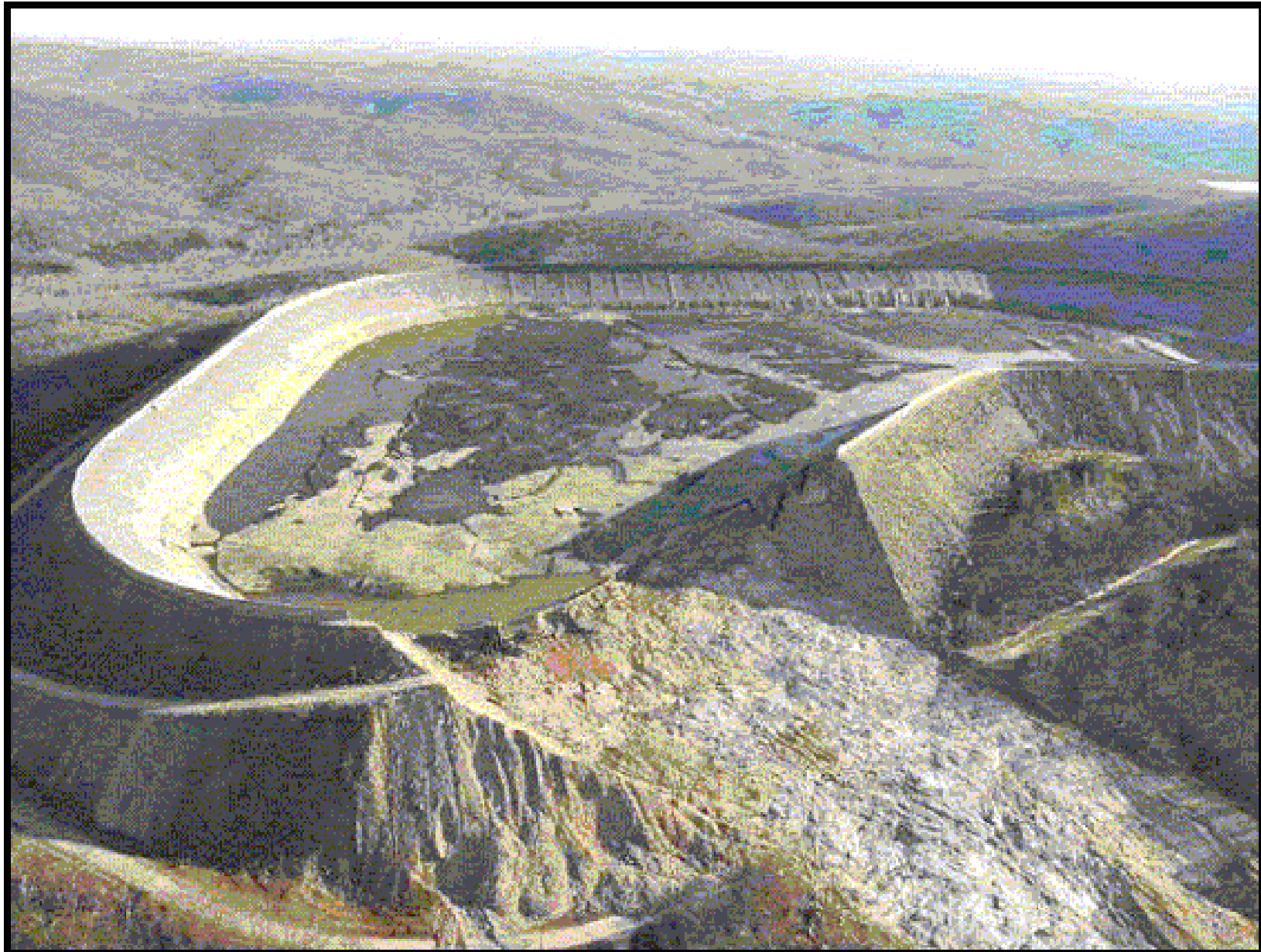




Taum Sauk – Upper Reservoir Full
Figure 1-1



Taum Sauk Upper Reservoir Breached

Figure 1-2



Taum Sauk Reservoir

14 December 2005 Dam Rupture - Lesterville, MO

UNCLASSIFIED
//For Official Use Only

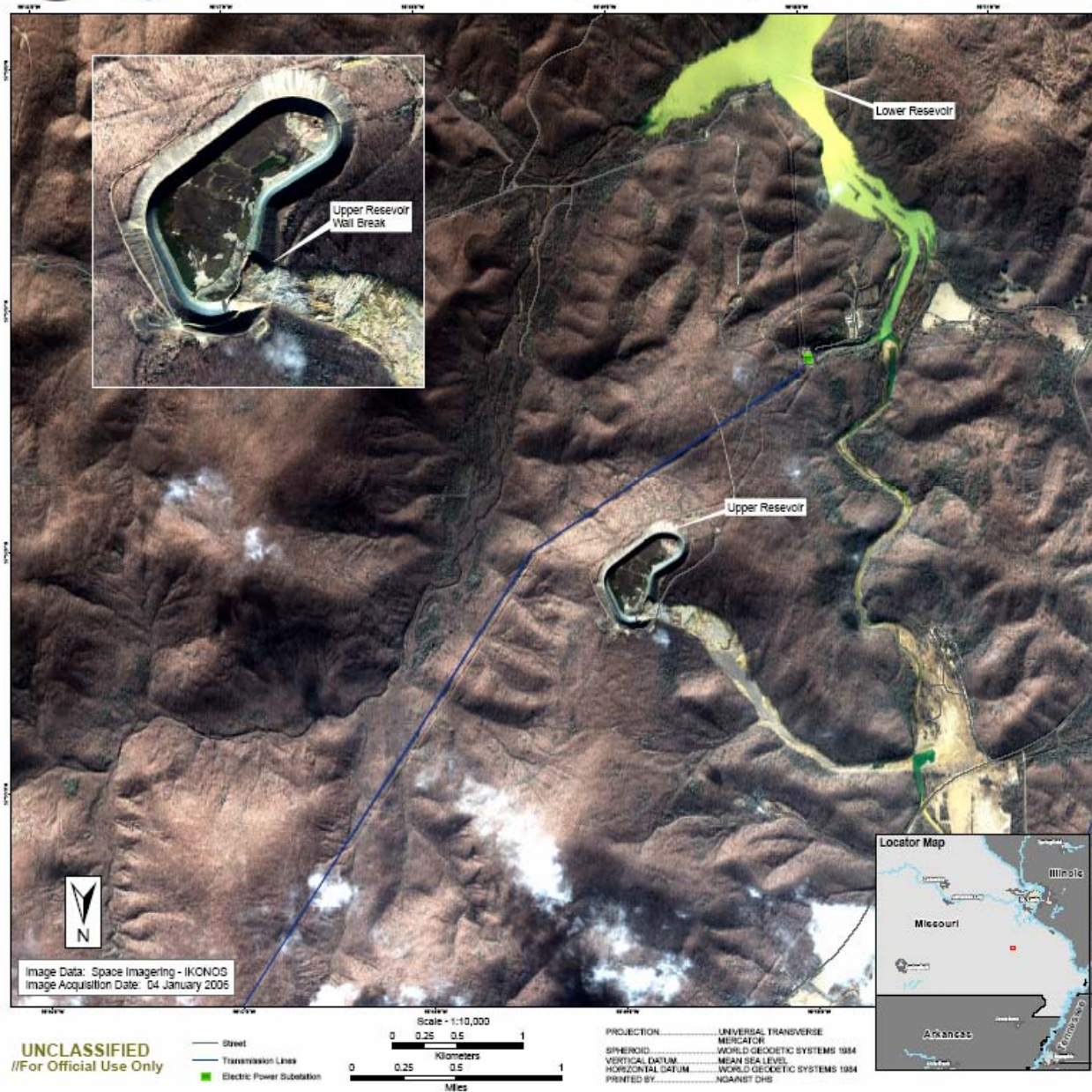


Figure 1-3

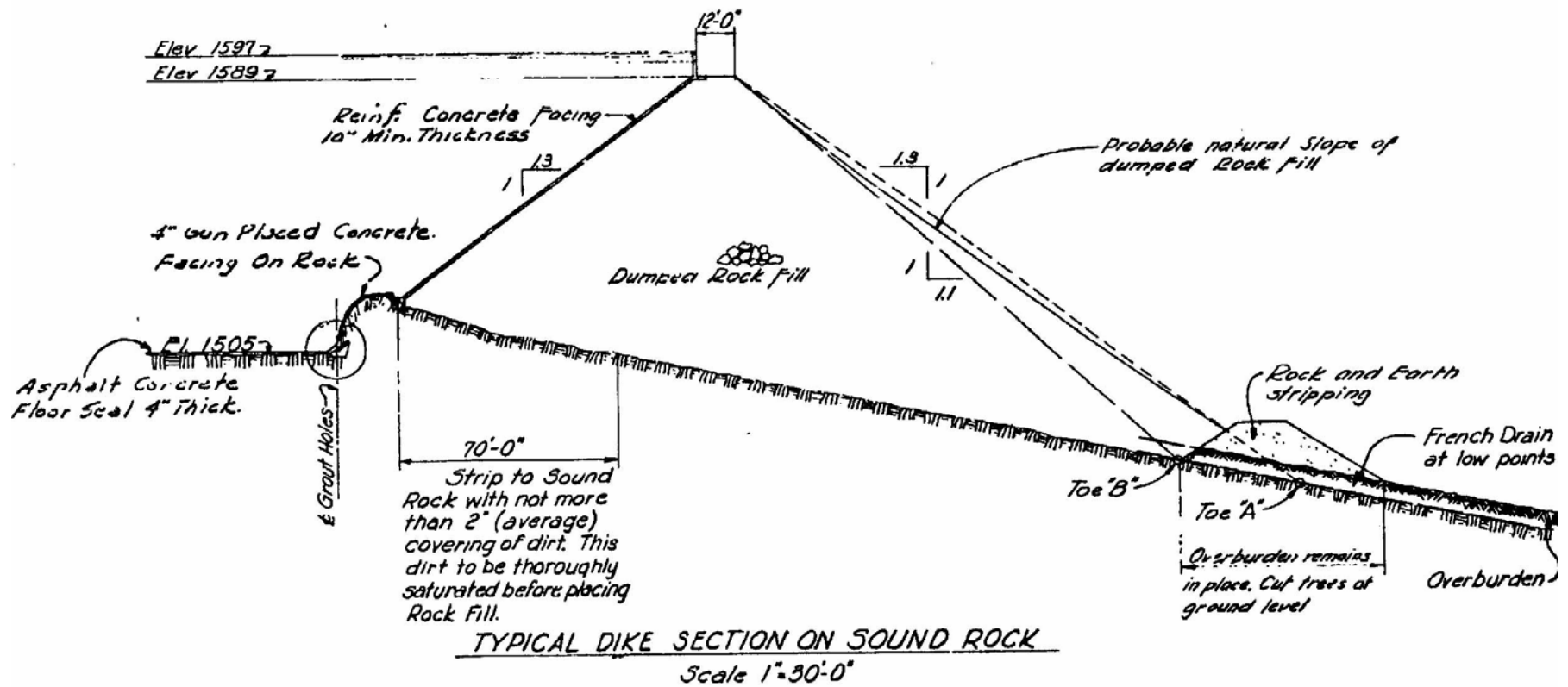
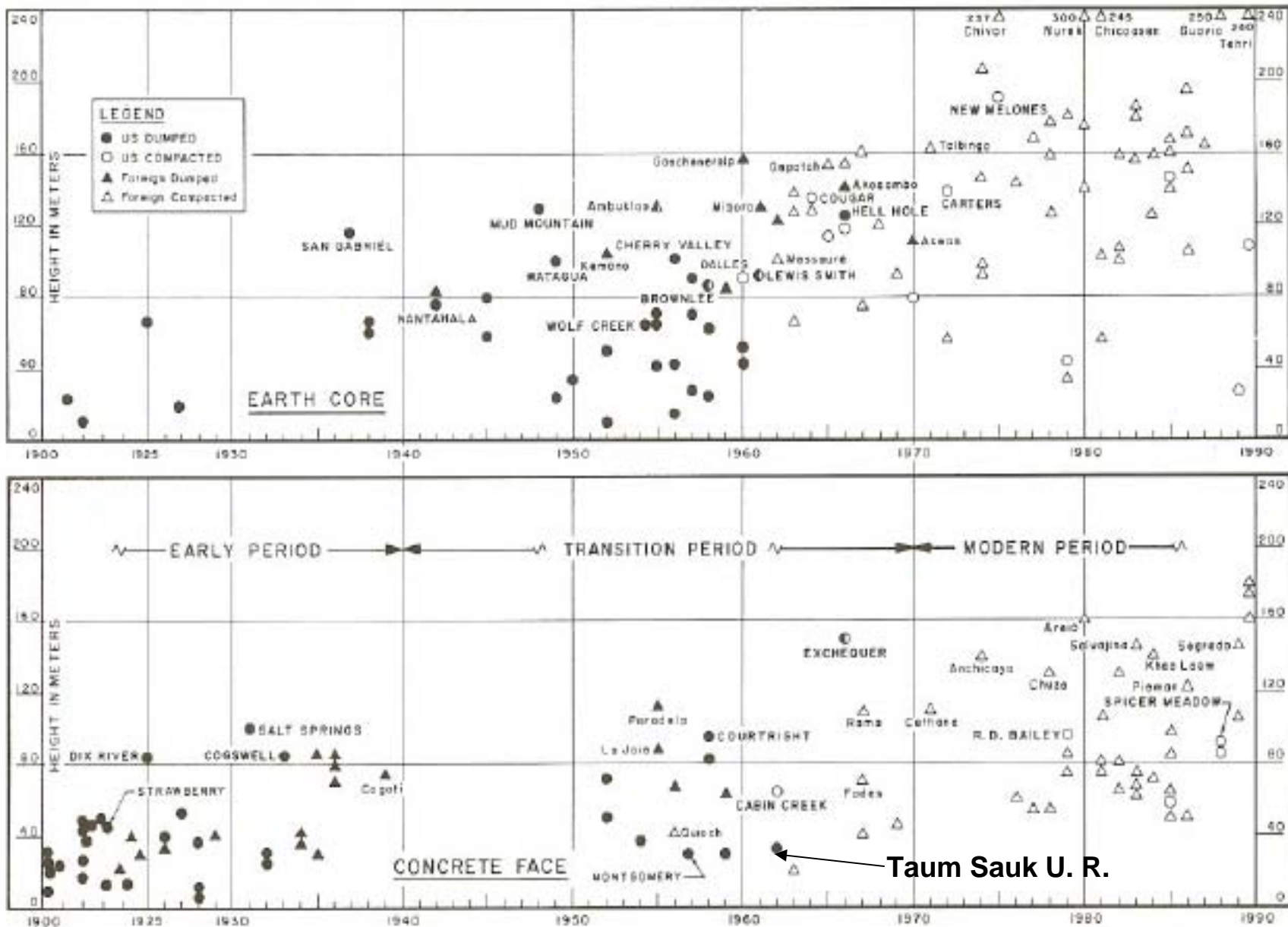
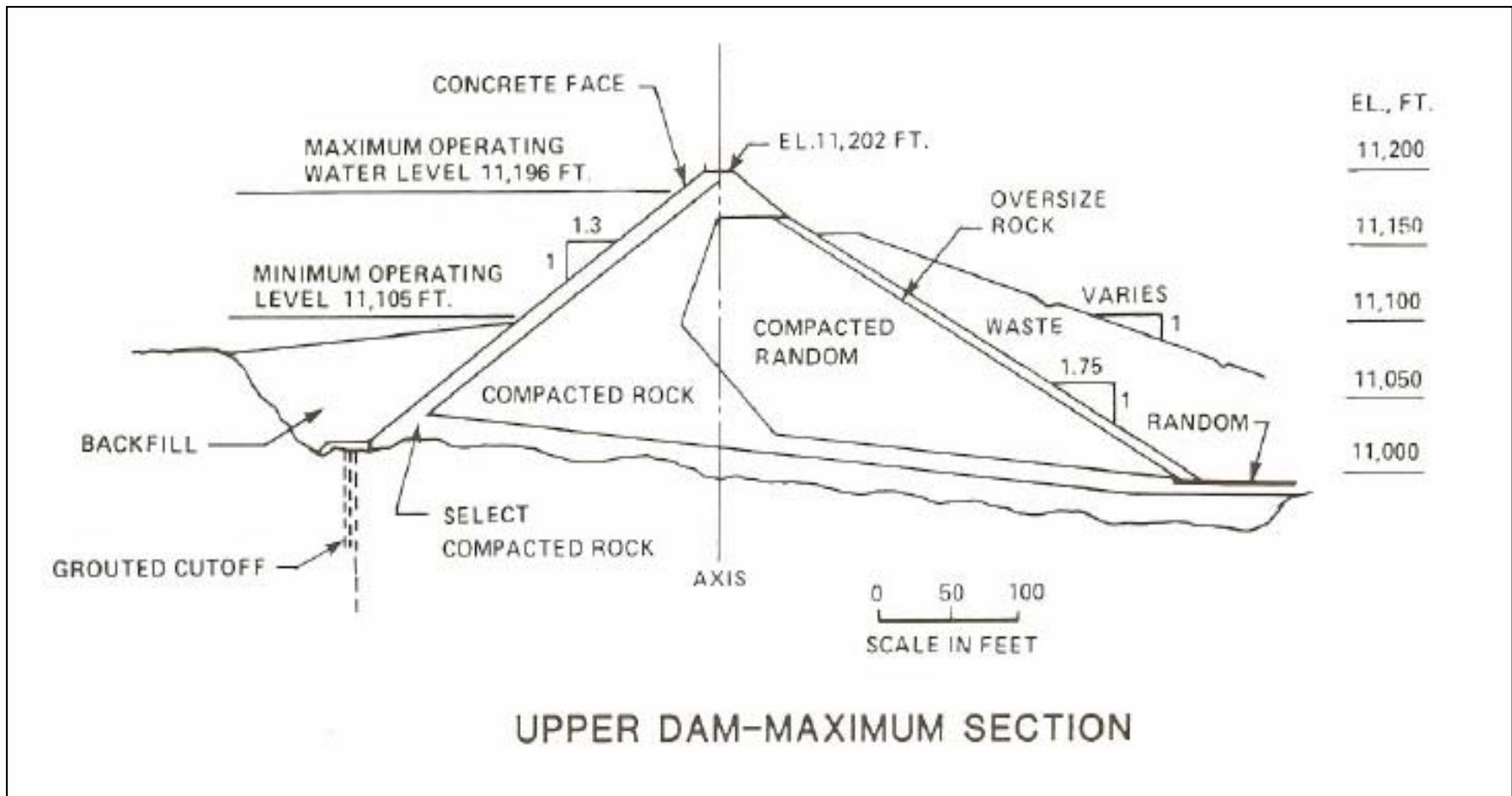


Figure 2-1 Cross section from original design drawings



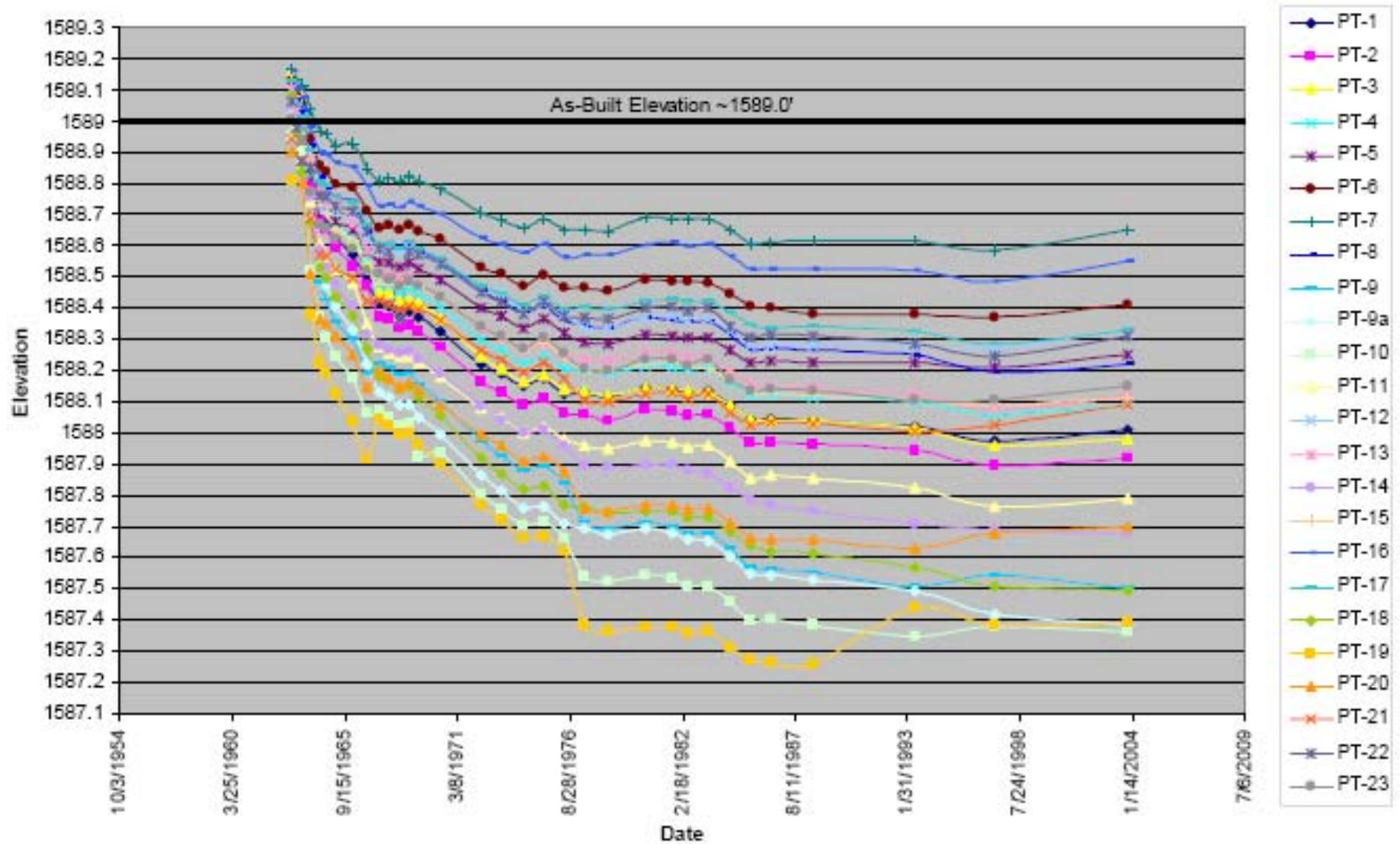
Trends in Type and Height of Rockfill Dams

Figure 3-1



Cabin Creek Upper Reservoir Embankment

Figure 3-2



Total Settlement History
Upper Reservoir Pin Elevations

Figure 3-3

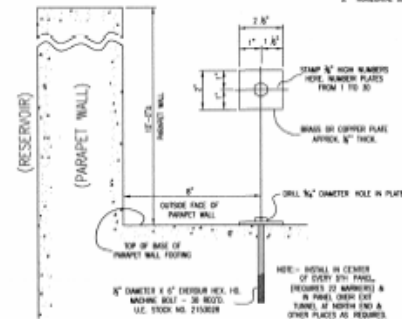
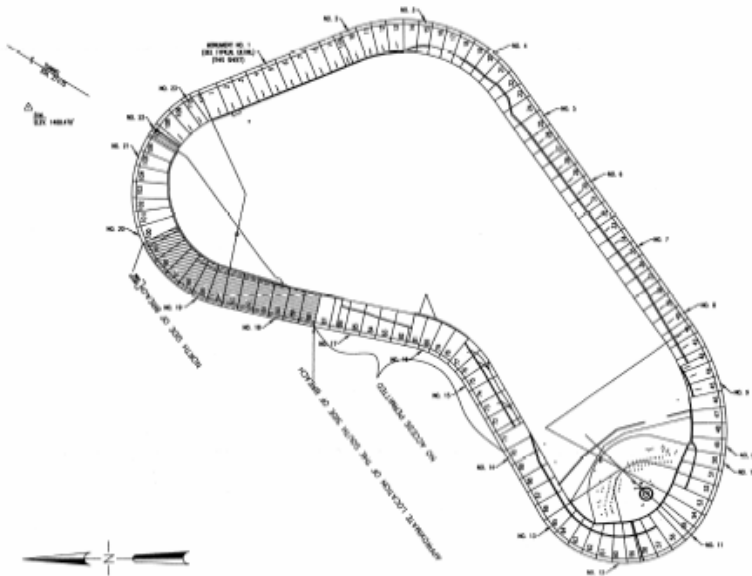
TAUM SAUK UPPER RESERVOIR MONUMENT SURVEY DATA

STATION	8/22/1987	8/28/1988	5/29/1993	5/11/1997	11/18/1998	11/18/1998	11/18/1998	11/18/1998	11/18/1998	11/18/1998	11/18/1998	11/18/1998	11/18/1998
1	1507.847	1508.011	1508.011	1507.914	1508.011	1508.011	1508.011	1508.011	1508.011	1508.011	1508.011	1508.011	1508.011
2	1507.869	1507.862	1507.862	1507.862	1507.862	1507.862	1507.862	1507.862	1507.862	1507.862	1507.862	1507.862	1507.862
3	1508.245	1508.088	1508.014	1507.917	1508.011	1508.011	1508.011	1508.011	1508.011	1508.011	1508.011	1508.011	1508.011
4	1508.148	1508.117	1508.024	1508.021	1508.021	1508.021	1508.021	1508.021	1508.021	1508.021	1508.021	1508.021	1508.021
5	1508.217	1508.215	1508.215	1508.215	1508.215	1508.215	1508.215	1508.215	1508.215	1508.215	1508.215	1508.215	1508.215
6	1508.409	1508.415	1508.409	1508.409	1508.415	1508.415	1508.415	1508.415	1508.415	1508.415	1508.415	1508.415	1508.415
7	1508.612	1508.616	1508.616	1508.616	1508.616	1508.616	1508.616	1508.616	1508.616	1508.616	1508.616	1508.616	1508.616
8	1508.367	1508.365	1508.349	1508.349	1508.349	1508.349	1508.349	1508.349	1508.349	1508.349	1508.349	1508.349	1508.349
9	1507.610	1507.600	1507.610	1507.610	1507.610	1507.610	1507.610	1507.610	1507.610	1507.610	1507.610	1507.610	1507.610
10	1507.540	1507.529	1507.490	1507.417	1507.380	1507.380	1507.380	1507.380	1507.380	1507.380	1507.380	1507.380	1507.380
11	1507.487	1507.484	1507.447	1507.376	1507.360	1507.360	1507.360	1507.360	1507.360	1507.360	1507.360	1507.360	1507.360
12	1507.884	1507.882	1507.824	1507.761	1507.700	1507.700	1507.700	1507.700	1507.700	1507.700	1507.700	1507.700	1507.700
13	1508.223	1508.217	1508.217	1508.217	1508.217	1508.217	1508.217	1508.217	1508.217	1508.217	1508.217	1508.217	1508.217
14	1508.462	1508.462	1508.427	1508.373	1508.320	1508.320	1508.320	1508.320	1508.320	1508.320	1508.320	1508.320	1508.320
15	1507.809	1507.800	1507.708	1507.667	1507.600	1507.600	1507.600	1507.600	1507.600	1507.600	1507.600	1507.600	1507.600
16	1508.143	1508.149	1508.116	1508.080	1508.116	1508.116	1508.116	1508.116	1508.116	1508.116	1508.116	1508.116	1508.116
17	1508.524	1508.527	1508.519	1508.486	1508.520	1508.520	1508.520	1508.520	1508.520	1508.520	1508.520	1508.520	1508.520
18	1508.130	1508.142	1508.120	1508.087	1508.130	1508.130	1508.130	1508.130	1508.130	1508.130	1508.130	1508.130	1508.130
19	1507.814	1507.810	1507.800	1507.800	1507.800	1507.800	1507.800	1507.800	1507.800	1507.800	1507.800	1507.800	1507.800
20	1507.480	1507.480	1507.430	1507.462	1507.460	1507.460	1507.460	1507.460	1507.460	1507.460	1507.460	1507.460	1507.460
21	1507.711	1507.717	1507.717	1507.680	1507.700	1507.700	1507.700	1507.700	1507.700	1507.700	1507.700	1507.700	1507.700
22	1508.108	1508.099	1508.070	1508.035	1508.090	1508.090	1508.090	1508.090	1508.090	1508.090	1508.090	1508.090	1508.090
23	1508.211	1508.217	1508.205	1508.245	1508.210	1508.210	1508.210	1508.210	1508.210	1508.210	1508.210	1508.210	1508.210
24	1508.089	1508.080	1508.150	1508.077	1508.130	1508.130	1508.130	1508.130	1508.130	1508.130	1508.130	1508.130	1508.130


NOTES:

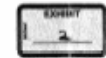
- DATA FOR SURVEY SURVEY WAS CALCULATED FROM SETBACK DATA (STANDARD) DERIVED FROM PLANS.
- HORIZONTAL DATA COMMENCED IN 2001.
- DATE OF DATA: DATA SHOWN ON THIS TABLE IS FROM RECORDS PROVIDED BY OWNER. EXCEPT FOR THE DATA COLLECTED 11-18-01 AND 12-20-02 WHICH IS ACTUAL FIELD DATA COLLECTED BY SURVEY GROUP SURVEY CREWS.
- SEE MAP: TOP OF CORNER BOLT SET IN TOP OF CONCRETE GRADE FINISH (DRAINAGE AND FLOORING 2 1/2' NORTH FROM CENTERLINE OF GATE AT BASE OF NORTH DAM).
- HORIZONTAL SURVEY DATA BASED ON 1983 STATE PLANE COORDINATE SYSTEM.

ELEVATION = 1985 ME (LOWWATER)
 MONUMENT = 42001100
 DATUM = 72033201



TYPICAL DETAIL
 MONUMENT AT PARAPET
 WALL
 SCALE: NOT TO SCALE

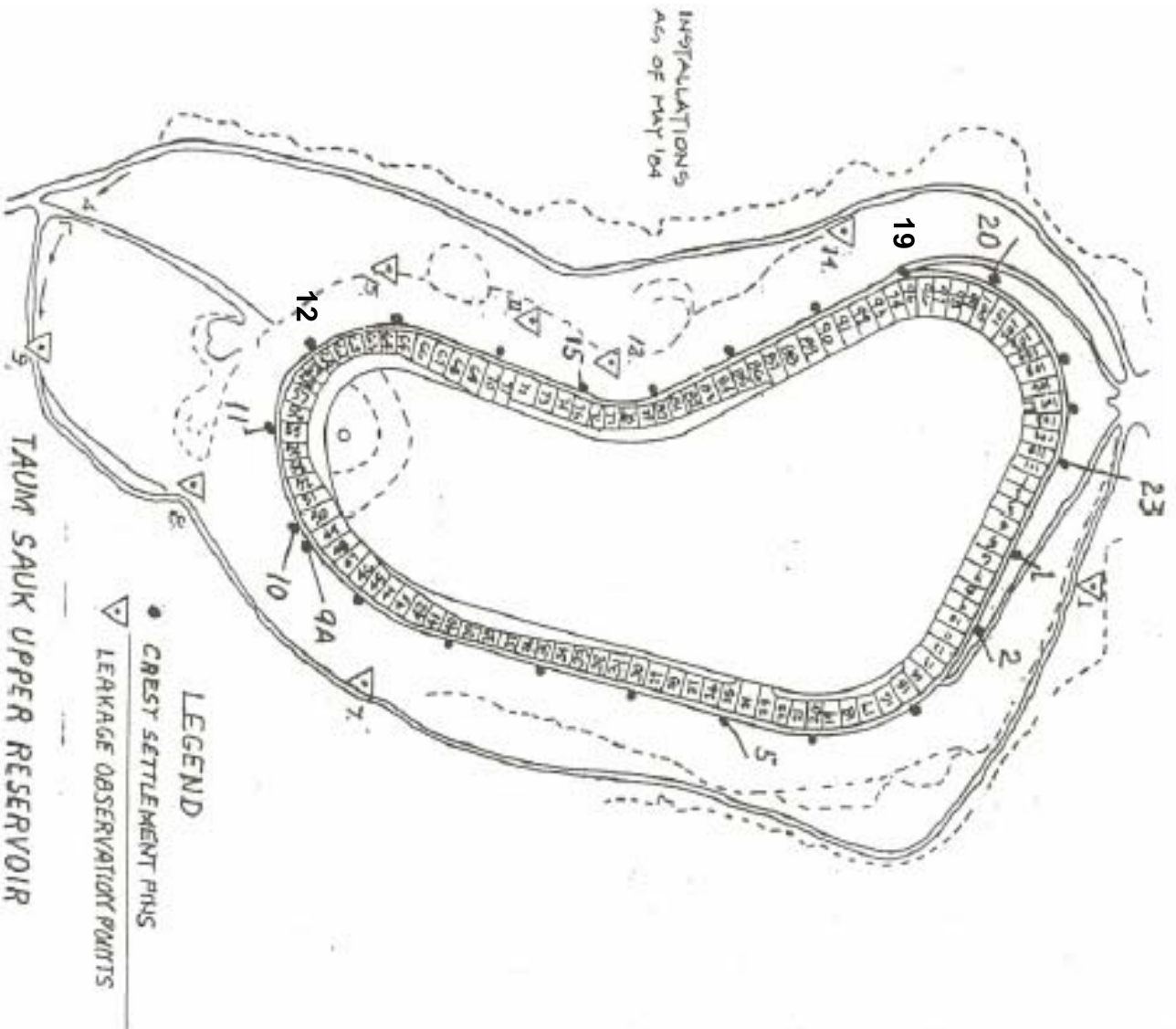
NO.	DATE	BY/CHKD	
1	12/22/00	DETAILED SCALE	
2	1/22/02	AMERICAN SURVEYING AND MAPPING, INC.	
PROJECT NO.	CONTRACT NO.	 68 Progress Parkway Maryland Heights, Missouri 63043-2700 (314) 621-8888	
			S2
DATE			



MO666026

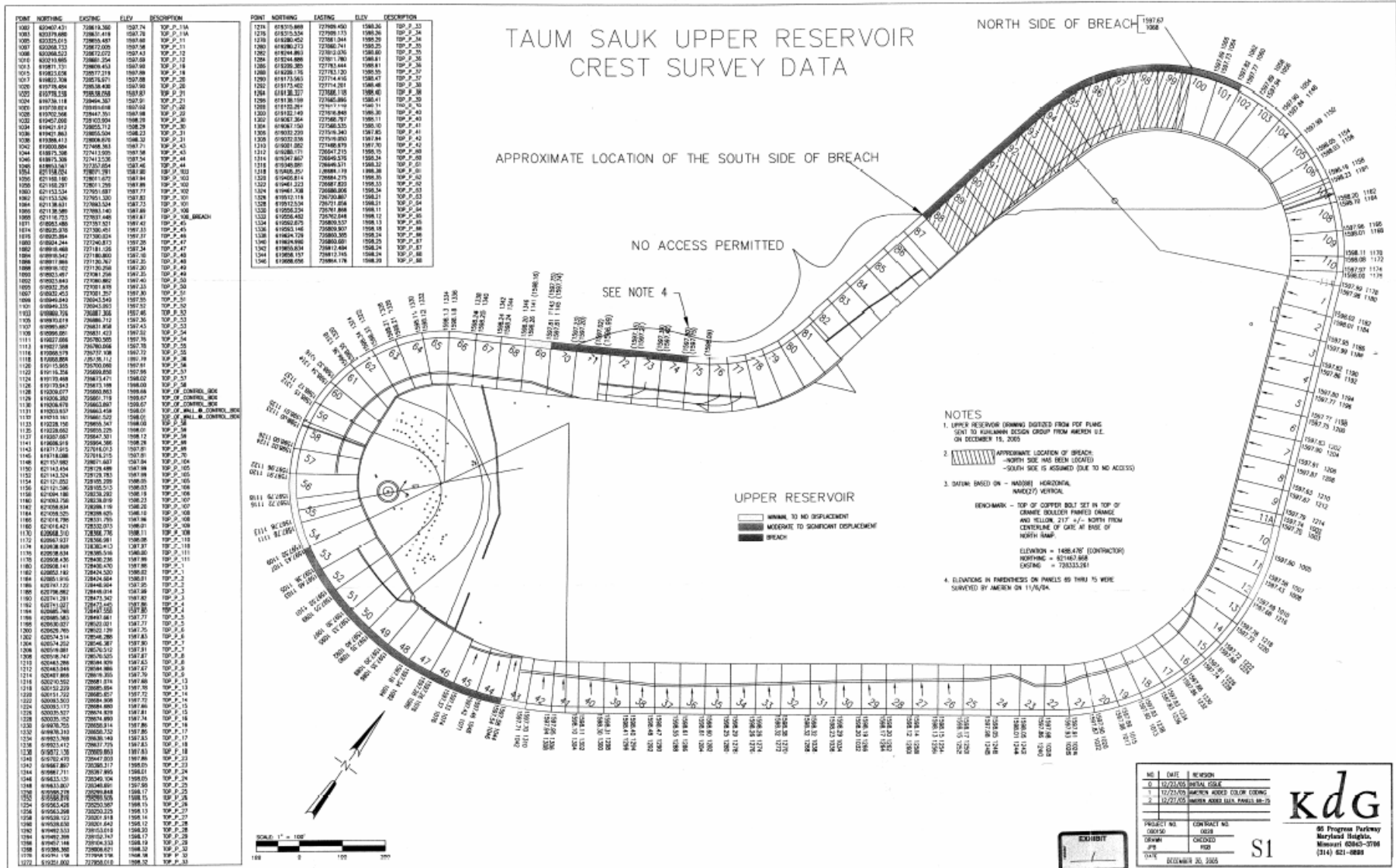
Figure 3-4
 (See Large Drawing S2 Provided)

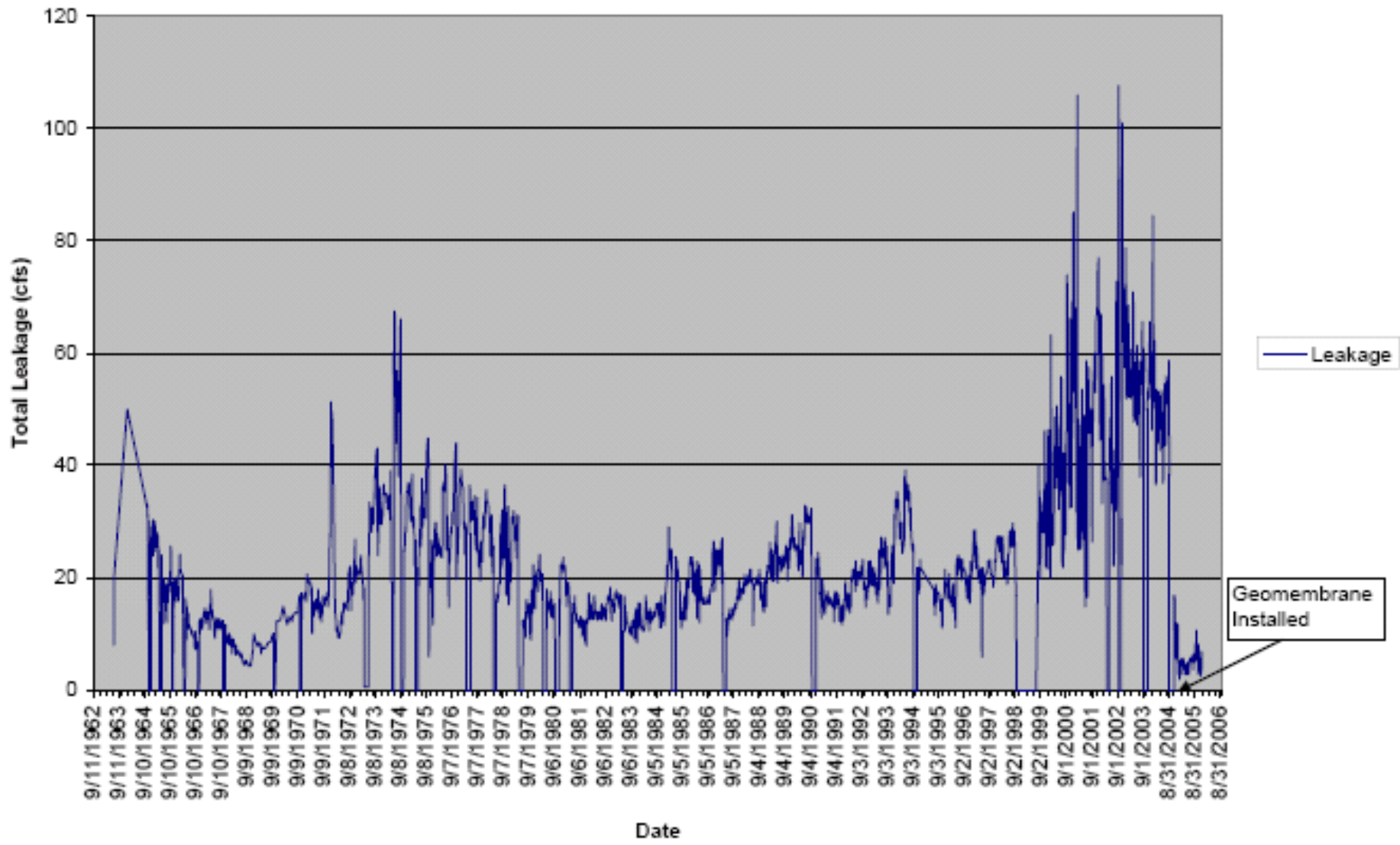
Source: J. Barry Cooke & Arthur Strussburger, "1998 Review of Safety Report (Seventh Five-Year Report), Inspection of Project Works, Taum Sauk Project," March 1998



REV 1/89 Figure 5-1. Upper Dam Settlement Monuments and Weir Locations

Figure 3-4A

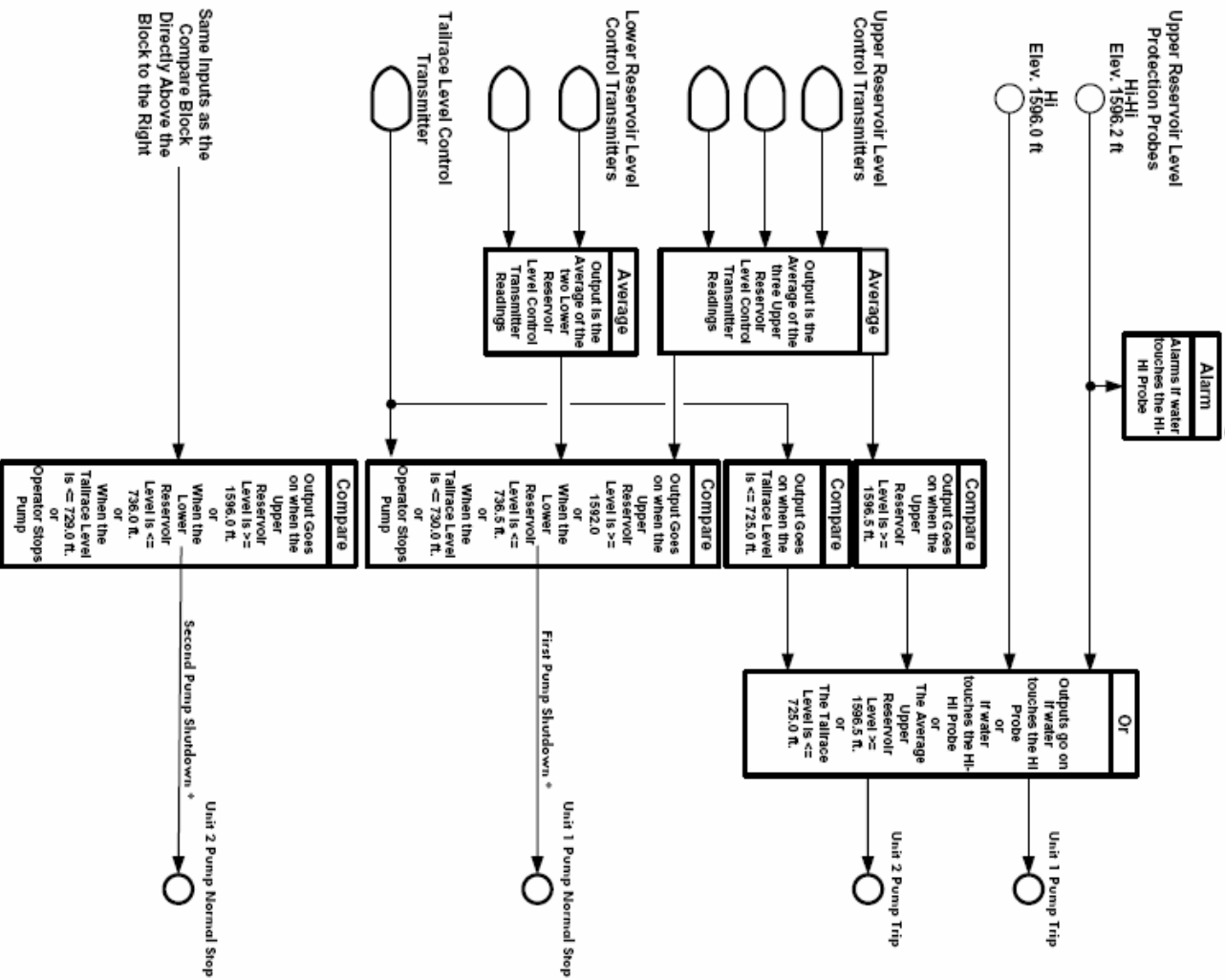




Total Leakage (cfs) vs Time

Figure 3-6

Taum Sauk Pump Shutdown Logic As-Designed, 11/01/2004



* Pump shutdown order is operator selectable.

Figure 5-1

Taum Sauk Pump Shutdown Logic 12/01/2004

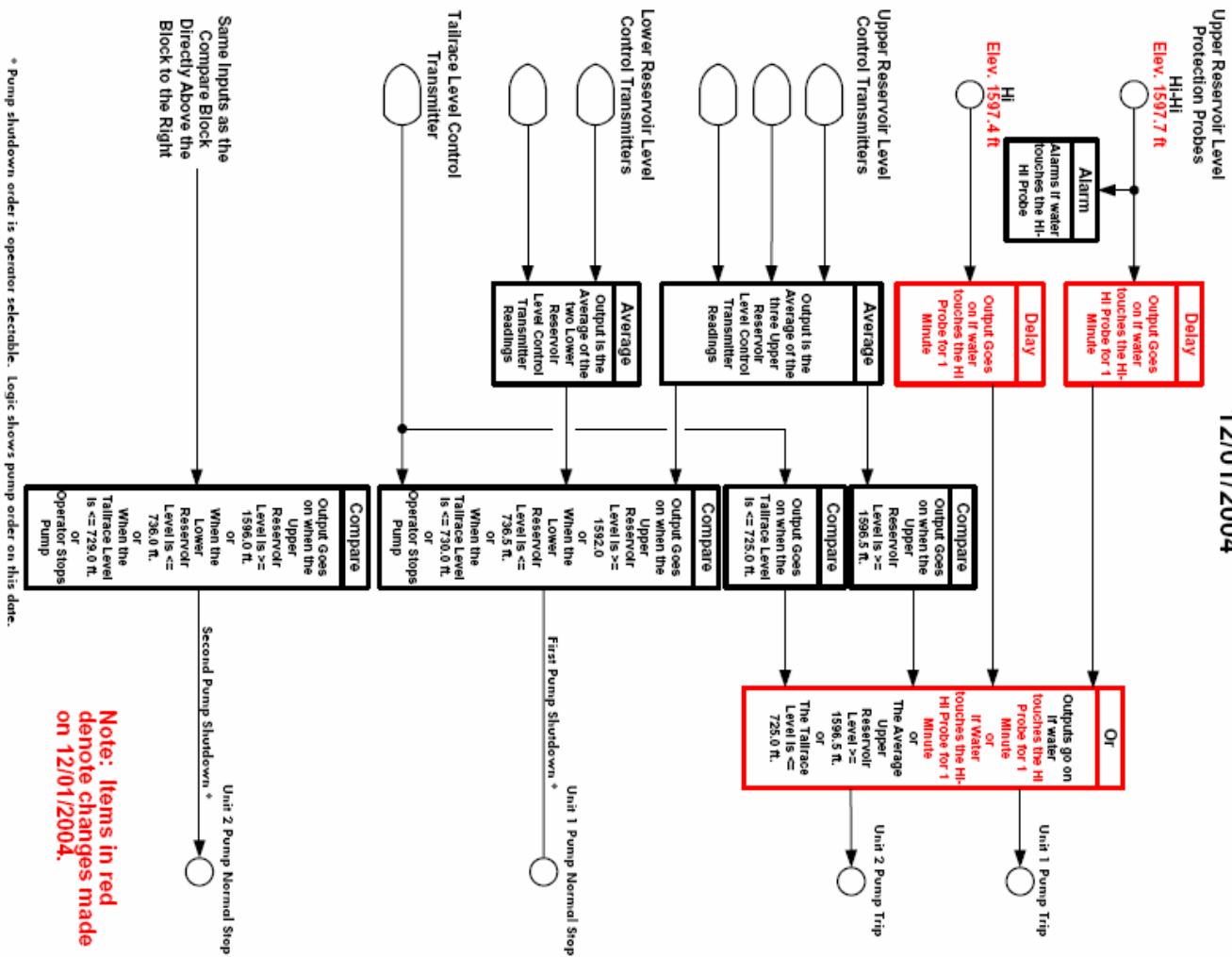
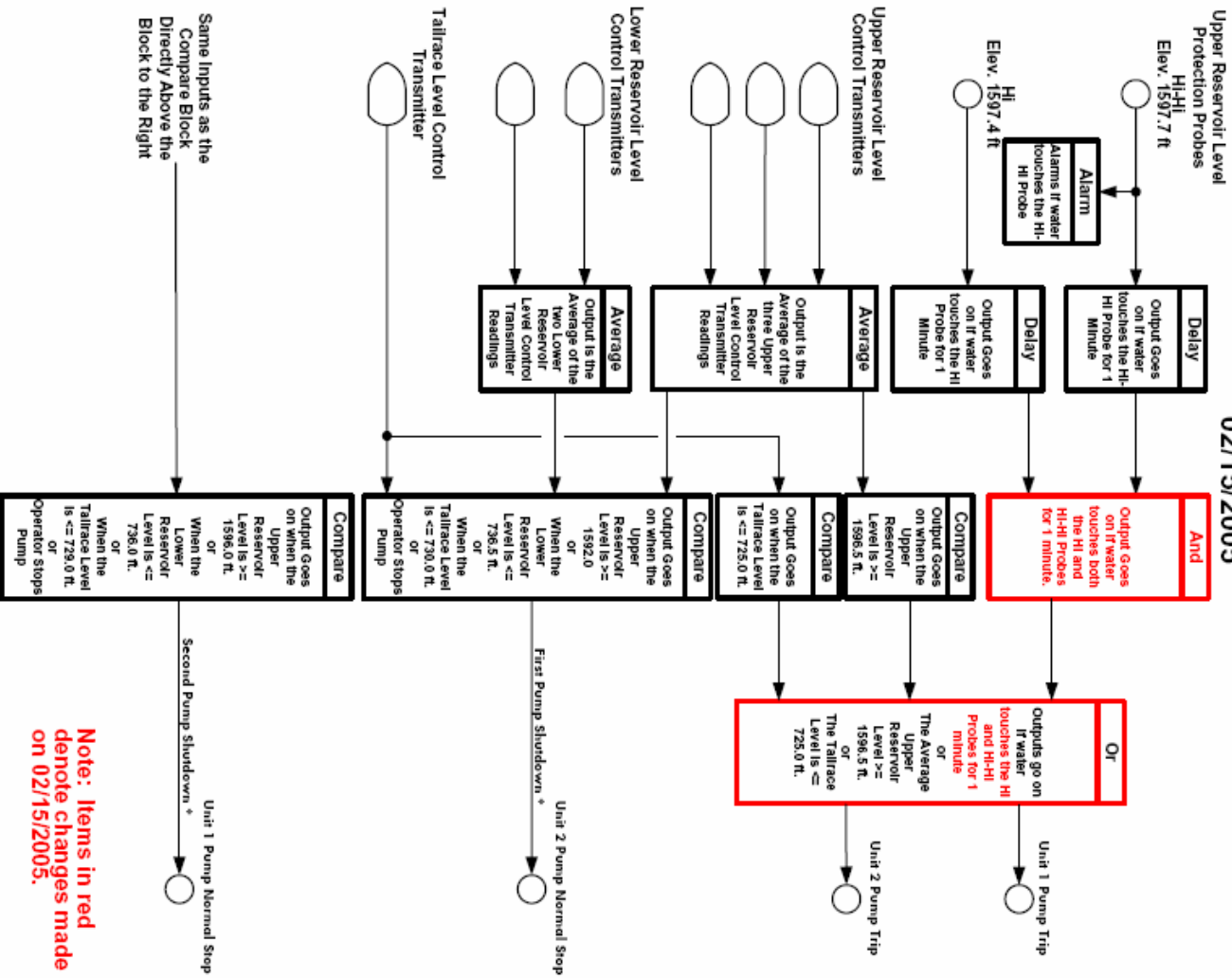


Figure 5-2

Taum Sauk Pump Shutdown Logic

02/15/2005



Note: Items in red denote changes made on 02/15/2005.

Figure 5-3



Taum Sauk
Upper Reservoir
Breach 12/14/05

Figure 6-1

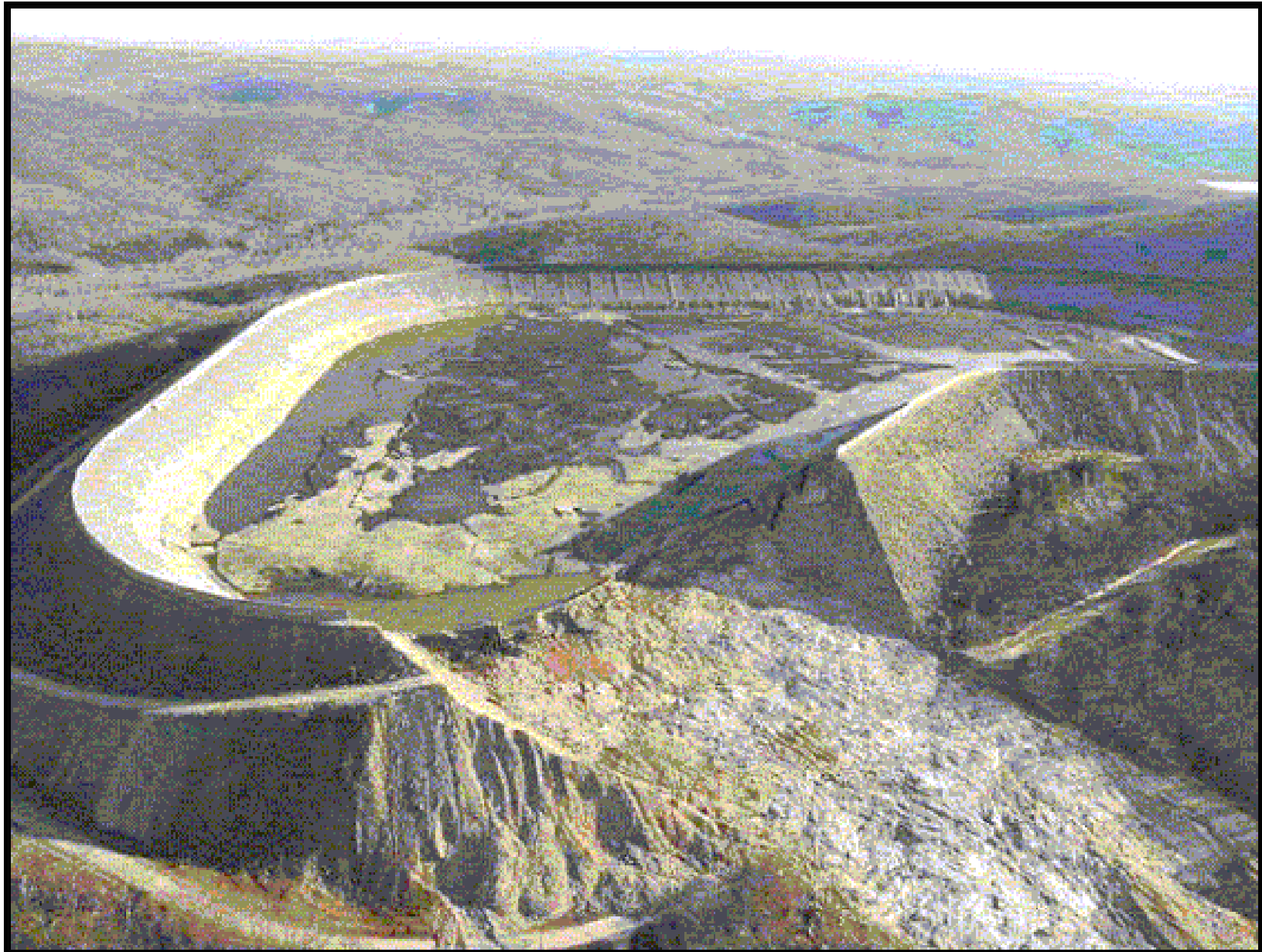
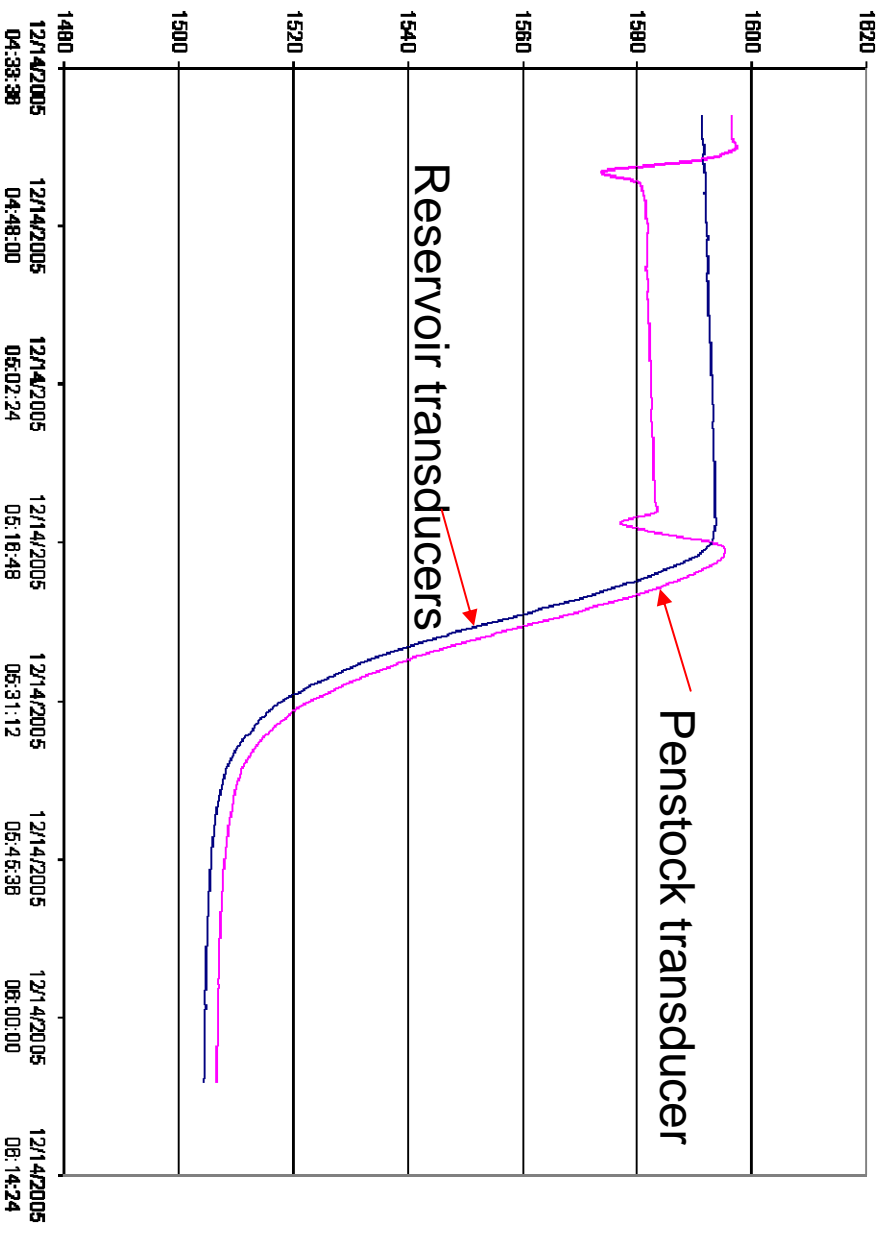


Figure 6-2



Dec. 14th breach.

Figure 6-3

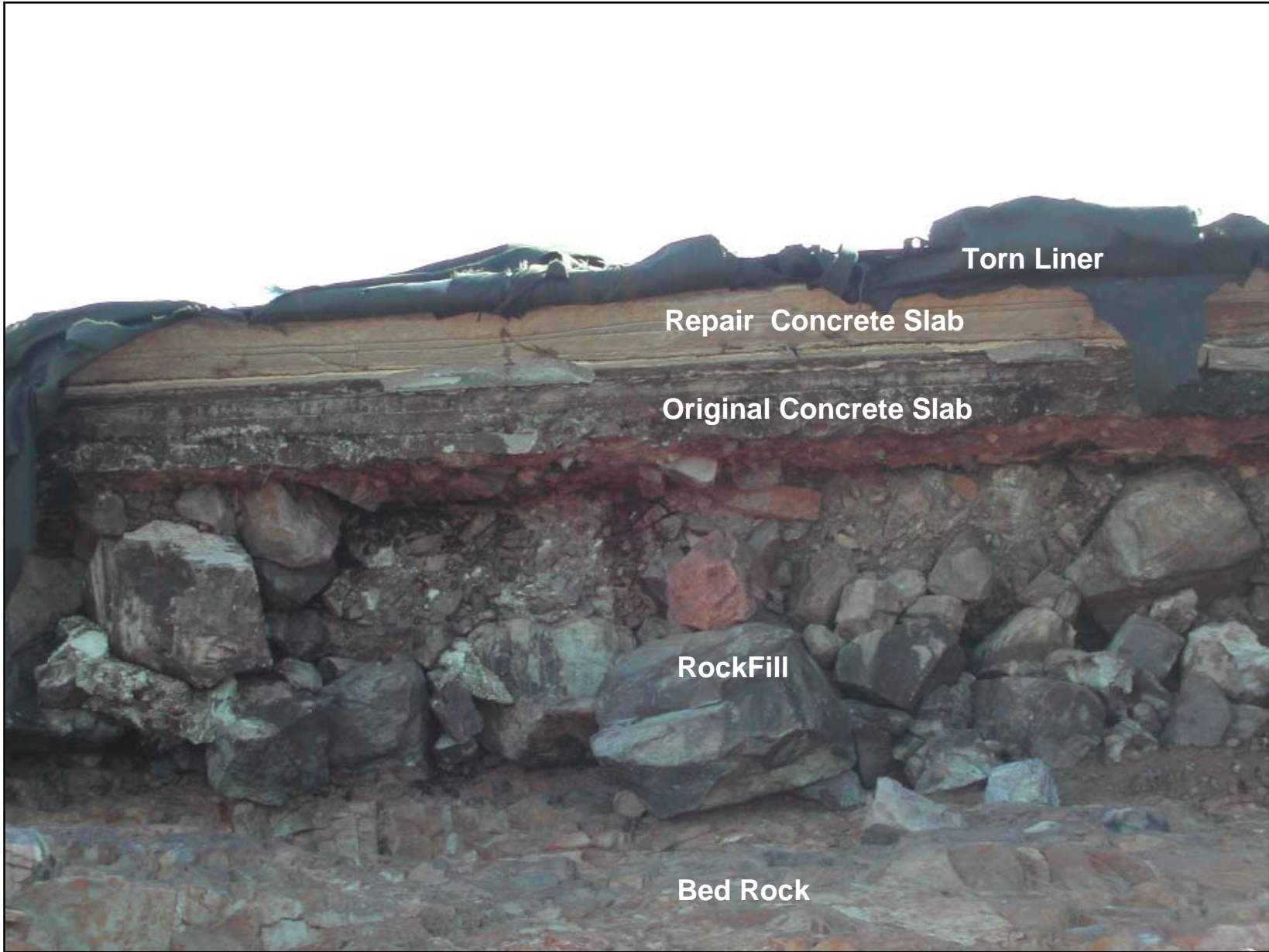


Figure 6-4



Eroded foundation, note rock jointing and overlying clay materials

Figure 6-5



Rockfill between top of rock and base of plinth

Figure 6-6



Rockfill between top of rock and base of plinth,
note reddish grout in rockfill beneath the plinth

Figure 6-7



Rockfill between top
of rock and base of plinth

Figure 6-8

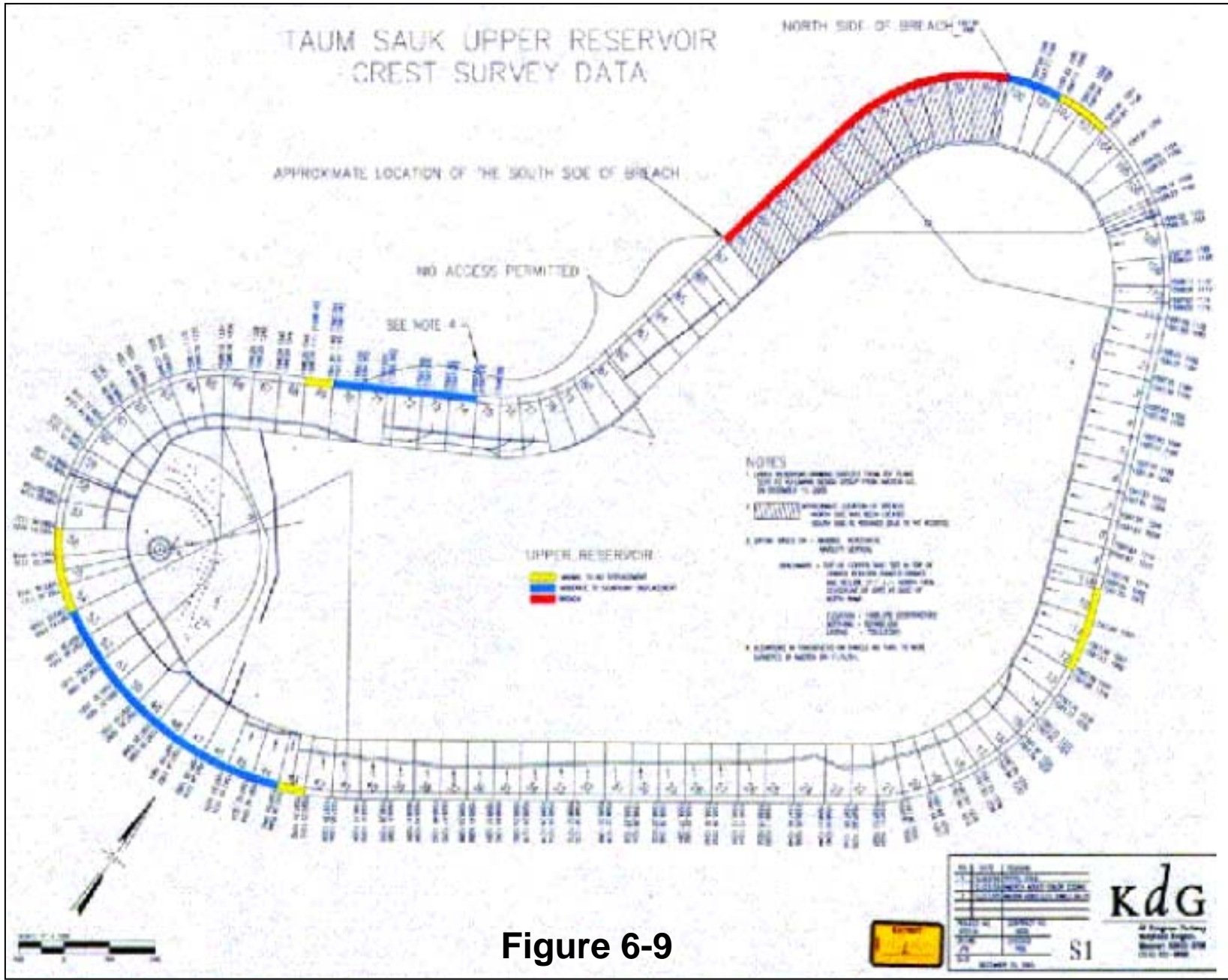


Figure 6-9

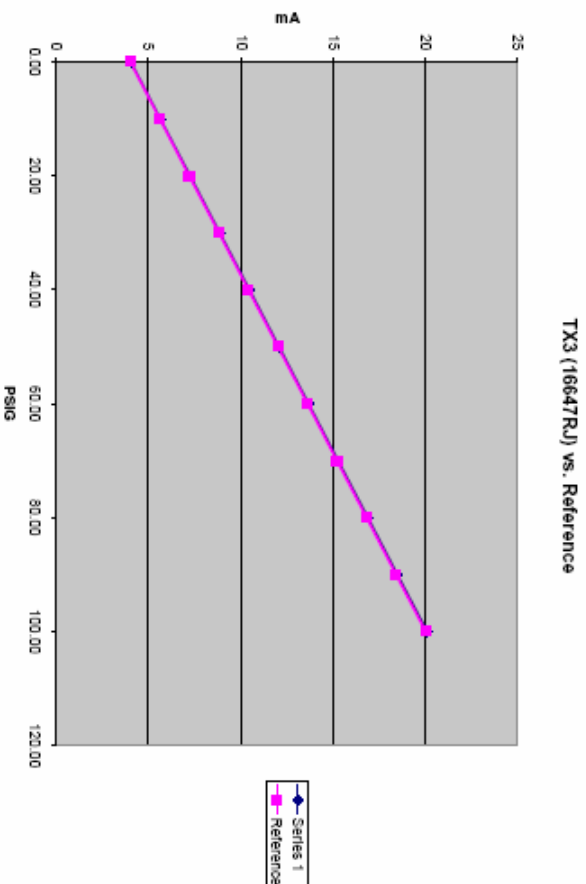


Figure 18: TX3 (16647RJ) vs. Reference

TX2 (16646RJ) vs. Reference

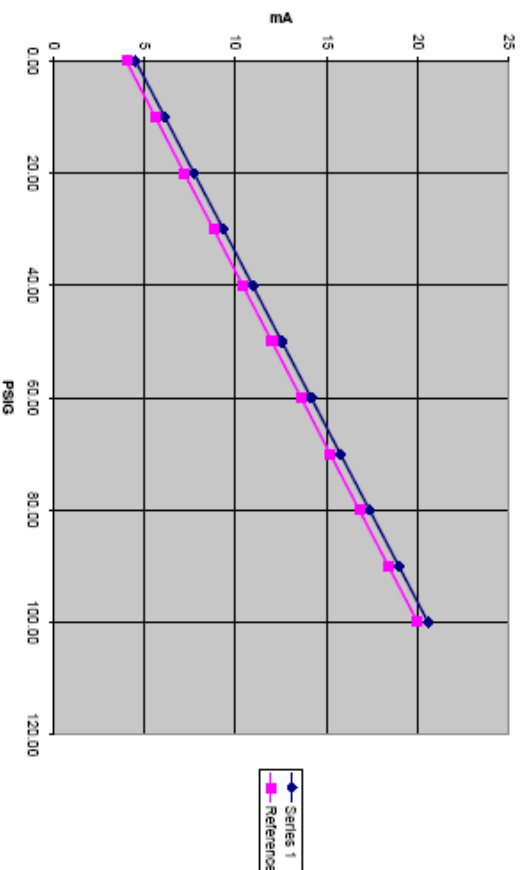


Figure 17: TX2 (16646RJ) vs. Reference

Pressure Transducers TX2 and TX3 Compared to Reference Transducer (TX2 reads average of 7.86 feet high and TX3 reads average of 0.85 feet high)

Figure 7-1

TX2 (16646RJ) at 40 PSIG

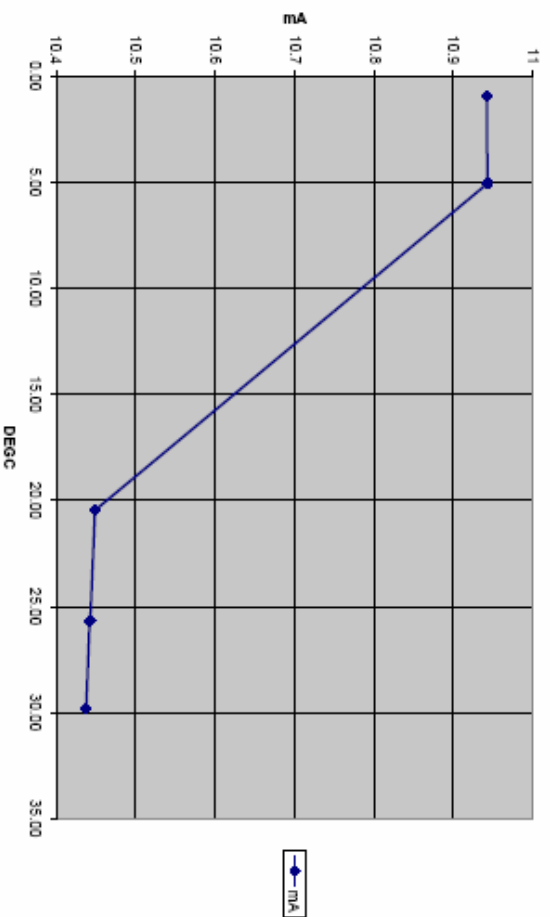


Figure 19: Temperature Sensitivity of TX2

TX3 (16647RJ) at 40 PSIG

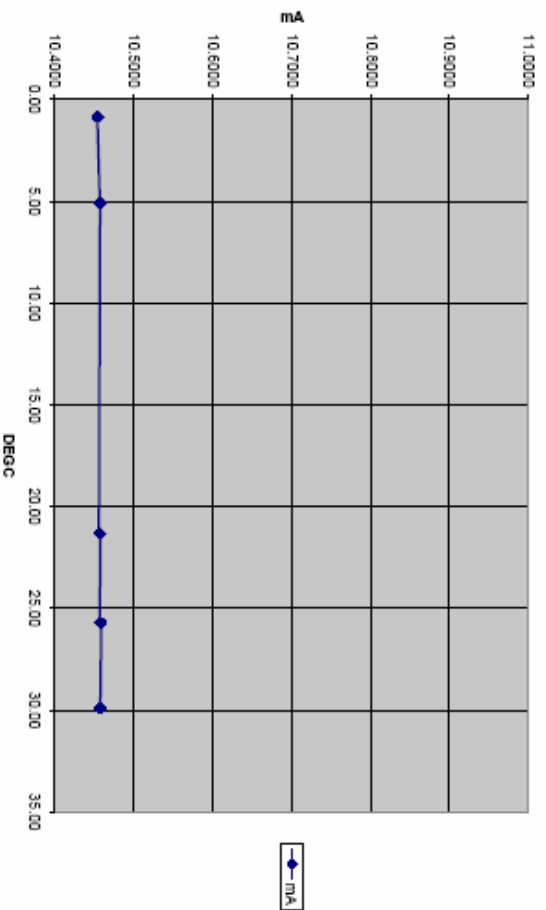


Figure 20: Temperature Sensitivity of TX3

**Pressure Transducer Temperature Sensitivity
(TX2 Output Shift Represents +7.11 Ft. of Water Level
at 5 degrees compared to 20 degrees)**

Figure 7-2

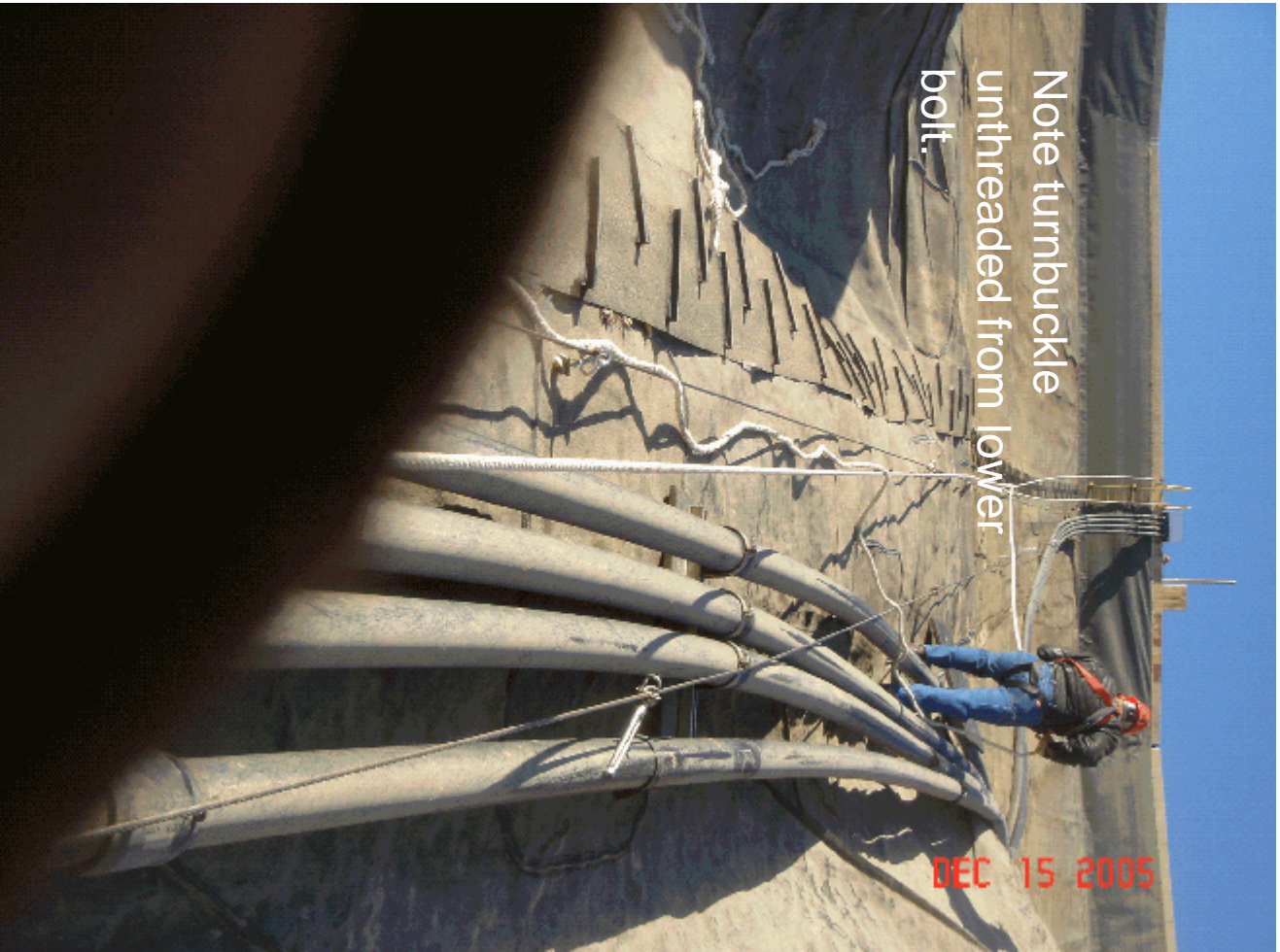


Figure 7-3

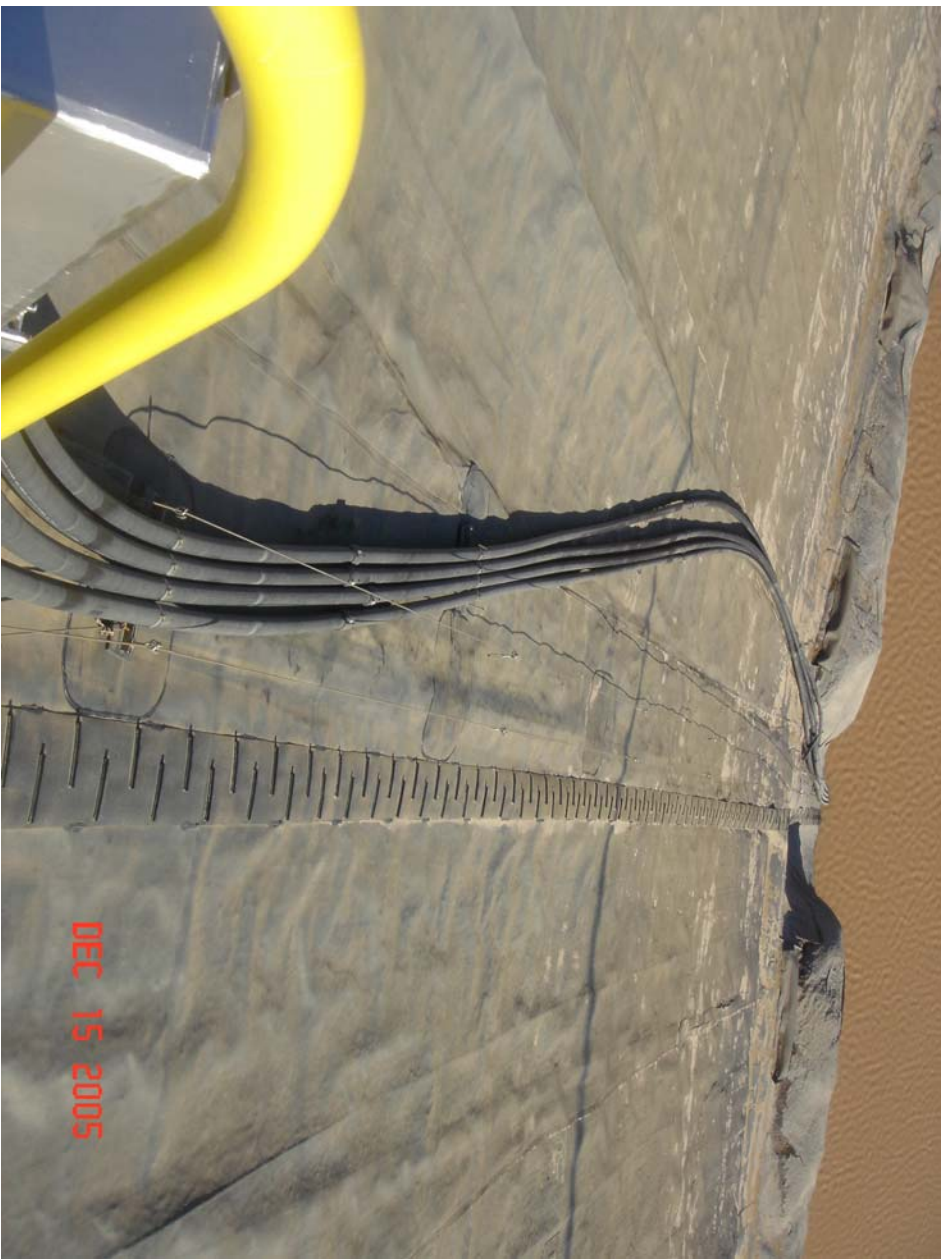
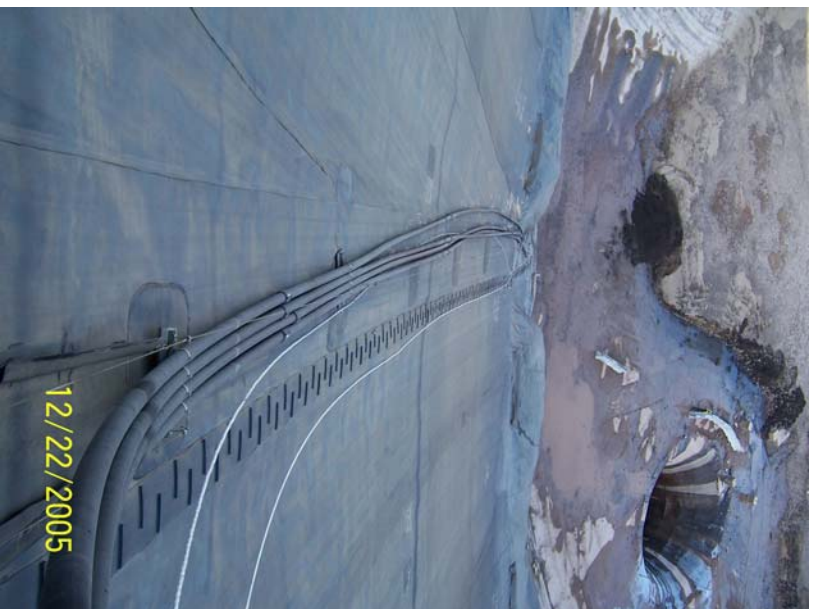
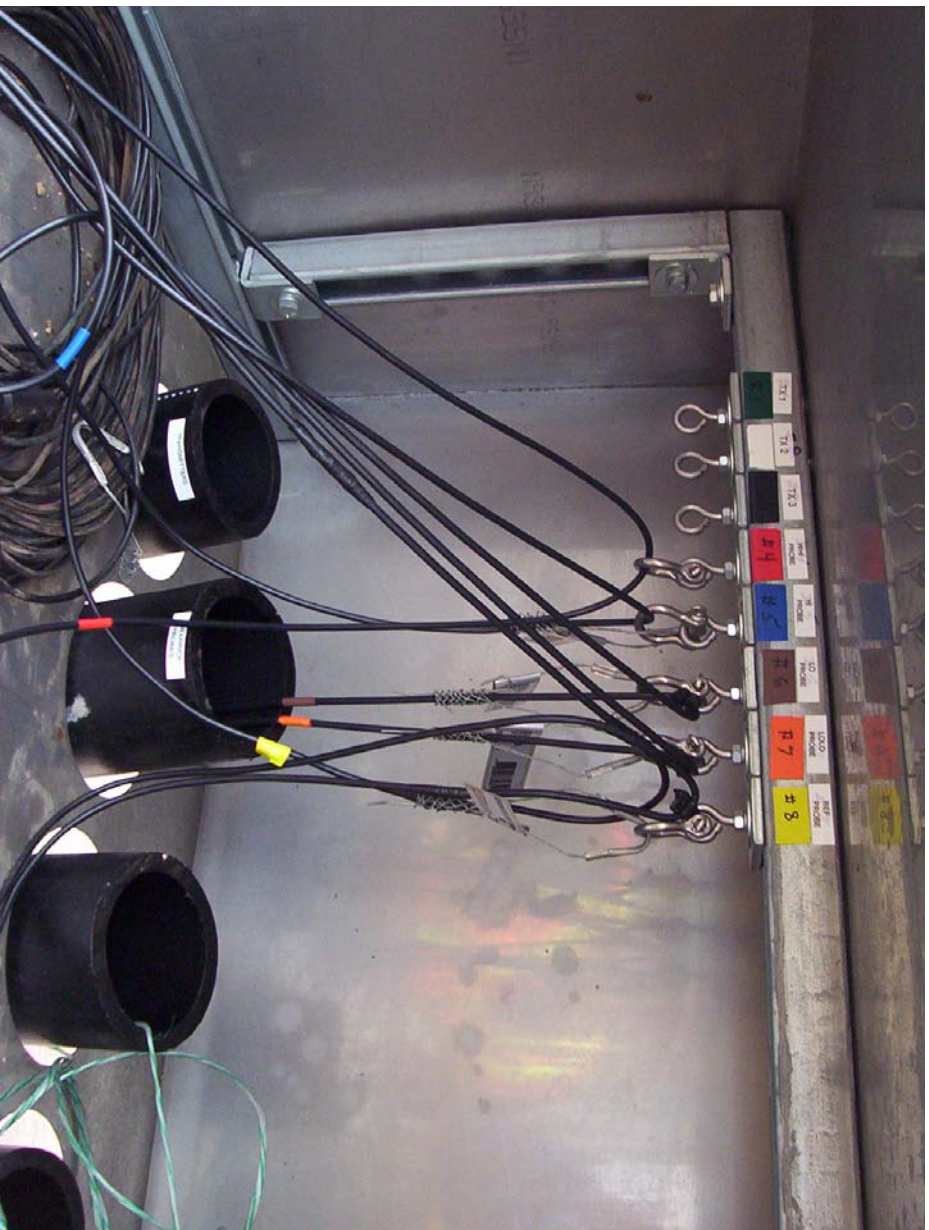


Figure 7-4



Note, straightening of protective pipes between dates of above photos.

Figure 7-5



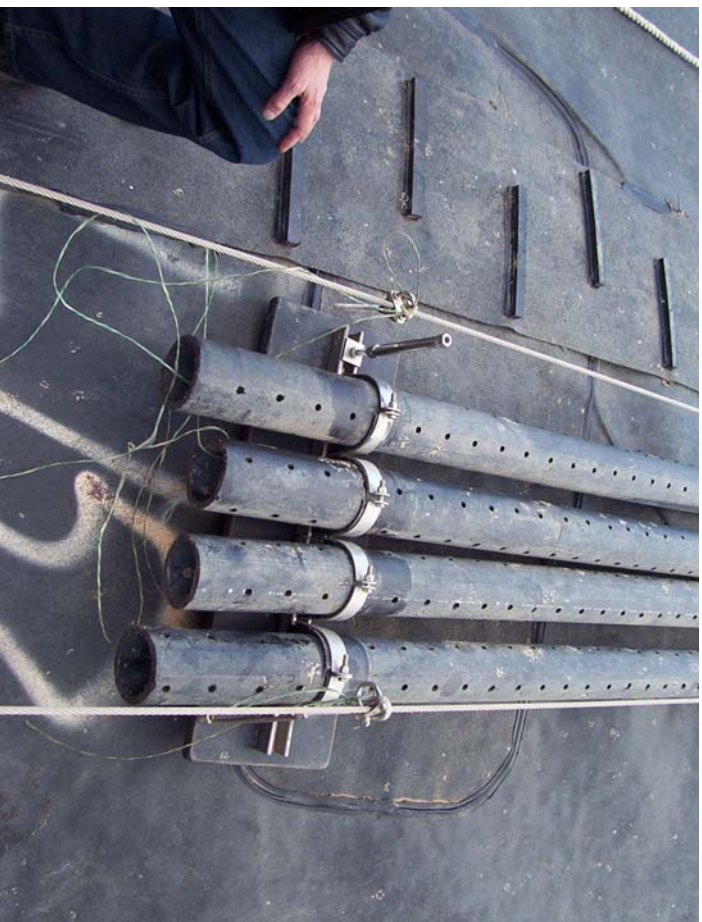
**Upper ends of protective pipes
with instrument cables in enclosure on parapet.
Pressure transducers use left pipe
and conductivity probes use the second pipe from left.**

Figure 7-6



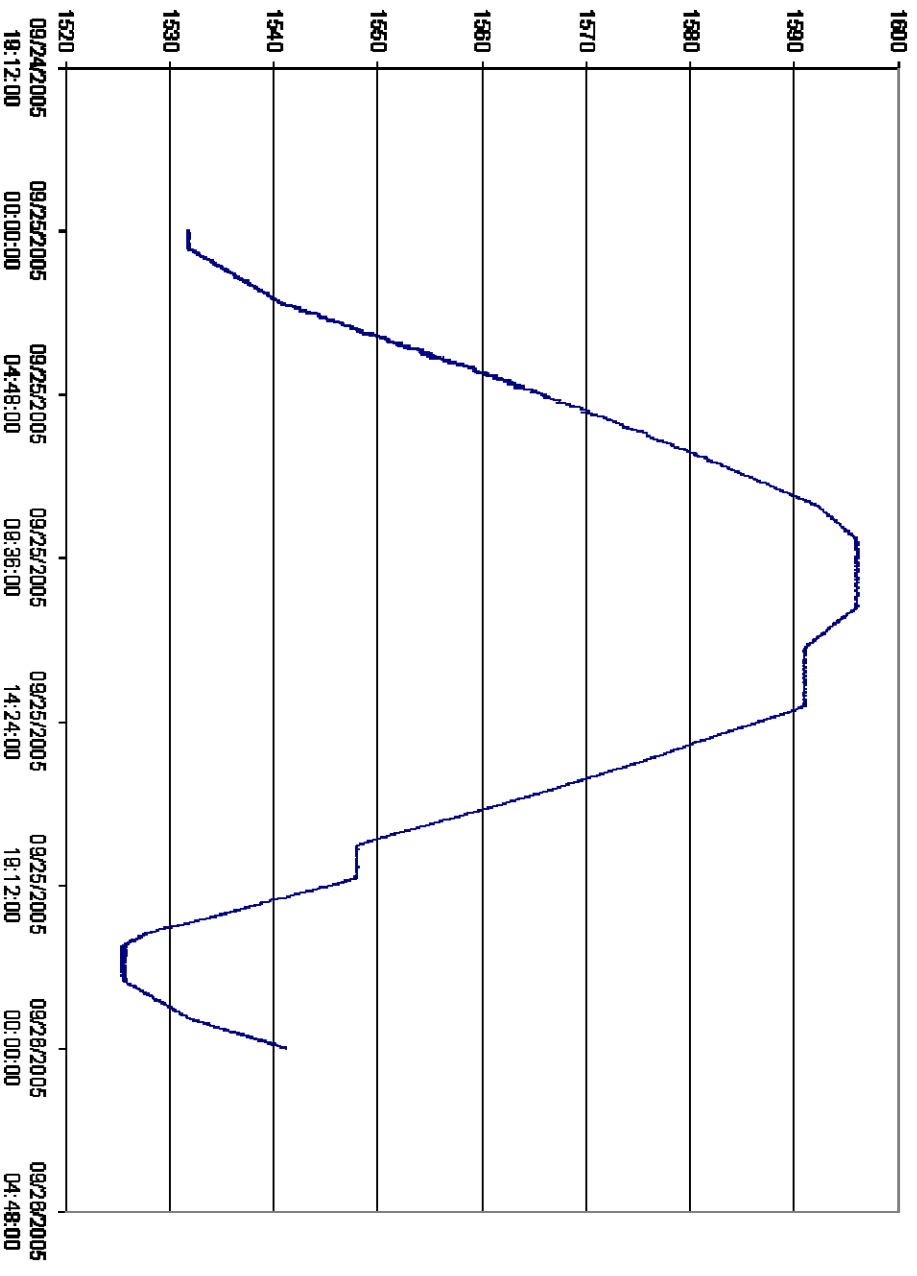
Protective pipe base plates are not anchored to reservoir.
Left guy cable has come loose from base plate in top photo.

Figure 7-7



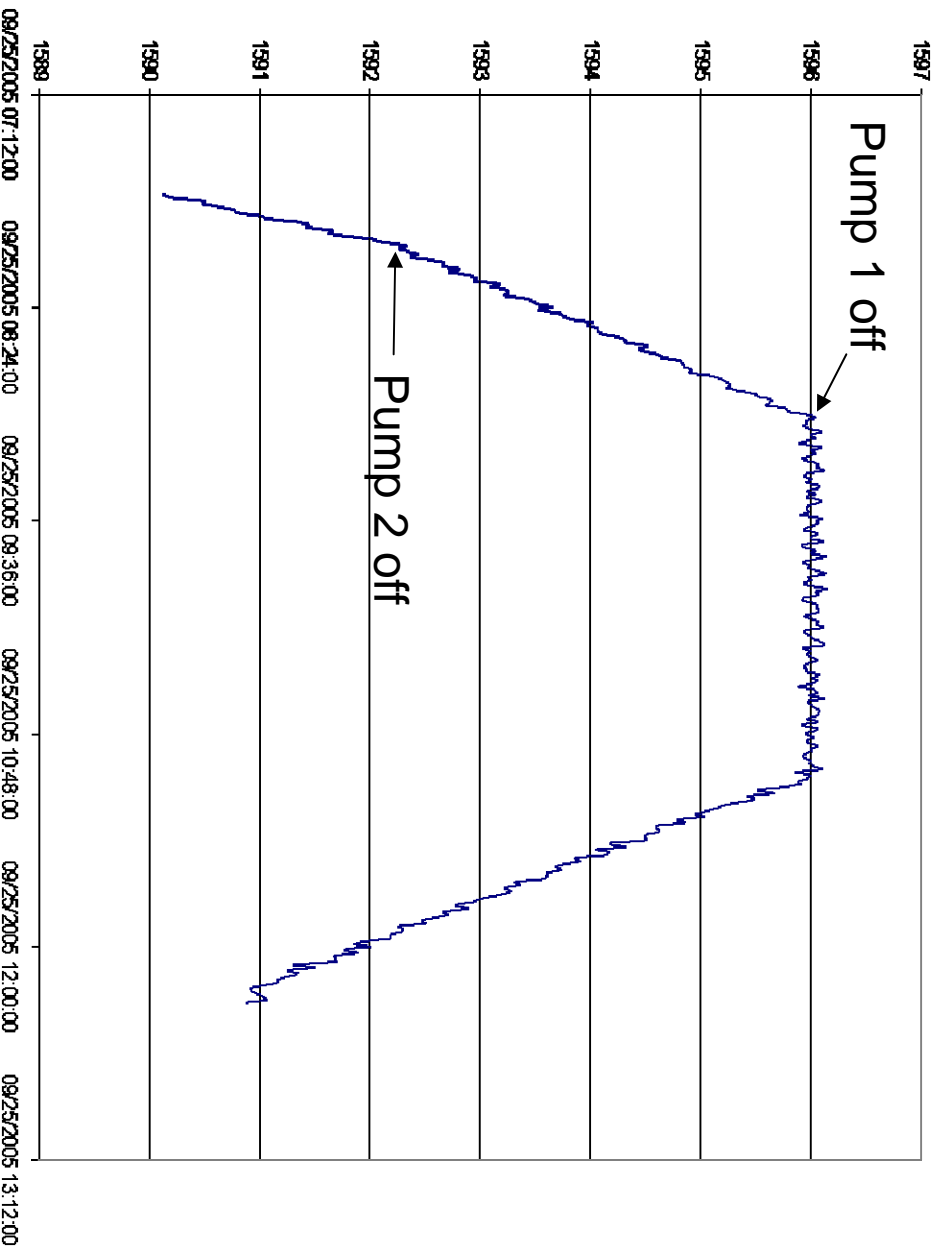
Protective pipe support system as found. Note eye bolt unthreaded from turnbuckle. Also note lock washer in place at connection to U channel but lack of lock washer at turnbuckle.

Figure 7-8



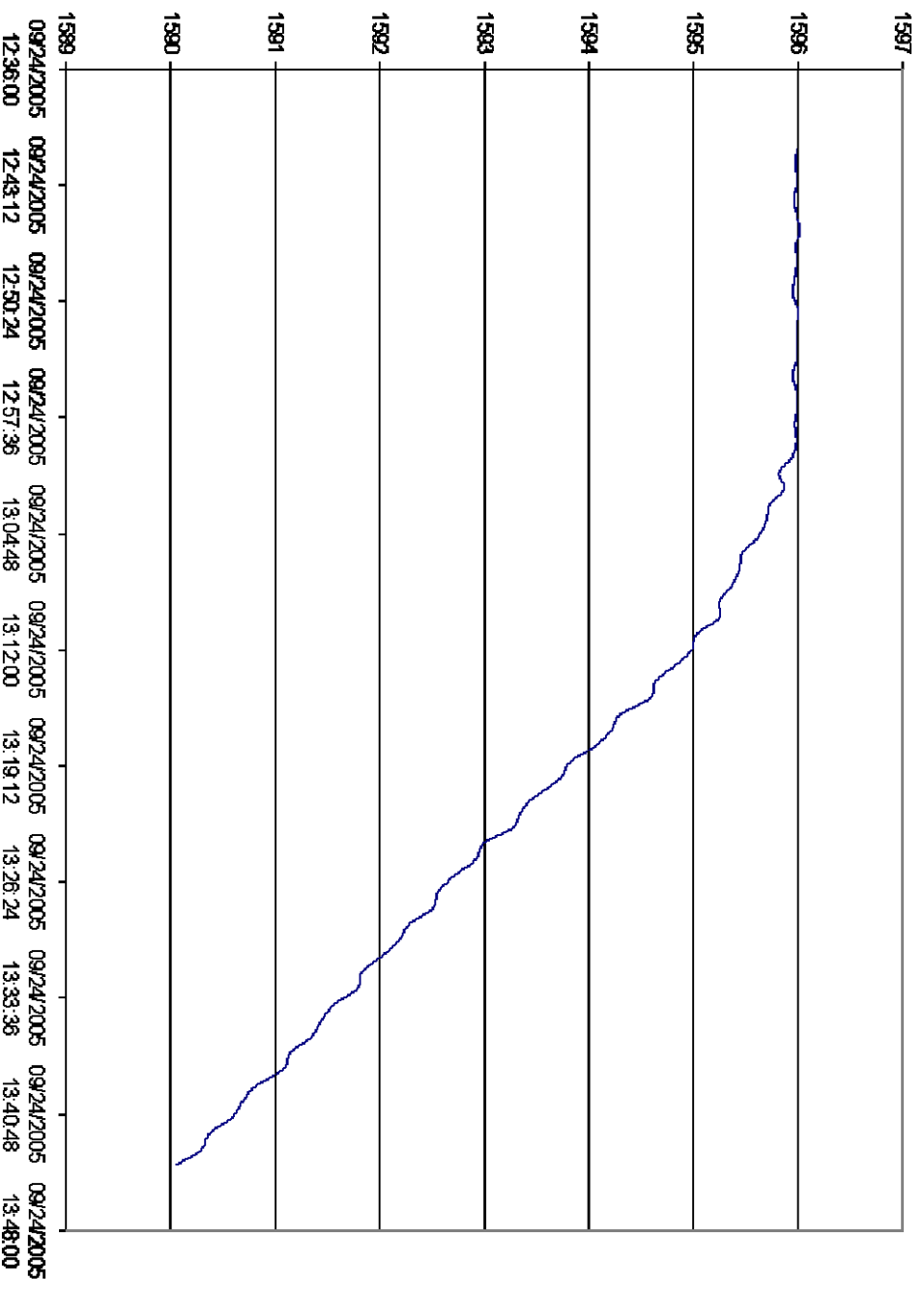
Hurricane Rita Event

Figure 7-9



Hurricane Rita Event

Figure 7-10



Generation start on day prior to Hurricane Rita. Note smaller level variations compared to next day.

Figure 7-11

Taum Sauk Pump Shutdown Logic

09/27/2005

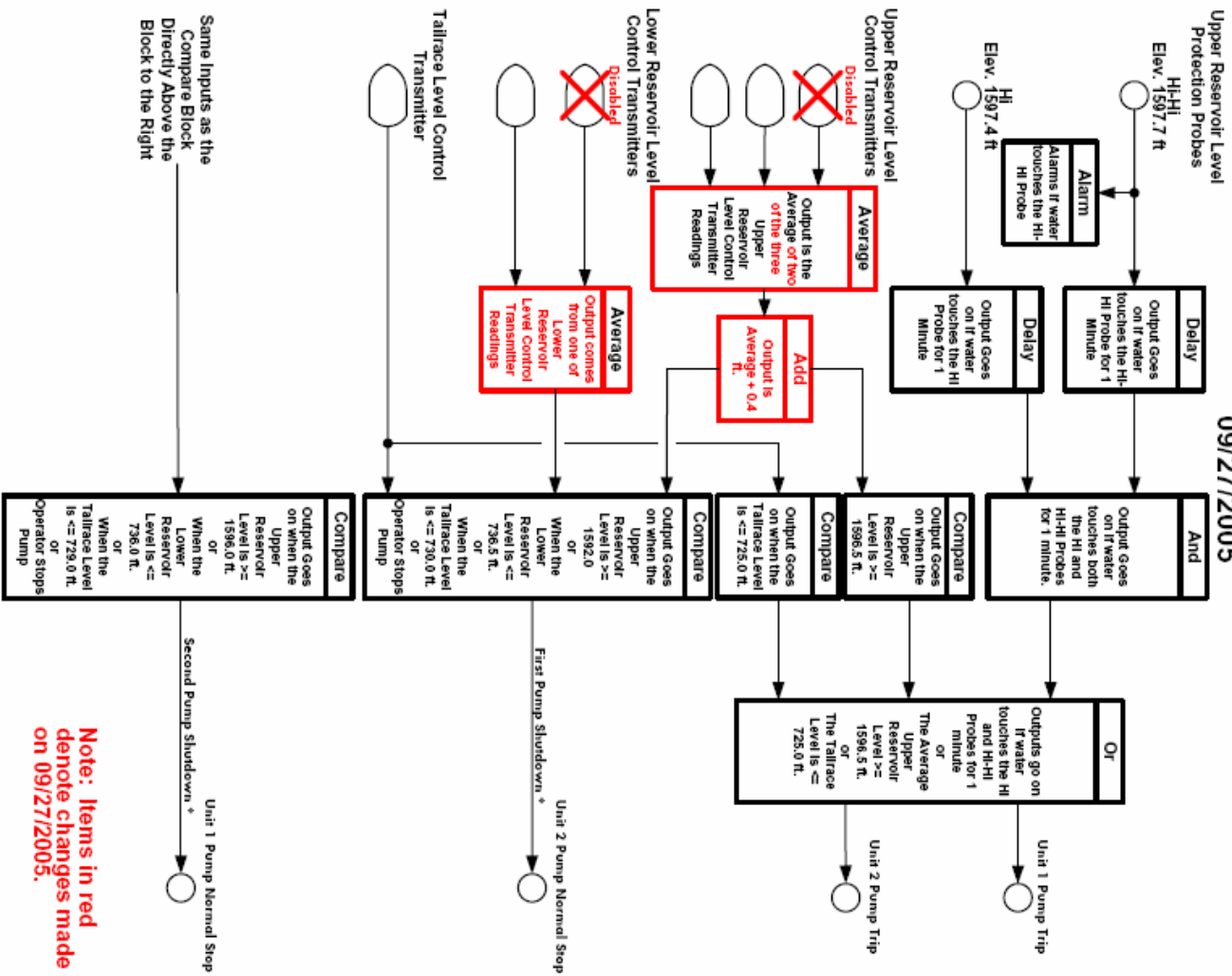
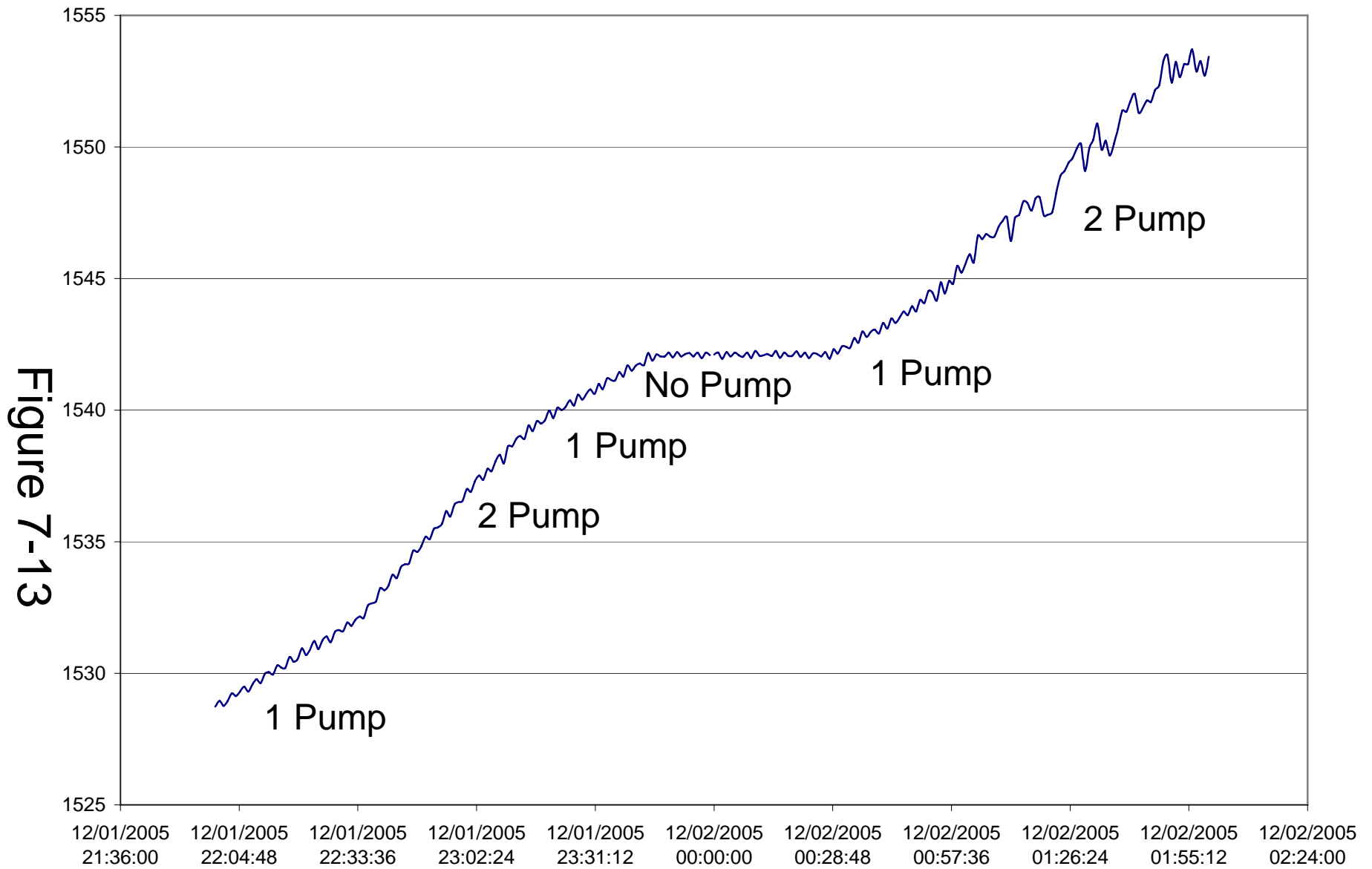
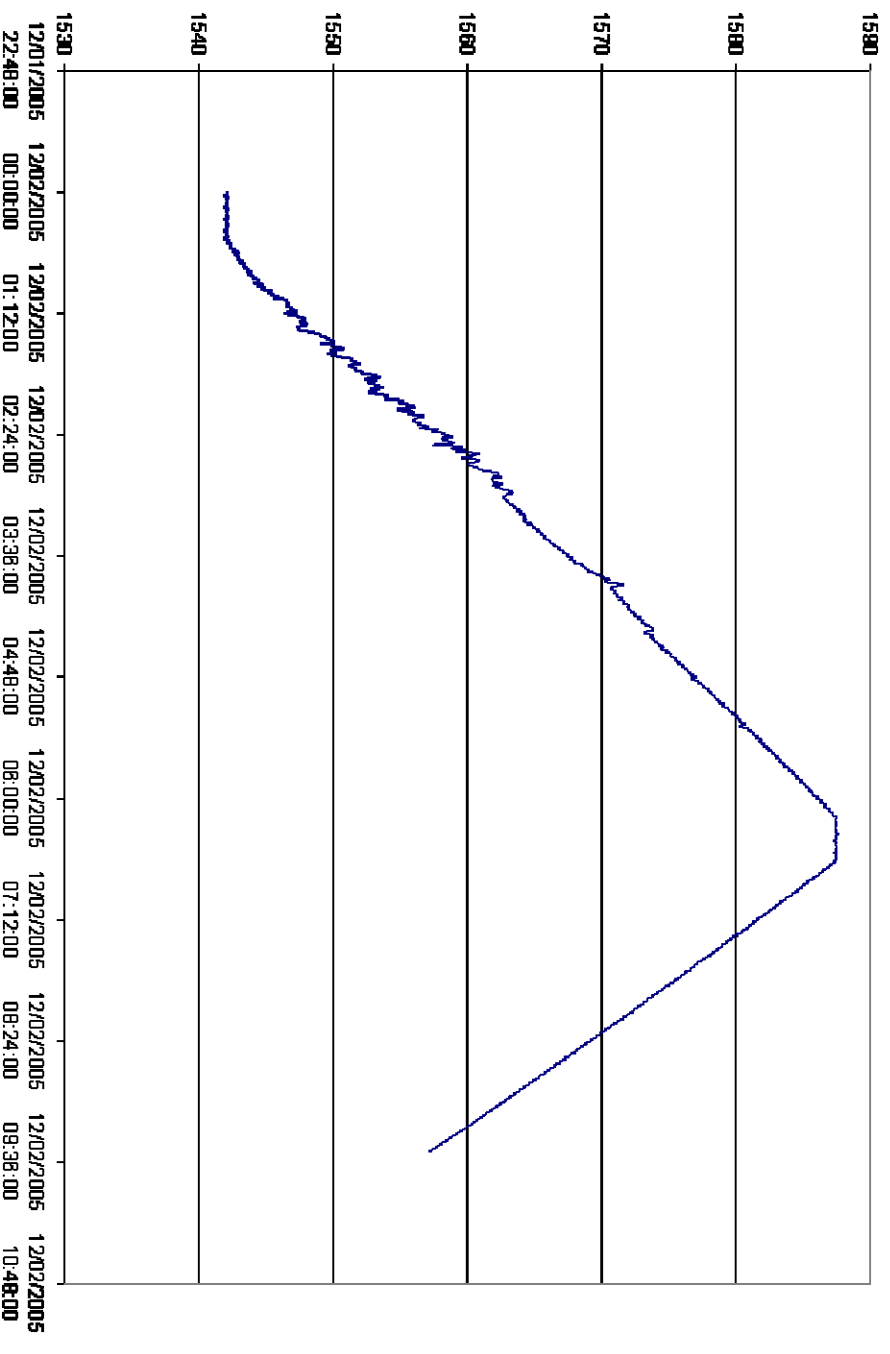


Figure 7-12

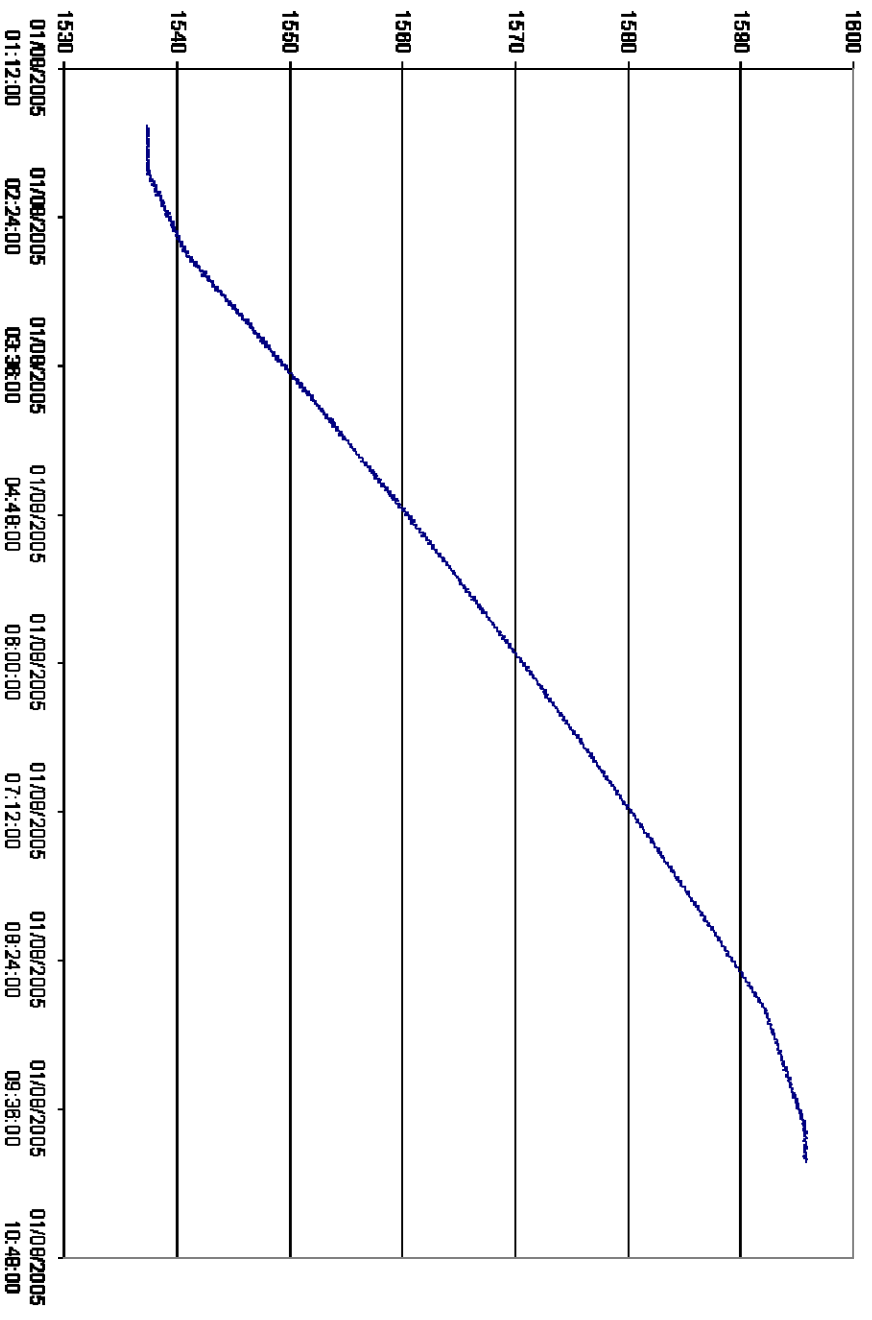


Upper Reservoir Level from Dec. 1st and 2nd.



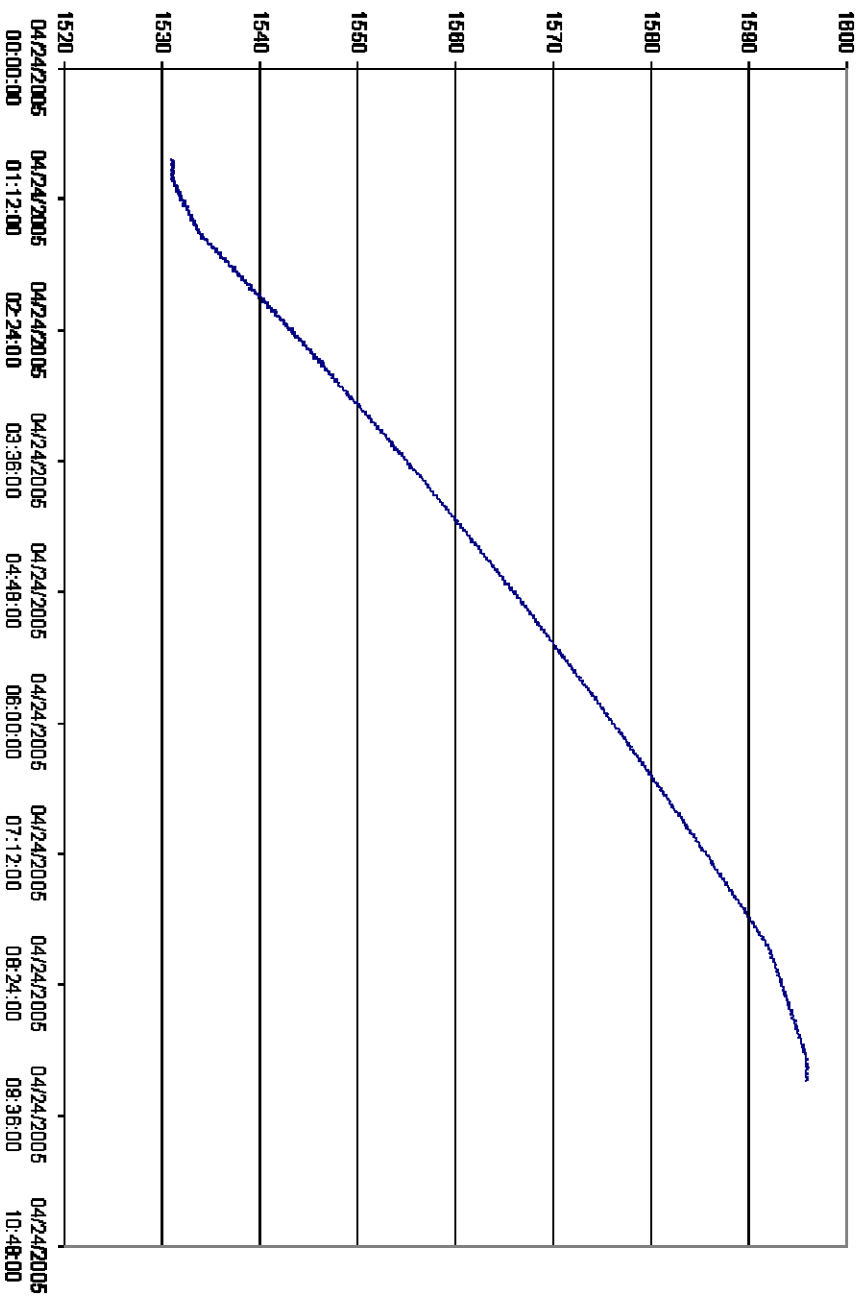
Dec. 2nd. Note erratic behavior on rising and lower level compared to falling level.

Figure 7-14



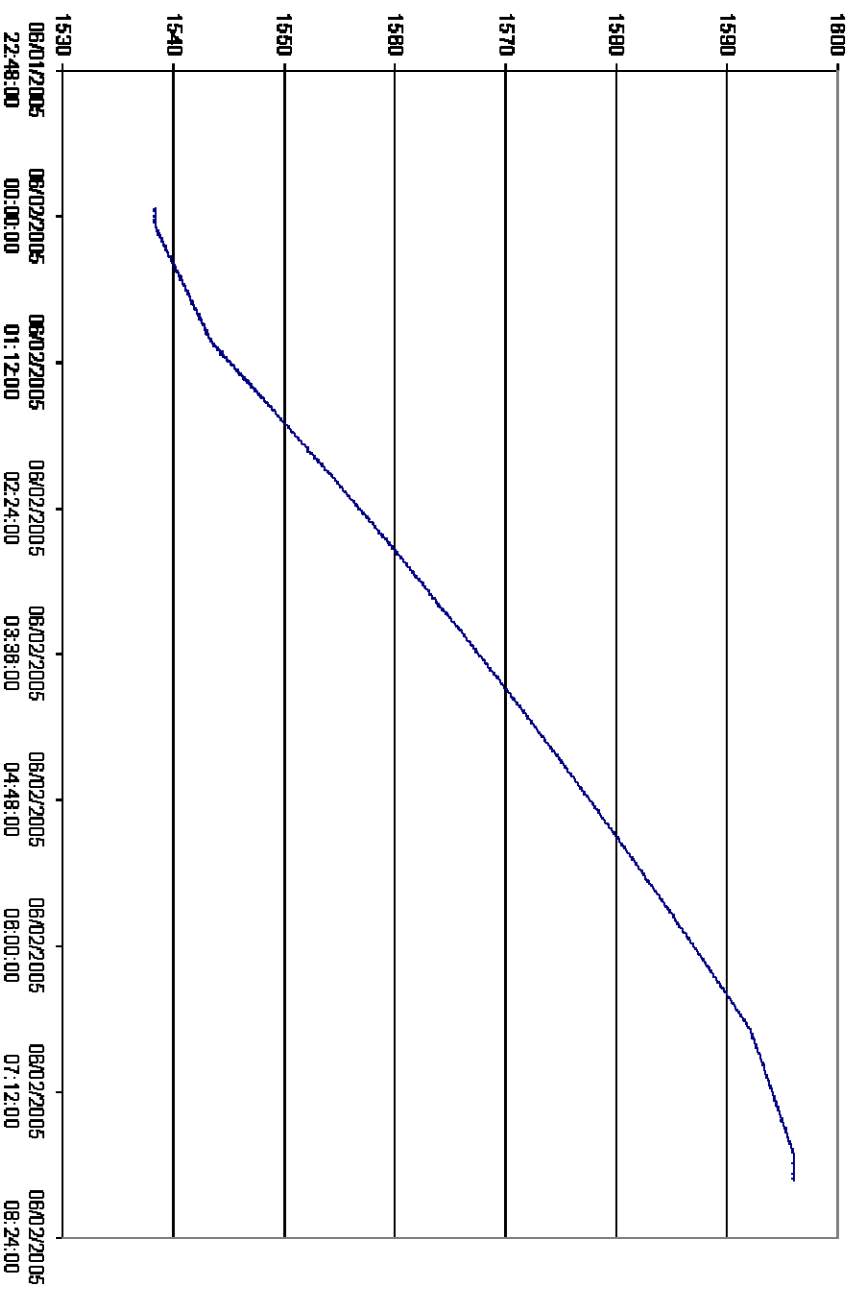
Jan. 2005 two pump operation.

Figure 7-15



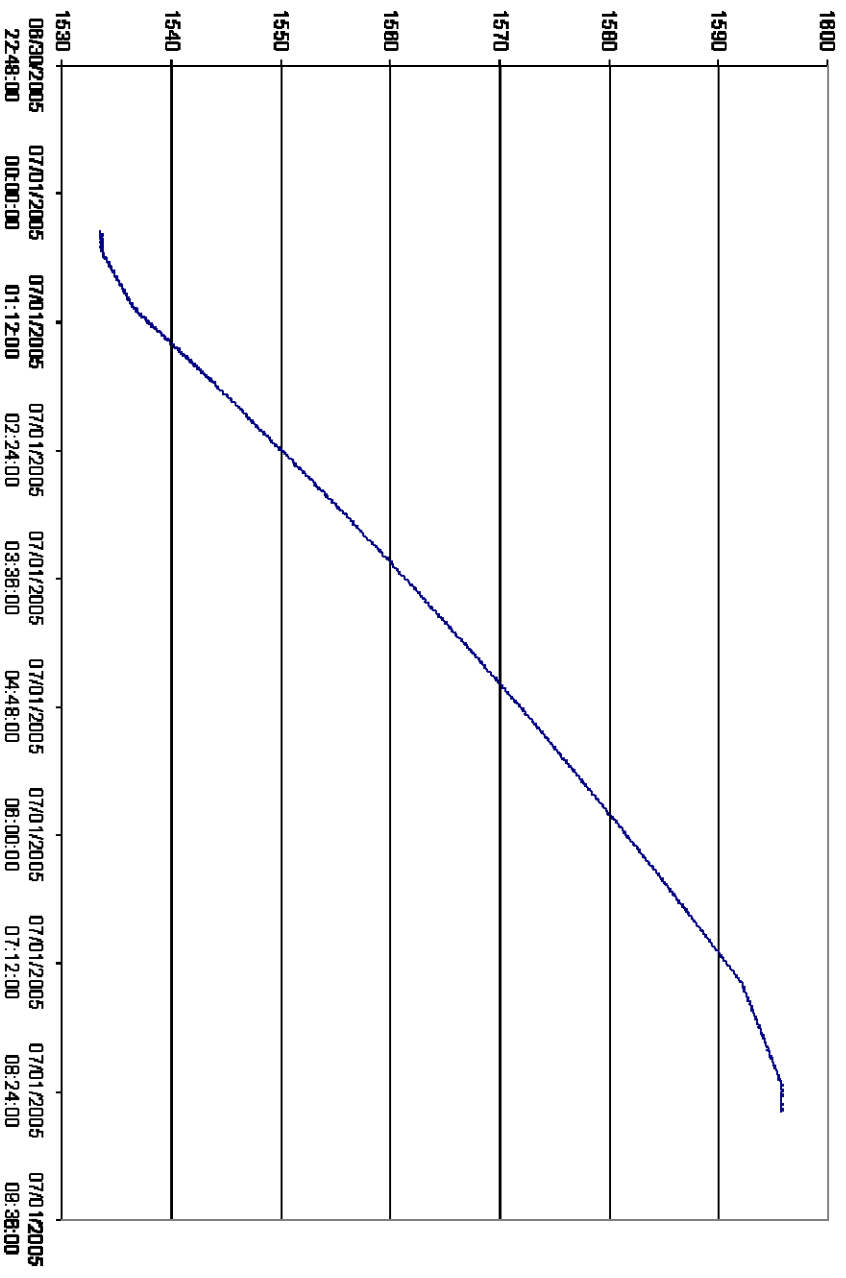
April 2005 two pump operation.

Figure 7-16



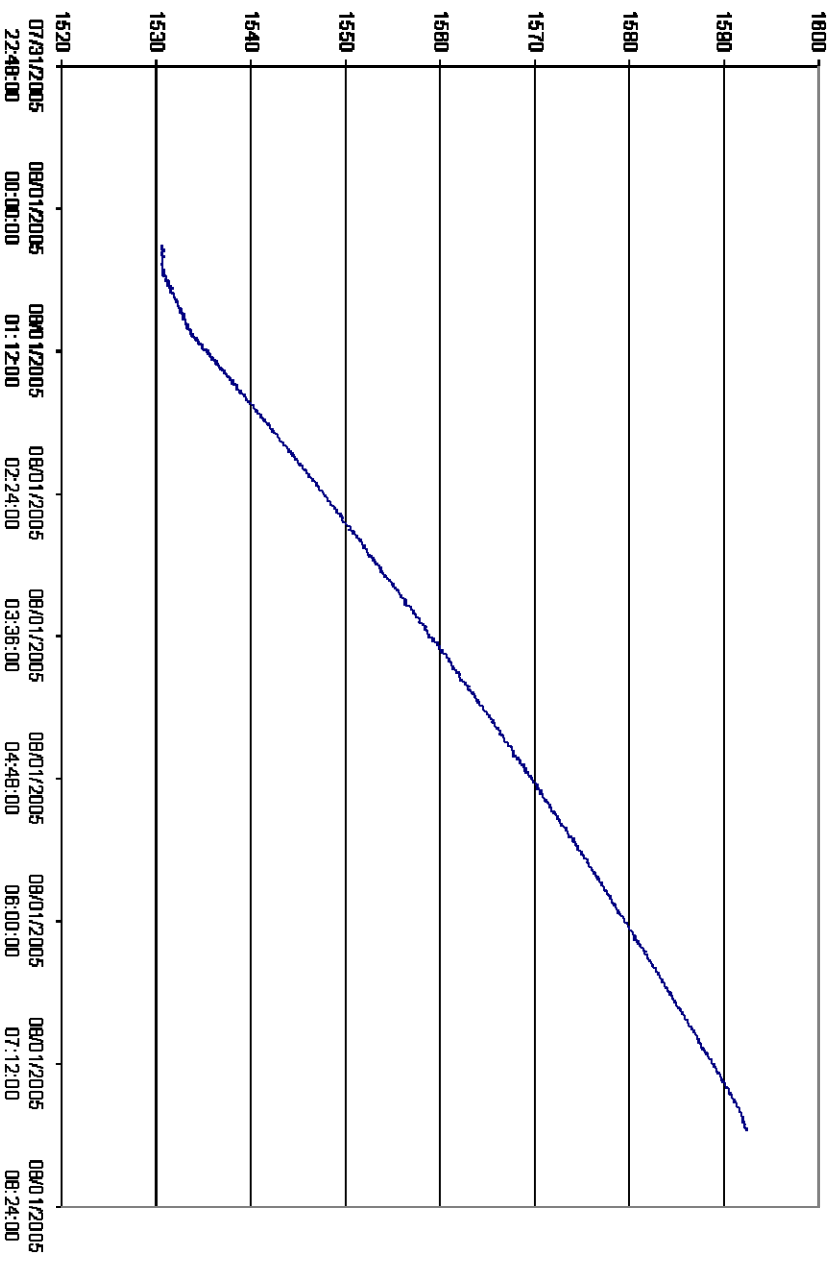
June 2005 two pump operation.

Figure 7-17



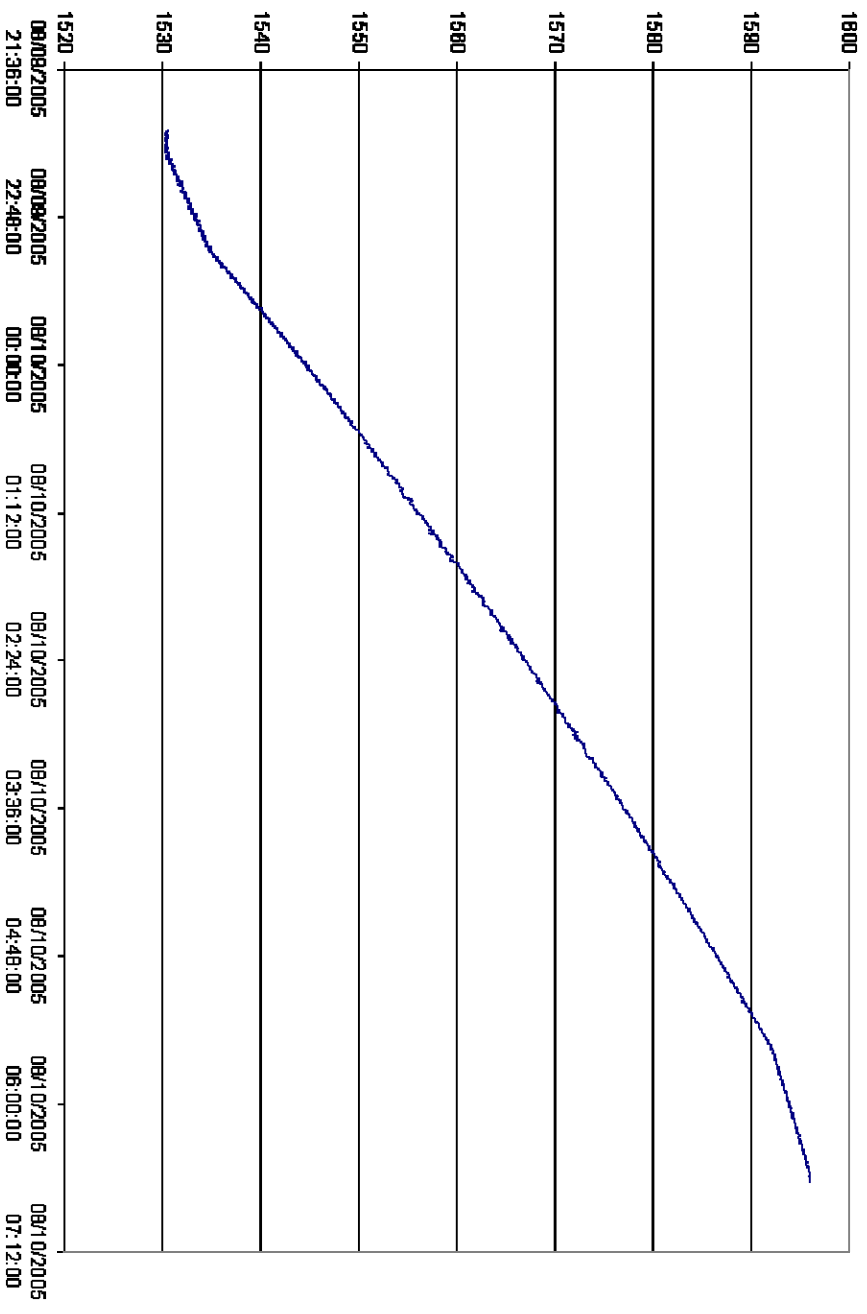
July 2005 two pump operation.

Figure 7-18



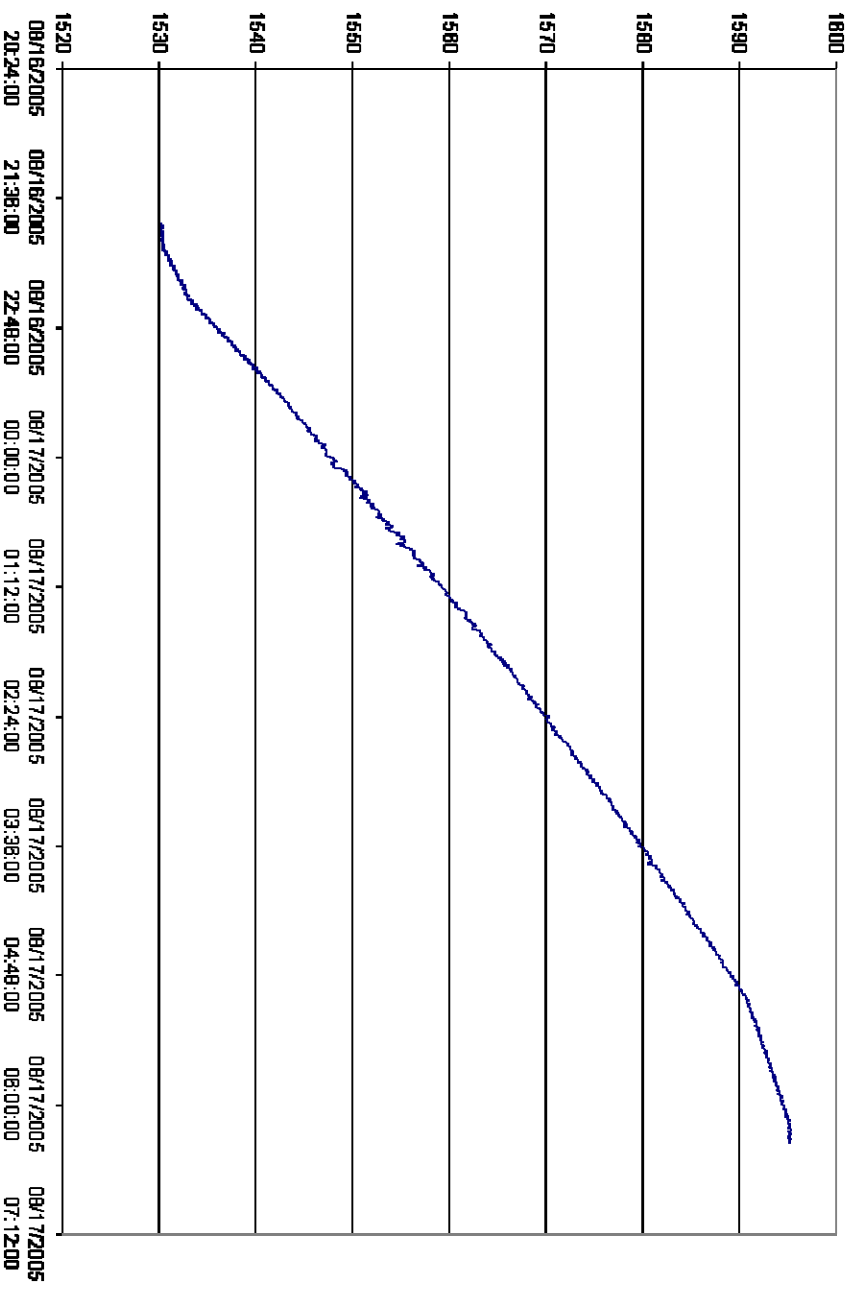
August 1, 2005 two pump operation.

Figure 7-19



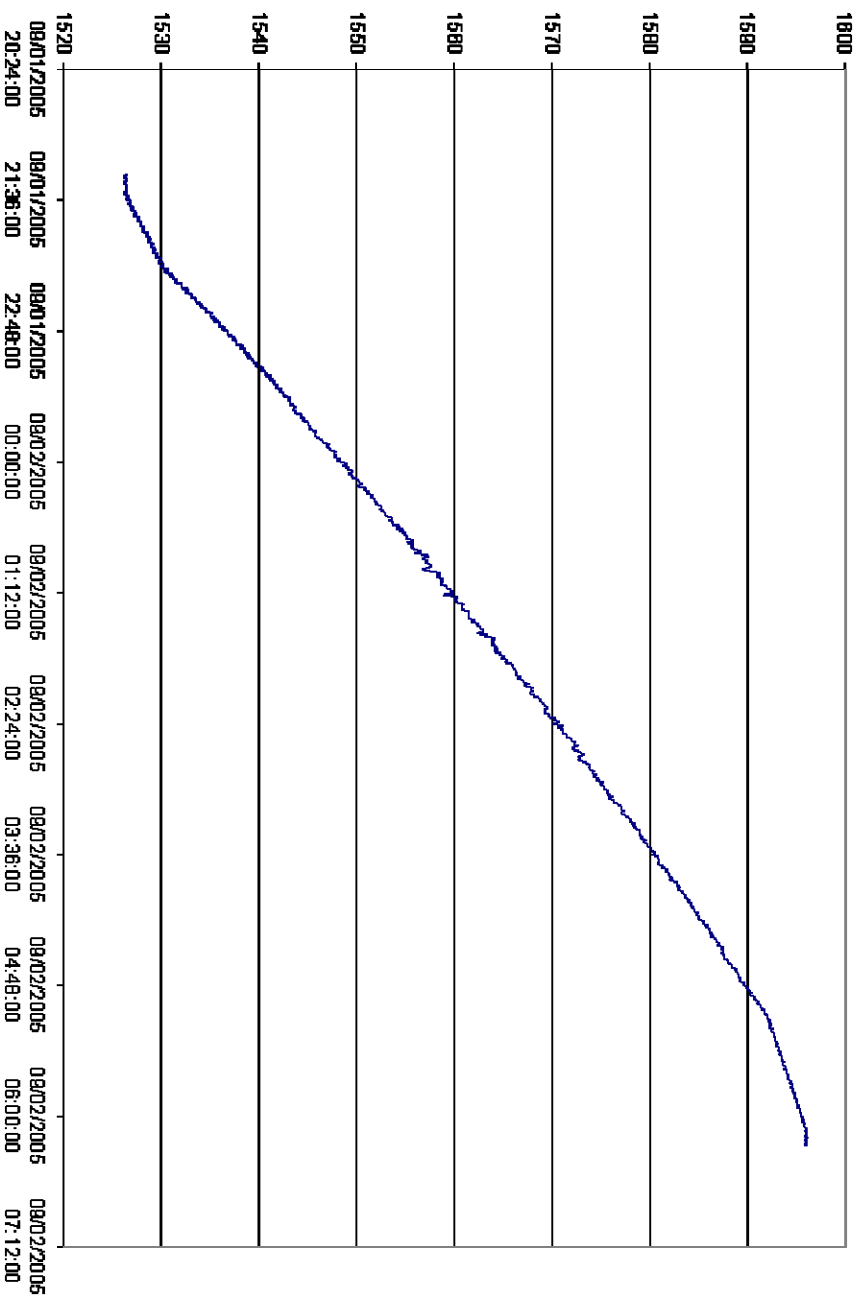
August 10, 2005 two pump operation.

Figure 7-20



August 17, 2005 two pump operation.

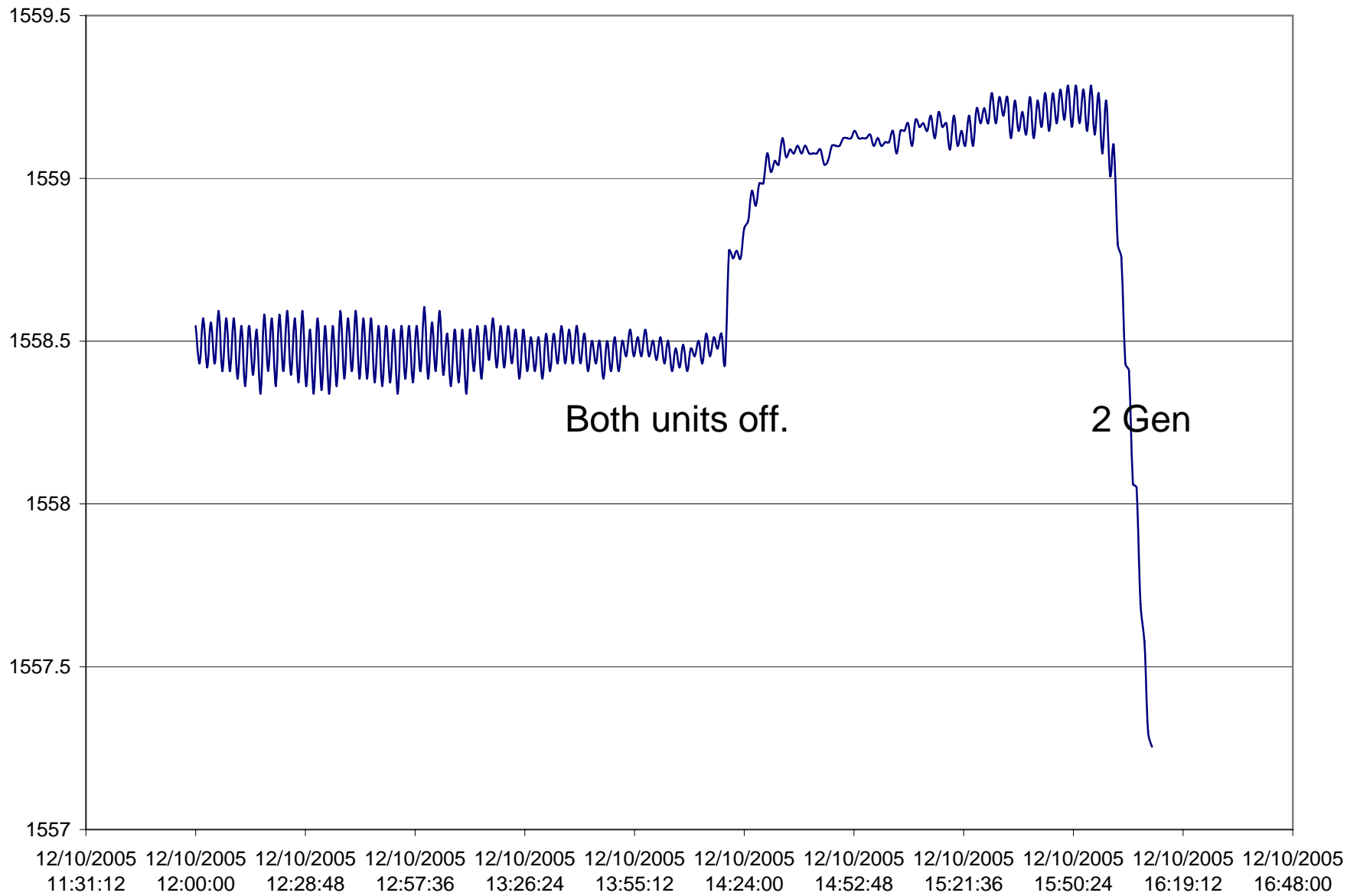
Figure 7-21



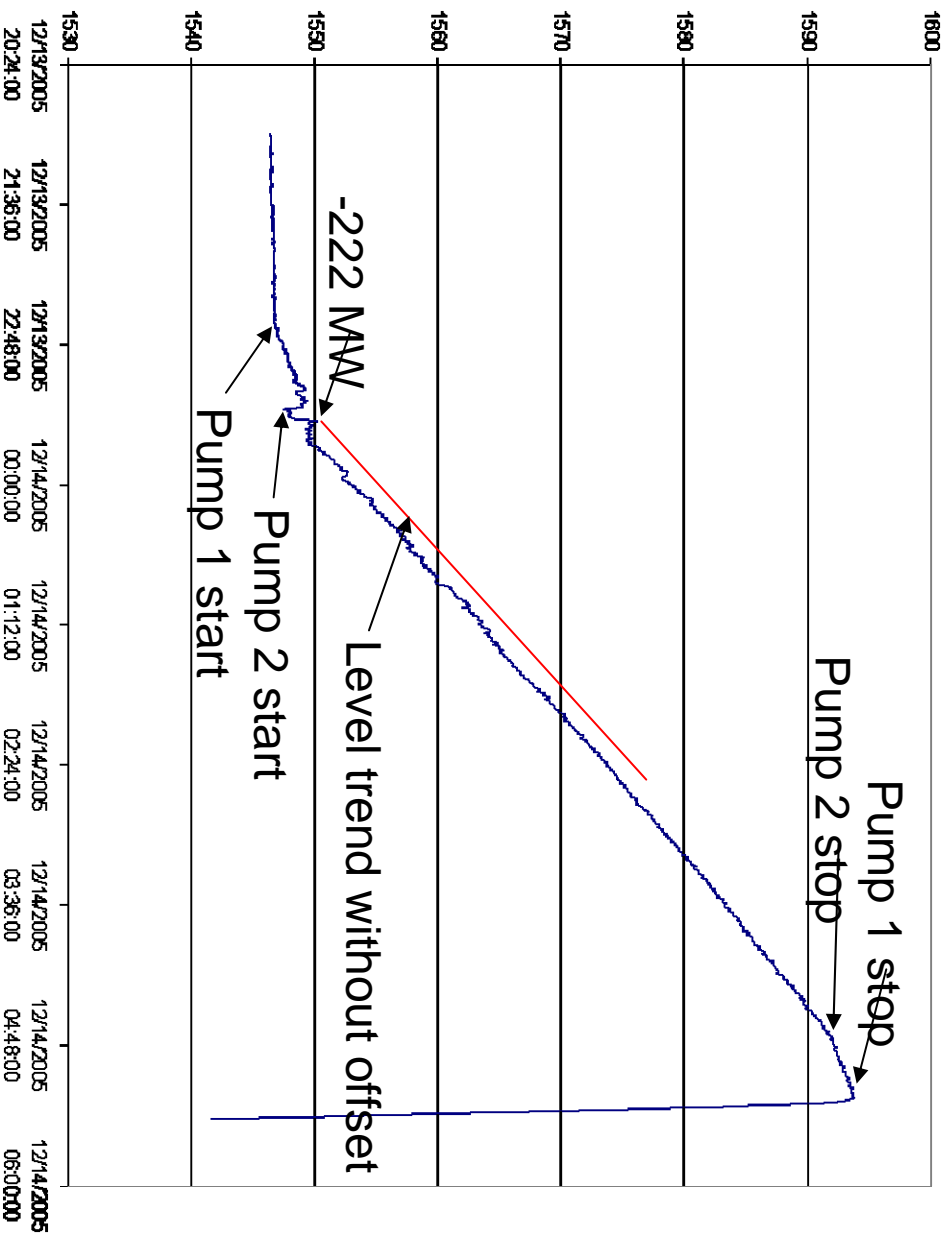
Sept. 2005 two pump operation.

Figure 7-22

Figure 7-23

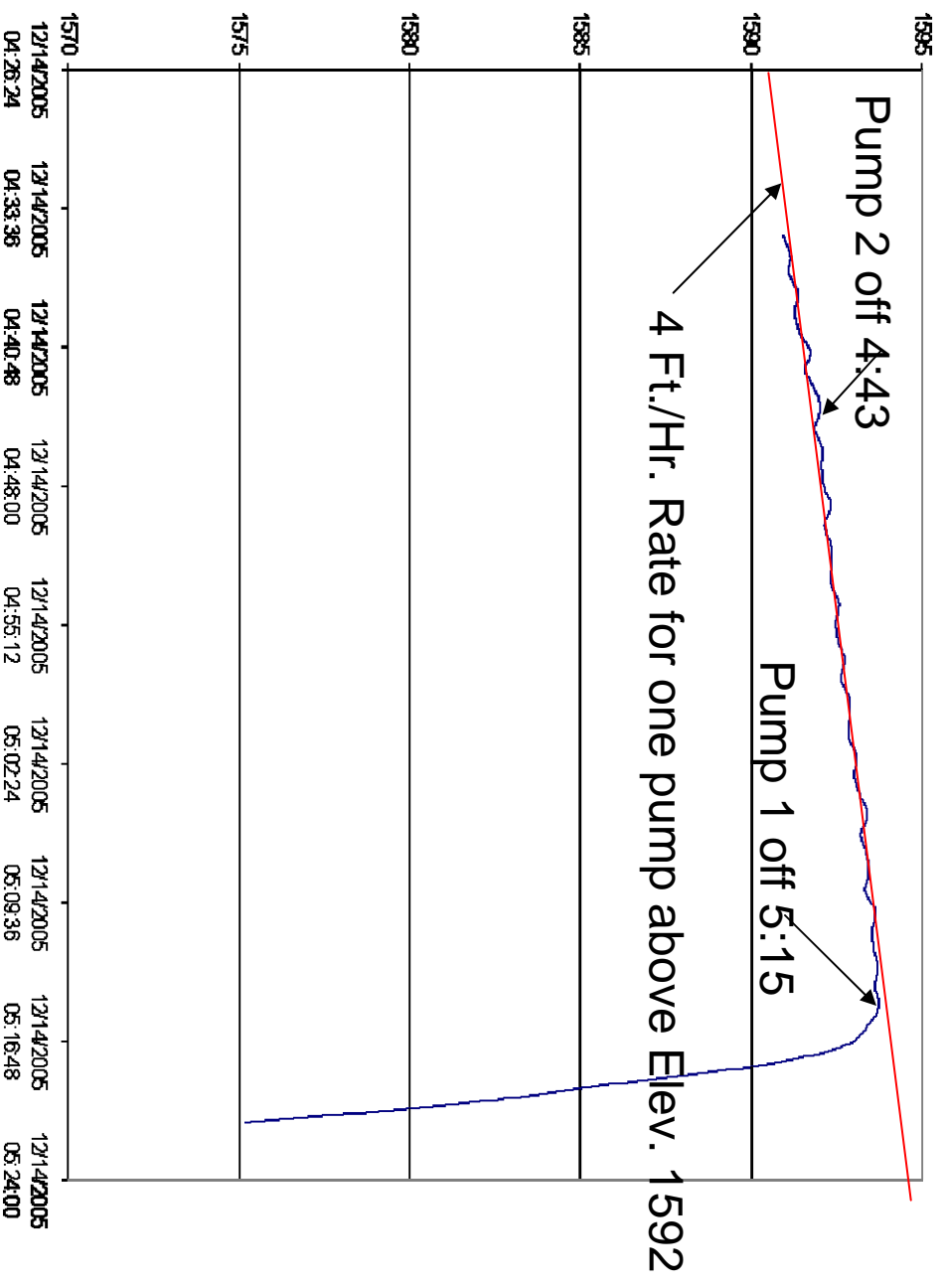


Erratic level indications on Dec. 10th.



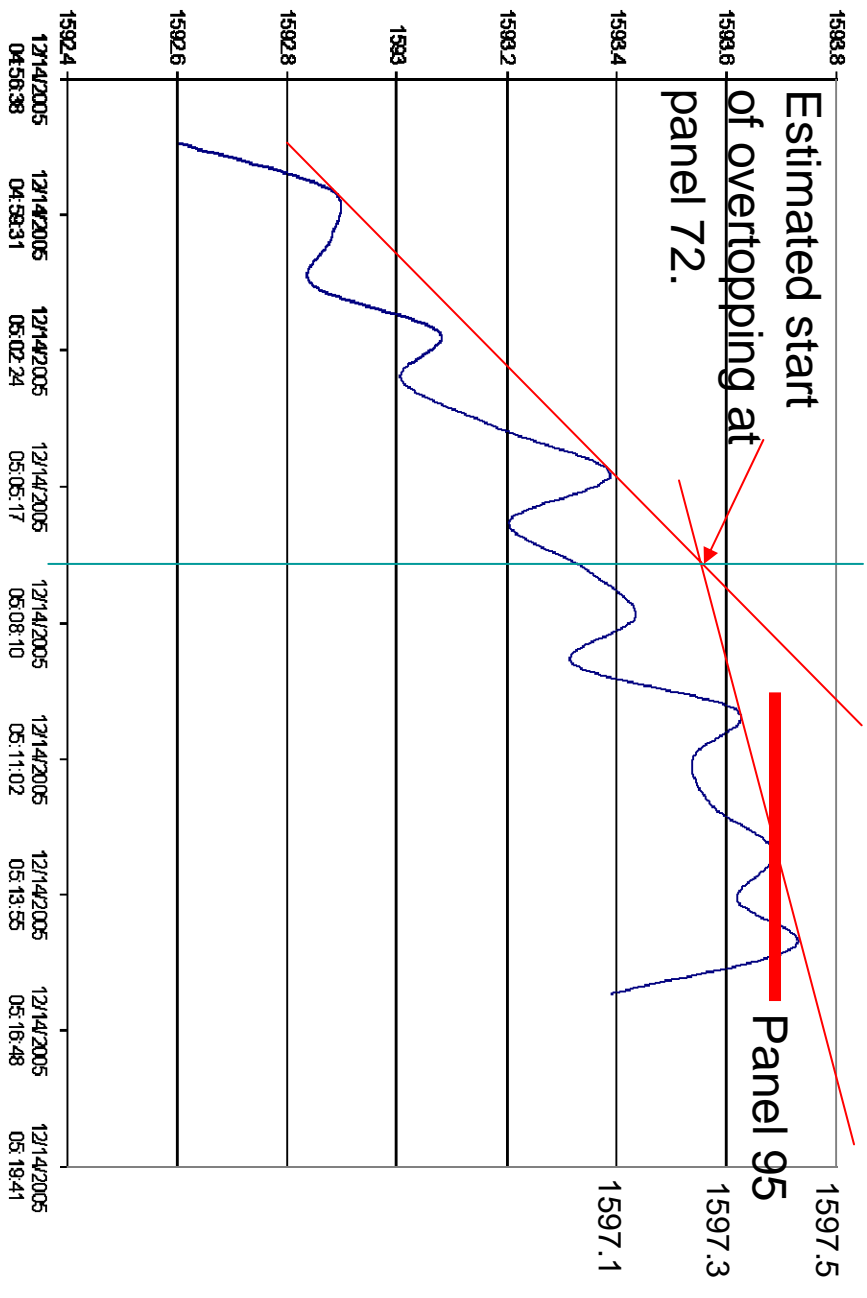
**Level indications after pump 2 start shows an offset.
-222 MW = Completion of pump 2 start sequence.**

Figure 7-24



Water level indications at breach event.

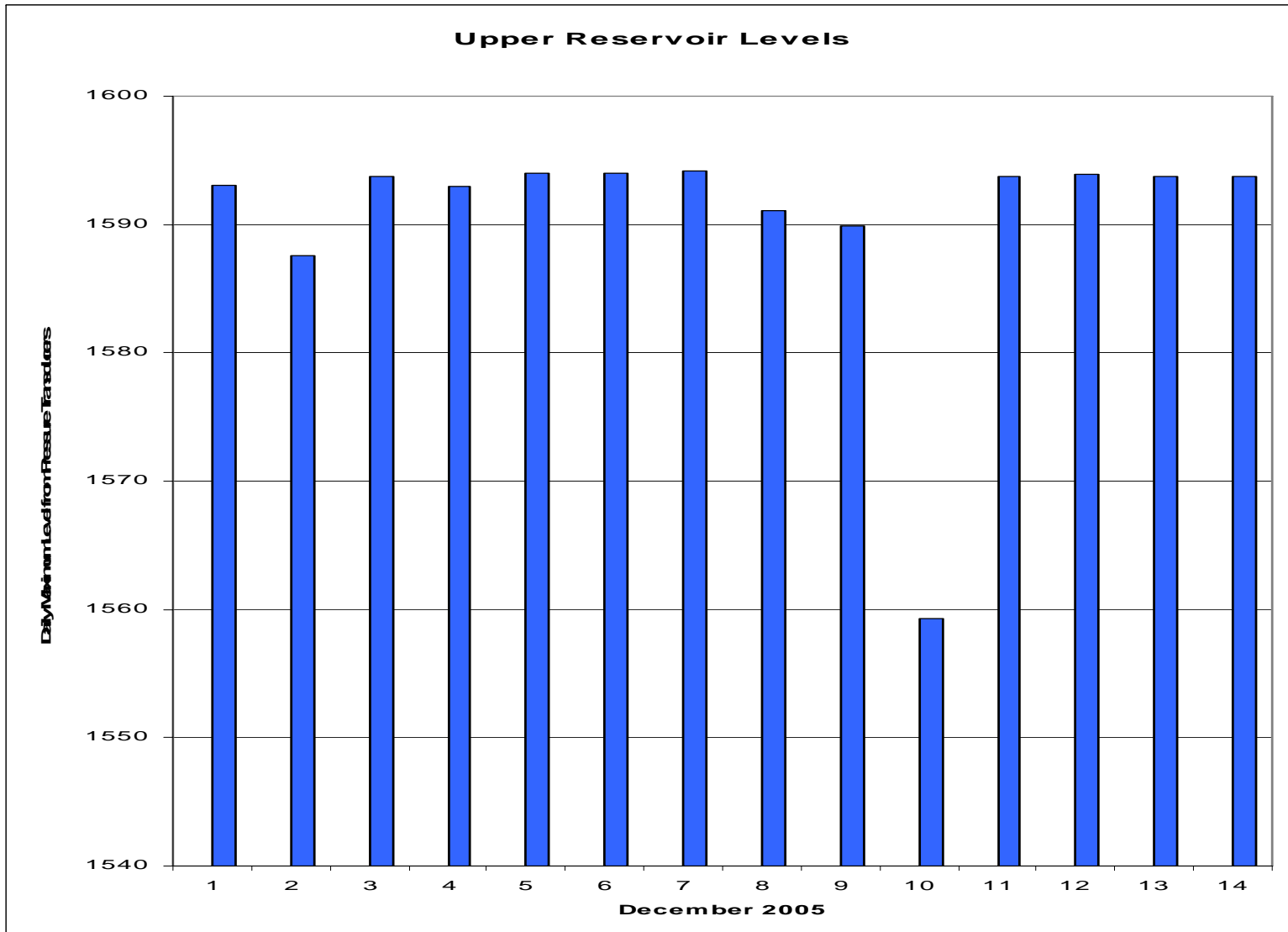
Figure 7-25



Water level indications (left scale)
and adjusted (right scale) prior to breach event.

Figure 7-26

Figure 7-27



Daily maximum indicated levels.

Figure 7-28

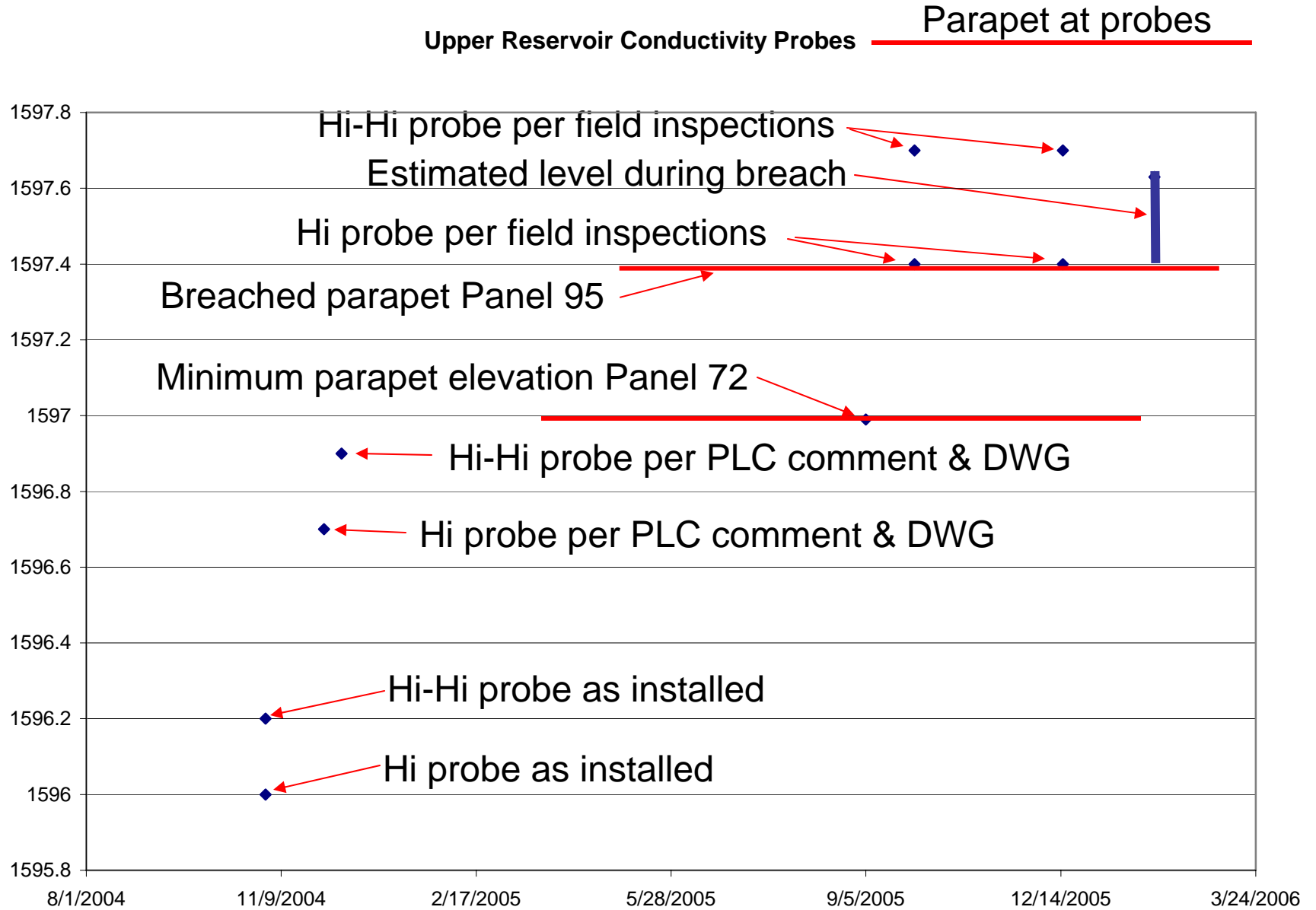


Figure 7-29

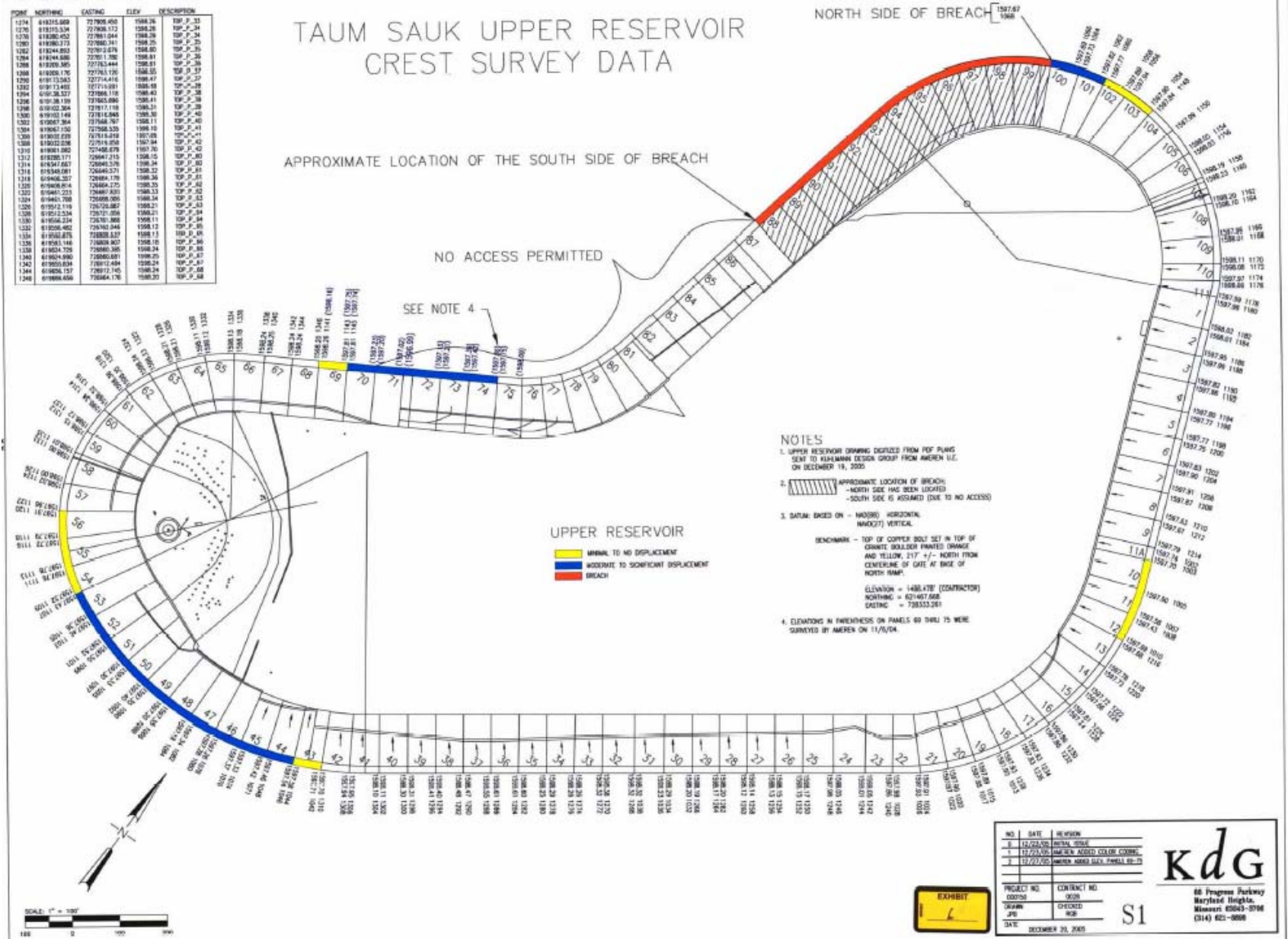
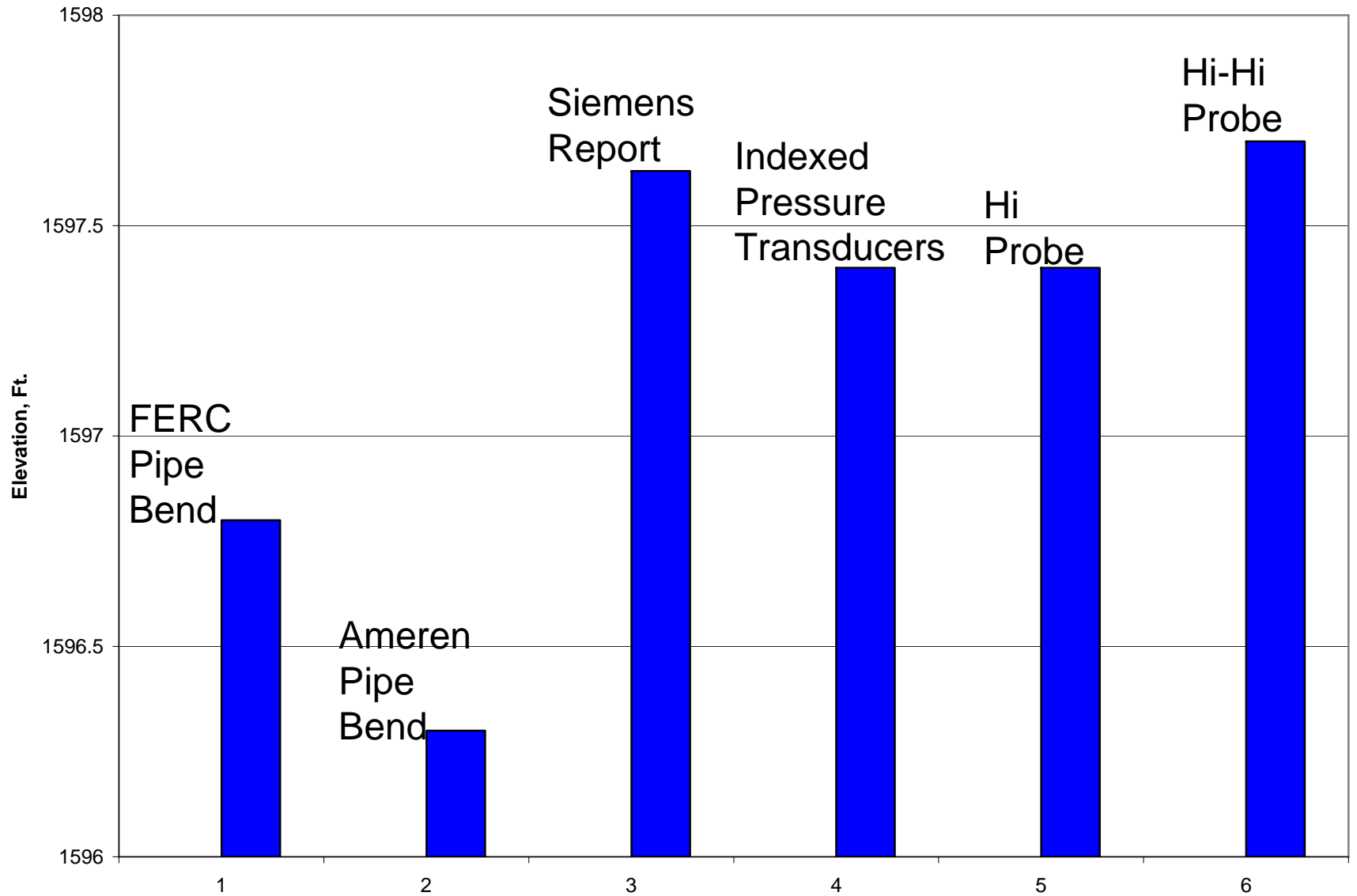
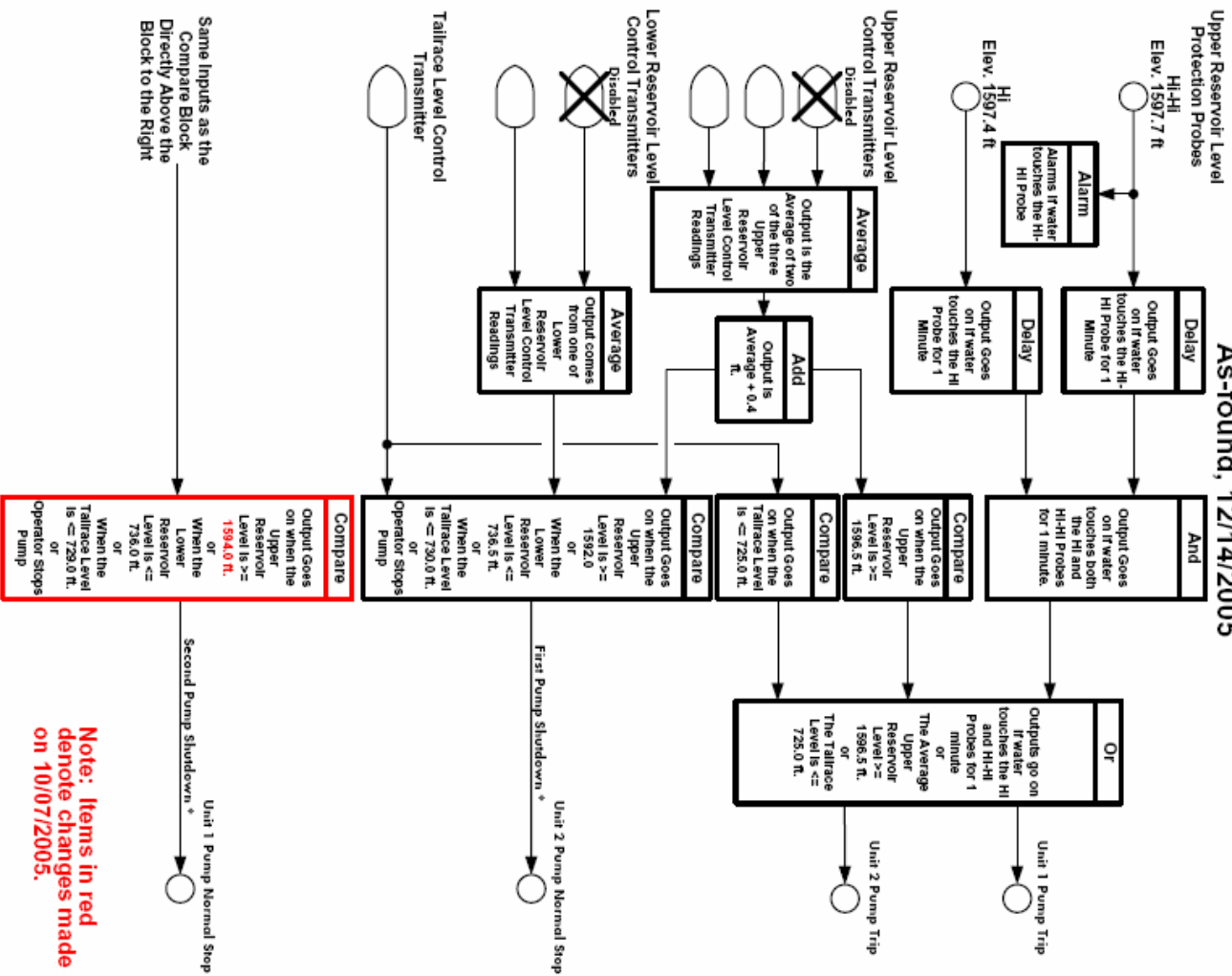


Figure 7-30



Estimates of Maximum Reservoir Level Before Breach

Taum Sauk Pump Shutdown Logic As-found, 12/14/2005



Note: Due to programming error made on Sept. 16, 2005, Unit 2 pump shutdown due to level protection probe response was disabled.

Figure 7-31

