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**Date:** 4/3/2006 9:57:18 AM  
**Subject:** Grassy Trail Monitoring - March 31, 2006

Attached are the monitoring results obtained from site visit on Friday, March 31, 2006. It will be noted that Inclinometers 2, 3 and 4 are now being read on a weekly basis. The water level in the reservoir rose to within 17 inches of the spillway, therefore, piezometer readings were also obtained.

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## RB&G ENGINEERING

### Grassy Trail Dam, Seismic Summary for March 31, 2006

For the one-week period between March 24 and March 31, 2006 the number of MIS (Mining Induced Seismicity) earthquakes recorded near the site by the UUSS decreased from 13 to 9. These MIS earthquakes ranged in magnitude from 1.3 to a high of 2.1, down from the higher 2.6, 2.3, and 2.2 magnitude earthquakes from the previous week.

The number of events recorded on the Hillside accelerometer increased during the past week from 53 to **65** seismic events. The Dam unit increased from 42 to **45** events. As shown on the attached graph the highest number of events recorded on the Hillside to date, peaked on last Friday March 24<sup>th</sup> at 13 events and gradually declined as the week went on.

During the week Peak Ground Acceleration (PGA) values increased slightly on the Hillside from last weeks high of 0.219g to **0.242g**, but still down from the previous high two weeks ago of 0.348g on March 11. PGA values on the Dam decreased from 0.191g to **0.182g**.

Mining continues to move away from the axis of the dam and toward the draw north of the dam. Lag time between mining and the rock-bursts will likely lead to additional rock-bursts in the mined area near the dam.

The water level in the reservoir has risen this past week and is now only 17 inches below the top of the spillway. Due to this increase, piezometer readings were also taken. As shown on the attached piezometer figures, Observation Well #1 continues to be erratic showing a rise of 2.8 feet. Piezometers 5, 6, and 7 located at the toe of the dam have risen between 0.55 and 1 foot.

Inclinometers 2, 3, and 4 were read this week. As shown on the inclinometer readings, I-4 continues to show an increase in movement toward the east with the total movement since February 2005, being less than ¼ inch. Inclinometer I-2 shows an increase in rate of movement toward the east and northeast of about ¼ inch in the past two weeks. Inclinometer I-3 continues to show the same type of movement as in the past.

During this site visit much of the crest of the dam was covered with snow and water and no new cracks or signs of movement were noted. This week surveyors from RB&G Engineering placed several new monitoring survey points up on the slope just above the outlet works on the east side of the canyon.

Several people have inquired about the meaning of term PGA used in these reports. A definition taken from the internet states: *Peak ground acceleration (PGA) is a measure of earthquake acceleration. Unlike the Richter magnitude scale, it is not a measure of the total size of the earthquake, but rather how hard the earth shakes in a given location. Unlike the Mercalli scale, it is measured by instruments, not from personal reports, although it generally correlates well with the Mercalli scale. Peak ground acceleration can be measured in g (the acceleration due to gravity) or m/s<sup>2</sup>.*

Michael Hansen  
RB&G ENGINEERING

Grassy Trail Dam, Carbon County, Utah  
2006 Hillside unit #9690 Dam #9689

Event Report: Event List - c:\blastevent

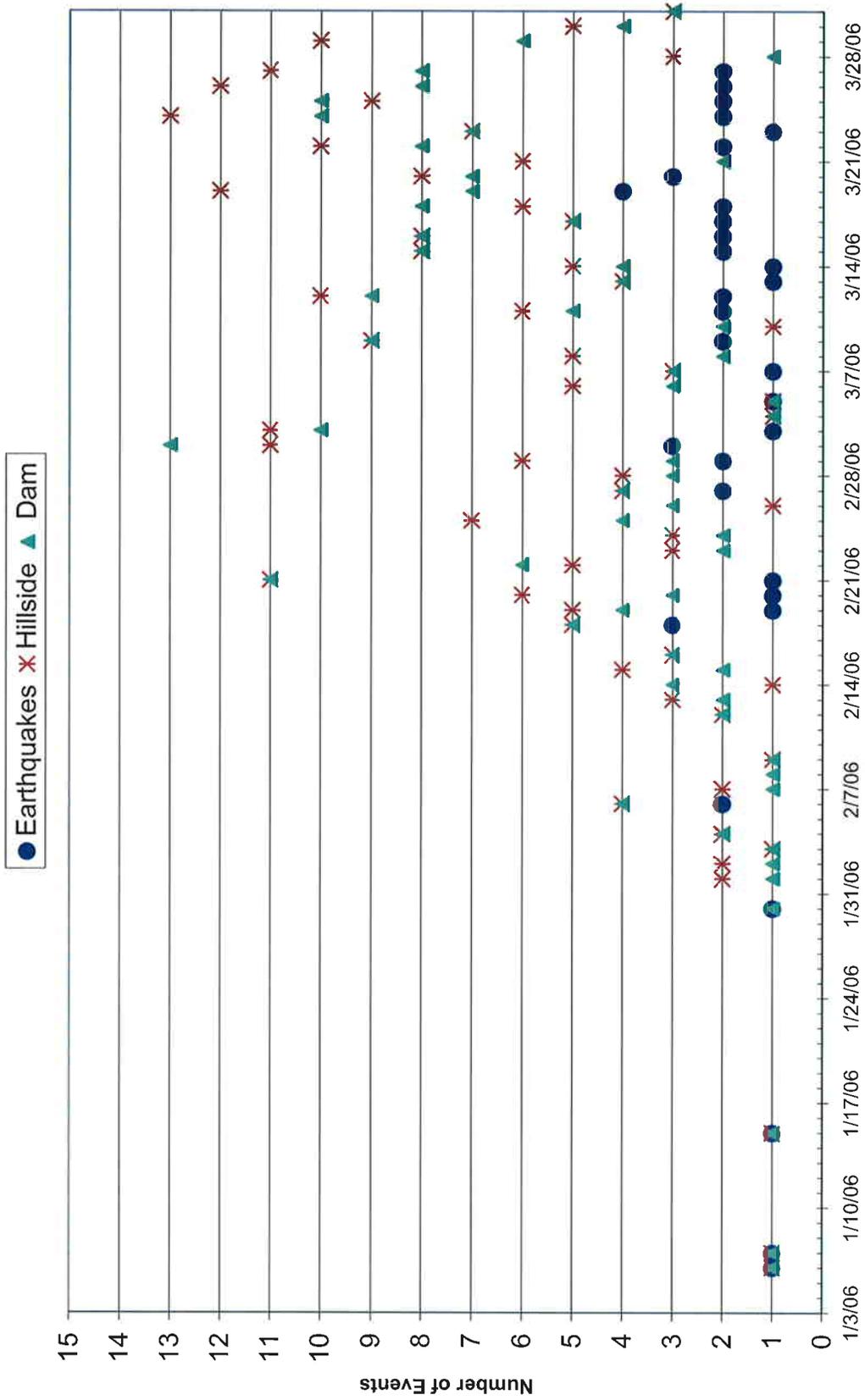
Type	Serial No.	Date/Time	Tran Peak (mm/s)	Vert Peak (mm/s)	Long Peak (mm/s)	PVS1 (mm/s)	Trigger	Tran Accel (g)	Vert Accel (g)	Long Accel (g)	Description	Post Event first line
LOG	BE9689	Mar 24 /06 09:26:18	***	***	***	***	***	***	***	***	Start Monitoring	Start Monit
LOG	BE9690	Mar 24 /06 10:36:57	***	***	***	***	***	***	***	***	Start Monitoring	Start Monit
W	BE9689	Mar 24 /06 11:06:33	0.571	0.397	0.619	0.695	Long	0.00663	0.00663	0.0133	Grassy Tr. Dam	
W	BE9690	Mar 24 /06 11:06:33	0.349	0.302	0.651	0.652	Long	0.00497	0.00497	0.00663	Hillside	
LOG	BE9689	Mar 24 /06 11:19:04	***	***	***	***	***	***	***	***	Keyboard Stop	No events
LOG	BE9689	Mar 24 /06 11:19:44	***	***	***	***	***	***	***	***	Start Monitoring	Start Monit
W	BE9689	Mar 24 /06 11:45:31	1.14	1.02	1.57	1.75	Vert	0.00994	0.00829	0.0116	Grassy Tr. Dam	
W	BE9690	Mar 24 /06 11:45:32	0.873	0.667	1.70	1.73	Vert	0.00663	0.00663	0.00994	Hillside	
W	BE9689	Mar 24 /06 13:22:43	0.492	0.381	0.603	0.690	Long	0.00663	0.00497	0.0133	Grassy Tr. Dam	
W	BE9690	Mar 24 /06 13:22:44	0.651	0.286	0.841	0.961	Long	0.00663	0.00663	0.00663	Hillside	
W	BE9689	Mar 24 /06 13:36:08	0.254	0.317	0.746	0.762	Long	0.00663	0.00663	0.0149	Grassy Tr. Dam	
W	BE9690	Mar 24 /06 14:44:45	0.524	0.270	0.825	0.835	Long	0.00663	0.00663	0.00663	Hillside	
W	BE9690	Mar 24 /06 16:16:30	0.698	0.238	0.635	0.750	Long	0.00663	0.00663	0.00663	Hillside	
W	BE9689	Mar 24 /06 16:16:59	0.984	0.921	1.90	2.10	Vert	0.00994	0.00829	0.0149	Grassy Tr. Dam	> Eq mag 1.6
W	BE9690	Mar 24 /06 16:17:00	0.873	0.698	1.98	1.99	Vert	0.00829	0.00994	0.0133	Hillside	
W	BE9689	Mar 24 /06 16:43:18	0.206	0.206	0.619	0.626	Long	0.00663	0.00663	0.0133	Grassy Tr. Dam	
W	BE9689	Mar 24 /06 17:30:54	0.825	0.857	1.32	1.48	Vert	0.00663	0.00829	0.0149	Grassy Tr. Dam	
W	BE9690	Mar 24 /06 17:30:54	1.03	0.635	1.89	1.98	Vert	0.00829	0.00829	0.00994	Hillside	> 1.5
W	BE9690	Mar 24 /06 18:11:04	0.492	0.349	0.778	0.819	Long	0.00663	0.00663	0.00829	Hillside	
W	BE9689	Mar 24 /06 20:41:54	0.873	0.778	1.16	1.36	Vert	0.00829	0.00663	0.0116	Grassy Tr. Dam	
W	BE9690	Mar 24 /06 20:41:55	0.683	0.556	1.37	1.37	Long	0.00663	0.00663	0.00994	Hillside	
W	BE9689	Mar 24 /06 20:47:49	0.619	0.317	0.349	0.725	Tran	0.00829	0.00663	0.00663	Grassy Tr. Dam	
W	BE9690	Mar 24 /06 20:47:50	0.429	0.540	0.825	0.890	Long	0.00497	0.00829	0.00663	Hillside	
W	BE9690	Mar 24 /06 21:35:37	0.444	0.317	0.635	0.657	Long	0.00663	0.00497	0.00663	Hillside	
W	BE9689	Mar 24 /06 22:38:18	26.9	13.8	17.4	30.4	Vert	0.182	0.0762	0.118	Grassy Tr. Dam	> 2.3
W	BE9690	Mar 24 /06 22:38:19	***	7.94	18.3	***	Vert	0.242	0.0646	0.131	Hillside	
W	BE9690	Mar 25 /06 06:46:51	0.571	0.365	0.825	0.864	Long	0.00663	0.00497	0.00994	Hillside	
W	BE9689	Mar 25 /06 10:09:59	0.175	0.222	0.635	0.645	Long	0.00663	0.00663	0.0149	Grassy Tr. Dam	
W	BE9689	Mar 25 /06 10:26:20	1.14	1.37	1.81	2.16	Vert	0.0133	0.0116	0.0199	Grassy Tr. Dam	
W	BE9690	Mar 25 /06 10:26:21	1.71	1.10	2.38	2.47	Vert	0.0166	0.00994	0.0199	Hillside	> 1.5
W	BE9690	Mar 25 /06 12:09:20	0.556	0.349	0.873	0.916	Long	0.00663	0.00497	0.00829	Hillside	
W	BE9689	Mar 25 /06 13:43:55	0.683	0.460	0.667	0.879	Long	0.00829	0.00663	0.00829	Grassy Tr. Dam	
W	BE9690	Mar 25 /06 13:43:56	0.651	0.365	1.08	1.09	Long	0.00829	0.00663	0.00829	Hillside	
W	BE9689	Mar 25 /06 14:30:46	1.13	1.14	1.67	1.83	Vert	0.00994	0.00994	0.0166	Grassy Tr. Dam	
W	BE9690	Mar 25 /06 14:30:47	1.11	0.794	1.97	2.04	Vert	0.00829	0.00663	0.0116	Hillside	> 1.4
W	BE9689	Mar 25 /06 15:53:43	0.714	0.397	0.444	0.805	Tran	0.00829	0.00663	0.0149	Grassy Tr. Dam	
W	BE9689	Mar 25 /06 17:53:24	0.857	0.429	0.714	0.954	Long	0.00829	0.00663	0.0149	Grassy Tr. Dam	
W	BE9690	Mar 25 /06 17:53:24	0.444	0.365	0.873	0.882	Long	0.00663	0.00663	0.00663	Hillside	
W	BE9689	Mar 25 /06 18:35:16	0.571	0.413	0.619	0.683	Long	0.00663	0.00663	0.0166	Grassy Tr. Dam	
W	BE9690	Mar 25 /06 18:35:16	0.778	0.381	0.889	0.956	Long	0.00663	0.00663	0.00829	Hillside	
W	BE9689	Mar 25 /06 18:58:36	0.238	0.302	0.762	0.772	Long	0.00663	0.00663	0.0149	Grassy Tr. Dam	
W	BE9690	Mar 25 /06 19:47:45	0.683	0.270	0.825	0.838	Long	0.00663	0.00663	0.00994	Hillside	
W	BE9689	Mar 25 /06 19:50:49	1.90	1.14	1.27	2.03	Tran	0.0199	0.00994	0.0199	Grassy Tr. Dam	
W	BE9690	Mar 25 /06 19:50:49	2.94	1.30	1.83	3.00	Vert	0.0249	0.0149	0.0149	Hillside	
W	BE9689	Mar 25 /06 23:48:05	0.349	0.302	0.603	0.664	Long	0.00663	0.00829	0.0166	Grassy Tr. Dam	
W	BE9689	Mar 26 /06 08:22:06	0.778	0.476	0.571	0.953	Tran	0.00994	0.00663	0.0116	Grassy Tr. Dam	
W	BE9690	Mar 26 /06 08:22:06	0.508	0.651	1.05	1.17	Vert	0.00663	0.00829	0.00829	Hillside	
W	BE9690	Mar 26 /06 09:37:25	0.270	0.302	0.698	0.739	Long	0.00663	0.00497	0.00994	Hillside	
W	BE9690	Mar 26 /06 09:37:38	0.413	0.333	0.778	0.779	Long	0.00497	0.00663	0.00663	Hillside	
W	BE9689	Mar 26 /06 10:24:49	1.21	1.49	2.02	2.22	Vert	0.00994	0.0116	0.0133	Grassy Tr. Dam	> 1.7
W	BE9690	Mar 26 /06 10:24:50	1.56	0.937	2.67	2.79	Vert	0.00994	0.00994	0.0149	Hillside	
W	BE9690	Mar 26 /06 12:38:30	0.413	0.317	0.651	0.666	Long	0.00663	0.00663	0.00663	Hillside	
W	BE9689	Mar 26 /06 13:00:48	0.651	0.492	0.810	0.978	Long	0.00663	0.00663	0.0199	Grassy Tr. Dam	
W	BE9690	Mar 26 /06 13:00:48	0.730	0.524	1.19	1.28	Long	0.00663	0.00663	0.00829	Hillside	
W	BE9689	Mar 26 /06 13:23:41	0.619	0.651	1.05	1.13	Vert	0.00663	0.00663	0.0116	Grassy Tr. Dam	
W	BE9690	Mar 26 /06 13:23:41	0.746	0.508	1.17	1.25	Long	0.00829	0.00663	0.00829	Hillside	
W	BE9690	Mar 26 /06 13:32:11	0.302	0.333	0.730	0.772	Long	0.00663	0.00829	0.00829	Hillside	
W	BE9689	Mar 26 /06 15:41:53	0.540	0.556	0.857	0.978	Long	0.00663	0.00663	0.00994	Grassy Tr. Dam	
W	BE9690	Mar 26 /06 15:41:53	0.635	0.381	1.06	1.11	Long	0.00663	0.00663	0.00663	Hillside	
W	BE9690	Mar 26 /06 15:46:56	0.381	0.333	0.794	0.830	Long	0.00663	0.00663	0.00829	Hillside	
W	BE9689	Mar 26 /06 19:23:14	0.746	1.03	1.65	1.79	Vert	0.0116	0.00994	0.0149	Grassy Tr. Dam	
W	BE9690	Mar 26 /06 19:23:14	1.03	0.714	1.64	1.68	Vert	0.00829	0.00994	0.00994	Hillside	

**Grassy Trail Dam, Carbon County, Utah  
2006 Hillside unit #9690 Dam #9689**

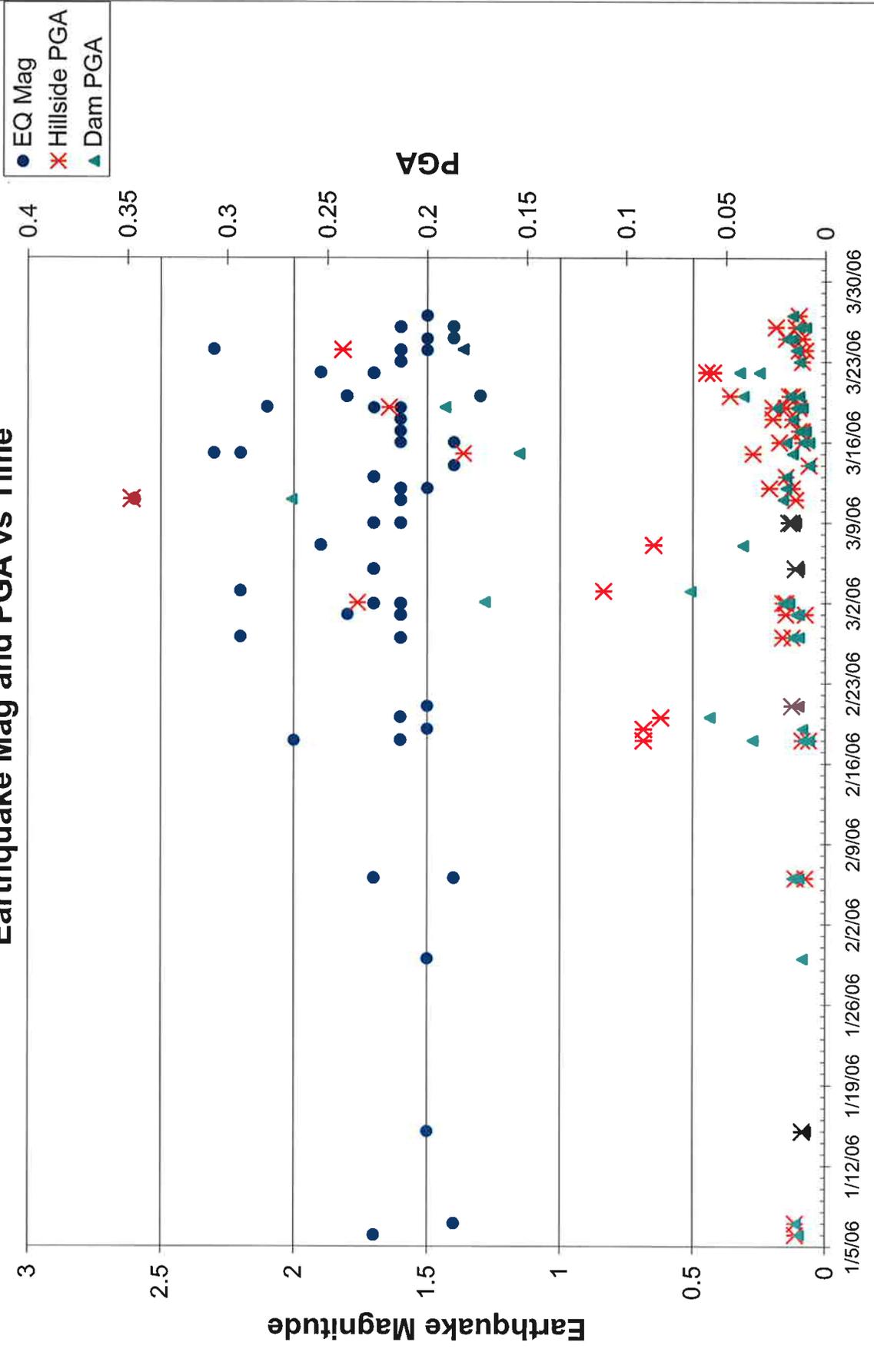
**Event Report: Event List - c:\blast\event**

Type	Serial No.	Date/Time	Tran Peak (mm/s)	Vert Peak (mm/s)	Long Peak (mm/s)	PVS1 (mm/s)	Trigger	Tran Accel (g)	Vert Accel (g)	Long Accel (g)	Description	Post Event first line
W	BE9689	Mar 26 /06 20:28:31	0.206	0.286	0.683	0.692	Long	0.00663	0.00663	0.00829	Grassy Tr. Dam	
W	BE9690	Mar 26 /06 23:07:43	1.48	1.16	3.79	3.83	Vert	0.0133	0.0116	0.0249	Hillside	
W	BE9689	Mar 26 /06 23:07:44	1.10	0.540	1.14	1.54	Long	0.00994	0.00663	0.00829	Grassy Tr. Dam	1.4
W	BE9690	Mar 27 /06 02:58:29	0.540	0.651	1.22	1.30	Vert	0.00829	0.00829	0.00994	Hillside	
W	BE9690	Mar 27 /06 10:07:40	0.476	0.333	0.667	0.709	Long	0.00663	0.00663	0.00663	Hillside	
W	BE9690	Mar 27 /06 12:50:26	0.476	0.333	0.778	0.809	Long	0.00663	0.00663	0.00829	Hillside	
W	BE9690	Mar 27 /06 13:51:27	0.413	0.333	0.825	0.879	Long	0.00497	0.00663	0.00663	Hillside	
W	BE9689	Mar 27 /06 14:22:35	1.27	1.48	2.06	2.30	Vert	0.00994	0.0116	0.0149	Grassy Tr. Dam	
W	BE9690	Mar 27 /06 14:22:35	1.10	1.03	2.27	2.32	Vert	0.00829	0.0133	0.0149	Hillside	
W	BE9689	Mar 27 /06 14:29:57	1.13	0.730	0.825	1.22	Tran	0.0116	0.00663	0.00829	Grassy Tr. Dam	
W	BE9690	Mar 27 /06 14:29:57	1.90	0.937	1.02	1.95	Tran	0.0166	0.0116	0.0116	Hillside	
W	BE9689	Mar 27 /06 17:49:45	0.889	0.524	0.587	0.951	Tran	0.00829	0.00663	0.0133	Grassy Tr. Dam	
W	BE9690	Mar 27 /06 17:49:45	0.873	0.619	1.49	1.64	Tran	0.00994	0.00829	0.0116	Hillside	
W	BE9689	Mar 27 /06 19:11:48	0.508	0.460	0.698	0.797	Long	0.00663	0.00663	0.00663	Grassy Tr. Dam	
W	BE9690	Mar 27 /06 19:11:48	0.429	0.349	0.746	0.755	Long	0.00663	0.00663	0.00829	Hillside	
W	BE9689	Mar 27 /06 19:23:48	0.302	0.238	0.603	0.624	Long	0.00663	0.00663	0.0149	Grassy Tr. Dam	
W	BE9689	Mar 27 /06 21:28:08	0.778	0.571	0.873	1.16	Tran	0.00829	0.00829	0.0116	Grassy Tr. Dam	
W	BE9690	Mar 27 /06 21:28:08	0.873	1.21	1.83	1.94	Vert	0.00829	0.0133	0.0133	Hillside	1.5
W	BE9689	Mar 27 /06 22:01:59	15.7	6.62	7.08	16.6	Vert	0.133	0.0414	0.0679	Grassy Tr. Dam	
W	BE9690	Mar 27 /06 22:01:59	22.8	5.92	7.46	23.4	Vert	0.156	0.0530	0.0580	Hillside	NA
W	BE9689	Mar 27 /06 22:08:52	0.889	0.460	0.492	0.976	Tran	0.00994	0.00663	0.0166	Grassy Tr. Dam	
W	BE9690	Mar 27 /06 22:08:52	0.540	0.492	0.698	0.855	Long	0.00663	0.00829	0.00663	Hillside	
W	BE9690	Mar 28 /06 18:36:44	0.587	0.333	0.714	0.899	Long	0.00663	0.00663	0.00829	Hillside	
W	BE9690	Mar 28 /06 18:43:05	0.429	0.270	0.651	0.720	Long	0.00497	0.00829	0.00663	Hillside	
W	BE9689	Mar 28 /06 19:19:20	0.603	0.413	0.587	0.800	Tran	0.00663	0.00663	0.00663	Grassy Tr. Dam	
W	BE9690	Mar 28 /06 19:19:20	0.381	0.333	0.794	0.824	Long	0.00497	0.00663	0.00663	Hillside	
W	BE9690	Mar 29 /06 10:30:01	0.492	0.556	0.857	0.974	Long	0.00663	0.00663	0.00829	Hillside	
W	BE9689	Mar 29 /06 10:30:02	0.841	0.429	0.524	0.914	Tran	0.00829	0.00829	0.0149	Grassy Tr. Dam	
W	BE9690	Mar 29 /06 10:45:58	0.556	0.333	0.730	0.792	Long	0.00663	0.00829	0.00829	Hillside	
W	BE9689	Mar 29 /06 10:45:59	0.556	0.429	0.651	0.781	Long	0.00663	0.00663	0.0133	Grassy Tr. Dam	
W	BE9690	Mar 29 /06 13:12:24	0.302	0.270	0.698	0.750	Long	0.00663	0.00497	0.00663	Hillside	
W	BE9689	Mar 29 /06 13:55:07	0.492	0.286	0.603	0.664	Long	0.00663	0.00663	0.0133	Grassy Tr. Dam	
W	BE9690	Mar 29 /06 14:00:51	0.333	0.222	0.603	0.643	Long	0.00497	0.00497	0.00663	Hillside	
W	BE9690	Mar 29 /06 16:50:48	0.714	0.381	0.921	1.03	Long	0.00829	0.00663	0.00829	Hillside	
W	BE9689	Mar 29 /06 16:50:49	0.714	0.524	0.794	0.935	Long	0.00663	0.00663	0.00829	Grassy Tr. Dam	
W	BE9690	Mar 29 /06 19:59:24	0.286	0.254	0.619	0.661	Long	0.00497	0.00497	0.00663	Hillside	
W	BE9690	Mar 29 /06 20:19:52	0.397	0.333	0.794	0.839	Long	0.00663	0.00663	0.00829	Hillside	
W	BE9690	Mar 29 /06 21:03:33	0.365	0.349	0.698	0.727	Long	0.00663	0.00663	0.00663	Hillside	
W	BE9689	Mar 29 /06 21:03:34	0.508	0.444	0.635	0.744	Long	0.00663	0.00663	0.0166	Grassy Tr. Dam	
W	BE9690	Mar 29 /06 22:50:58	0.810	0.730	1.41	1.53	Vert	0.00994	0.00994	0.0116	Hillside	
W	BE9689	Mar 29 /06 22:50:59	0.492	0.381	0.683	0.801	Long	0.00829	0.00663	0.00663	Grassy Tr. Dam	
W	BE9690	Mar 29 /06 22:52:22	0.540	0.286	0.603	0.686	Long	0.00663	0.00663	0.00663	Hillside	
W	BE9690	Mar 30 /06 00:42:13	0.714	1.10	1.95	2.06	Vert	0.00663	0.0133	0.0133	Hillside	
W	BE9689	Mar 30 /06 00:42:14	0.857	0.619	1.08	1.37	Vert	0.00994	0.00829	0.0166	Grassy Tr. Dam	
W	BE9690	Mar 30 /06 01:48:00	0.492	0.683	1.03	1.16	Vert	0.00829	0.00829	0.00829	Hillside	
W	BE9689	Mar 30 /06 01:48:02	0.841	0.476	0.556	0.981	Tran	0.00829	0.00663	0.0133	Grassy Tr. Dam	
W	BE9690	Mar 30 /06 21:20:36	0.524	0.397	1.10	1.16	Long	0.00663	0.00663	0.00829	Hillside	
W	BE9689	Mar 30 /06 21:20:37	0.508	0.492	0.810	0.931	Long	0.00663	0.00663	0.0166	Grassy Tr. Dam	
W	BE9690	Mar 30 /06 21:42:13	0.365	0.349	0.651	0.724	Long	0.00497	0.00663	0.00829	Hillside	
W	BE9690	Mar 30 /06 22:30:18	0.778	0.603	1.17	1.27	Vert	0.00829	0.00829	0.00994	Hillside	
W	BE9689	Mar 30 /06 22:30:19	0.984	0.714	1.21	1.37	Vert	0.00994	0.00829	0.0133	Grassy Tr. Dam	
W	BE9689	Mar 31 /06 03:47:16	0.667	0.317	0.349	0.716	Tran	0.00829	0.00663	0.0133	Grassy Tr. Dam	
W	BE9690	Mar 31 /06 06:05:15	0.730	0.444	0.889	0.998	Tran	0.00994	0.00994	0.00994	Hillside	
W	BE9690	Mar 31 /06 06:48:54	0.460	0.349	0.762	0.831	Long	0.00663	0.00663	0.00663	Hillside	
W	BE9689	Mar 31 /06 06:48:55	0.571	0.413	0.635	0.822	Long	0.00829	0.00829	0.0133	Grassy Tr. Dam	
W	BE9690	Mar 31 /06 09:15:42	0.540	0.365	0.889	0.946	Long	0.00829	0.00663	0.00663	Hillside	
W	BE9689	Mar 31 /06 09:15:43	0.571	0.444	0.794	0.911	Long	0.00829	0.00829	0.0149	Grassy Tr. Dam	
LOG	BE9689	Mar 31 /06 09:33:21	***	***	***	***	***	***	***	***	Keyboard Stop	No events
LOG	BE9690	Mar 31 /06 10:34:19	***	***	***	***	***	***	***	***	Keyboard Stop	No events

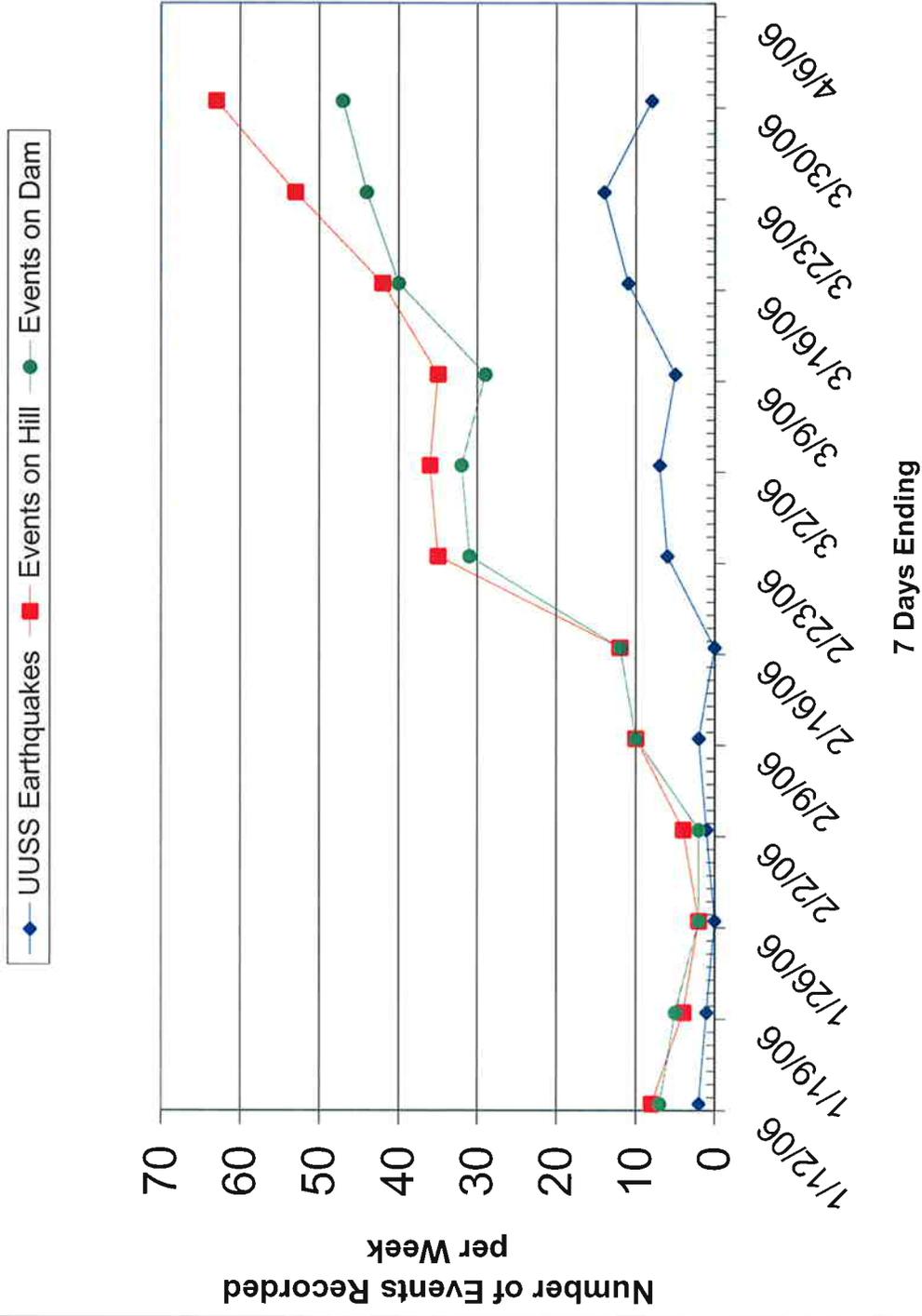
Number of Seismic Events Recorded per Day



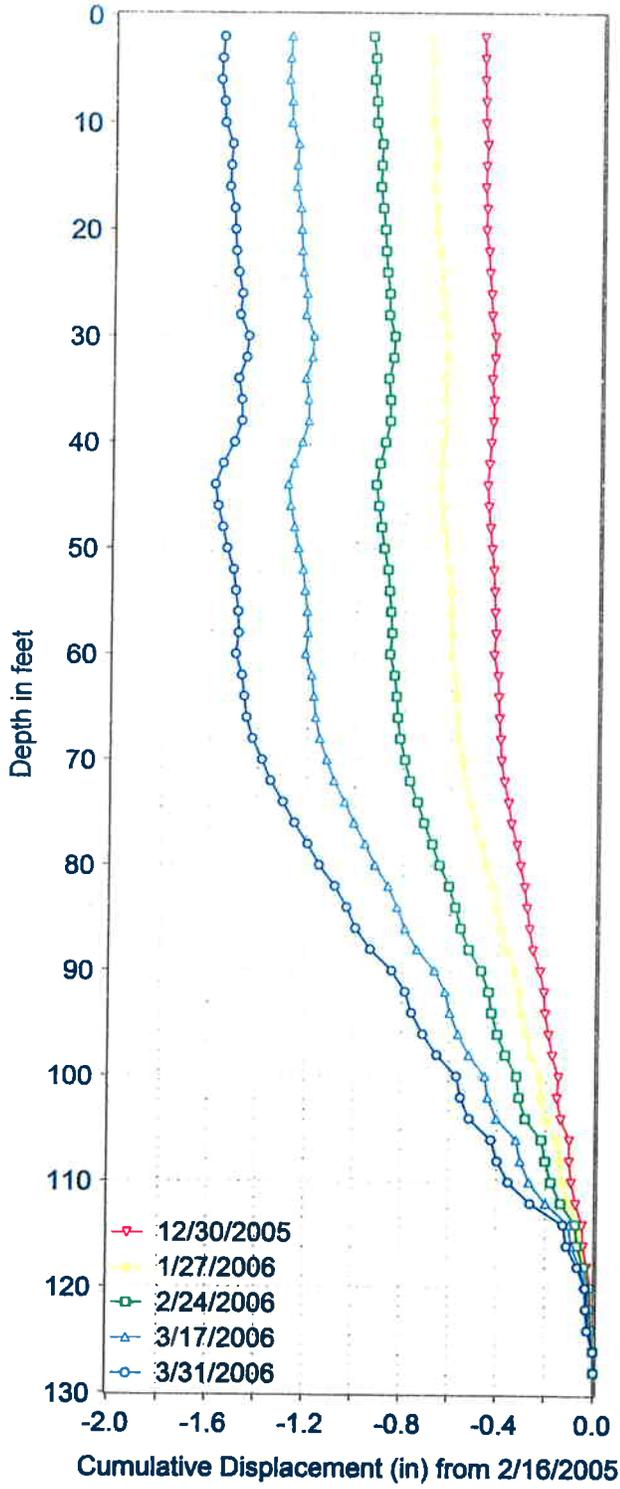
# Earthquake Mag and PGA vs Time



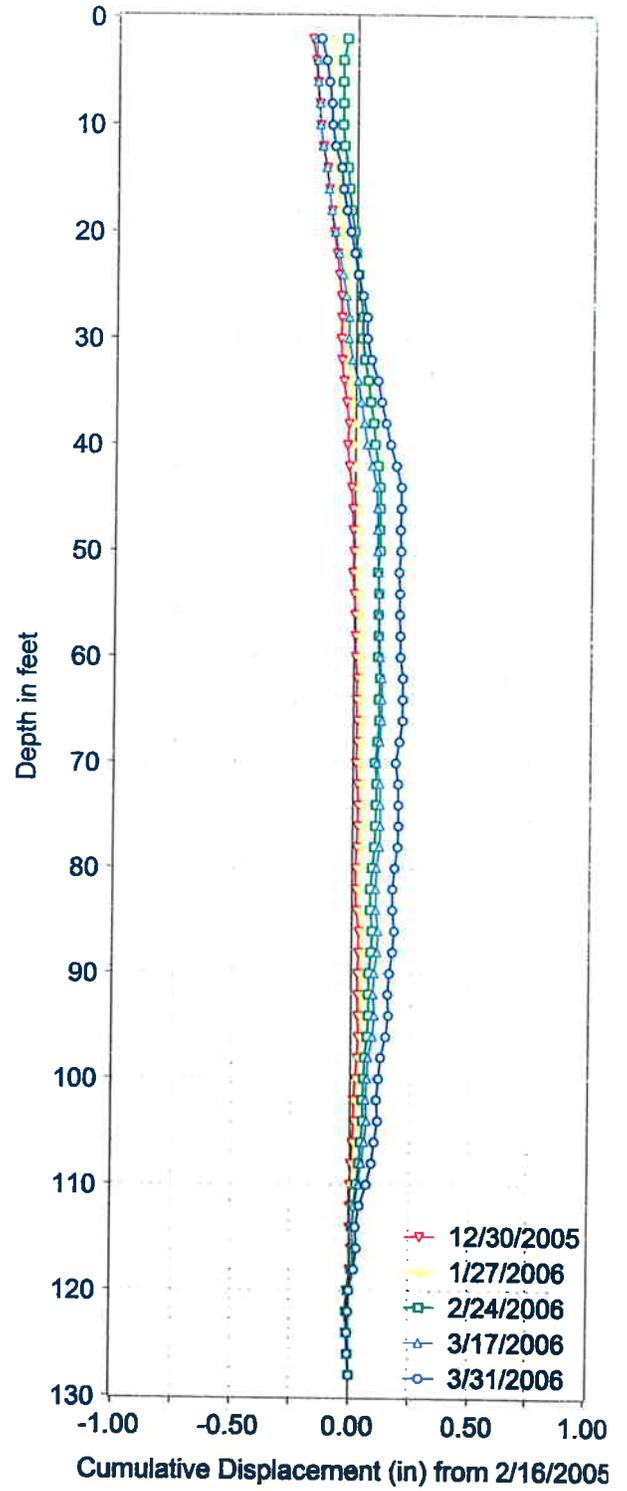
# Seismic Events per Seven day Period



GRASSY 2A, A-Axis



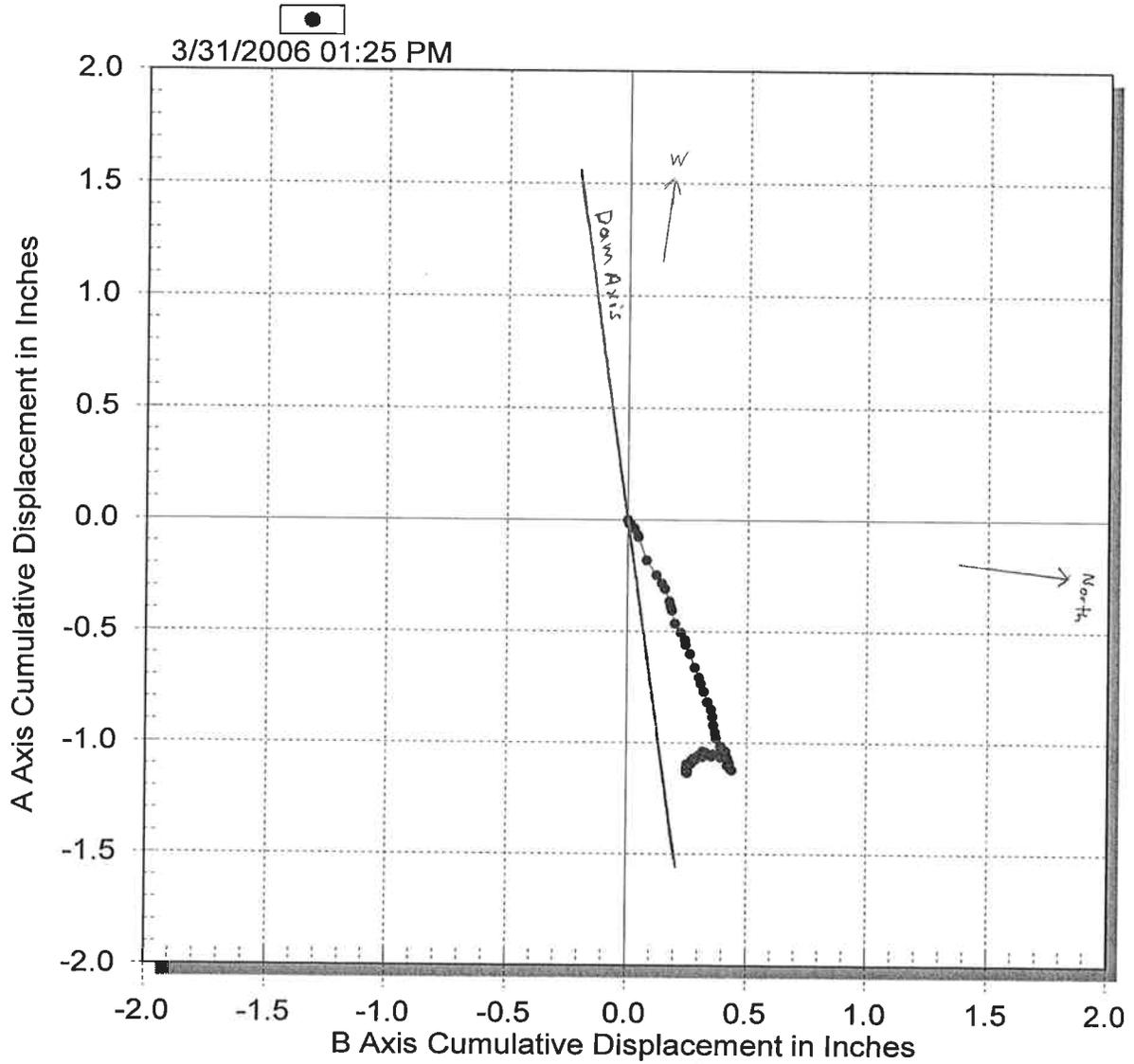
GRASSY 2A, B-Axis



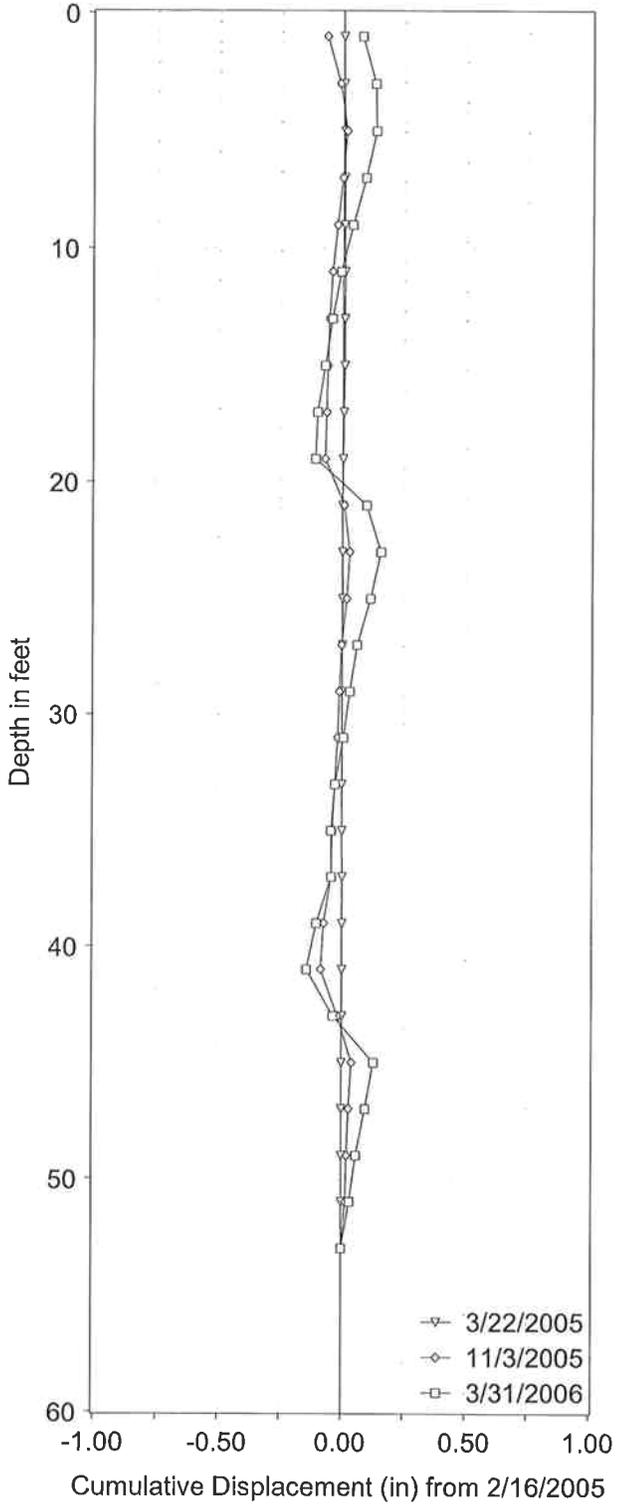


# GRASSY:2A - A Axis vs B Axis

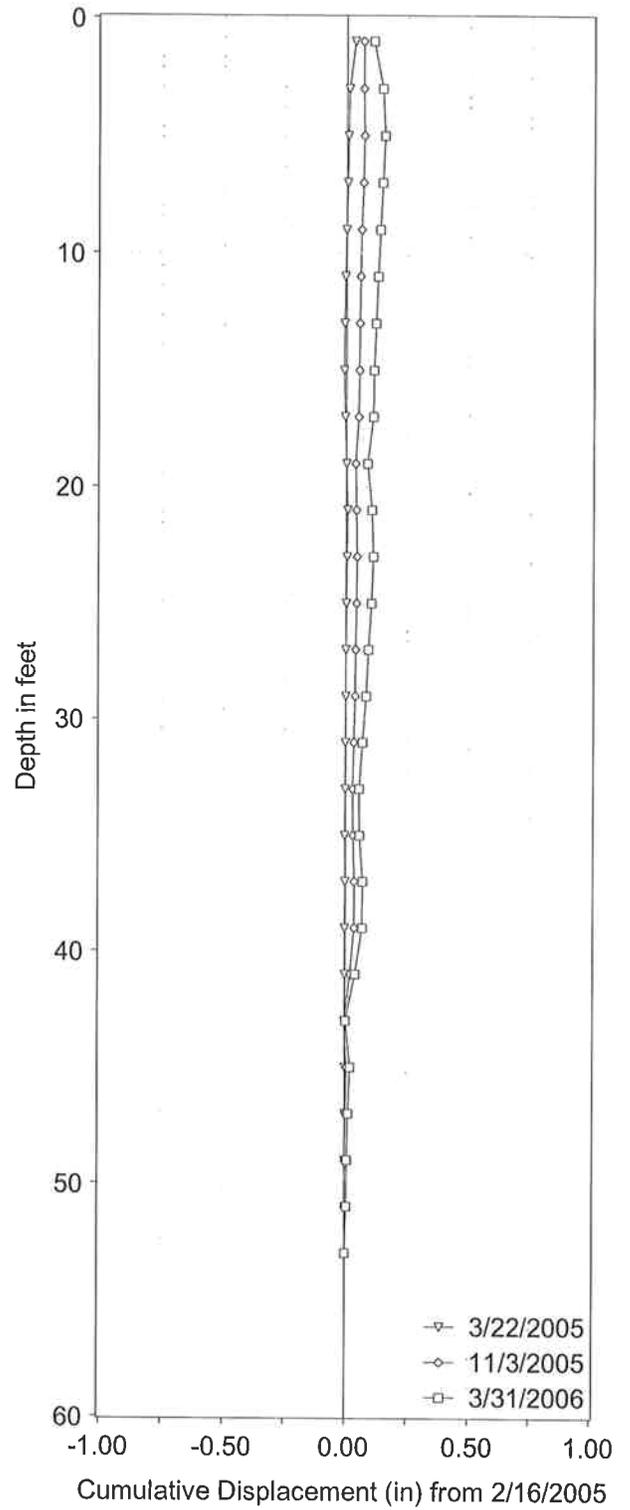
Initial survey: 12/10/2005 09:50 AM



GRASSY 3A, A-Axis

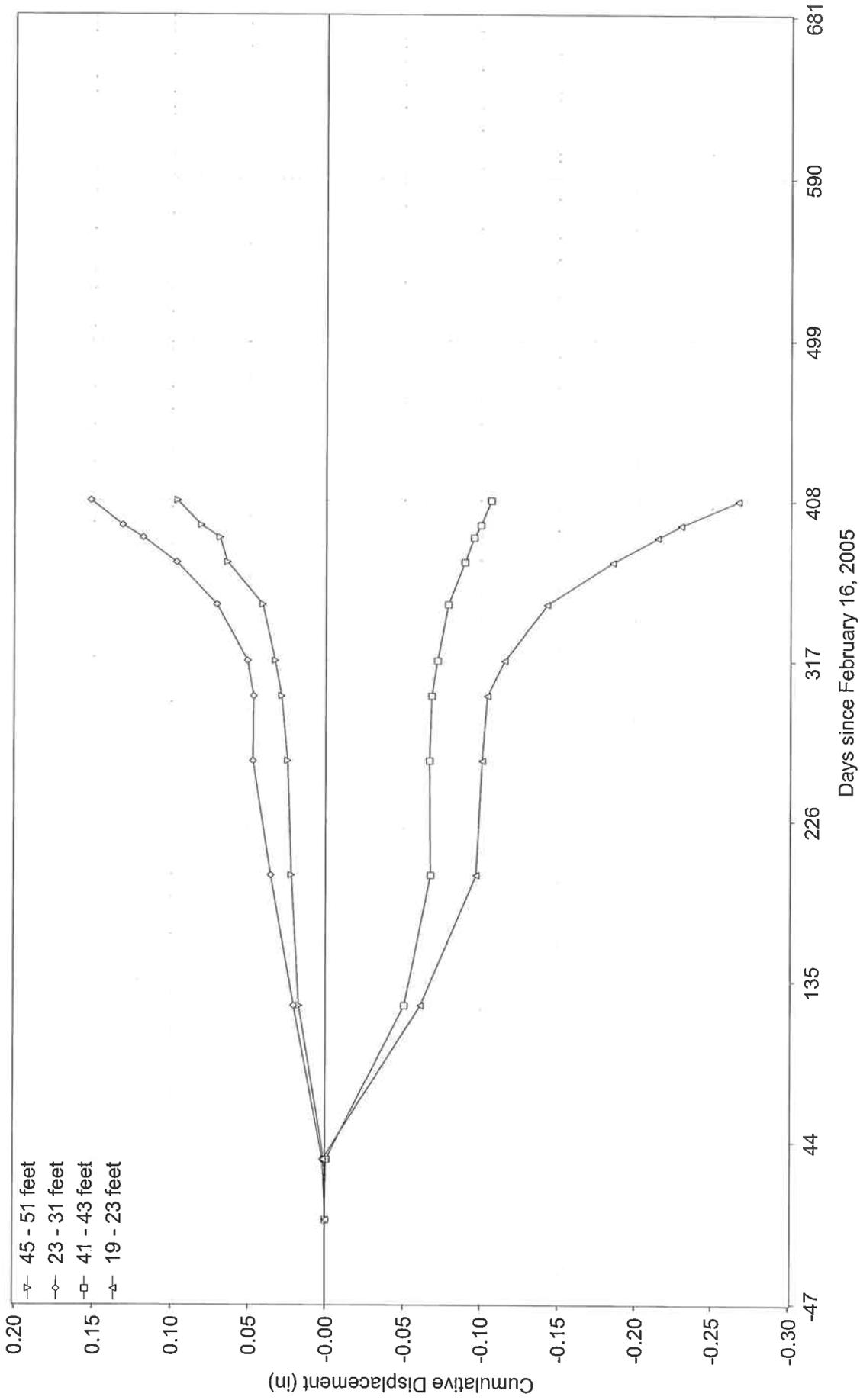


GRASSY 3A, B-Axis



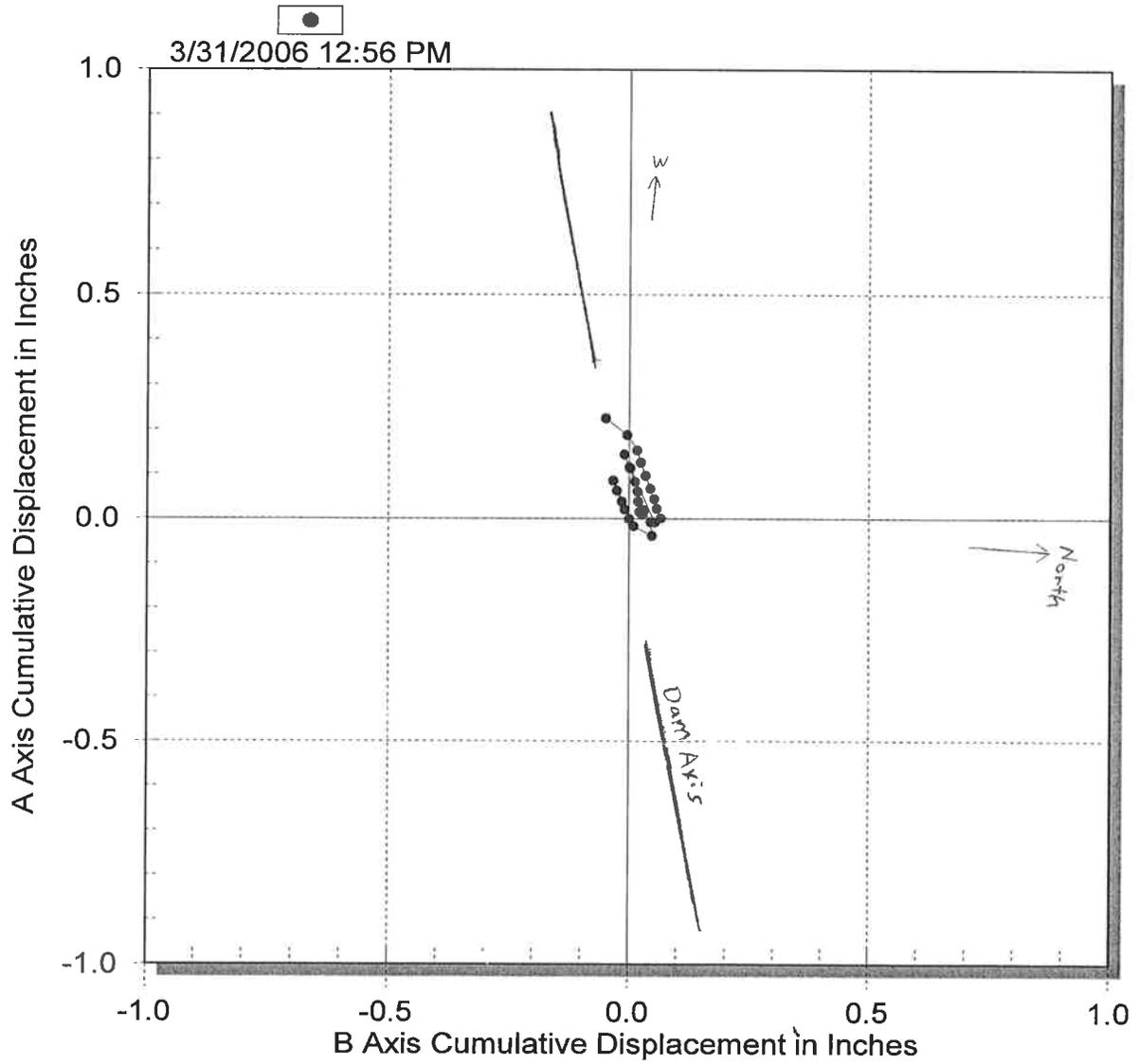
-30 degree skew

# GRASSY 3A, A-Axis

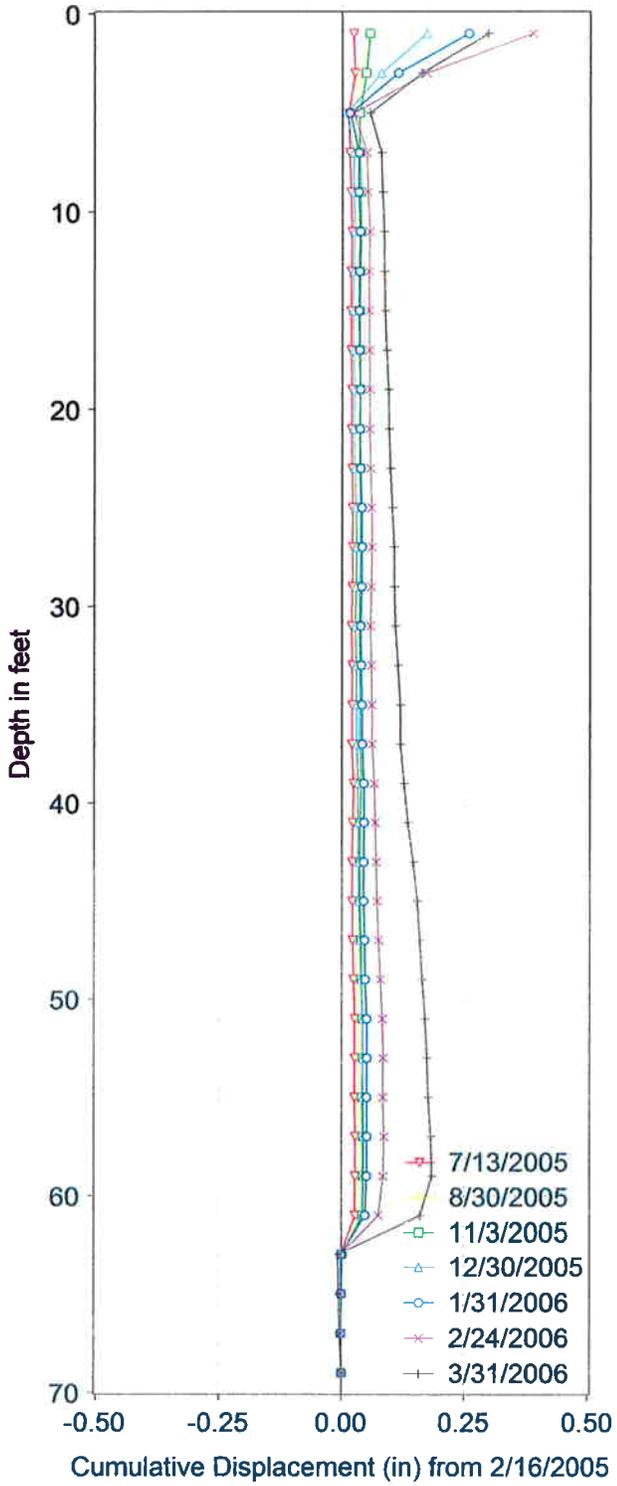


# GRASSY:3A - A Axis vs B Axis

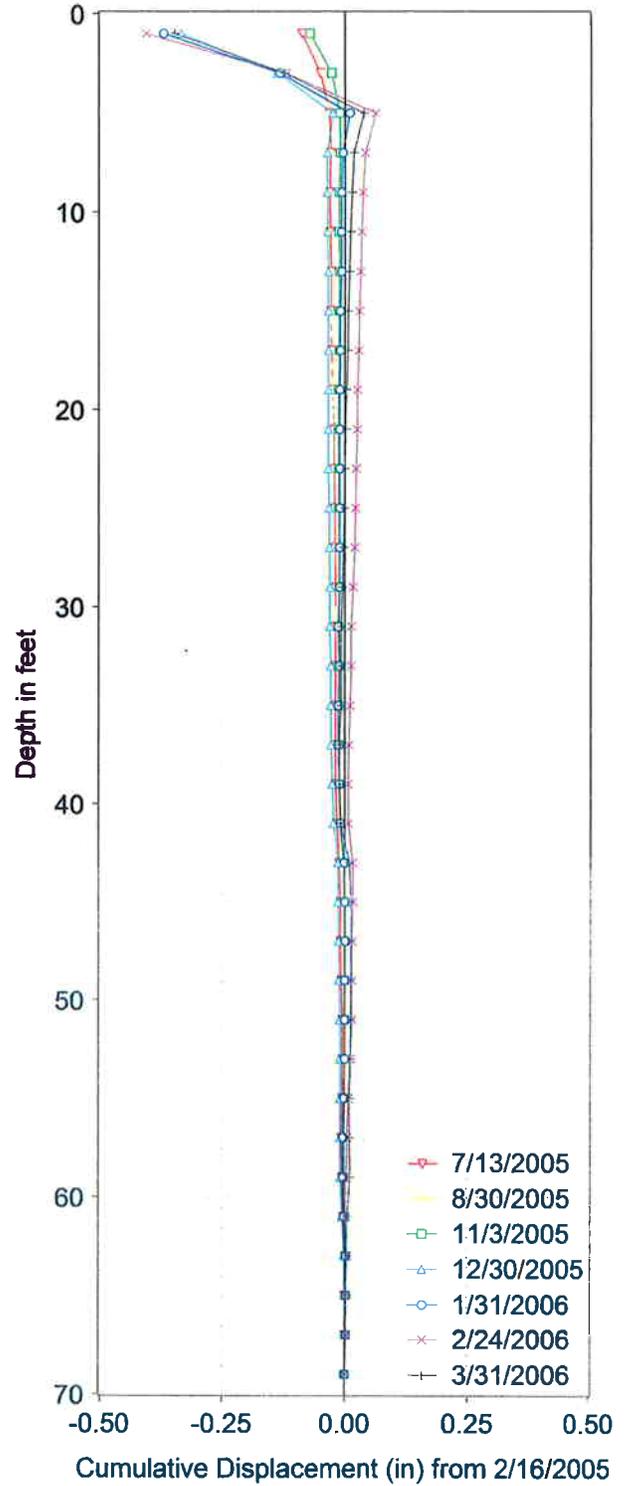
Initial survey: 12/10/2005 10:48 AM



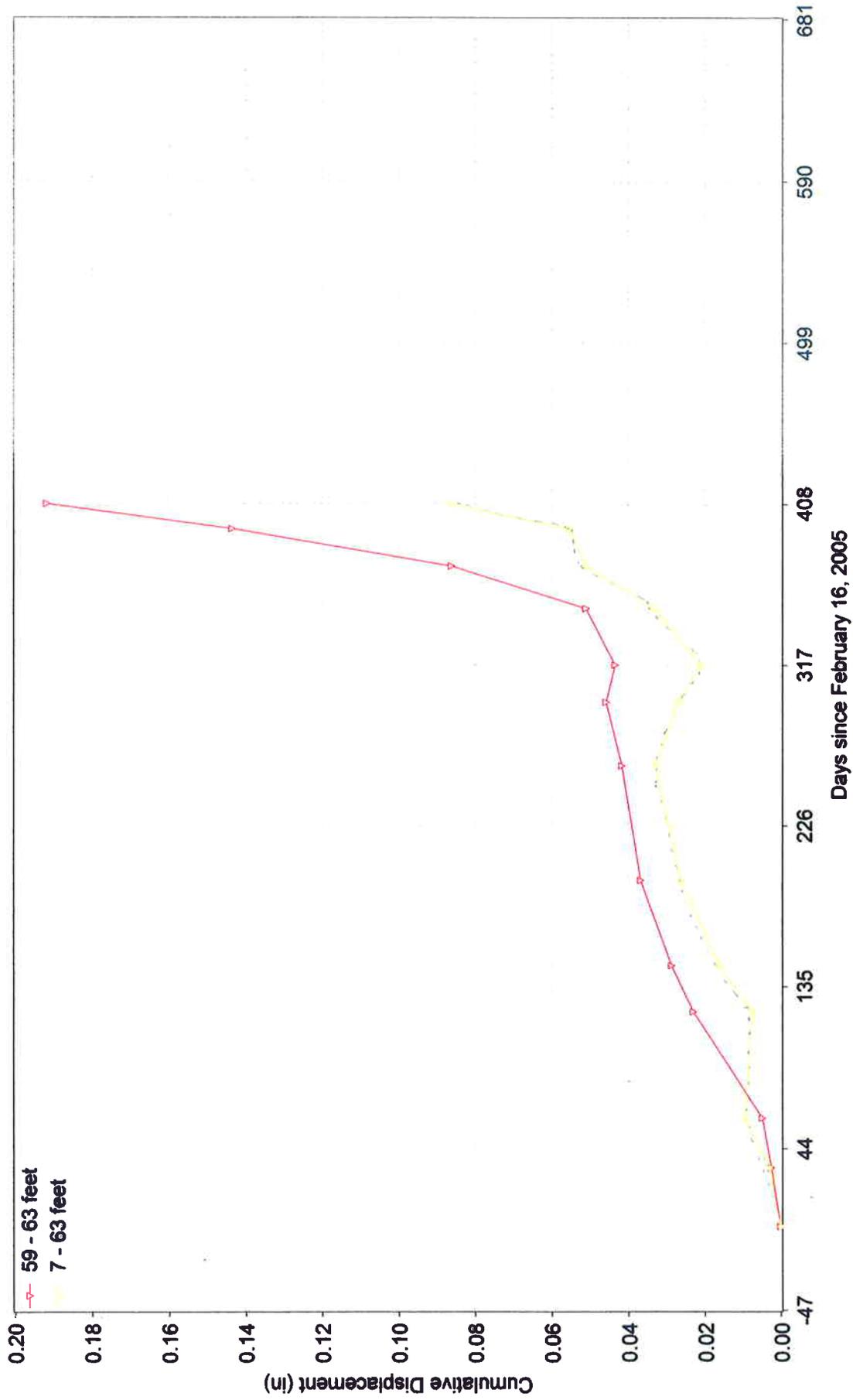
Grassy 4, A-Axis



Grassy 4, B-Axis

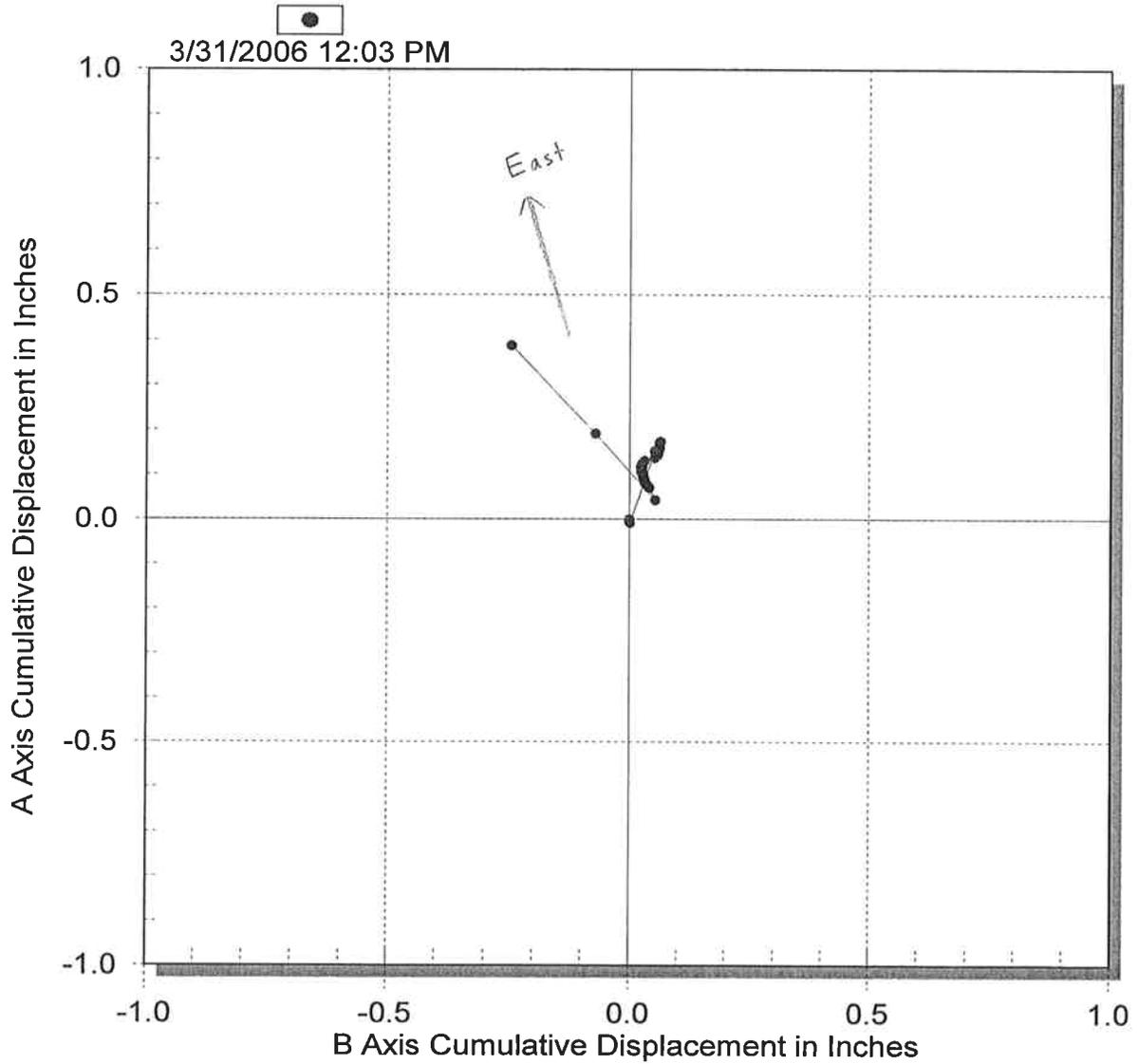


# Grassy 4, A-Axis



# Grassy:4 - A Axis vs B Axis

Initial survey: 2/16/2005 05:37 PM





# Grassy Trail Dam Reservoir Elevation and Piezometer Readings

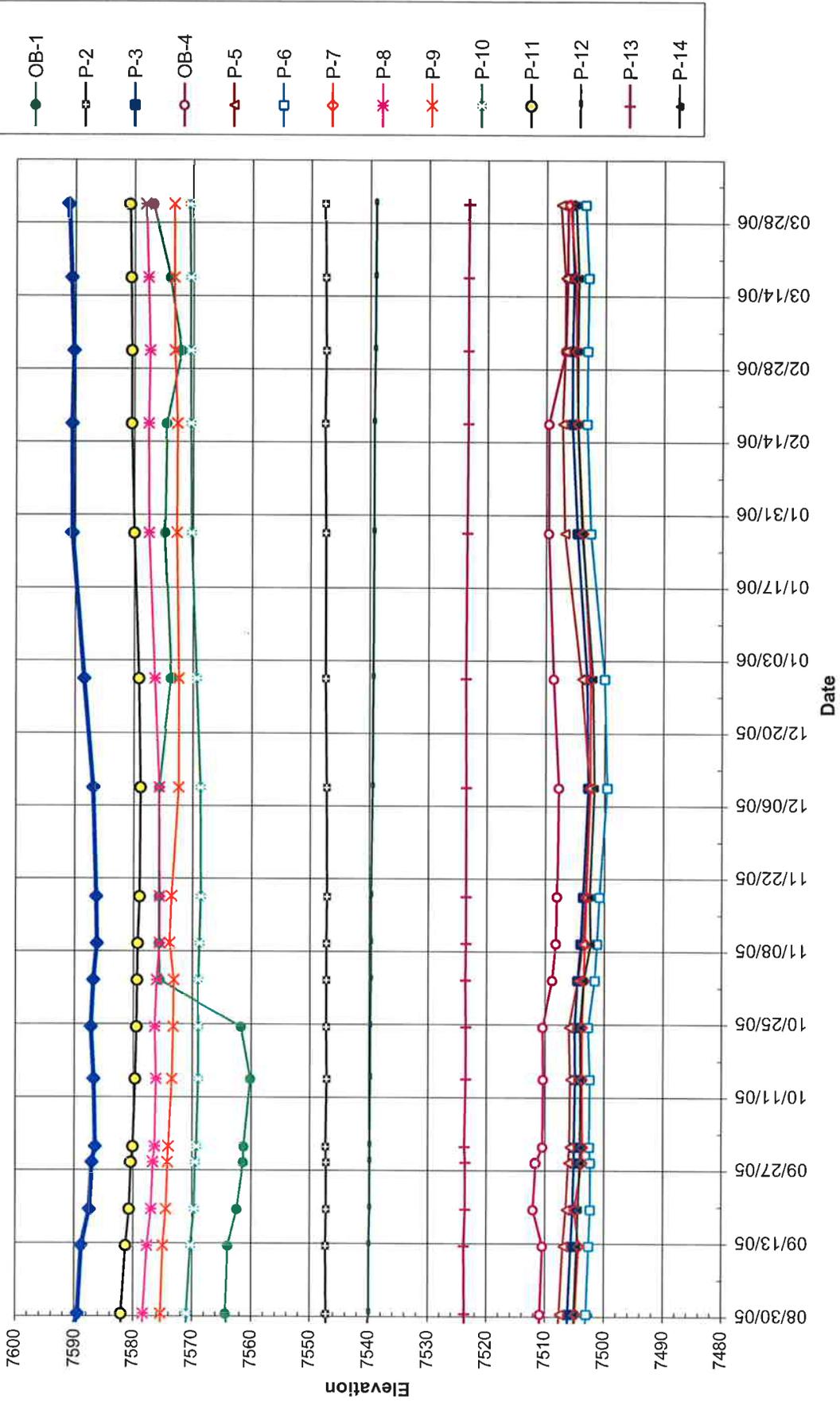


Figure Reservoir Elevation and Piezometer Readings  
August 30, 2005 to March 31, 2006

Grassy Trail Dam and Reservoir

**RB&G**  
**ENGINEERING**  
**INC.**  
Provo, Utah



# Grassy Trail Dam Reservoir Elevation and Piezometer Readings

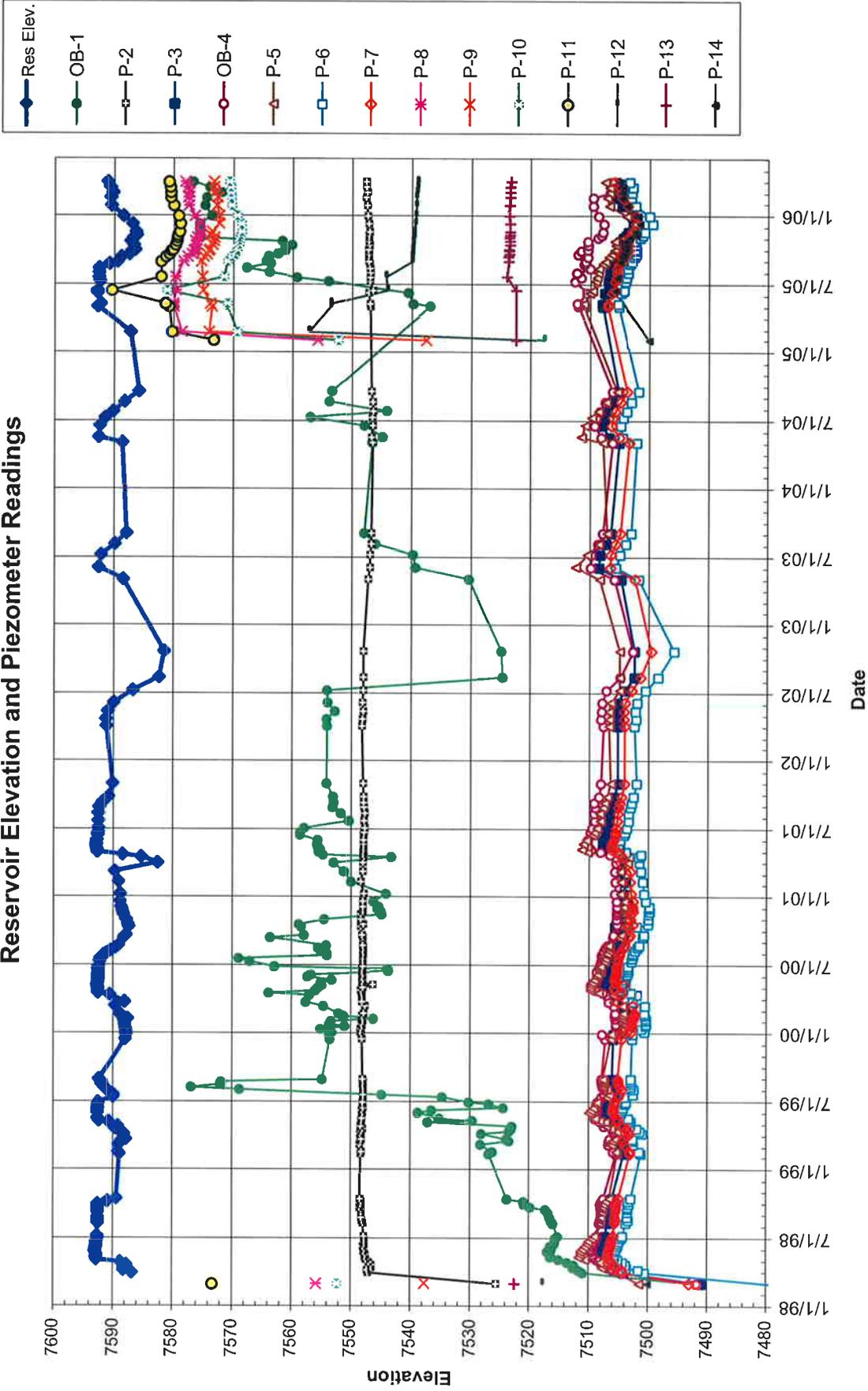


Figure Reservoir Elevation and Piezometer Readings  
March 1998 to March 31, 2006

Grassy Trail Dam and Reservoir

**RB&G**  
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**INC.**  
Provo, Utah

