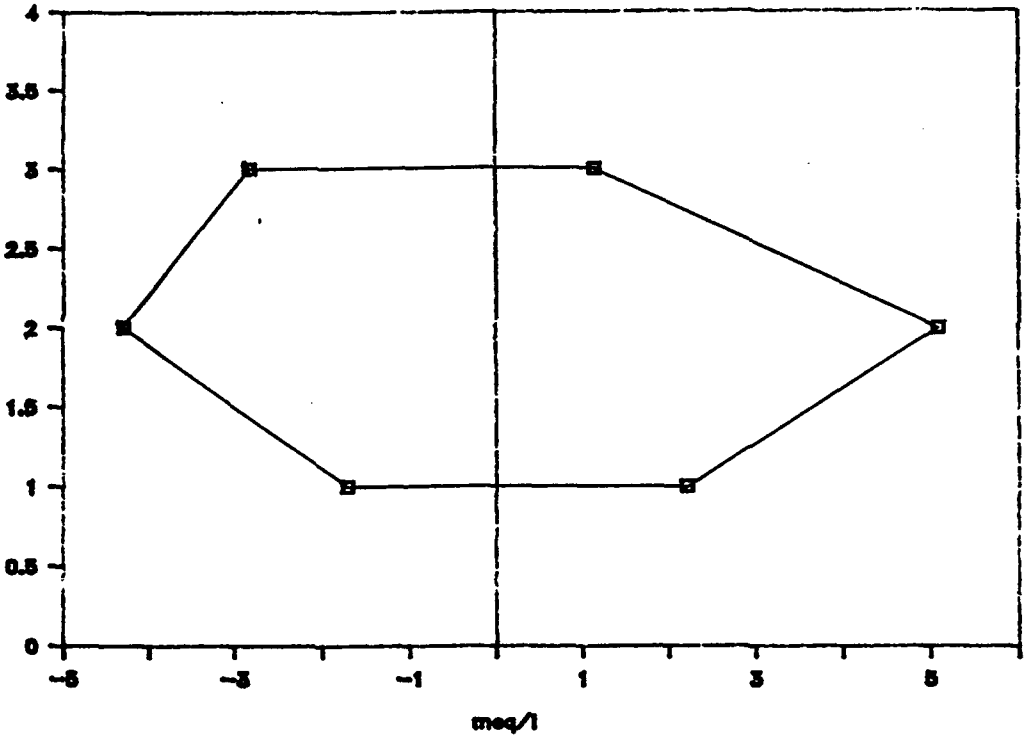
SW31001, 17-Apr-90



Ca HCO_3 type

SW08001, 18-Apr-90

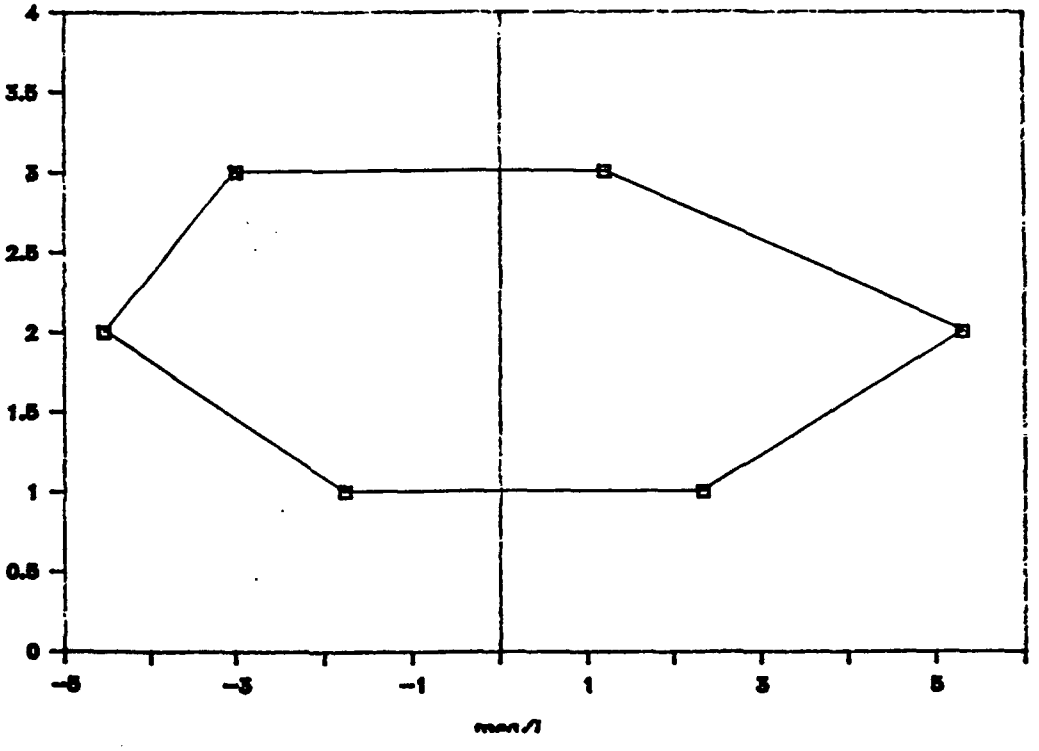
10



Ca HCO_3 type

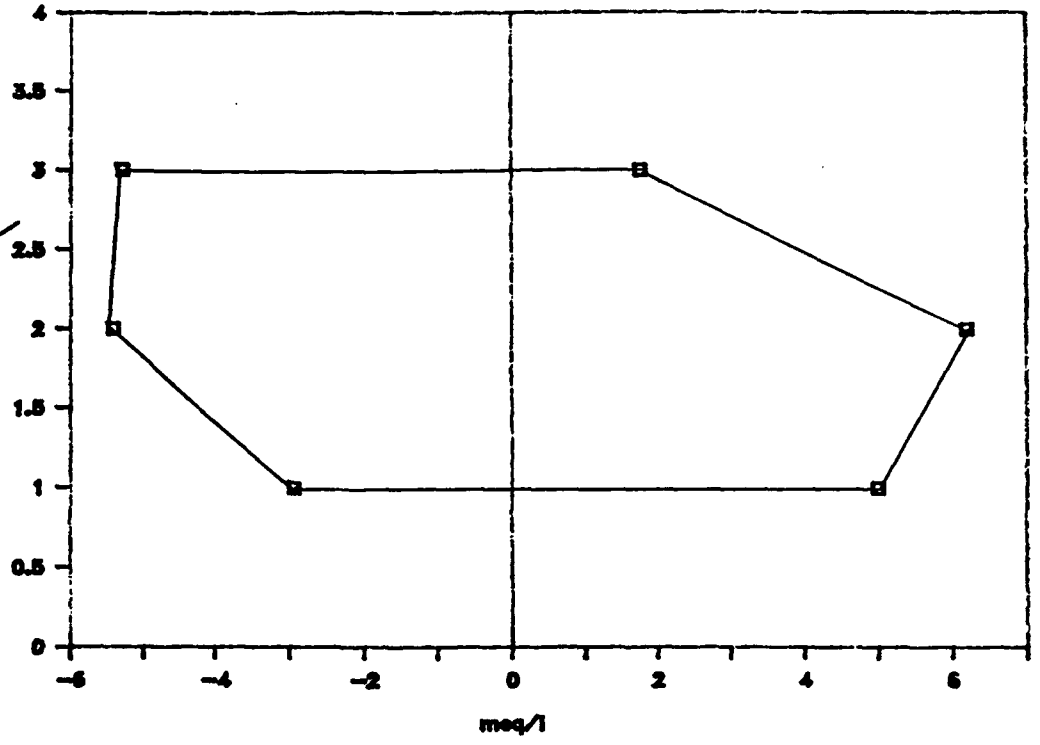
SW08003, 18-Apr-90

11



SW24002, 18-Apr-90

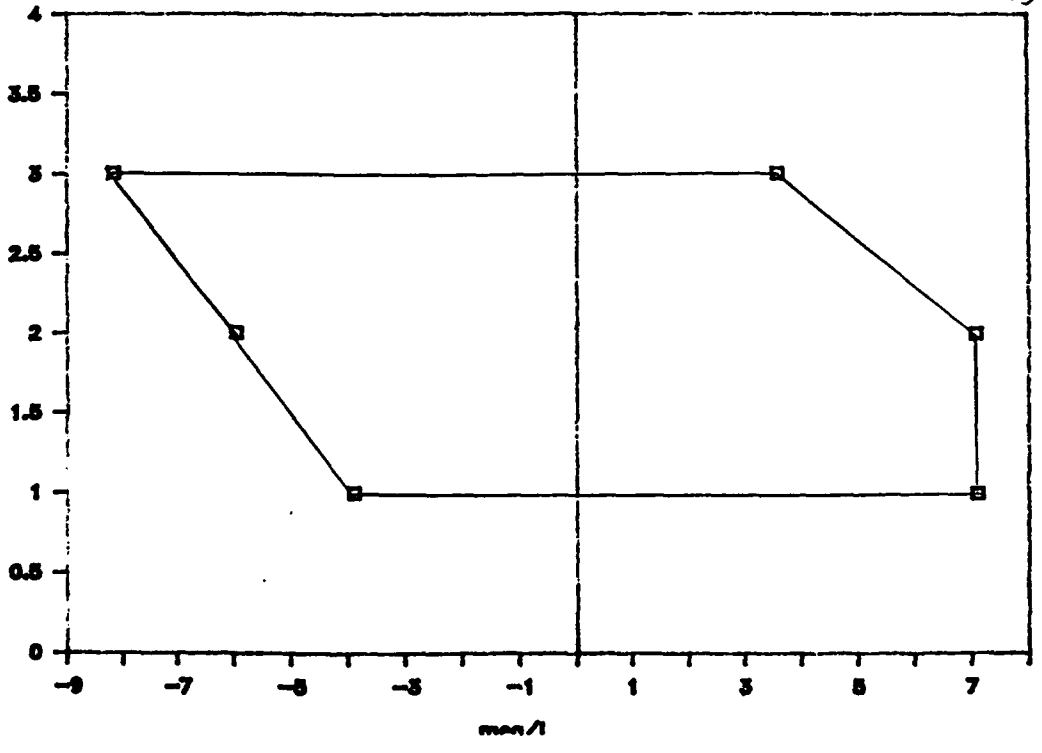
12



Na-Ca HCO_3 type

SW37001, 18-Apr-90

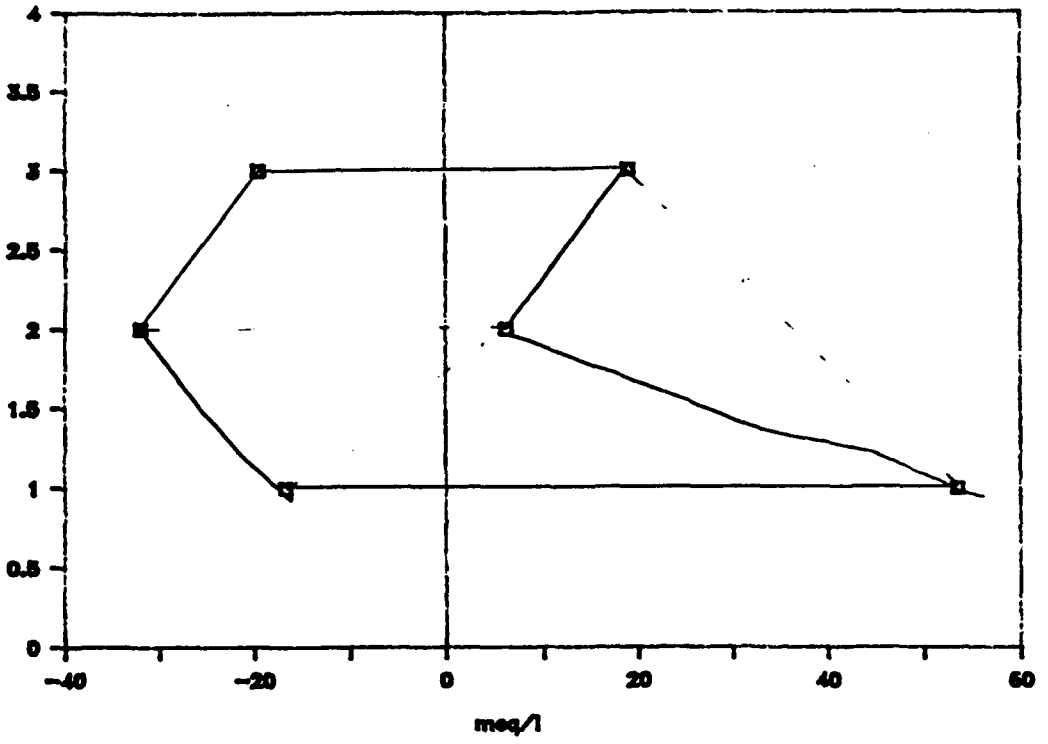
13



Na HCO_3 + SO_4 type

SW01002, 19-Apr-90

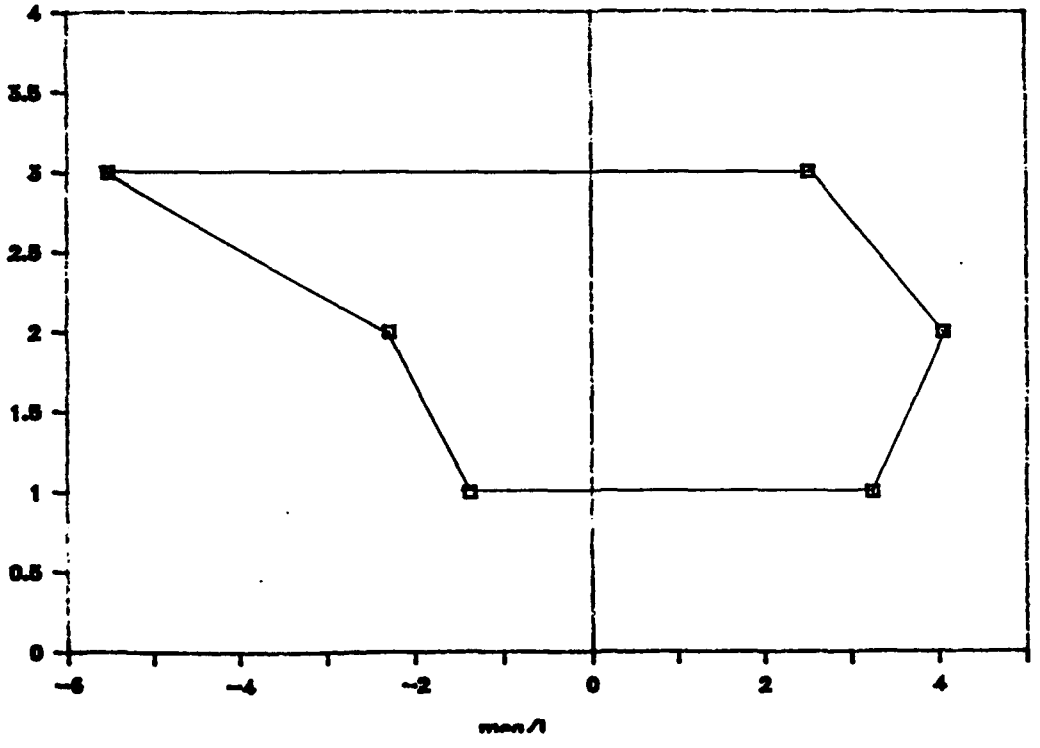
14



SO_4 type

SW02006, 19-Apr-90

15

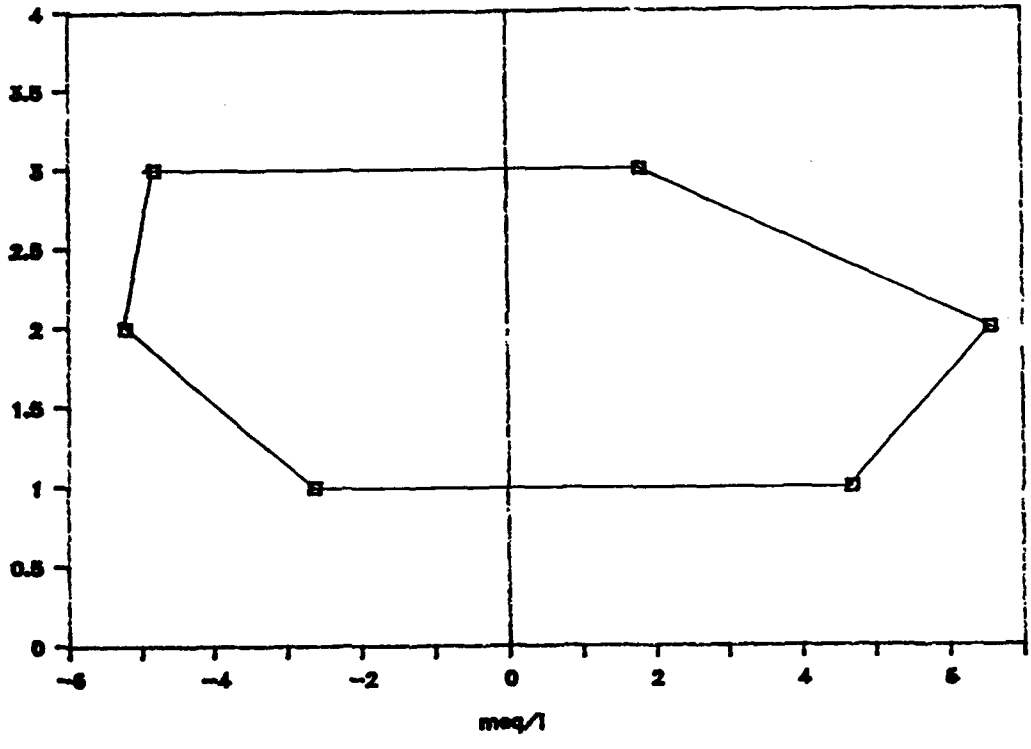


$NaHCO_3$ type

SW30002, 19-Apr-90

10

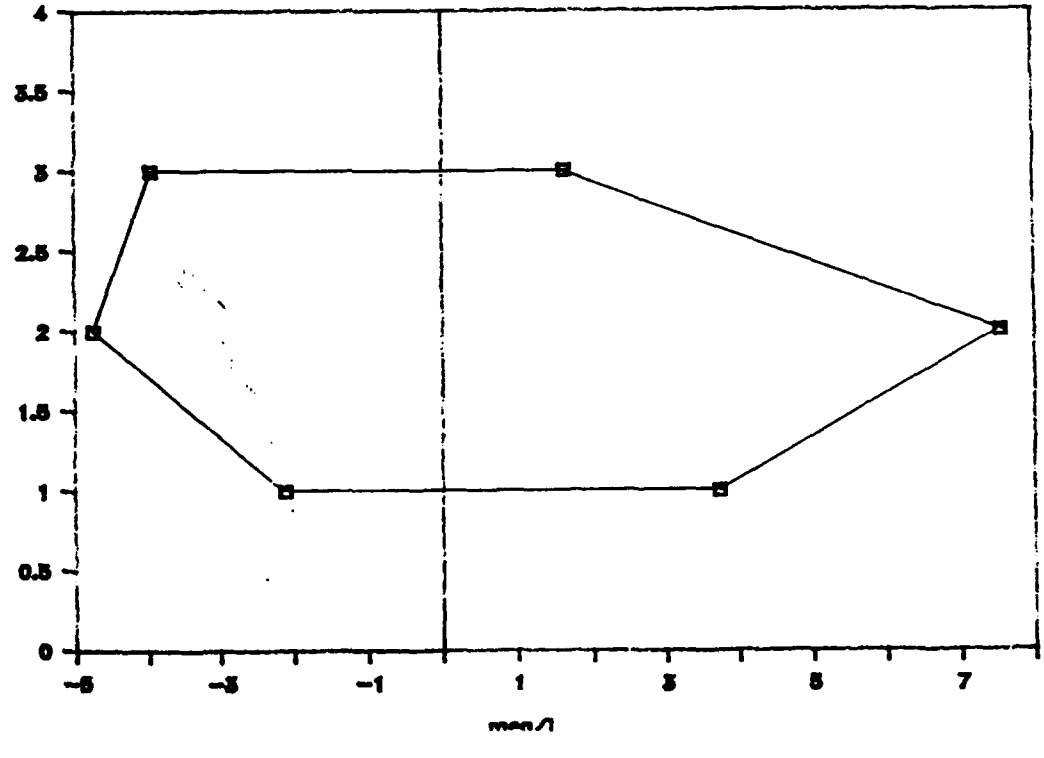
C - HCO_3 type



SW31002, 19-Apr-90

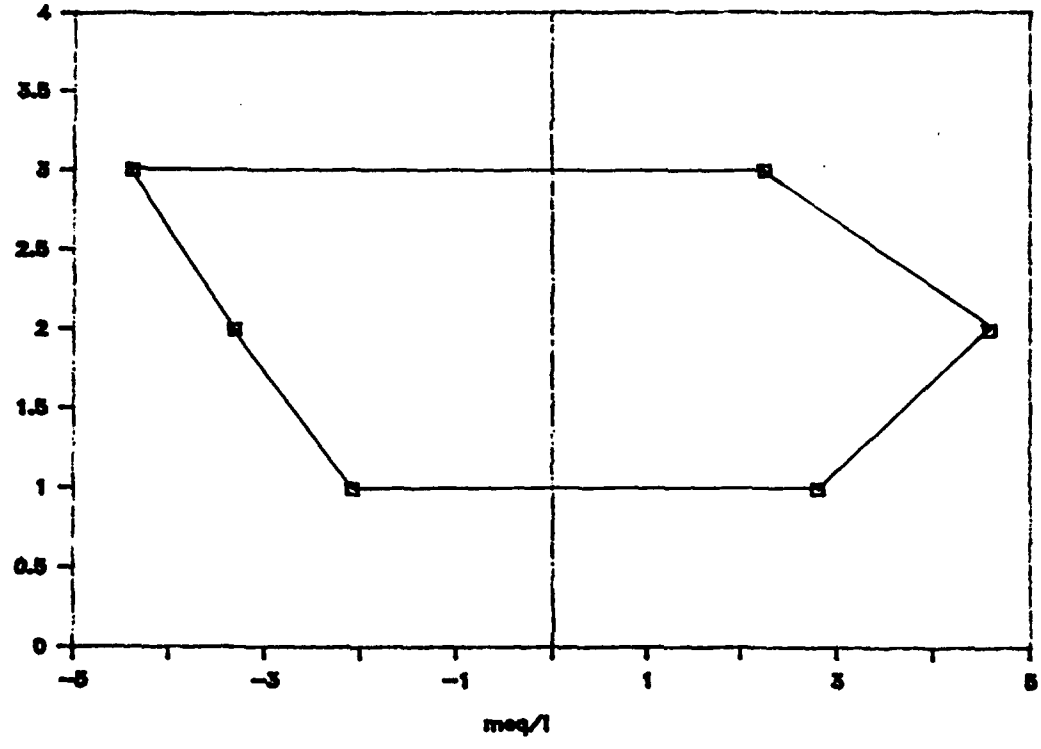
17

$CaHCO_3$



18

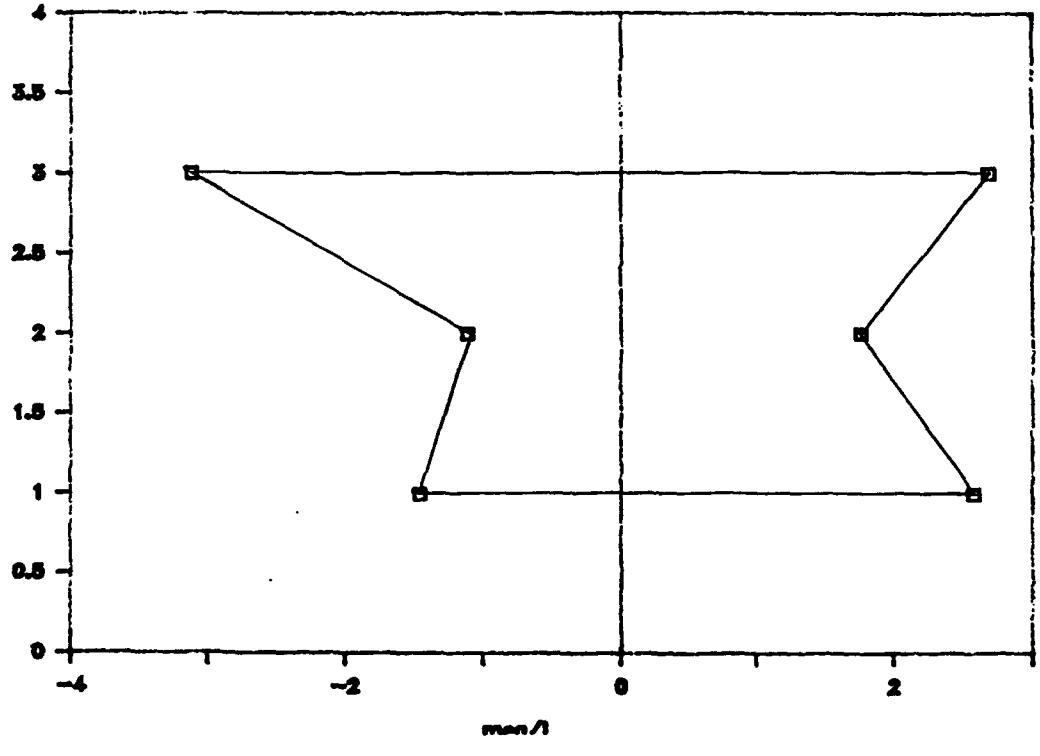
SW36001, 19-Apr-90



$NaHCO_3$ type

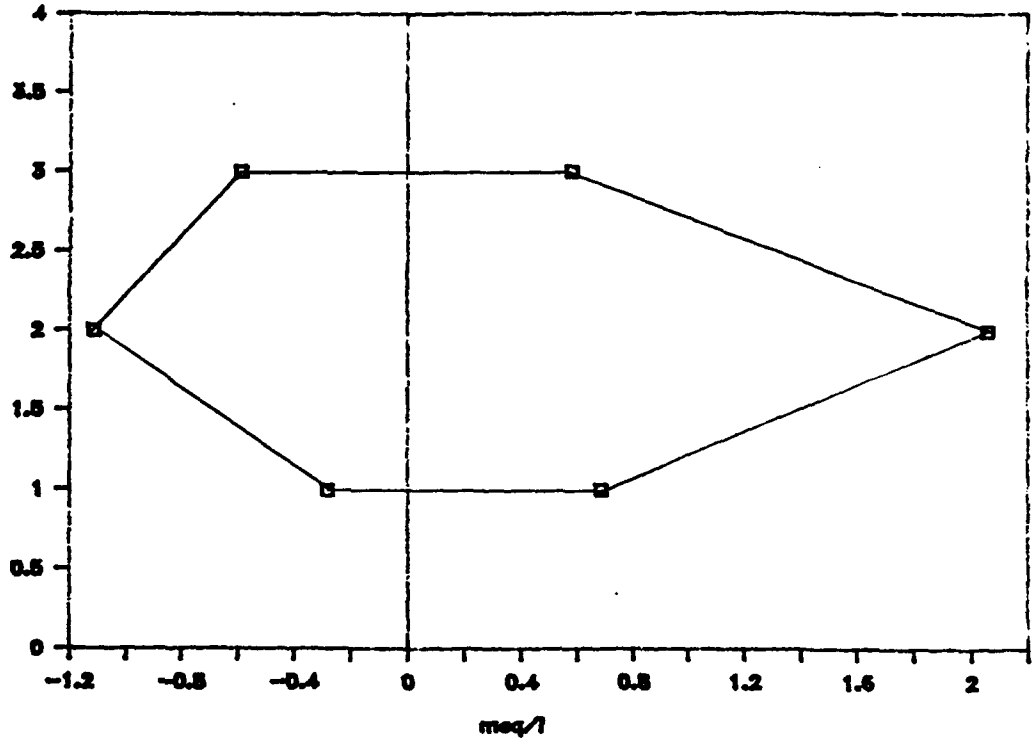
19

SW02006, 04-Sep-90

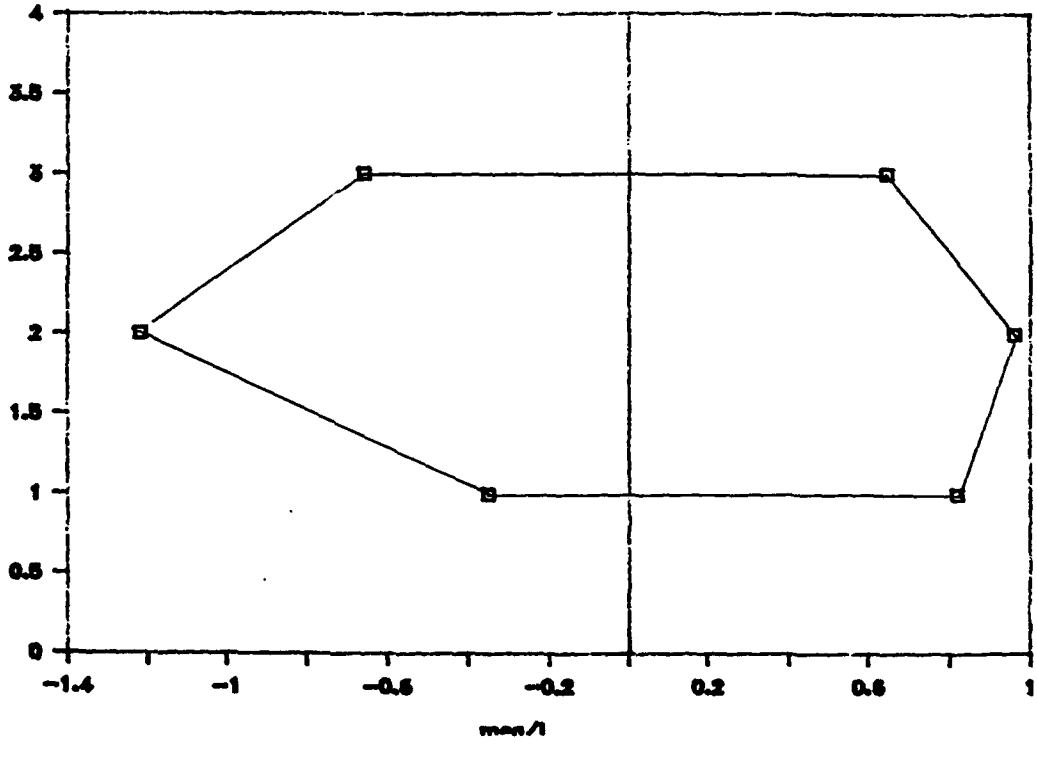


$NaClSO_4$ type

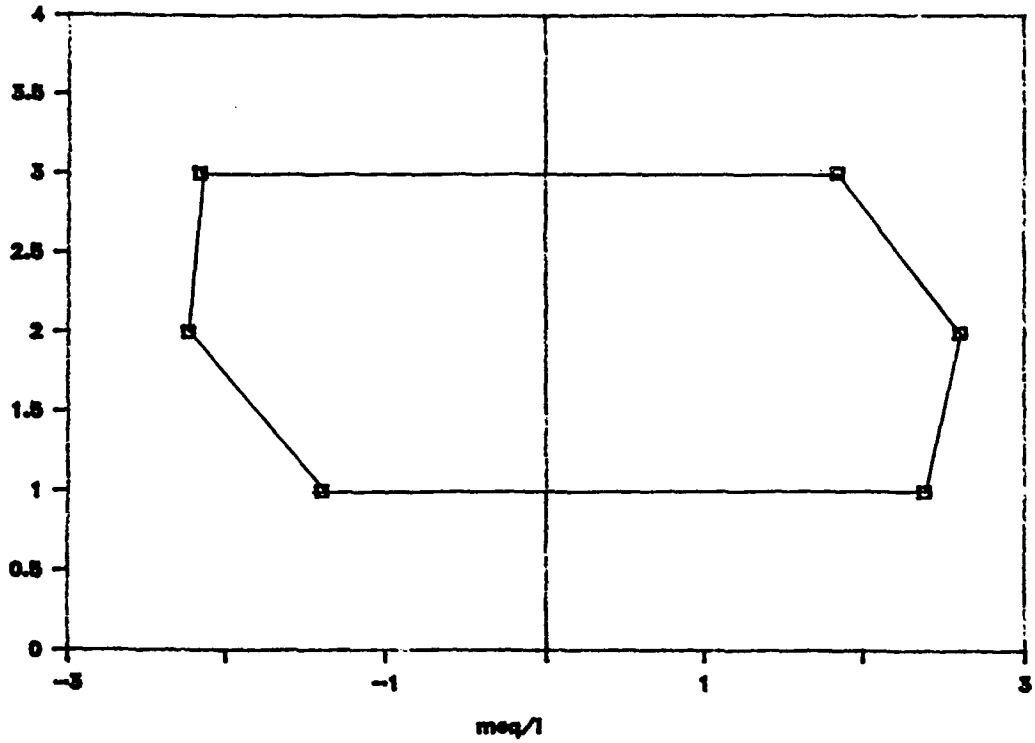
SW11001, 04-Sep-90



SW12002, 04-Sep-90

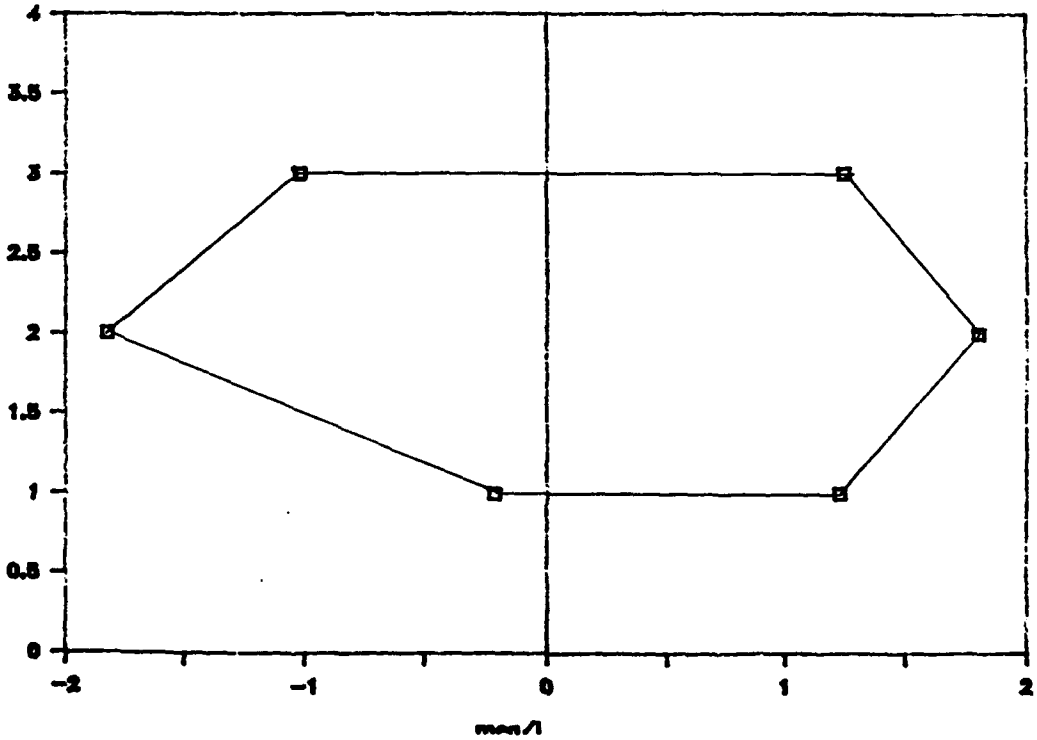


SW02001, 05-Sep-90



CaHCO3

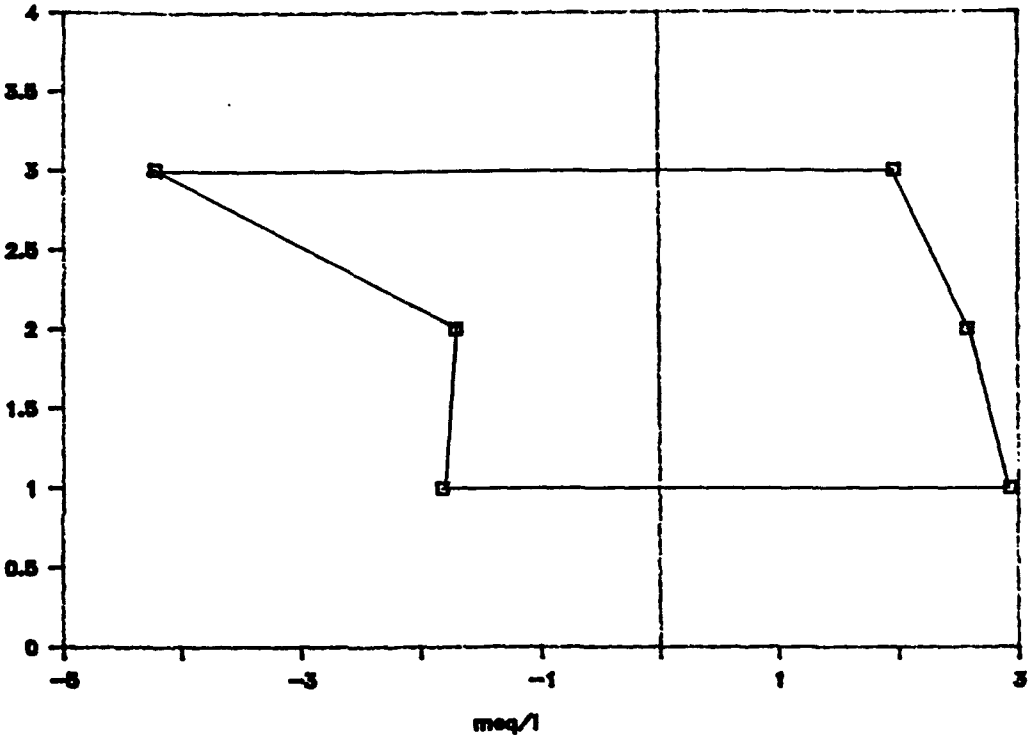
SW11002, 05-Sep-90



CaHCO3

2T

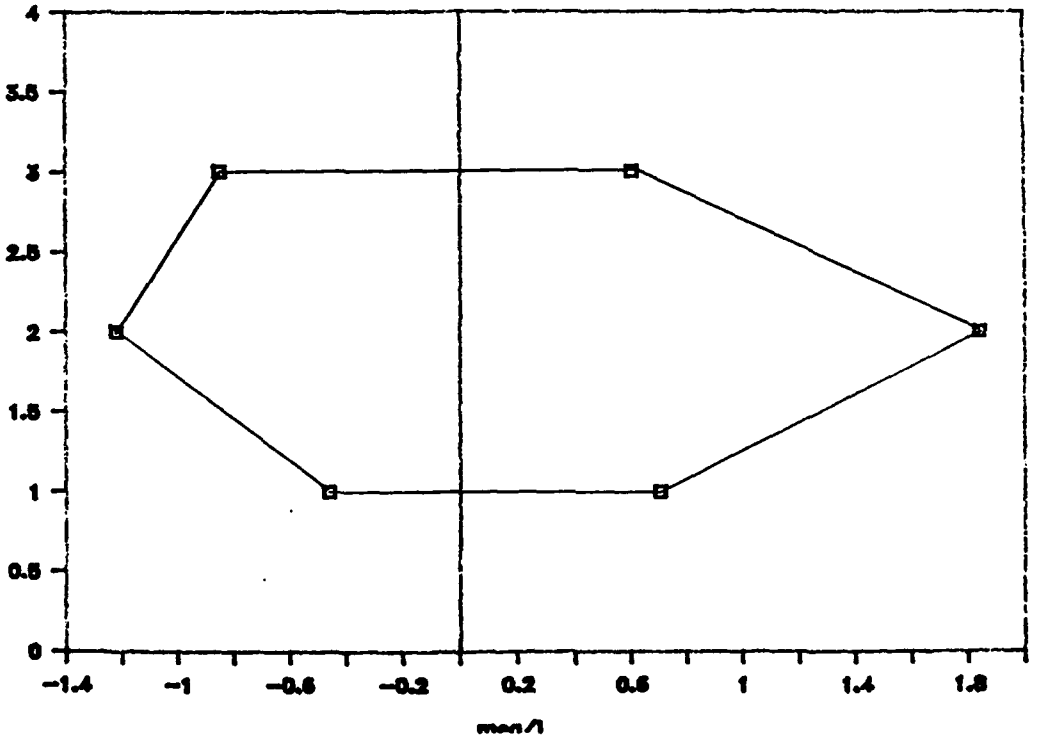
SW36001, 05-Sep-90



Na SO4

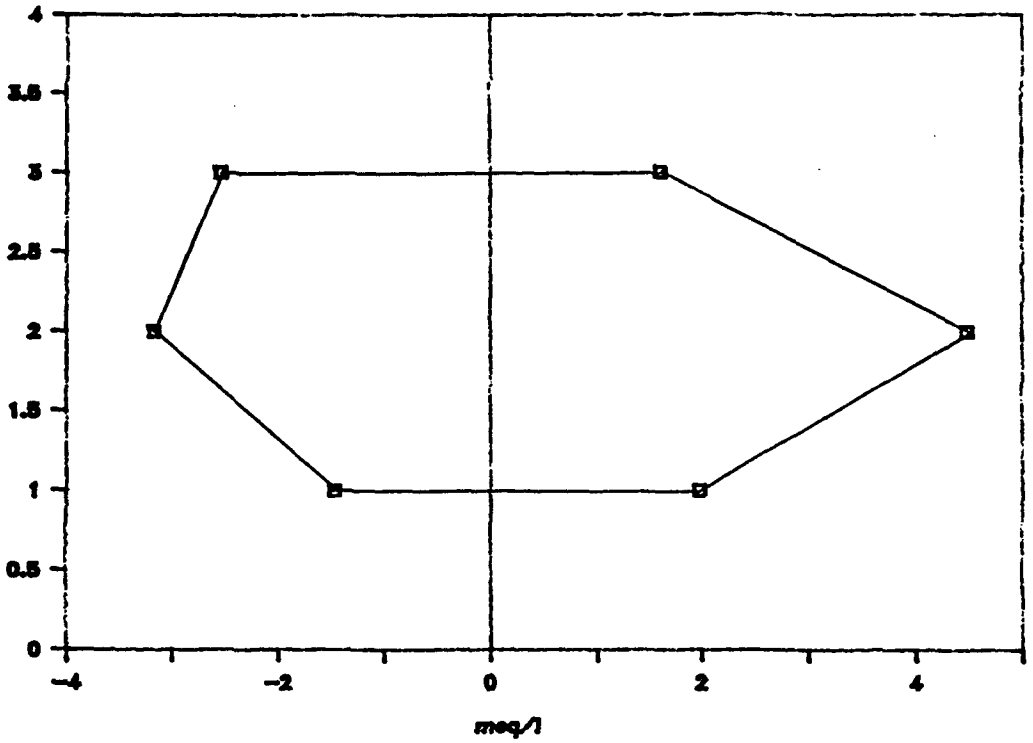
25

SW01001, 06-Sep-90

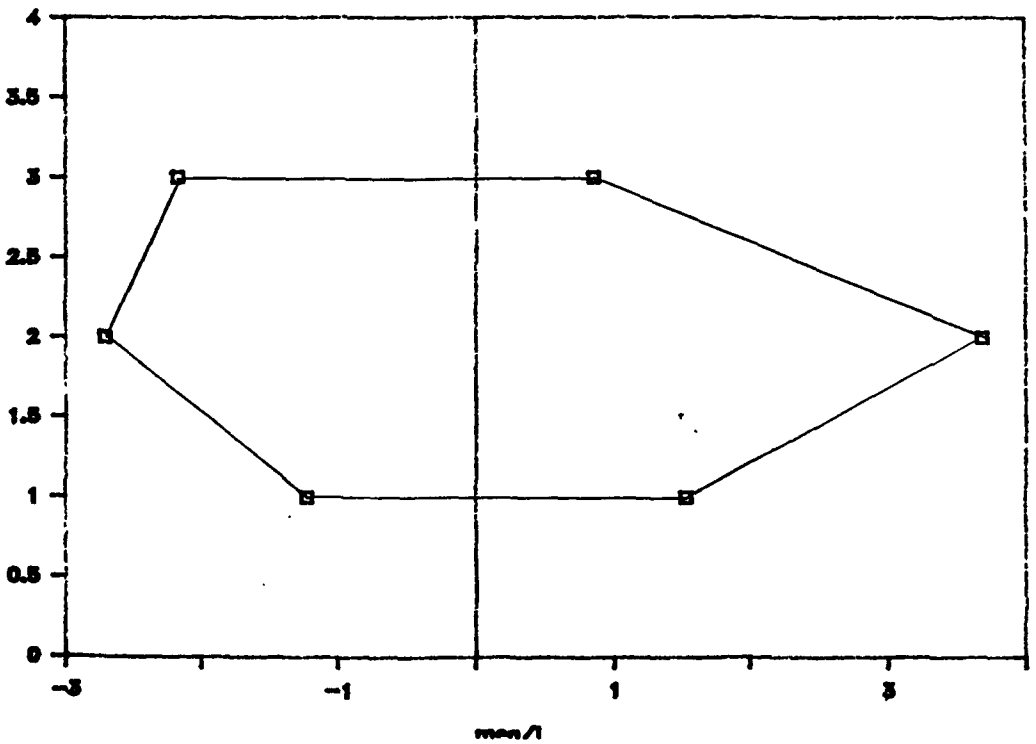


Cl - HCO3

SW12001, 06-Sep-90

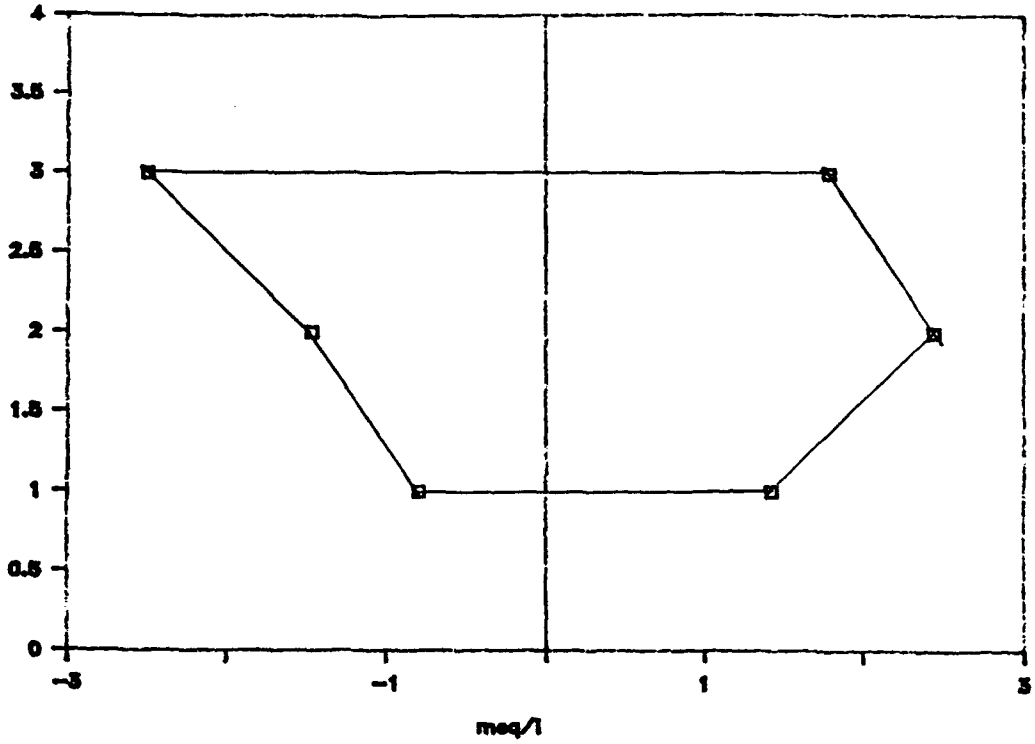


SW12005, 06-Sep-90



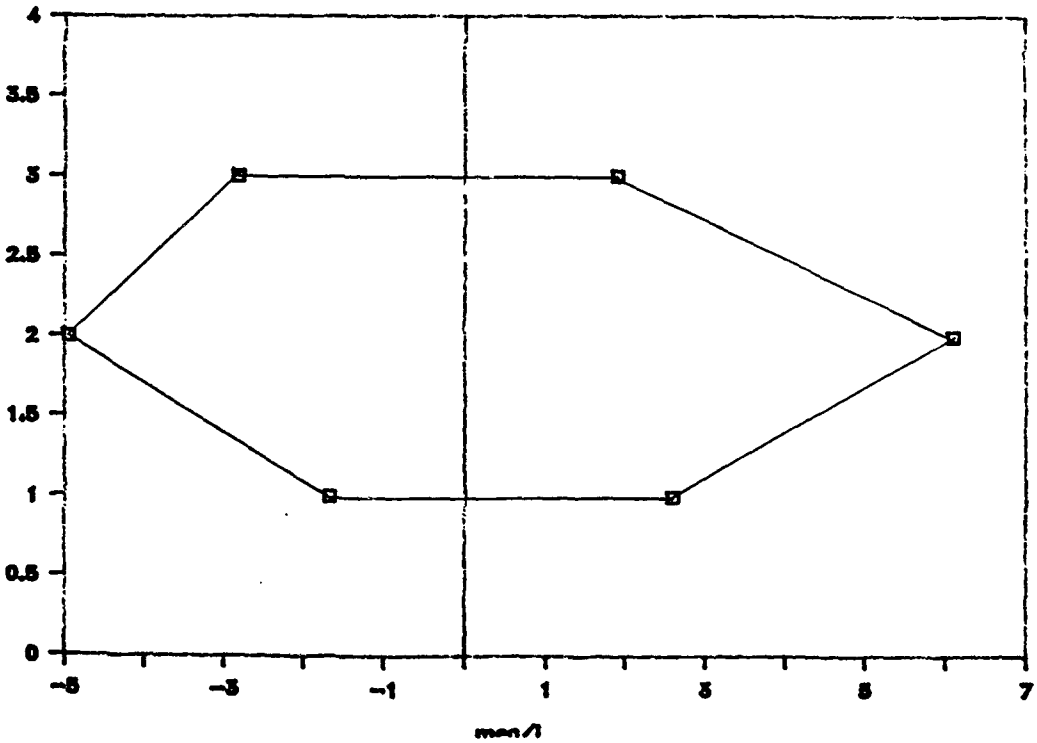
SW24001, 06-Sep-90

Na HCO_3

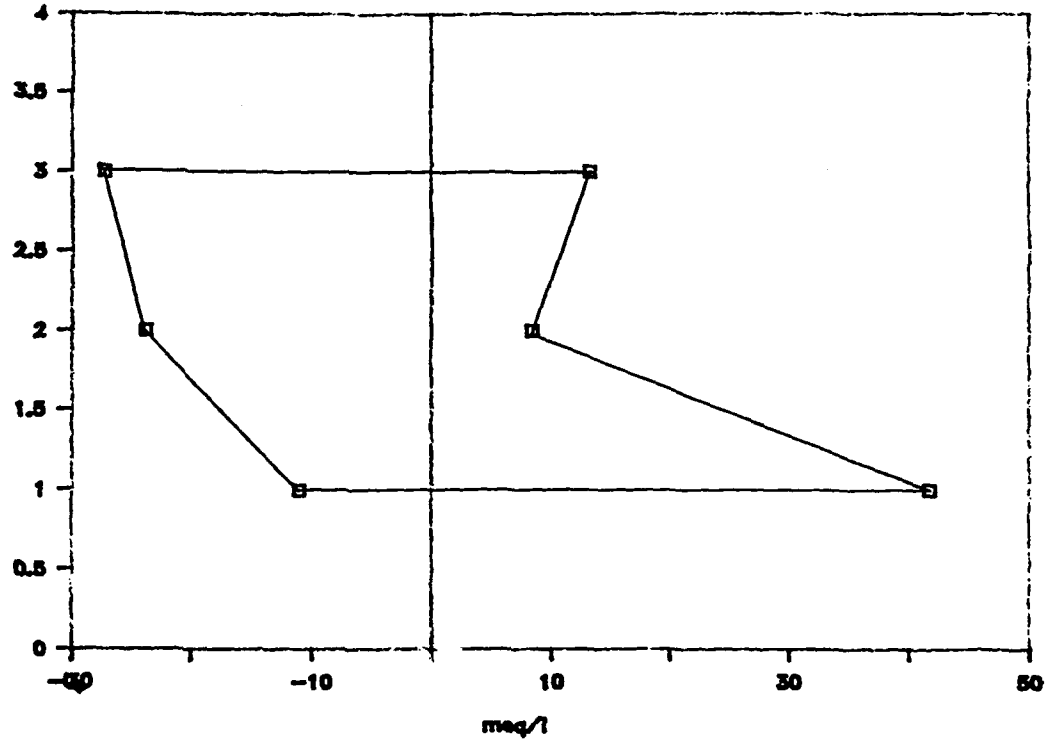


SW08003, 07-Sep-90

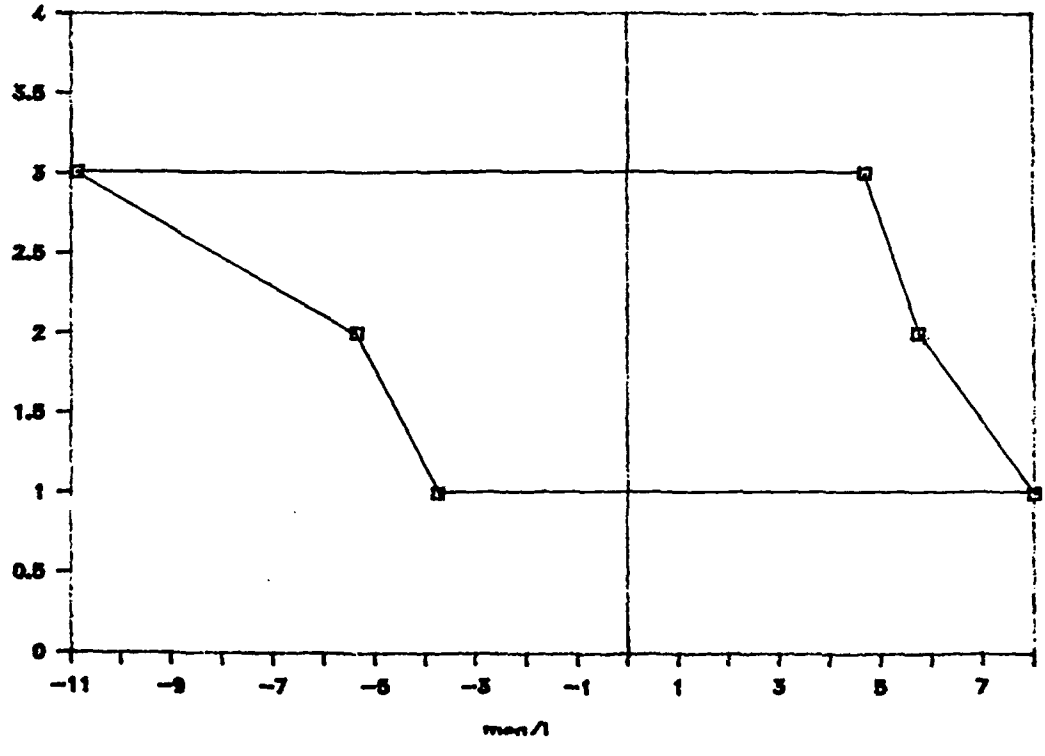
Cl . HCO_3



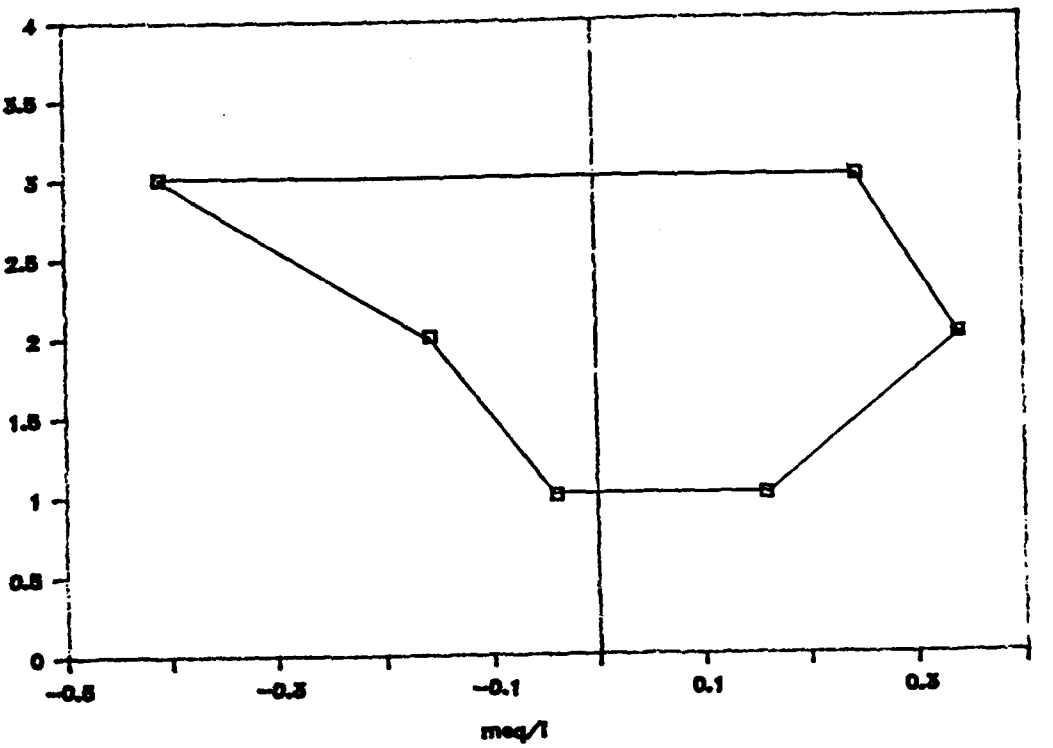
SW24002, 07-Sep-90



SW37001, 07-Sep-90

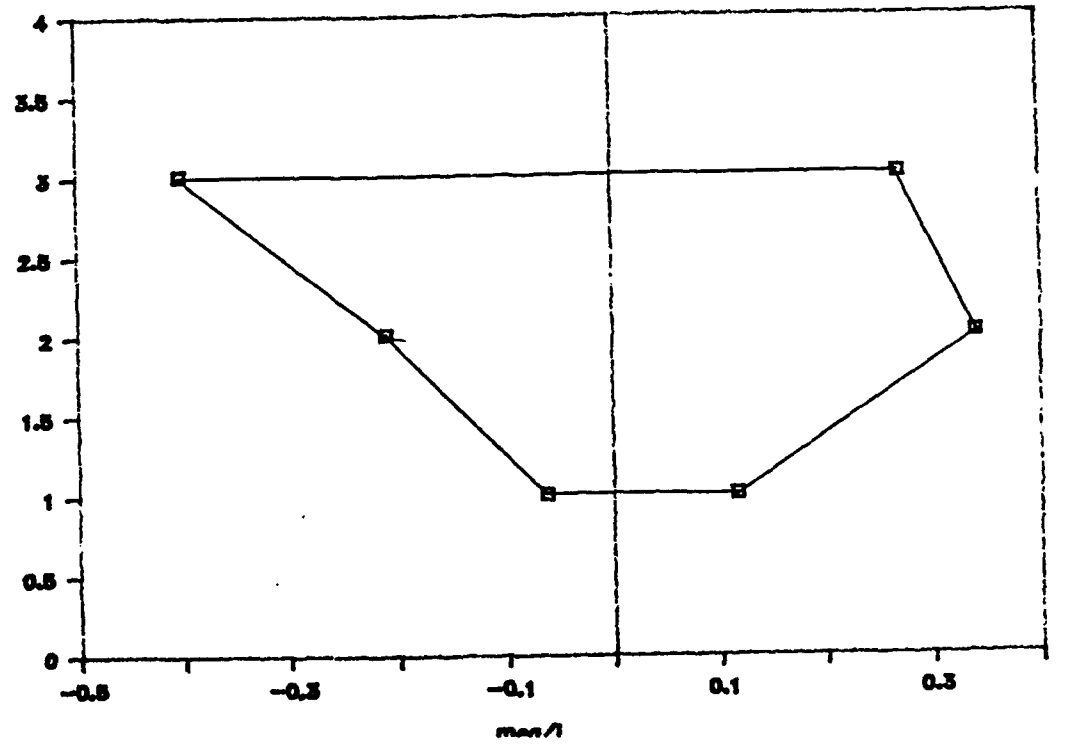


SW1001, ST 06-Mar-90



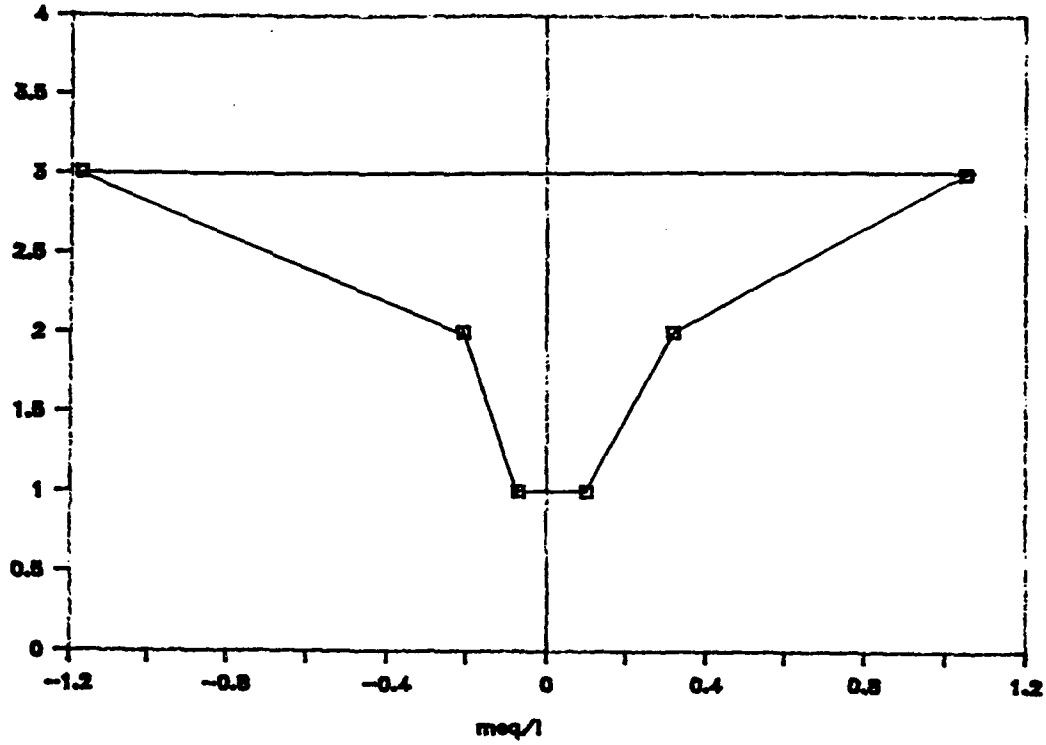
$NaHCO_3$

SW11002, ST 06-Mar-90



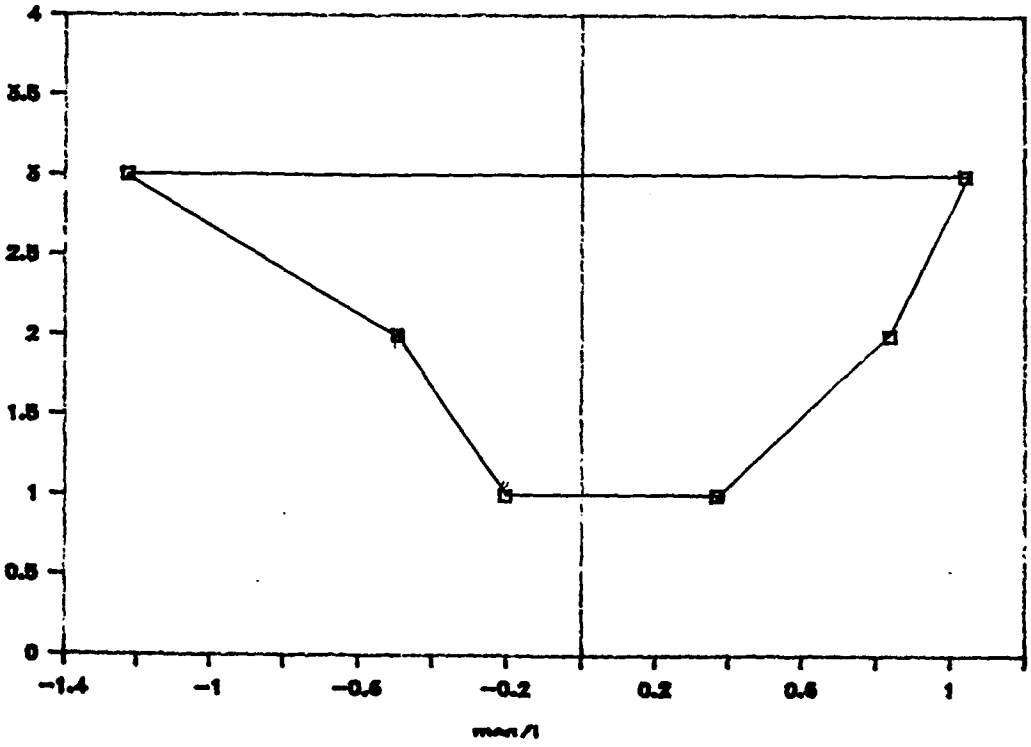
$NaHCO_3$

SW12004ST, 08-Mar-90



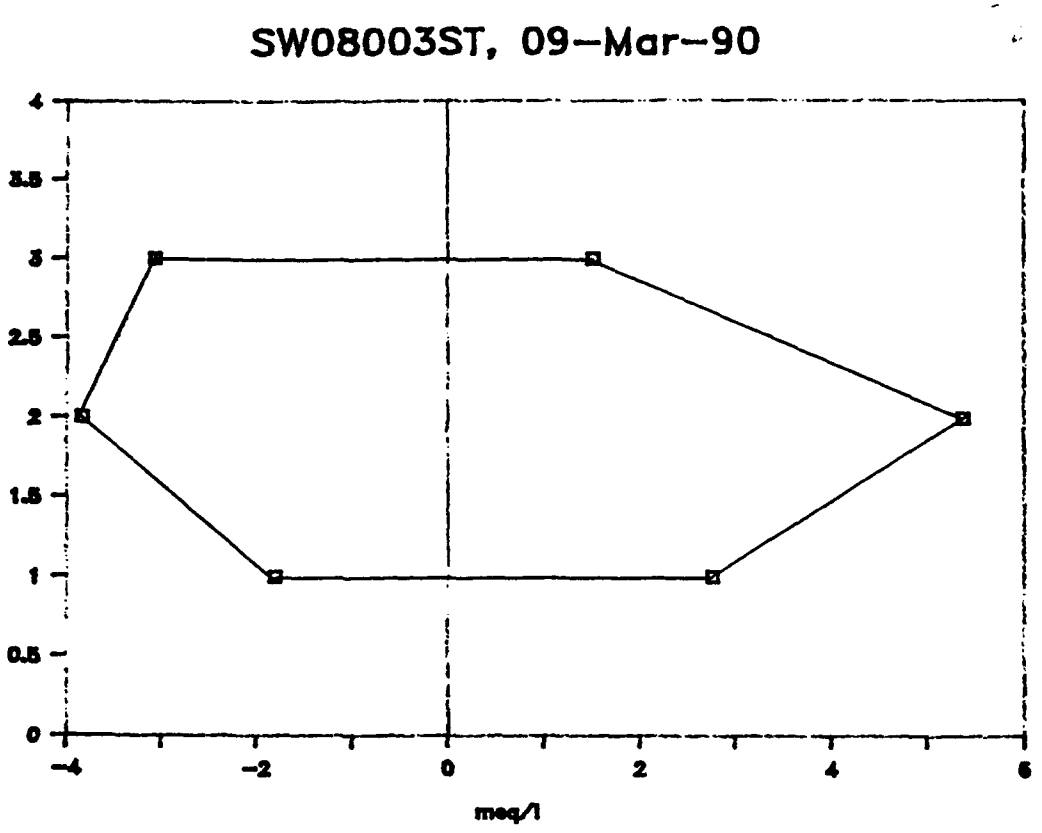
NaCl

SW12005ST, 08-Mar-90

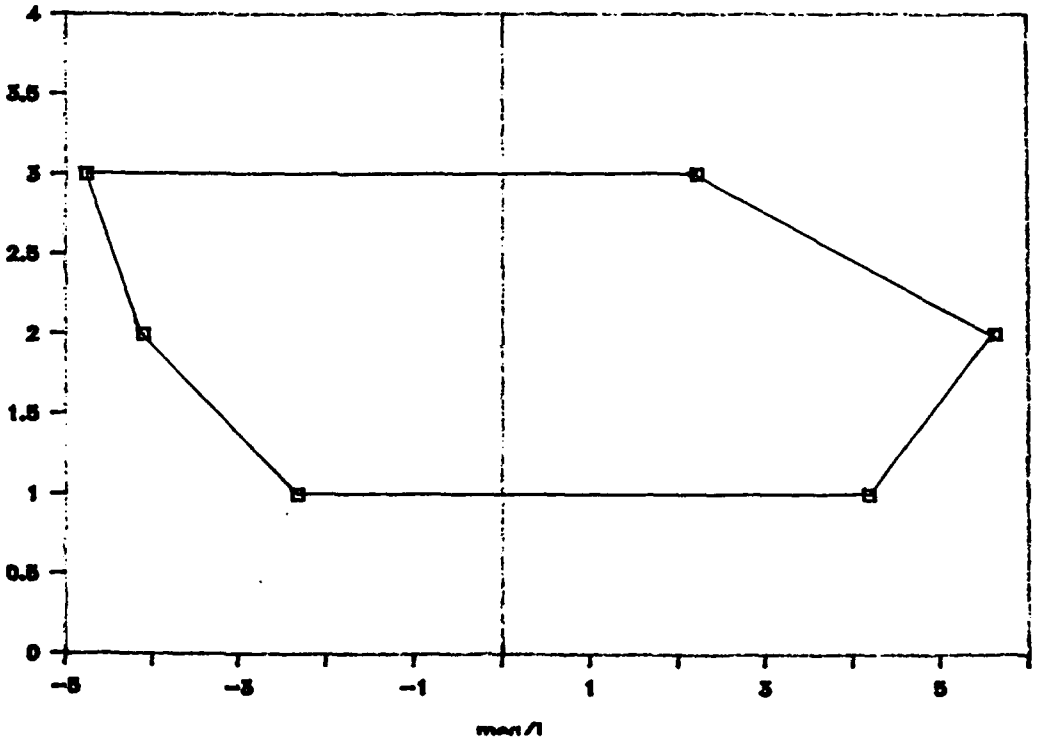


NaCl

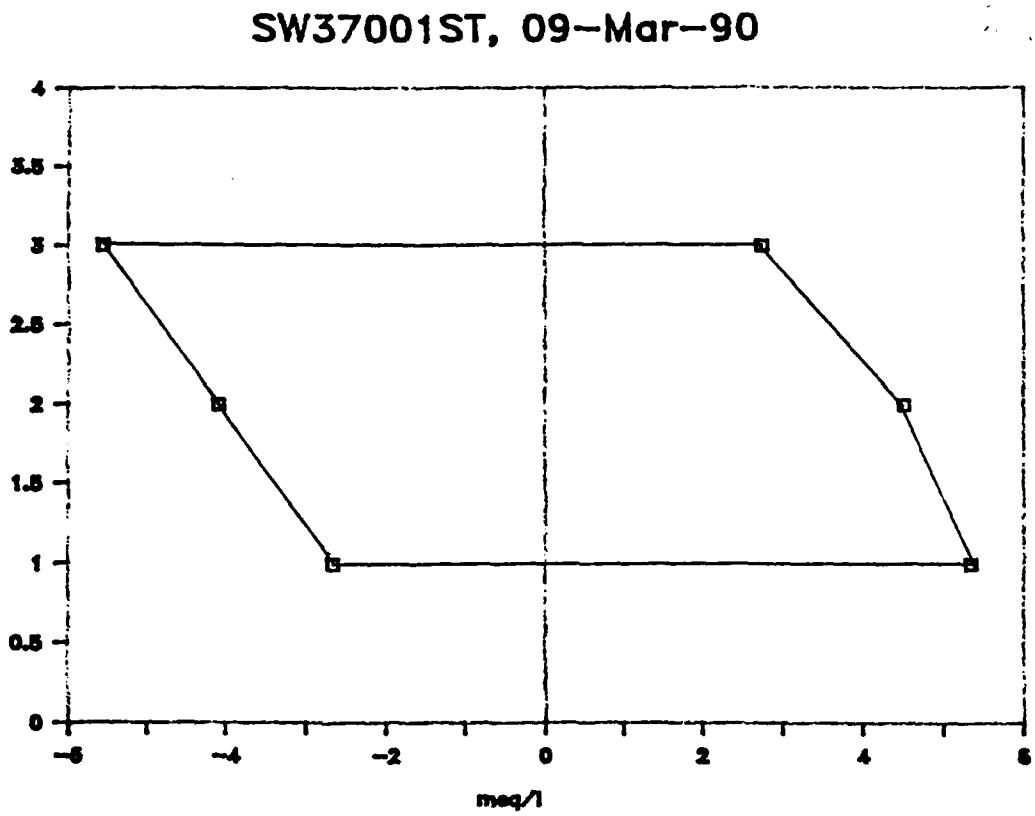
Ca HCO_3



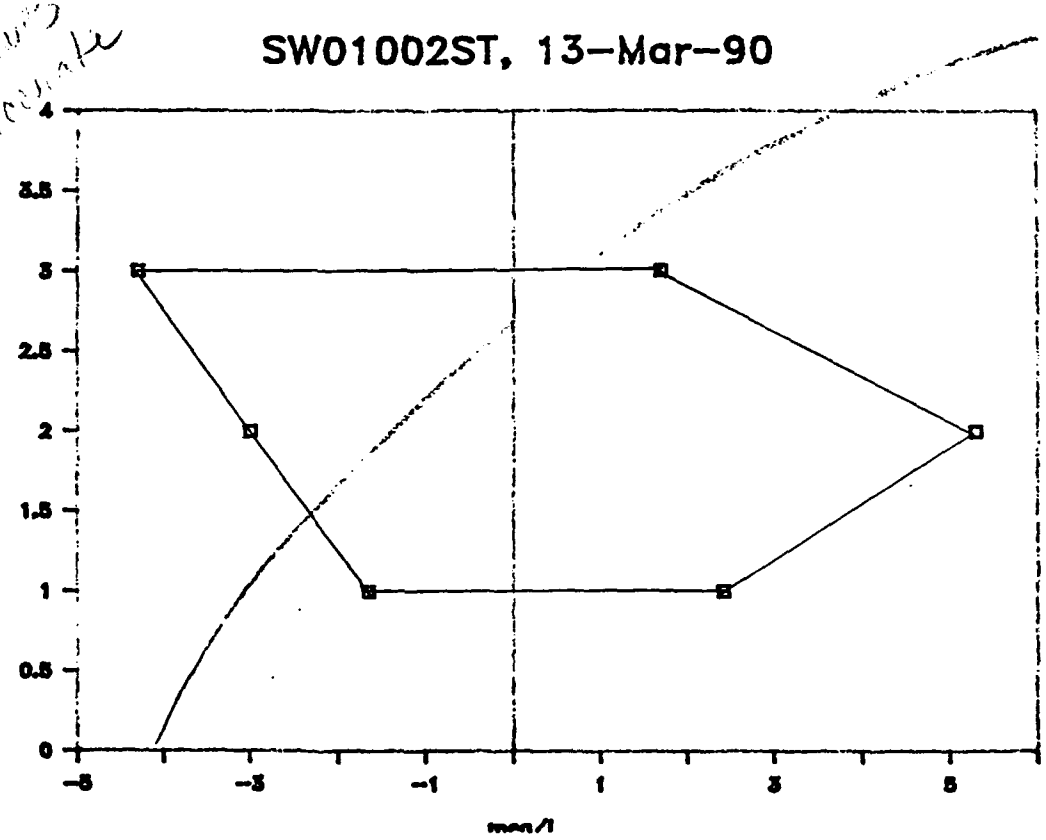
Na HCO_3



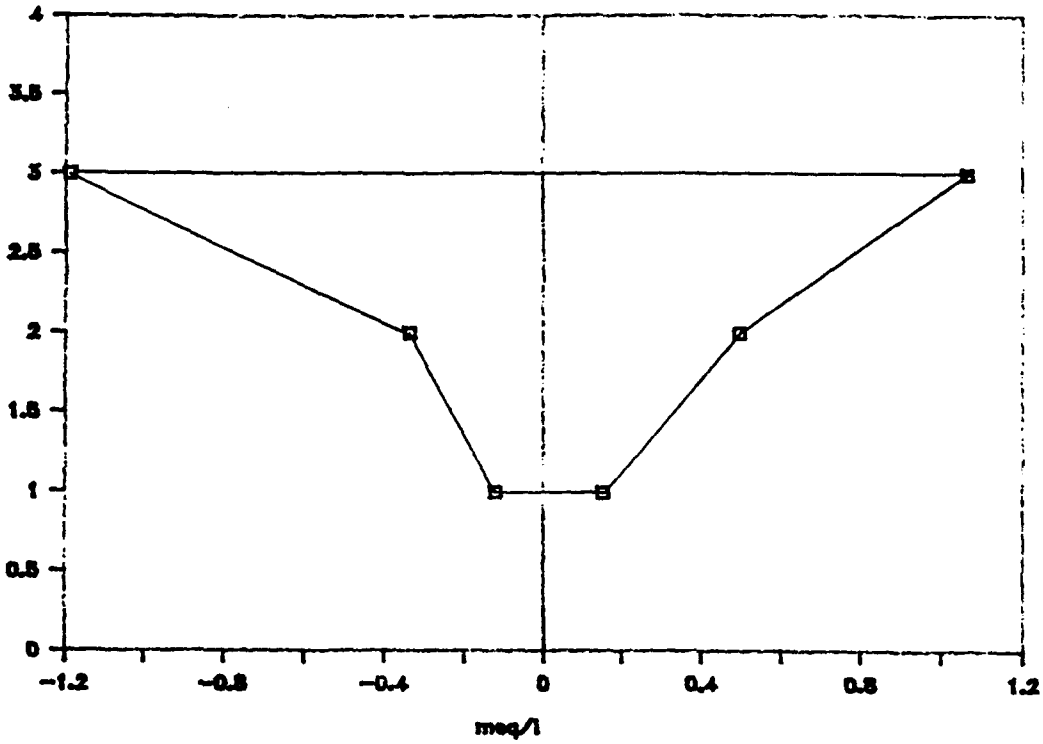
Na SO4



CO3+HCO3 Values are not accurate

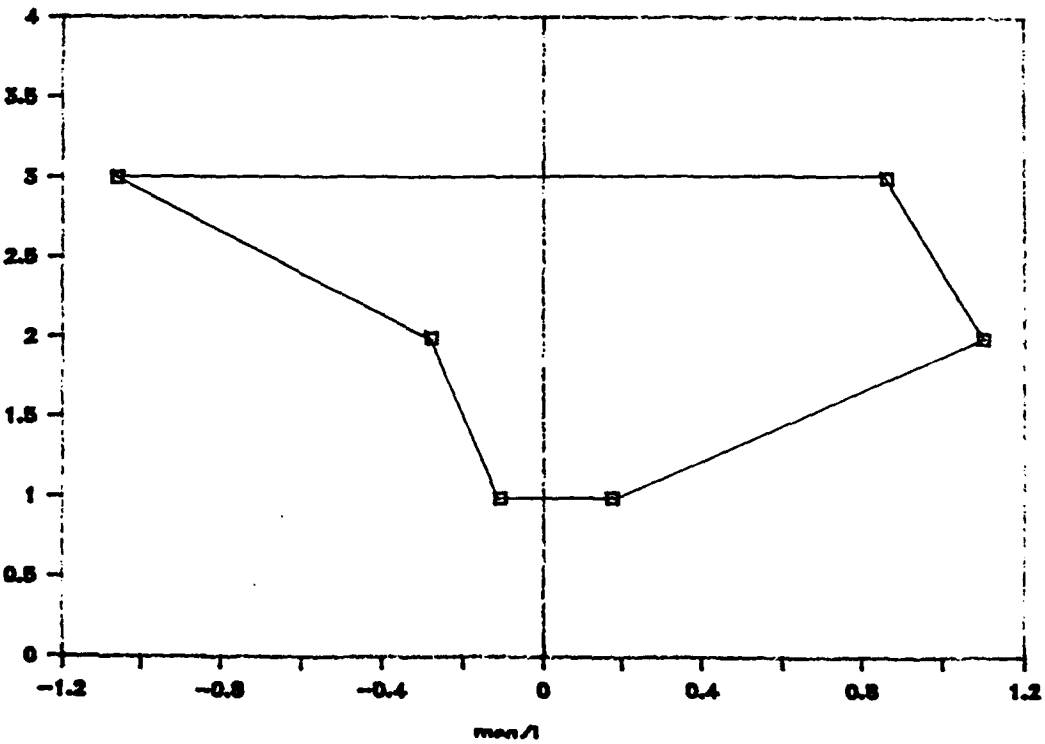


SW11001ST2, 13-Mar-90



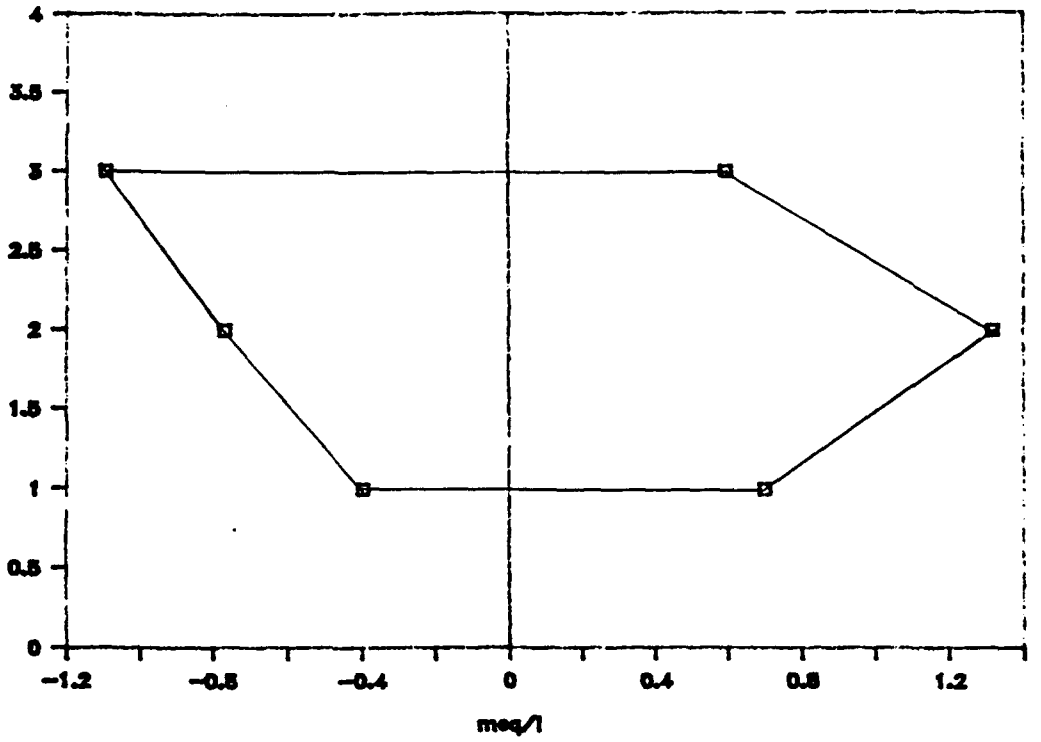
NaCl

SW11002ST2, 13-Mar-90



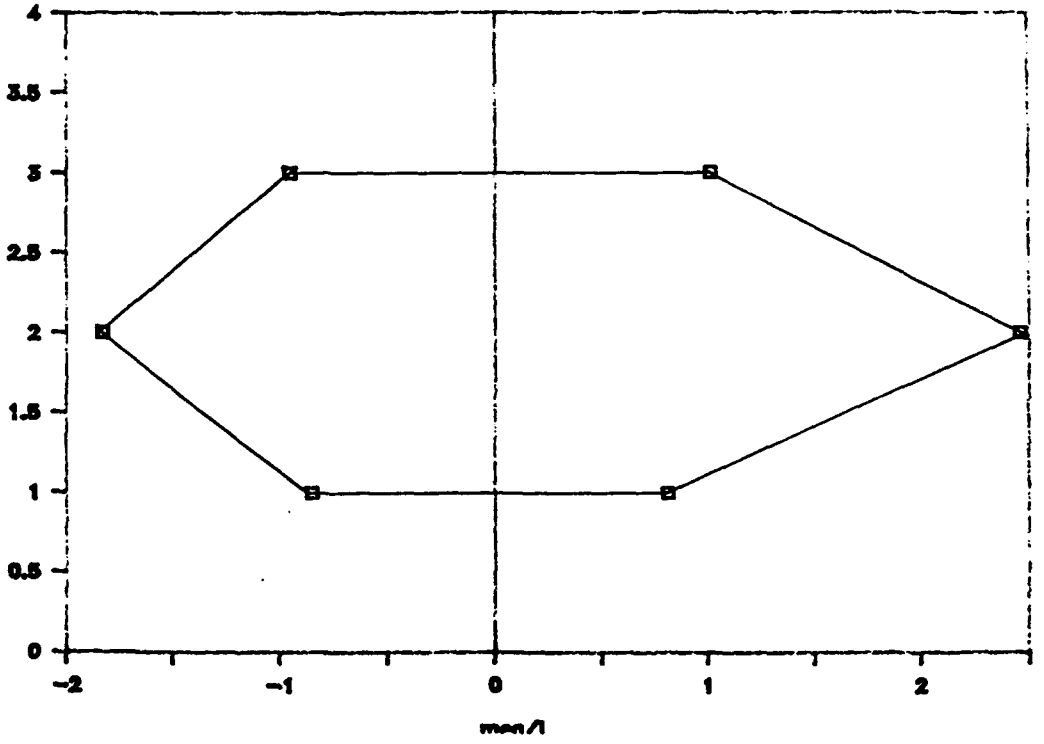
$NaHCO_3$

SW12005ST2, 13-Mar-90



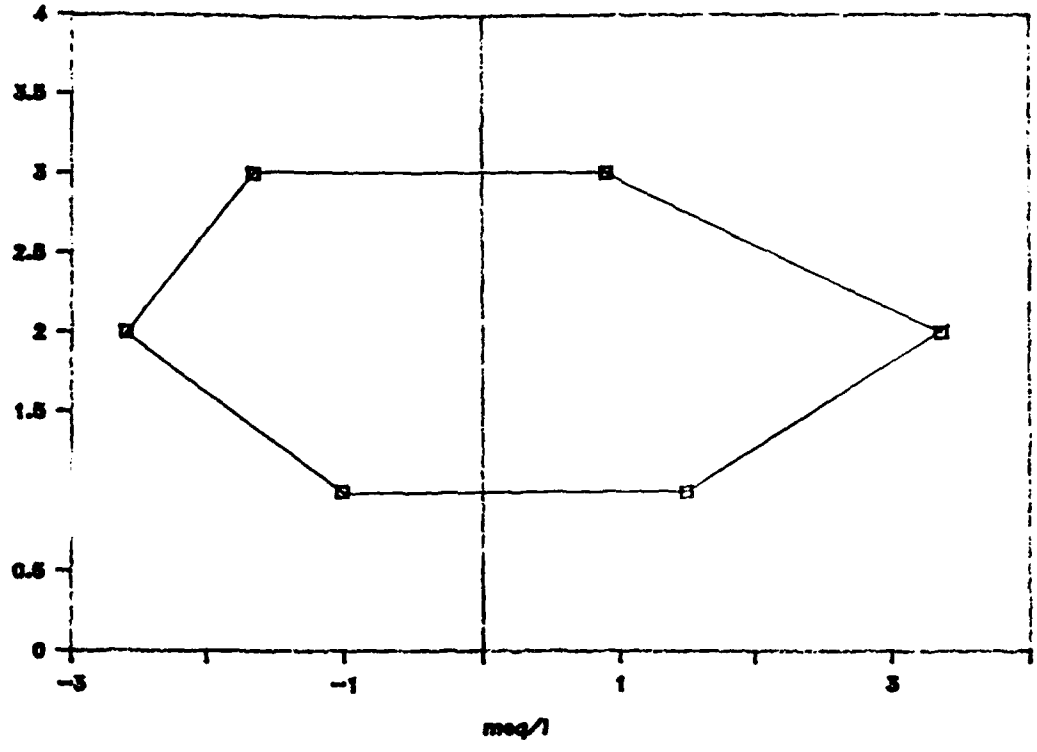
Na HCO_3

SW26001ST, 13-Mar-90



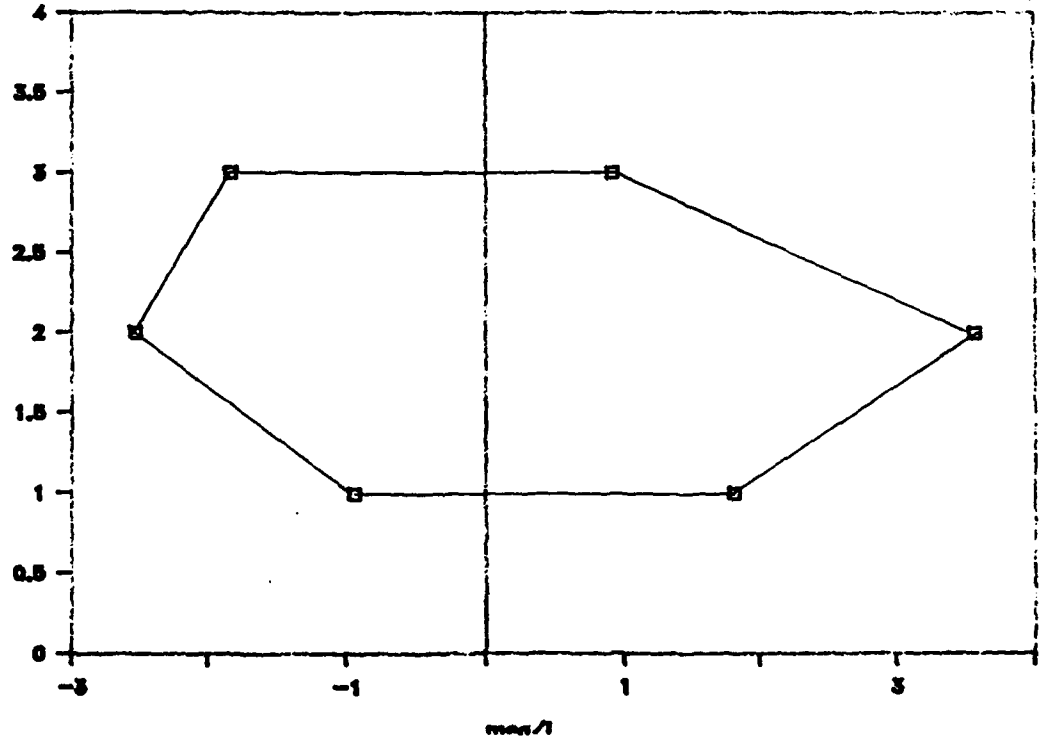
Ca HCO_3

SW08003ST2, 30-MaY-90



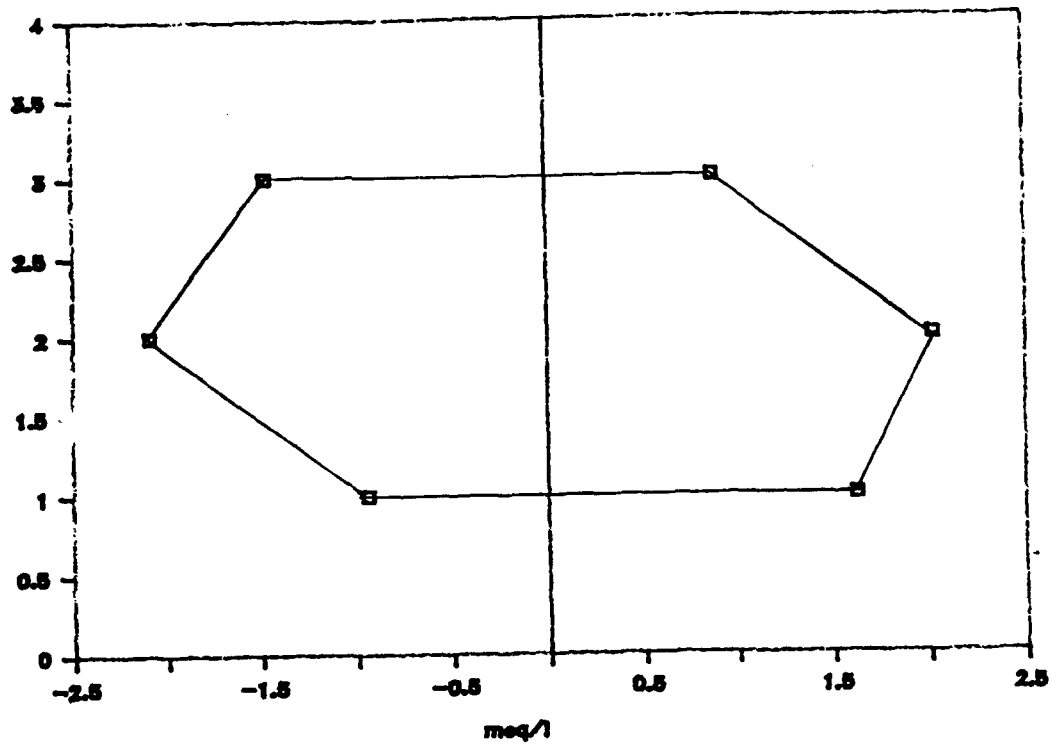
Ca HCO_3

SW08003ST3, 10-Jul-90



C. HCO_3

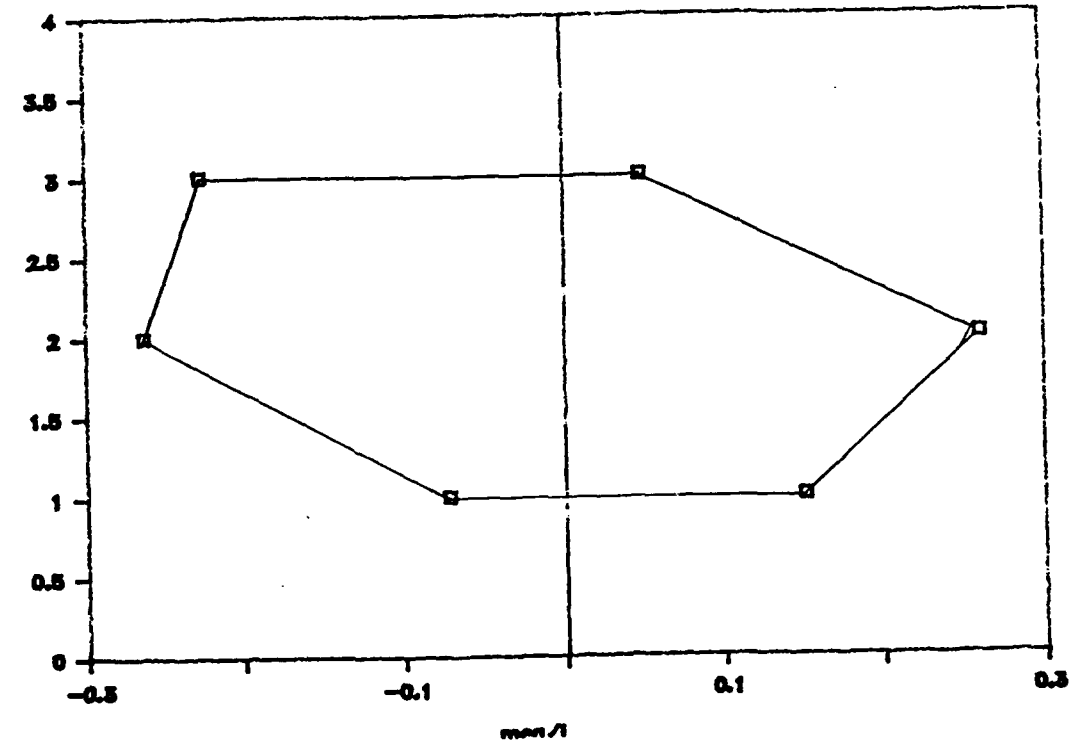
SW06002, 18-Jul-90



C.HCO3

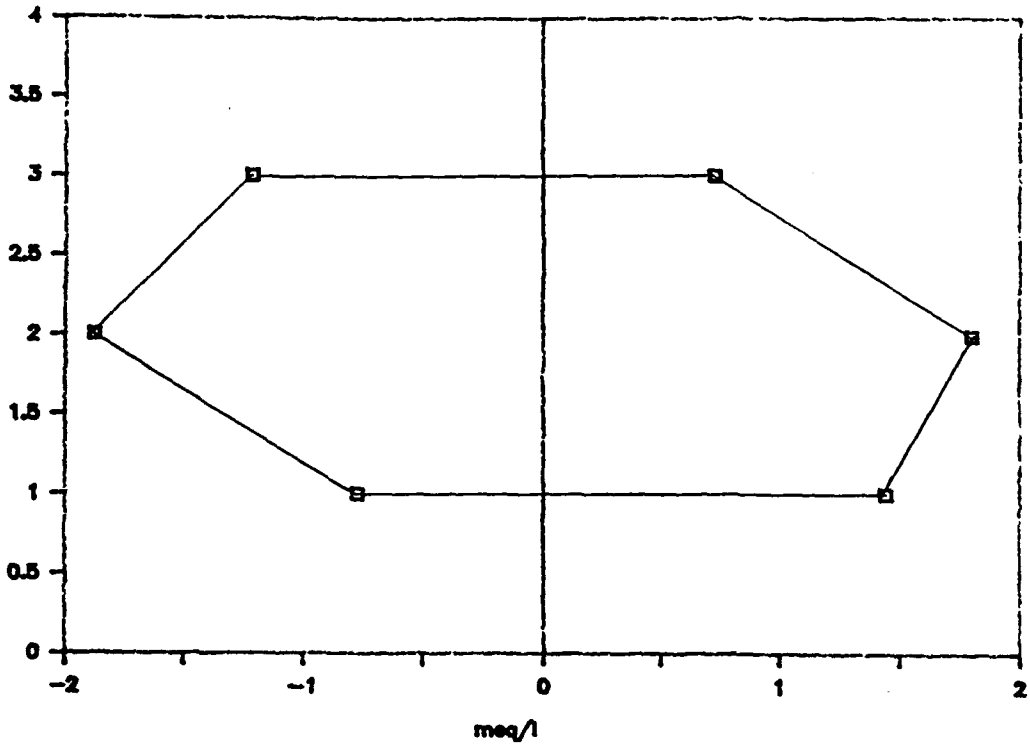
SW120006ST, 21-Jul-90

17



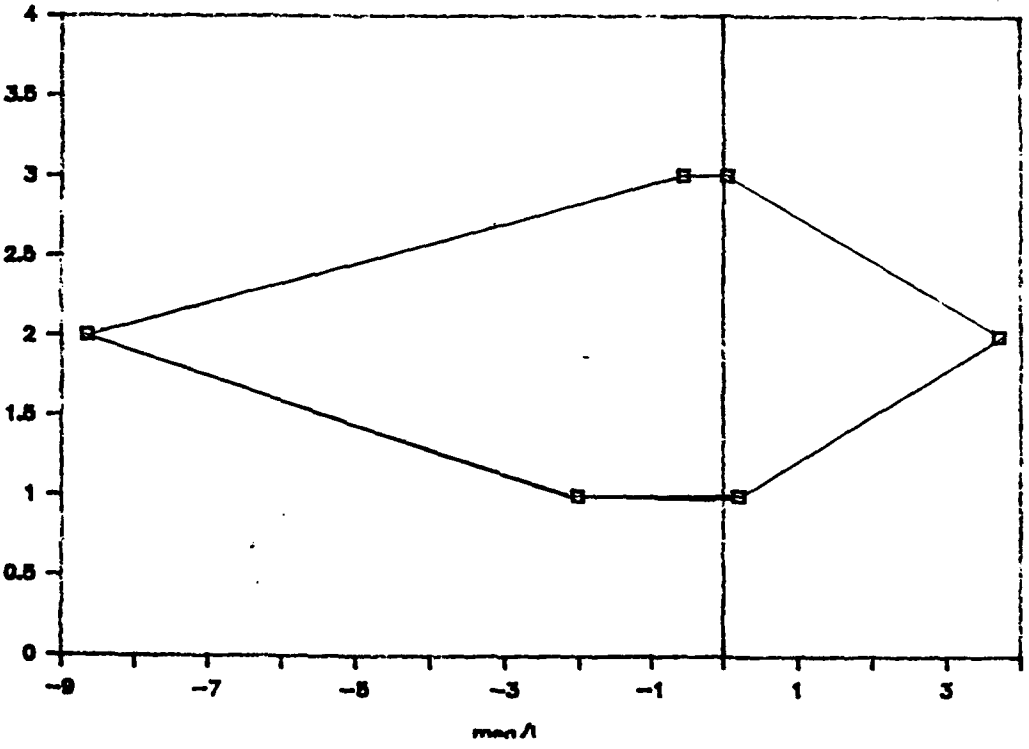
C.HCO3

SW06002ST1, 27-Jul-90



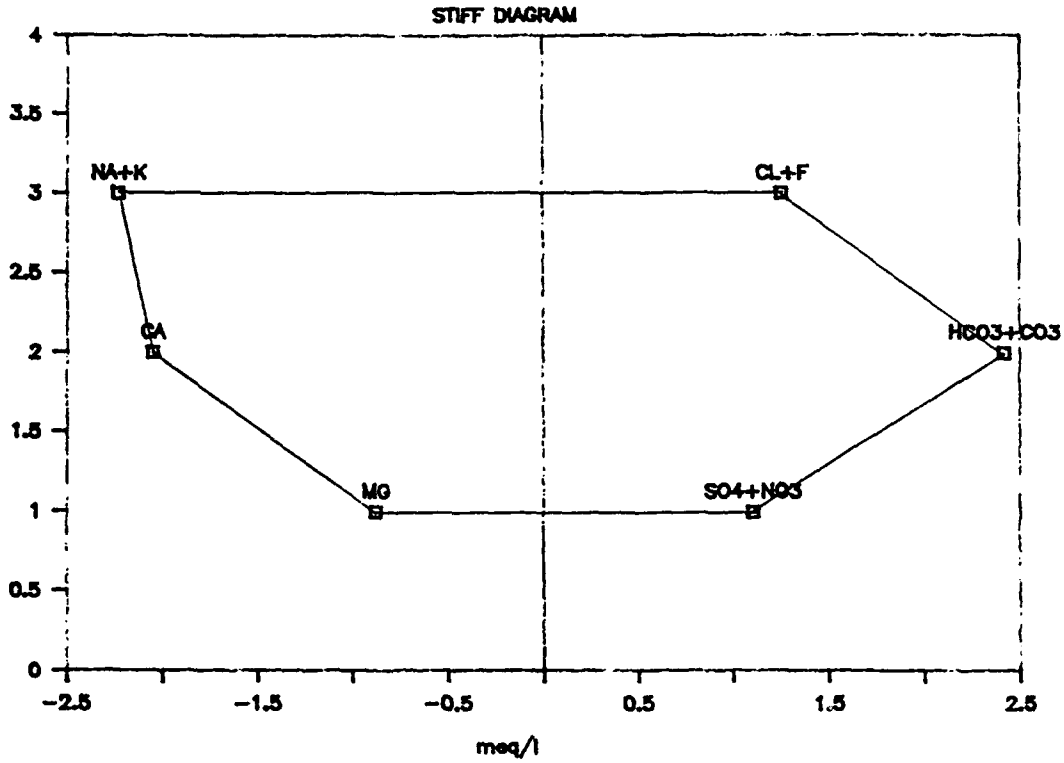
$CaHCO_3$

SW26001ST2, 19-Aug-90



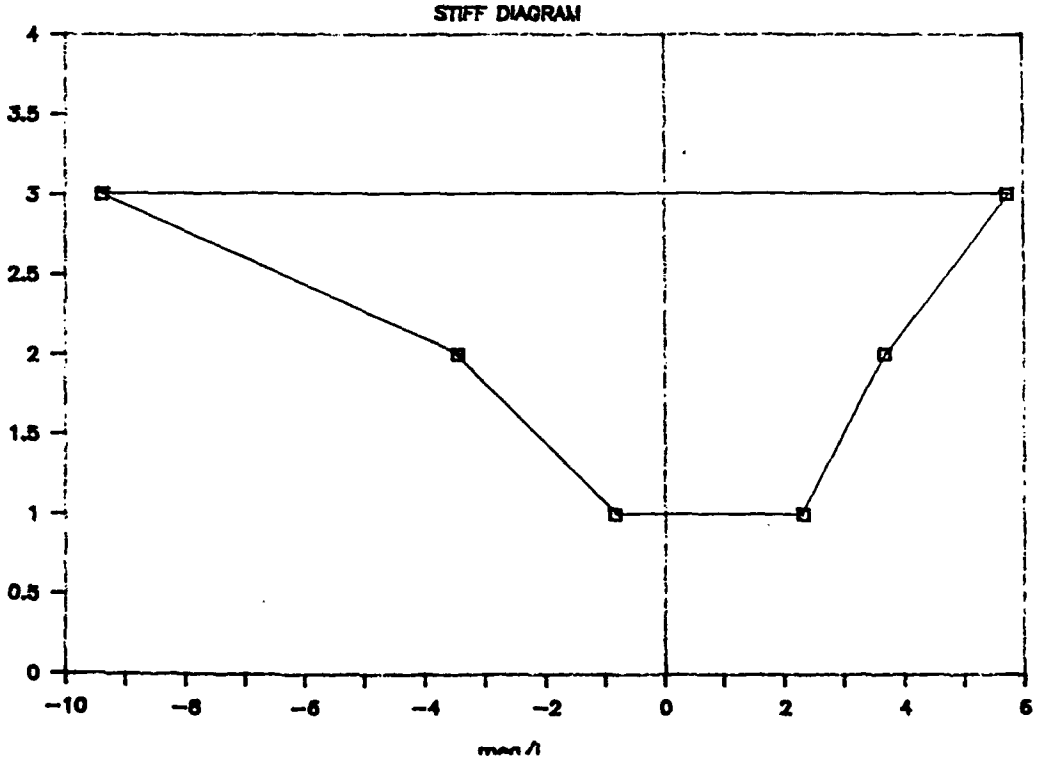
$NaHCO_3$

SW11001, 16-Apr-90



N HCO3 type water

SW11002, 16-Apr-90



N Cl water

APPENDIX B-6

WATER QUALITY FIELD DATA SUMMARY

/015

WATER YEAR 1990 RMA CMP SURFACE WATER FIELD DATA

Site ID	DATE	TITRATION RESULTS 8.3	7.0	5.1	4.8	4.5	4.3	ACID CONC.	DISCHARGE STAFF GUAGE READING CFS	FEET	COND.	TEMP (DEG. C)	CORRECTED COND. (@ 25 DEG C)	PH	TEMP (DEG. C)	D.O.	WEATHER	PREVIOUS PRECIPITATION
Spring Sampling Event																		
SW01001	17-Apr-90	NA	NA	NA	247	250	251	1.60	0.036	0.23	550	11	704	8.13	10.9	NA	OVERCAST, 45°F, CALM	TRACE, DRIZZLE-SNOW WITHIN THE LAST 18 HOURS
SW01002	19-Apr-90	NA	NA	NA	295	308	313	1.60	NA	NA	3800	14.5	4598	7.65	14.0	NA	PARTIALLY CLOUDY, 60°F, WIND S-15M	TRACE, RAIN AT 0700 MST 90109
SW01004	12-Apr-90	NA	41.4	NA	85.5	87.2	NA	0.16	NA	2.10	270	9	356	8.23	8.4	NA	OVERCAST, 40°-50°F CALM	90100 HAD SOME LIGHT RAIN
SW01005	12-Apr-90	8	NA	NA	126	127	129	1.60	NA	12.00	435	12.1	547	8.44	8.4	NA	PARTLY CLOUDY, APPROX. 60°F BREEZY	NONE
SW02003	12-Apr-90	NA	NA	NA	160	161	162	NA	NA	12.10	500	11.5	635	7.9	10.2	NA	PARTIALLY CLOUDY, WIND S-10 W, 60°F	NONE
SW02004	12-Apr-90	6	NA	NA	112	115	117	NA	NA	0.35	490	12	617	8.8	11.1	NA	PARTLY CLOUDY, WIND, S-10 W, 60°F	NONE
SW02006	19-Apr-90	38	NA	NA	193	198	203	1.60	0.0726	NA	820	19	918	9.35	18.6	NA	CLOUDY, 65°F, WINDS 10-20 MPH FROM THE NORTH	LIGHT SPRINKLE EARLIER IN DAY, BUT NO PRECIPITATION WHILE SAMPLING
SW07001	13-Apr-90	12	NA	NA	284	287	290	1.60	0.1004	NA	675	10.5	871	8.55	10.3	NA	CLOUDY, WIND 3-SE, 55°F	NONE
SW07002	13-Apr-90	22	NA	NA	245	248	253	1.60	0.2424	NA	600	14	732	8.75	13.7	NA	PARTIALLY CLOUDY, 55°F, WIND 1 SE	NONE
SW08001	18-Apr-90	NA	NA	NA	248	252	255	1.60	0.9656	4.27	620	17.5	713	6.64	17.7	NA	PARTIALLY CLOUDY, 70°F, WIND 1-15 NE	NONE
SW08003	18-Apr-90	13	NA	NA	260	263	265	1.60	1.081	0.52	600	17.2	694	8.55	15.6	NA	PARTIALLY CLOUDY, 70°F, WIND S-15M	NONE
SW11001	16-Apr-90	NA	NA	NA	111	117	121	1.60	0.0113	0.60	320	10.5	413	8.25	10.3	NA	OVERCAST, 40°F WIND 15-25	NONE
SW11002	16-Apr-90	53	NA	NA	176	180	184	1.60	0.0198	NA	850	10	1105	9.77	10.0	NA	OVERCAST, 40°F, WIND 10-25M	NONE
SW11003	17-Apr-90	NA	NA	NA	26	29	30	1.60	NA	1.61	149	8	200	7.76	7.3	NA	OVERCAST, 30°, 1-5 N WIND	TRACE SNOW-DRIZZLE DURING LAST 12 HOURS
SW12001	13-Apr-90	8	NA	NA	256	260	265	1.60	0.6915	NA	630	12	794	8.64	12.1	NA	PARTIALLY CLOUDY, 55°F, WIND 5-10 N	NONE
SW12004	13-Apr-90	NA	NA	NA	106	108	109	1.60 LT	0.0078	NA	310	9	409	7.68	7.1	NA	WINDS 15NE, PARTIALLY CLOUDY, APPROX. 50°F	NONE
SW12005	16-Apr-90	NA	NA	NA	460	466	475	1.60	0.3903	0.52	512	11.5	650	8.47	10.9	NA	OVERCAST, 50°F, WIND 10-25 E	NONE
SW12007	16-Apr-90	NA	NA	NA	NA	NA	NA	1.60	NA	1.35	400	14.5	484	7.04	10.2	NA	CLOUDY, WIND 5-10 NW	SLIGHTLY WET DUE TO RAIN THE NIGHT BEFORE
SW24001	17-Apr-90	NA	NA	NA	162	165	167	1.60	22.2	NA	510	10	663	7.38	9.8	NA	OVERCAST, 35°F, WIND 3-5 N	TRACE DRIZZLE-SNOW DURING LAST 12 HOURS
SW24002	18-Apr-90	NA	NA	NA	306	309	311	1.60	1.121	1.12	790	13	980	8.24	10.8	NA	SUNNY, CLEAR 65°F, WIND 1-5 N	NONE
SW24003	17-Apr-90	90	NA	NA	145	148	156	1.60	NA	NA	1460	7	1986	8.48	7.6	NA	OVERCAST, 30°F, WIND 1-5 N	TRACE DRIZZLE-SNOW DURING LAST 12 HRS
SW24004	17-Apr-90	20	NA	NA	321	324	326	1.60	1.121	NA	720	7	979	8.6	5.9	NA	OVERCAST, 30°F, WIND 1-5 N	TRACE DRIZZLE-SNOW DURING LAST 12 HRS
SW30002	19-Apr-90	NA	NA	NA	321	325	329	1.60	1.25	NA	800	12.8	995	7.73	11.8	NA	CLOUDY, 60°F, WIND 10-30 N	TRACE RAIN @ 0700 MST 90109
SW31001	17-Apr-90	12	NA	NA	314	317	320	1.60 LT	0.0078	NA	700	11.5	889	8.6	11.0	NA	OVERCAST, 50°F, WIND 1-5 N	TRACE DRIZZLE-SNOW WITHIN LAST 18 HRS
SW31002	19-Apr-90	NA	NA	NA	365	372	377	1.60	NA	NA	710	12.9	882	8	12.0	NA	PARTIALLY CLOUDY, RAIN CLOUDS TO NW, 60°F, WIND 10-30 NW	TRACE RAIN AT 0700 MST 90109

WATER YEAR 1990 RMA CMP SURFACE WATER FIELD DATA

Site ID	DATE	TITRATION RESULTS 8.3	/.0	5.1	4.8	4.5	4.3	ACID CONC.	DISCHARGE GUAGE READING CFS	FEET	COND.	TEMP (DEG. C)	CORRECTED COND. (@ 25 DEG C)	Ph	TEMP (DEG. C)	D.O.	WEATHER	PREVIOUS PRECIPITATION
SW36001	19-Apr-90	NA	NA	NA	224	228	229	1.60	0.0113	NA	/20	13	893	/.99	12.2	NA	OVERCAST, 50'F, WIND 1-5 S	TRACE OF RAIN FOR APPROX. 10 MIN, 1/2 HR. BEFORE SAMPLING (NO RAIN DURING SAMPLING)
SW37001	18-Apr-90	47	NA	NA	342	350	355	1.60	0.9656	0.97	1100	11	1408	8.65	9.5	NA	CLEAR AND CALM, APPROX. 55'F	NONE
Fall Sampling Event																		
SW01001	06-Sep-90	NA	NA	NA	87	89	92	1.60	0.07	0.23	215	19	241	7.52	19.2	NA	CLOUDY, COOL, WIND 10 MPH WEST	LIGHT RAINS LAST NIGHT
SW02001	05-Sep-90	8	NA	NA	126	128	130	1.60	5.42	3.78	530	24	541	8.51	23.9	NA	CLEAR, WIND 10' W	NONE
SW02006	04-Sep-90	32	NA	NA	83	86	88	1.60	0.39	NA	620	26	608	8.88	24.5	NA	CLEAR, CALM, APPROX. 85'F	NONE
SW08003	07-Sep-90	NA	NA	NA	297	302	305	1.60	0.17	0.22	700	19	784	7.86	17.5	NA	CLEAR, WIND 5 N	NONE FOR A FEW DAYS
SW11001	04-Sep-90	38	NA	NA	98	101	103	1.60	0.04	0.52	172	20	189	8.51	22.1	NA	VERY HOT, CALM	NONE
SW11002	05-Sep-90	45	NA	NA	59	62	63	1.60	0.39	0.24	437	32	376	10.48	32.1	NA	PARTLY CLOUDY, WIND 10'W	NONE
SW12001	06-Sep-90	NA	NA	NA	219	222	224	1.60	0.26	NA	590	20	649	8.21	19.1	NA	PARTLY CLOUDY, WIND 5 MPH FROM NW	EARLIER RAIN SHOWER LAST NIGHT
SW12004	04-Sep-90	NA	NA	NA	46	47	48	1.60	NA	NA	232	27	223	8.11	26.0	NA	HOT, CALM CLEAR	NONE
SW12005	06-Sep-90	NA	NA	NA	178	180	184	1.60	0.44	0.56	420	16	496	7.88	16.5	NA	CLOUDY, COOL, CALM	LIGHT RAIN LAST NIGHT
SW24001	06-Sep-90	NA	NA	NA	118	120	122	1.60	0.04	NA	420	20	462	7.44	19.2	NA	PARTLY CLOUDY, WIND 10 W	RECEIVED LIGHT RAINFALL LAST NIGHT
SW24002	07-Sep-90	NA	NA	NA	408	415	420	1.60 LT	0.0078	0.59	4450	26	4361	7.44	27.4	NA	PARTLY CLOUDY, WARM, APPROX. 90'F, WIND, 10 MPH FROM NE	NONE
SW36001	05-Sep-90	NA	NA	NA	122	125	129	1.60	0.03	NA	580	19	650	7.75	18.8	NA	CLEAR AND CALM, APPROX. 75'F	NONE
SW37001	07-Sep-90	NA	NA	NA	271	281	287	1.60	0.05	0.67	1650	26	1617	7.98	24.7	NA	CLEAR, WARM, APPROX. 85'F, WIND 5 NE	NONE
Storm Sampling Event																		
SW01002 ST	13-Mar-90	NA	NA	255	263	265	NA	1.60	NA	NA	650	11.9	820	8.39	10.8	NA	SNOWING (WET SNOW) 25'F, WIND 3-10 N	SNOW DURING THE LAST 12 HOURS
SW04001 ST	09-Jul-90	NA	NA	NA	NA	NA	NA	1.60	NA	NA	810	21	875	14.62	17.8	NA	RAINING HARD AT PRESENT TIME, HARD RAIN LAST 1/2 HOUR	APPROX. 1/4" TO 1/2" RAIN IN LAST 1/2 HOUR
SW06002	18-Apr-90	NA	NA	NA	97	98	101	1.60	0.17	NA	405	26	397	7.94	23.5	NA	CLOUDY, STORM PASSED JUST SOUTH OF ARSENAL	LAST APPLICATION WAS AROUND 5 DAYS AGO
SW06002 ST1	27-Apr-90	NA	NA	NA	87	89	90	1.60	0.6008	NA	345	25	345	7.53	25.3	NA	CLEAR, CLAM	LIGHT SHOWERS SEVERAL DAYS EARLIER
SW08003 ST	09-Mar-90	NA	62	262	266	269	NA	1.60	2.358	0.76	700	13.5	861	8.18	12.8	NA	CLOUDY, CALM, 45'F	SNOW AND RAIN ON 3/6/90
SW08003-ST2	30-May-90	NA	NA	NA	163	166	168	1.60	NA	0.79	850	NA	NC	8.18	17.9	NA	CLOUDY, SLIGHT BREEZE SHIFTING	APPROX. 3" PRECIPITATION DURING THE STORM THE PREVIOUS DAY
SW08003 ST	10-Jul-90	NA	NA	1/2.8	1/8	1/8.2	NA	0.16	NA	0.23	450	22	477	8.06	20.9	NA	CLOUDY, WIND 7' NORTHWEST	MORE THAN 1/2" FROM A STORM AROUND 1900 MST 9[illegible]0
SW11001 ST	06-Mar-90	NA	5	NA	14	17	NA	1.60	5.289	1.49	65	9.8	85	7.89	9.1	NA	SNOWING HEAVILY, WIND 5-15 NE	HEAVY RAIN AND SOME SNOW THE PAST 12 HOURS

WATER YEAR 1990 RMA CMP SURFACE WATER FIELD DATA

Site ID	DATE	TITRATION RESULTS 8.3	7.0	5.1	4.8	4.5	4.3	ACID CONC.	DISCHARGE STAFF GUAGE READING CFS	FEET	COND.	TEMP (DEG. C)	CORRECTED COND. (@ 25 DEG C)	Ph	TEMP (DEG. C)	D.O.	WEATHER	PREVIOUS PRECIPITATION
SW11001 ST2	13-Mar-90	NA	NA	21	23	25	NA	1.60	6.579	1.27	129	13.5	159	7.42	13.1	NA	SNOWING, 25°F, WIND,3-10 M	SNOW-RAIN DURING LAST 12 HRS
SW11002 ST	06-Mar-90	NA	NA	NA	15	17	NA	1.60	14.295	0.50	54	9	71	6.9	8.4	NA	HIGH WINDS 10-40 M, SNOWING-SLEET	SNOW & RAIN DURING PAST 12 HRS
SW11002 ST2	13-Mar-90	24	NA	52	53	55	NA	1.60	22.548	NA	134	13	166	9.18	12.3	NA	SNOWING, 25°F, WIND 3-10 M	SNOW-RAIN DURING LAST 12 HOURS
SW11002 ST	09-Jul-90	7751 BROUGHT PH TO 13.4 THEN RAN OUT					NA	1.60	158.11	2.50	450	20	495	13.76	19.1	NA	1/2" OF RAIN IN LAST HOUR, RAINS ARE LETTING UP	APPROX. 1/2" OF RAIN LAST HOUR
SW12004 ST	08-Mar-90	NA	1	NA	15	16	NA	1.60	0.973	NA	112	10.9	144	7.06	10.1	NA	OVERCAST, COOL 40-45°F, WIND 1-5 M	SNOW AND RAIN PAST 48 HOURS
SW12005 ST	08-Mar-90	NA	5	NA	41	42	NA	1.60	3.741	NA	150	10.5	194	7.86	12.6	NA	OVERCAST, COOL 40-45°F, CALM	SNOW AND RAIN DURING PAST 48 HOURS
SW12005 ST2	13-Mar-90	NA	NA	62	64	66	NA	1.60	3.524	NA	183	12.5	229	7.98	12.2	NA	SNOWING, 25°F, WIND 3-10 M	SNOW-RAIN DURING LAST 12 HOURS
SW12005 ST2	29-Mar-90	NA	NA	NA	NA	NA	NA	NA	0.4387	NA	NA	NA	NC	NA	NA	NA	LIGHT SNOW, 30°F, WIND CALM	HAS BEEN SNOWING-RAINING INTERMITTENTLY APPROX. LAST 48 HRS
SW12006 ST	21-Jul-90	NA	NA	NA	11	12	13	1.60	0.1568	NA	52	19	58	7.65	25.3	NA	OVERCAST, LIGHT SPRINKLE	EARLIER RAIN LASTED ABOUT 30 MINUTES, LET UP AROUND 10 MIN. AGO
SW24002 ST	09-Mar-90	NA	100	273	277	282	NA	1.60	4.065	1.50	800	12.2	1005	8.19	11.3	NA	CLOUDY, 50°F, CALM	SNOW AND RAIN ON 3/5/90 AND 3/6/90
SW26001 ST	13-Mar-90	1	NA	115	117	123	NA	1.60	0.0299	4.43	260	12	328	8.4	10.9	NA	SNOWING, 25°F, WIND 2-30 M	SNOW-RAIN DURING LAST 12 HOURS
SW26001 ST2	19-Aug-90	67	NA	176	182	185	NA	1.60	0.57	4.76	64	17.5	74	9.27	16.0	NA	EARLIER PERIOD OF HEAVY RAIN & HAIL, FREQUENT LIGHTNING BOLTS	AROUND 1/2" TO 1" OF RAIN IN LAST 45 MINUTES
SW37001	29-Nov-89	NA	NA	NA	NA	NA	NA	1.60	0.0198	0.64	1300	1.3	1916	8.03	1.3	NA	COOL 45°F, PARTIALLY CLOUDY,	LIGHT SNOW ON 89331
SW37001 ST	09-Mar-90	NA	40	NA	223	226	NA	NA	4.518	1.35	875	12.2	1099	8.03	11.5	NA	CLOUDY, CALM 50°F	SNOW AND RAIN ON 3/5/90 AND 3/6/90

NA = NOT ANALYZED
NC = NOT CALCULATED
D.O. = DISSOLVED OXYGEN

APPENDIX B-7

PROCEDURE FOR SUSPENDED SOLIDS ANALYSIS

Appendix B-7 Procedure for Suspended Solids

Total suspended solids were determined by EPA Method 160 for nonfilterable residue. Nonfilterable residue is defined as those solids which are retained by a glass filter and dried to constant weight at 103-105° C. After drying to constant weight, nonfilterable residue is determined by weighing the filter with the residue and calculating the concentrations by:

$$mg/l = \frac{(A-B) \times 10000}{C}$$

where:

A = weight of filter and residue in mg;

B = weight of filter in mg; and

C = ml of sample filtered.

The practical range of the determination is 4 mg/l to 20,000 mg/l.