US Army Corps
of Engineers
Walla Walla District

1992 Reservoir Drawdown Test

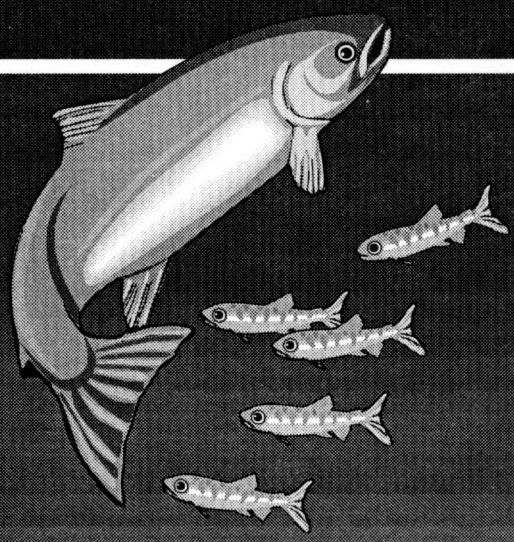
Lower Granite and Little Goose Dams

Appendix B

Wave Erosion Analysis for Drawdown

Appendix C

Settlement Gages



December 1993

APPENDIX B

WAVE EROSION ANALYSIS FOR EMBANKMENTS

1992 Reservoir Drawdown Test

Lower Granite and Little Goose Dams

Scott Leech
Walla Walla District
U.S. Army Corps of Engineers

APPENDIX B

TEST DRAWDOWN 1992 OF
LITTLE GOOSE AND LOWER GRANITE DAMS
WAVE EROSION ANALYSIS

1. INTRODUCTION.

In accordance with recommendations contained in the Record of Decision for the 1992 Options Analysis Document/Environmental Impact Statement for the Columbia River Salmon Flow Measures, a test drawdown of Little Goose and Lower Granite Reservoirs was conducted during the period of 1 to 31 March 1992. The drawdown test enabled the Corps of Engineers to evaluate the effects and feasibility of conducting reduced reservoir water levels on a regular basis. The lowering of water levels within the reservoirs theoretically would increase instream velocities that potentially would move salmon smolts downstream at a faster rate, which would theoretically increase their survival.

Lowering reservoir levels below the riprap armor on embankments raised concerns over the level of protection provided by the exposed rockfill. Wave erosion (surface erosion) reduces the factor of safety for slope stability by increasing slope angles. Maintaining dam and levee embankment stability is critical to the integrity and safety of the lower Snake River projects. In order to evaluate the adequacy of the rockfill in a wave environment, design wave heights were used to determine the rock slope protection required. The calculated protection was then compared to the existing rockfill.

2. PROTECTION ANALYSIS.

To evaluate the adequacy of the rockfill in a wave environment, a design wave height was determined with the aid of site meteorological data using the procedure contained in ETL 1110-2-305, 16 February 1984. The ETL called for a 50-year storm to determine the design wave height. After the wave height was determined, the rock slope protection was determined in accordance with the procedure of EM 1110-2-2300, 10 May 1982.

a. Lower Granite Dam North Embankment. The north embankment of Lower Granite Dam is protected from wave action from the crest to elevation 719 feet above mean sea level (fmsl) with riprap, below which the embankment slope is protected by rockfill. The lowest reservoir level expected during the drawdown period was anticipated to be 691 fmsl.

According the contract specifications and construction history, the granite rockfill material was well graded having a maximum particle size of 100 pounds (12 inches) and a minimum particle size of 1 inch. The rockfill thickness is 2.7 feet taken perpendicular to the slope. For protection during a 50-year storm, a maximum size particle of 127 pounds and minimum

particle size of 3 - 3/4 inches is required with a minimum thickness of 11.3 inches. Thus the existing rockfill may contain some undersized particles which may be washed out should the significant wave be experienced during the drawdown period. However, the as-built thickness compensates to a certain extent for the deficiency of smaller size particles. During the short period of the drawdown, the design event is unlikely to occur. It should also be noted that the prevailing winds at the site tend to blow the waves directly away from the dam.

b. Little Goose Dam North Embankment. Similar to Lower Granite Dam, riprap protection for the north embankment of Little Goose Dam extends from the crest to 628 fmsl, below which the embankment is protected by rockfill. During the drawdown, the lowest reservoir level expected was 617 fmsl.

The existing rockfill consists of a maximum particle size of 1000 pounds and a minimum particle size of 50 pounds. The thickness of the rockfill when measured perpendicular to the slope is 3.1 feet. For the 50-year storm environment, a maximum particle size of 302 pounds and a minimum particle size of 9.4 pounds is required with a minimum thickness of 1.3 feet. The existing rockfill exceeds the calculated values and should be adequate against anticipated wave action.

c. Lewiston Levees. The Lewiston levee slopes are protected with riprap from the crest to 730 fmsl, below which the slopes are protected by rockfill. At a flow of 40,000 cubic feet per second (cfs), the water surface elevation will be above 730 fmsl proceeding upstream from about river mile (RM) 3 on the Clearwater River. North and East Lewiston levee sections above RM 3 will be adequately protected through the entire drawdown sequence. Portions of the North and East levees downstream of RM 3, and the West levee will be areas where the drawdown water surface elevation falls below the riprap zone into the rockfill. The rockfill was originally specified to have an average particle size of 20 pounds (6 inches) with the material finer than six inches being not more than 20 percent finer than 1/2 inch and not more than 5 percent finer than the number 200 sieve.

Due to the multi-directional nature of the levees, the prevailing wind direction will have a greater influence than at Lower Granite and Little Goose Dams. The fetch, however, to affected embankments will be minimal. Considering maximum design winds, speeds on the order of 70 miles per hour (mph) would yield wave heights on the order of four feet. From meteorological wind data for Lewiston, maximum clocked speeds of 40 mph have been recorded for a ten year event. For the short period of the drawdown, the probability of a greater than 40 mph wind is low. As the period of drawdown is comparable to the period of initial reservoir filling it is not unreasonable to assume the existing rockfill, although relatively fine graded may be adequate. The possibility does exists for damage due to wave action should a major storm be experienced during the drawdown.

APPENDIX C

SETTLEMENT GAGES

1992 Reservoir Drawdown Test

Lower Granite and Little Goose Dams

Andrea L. Shoulders
Walla Walla District
U.S. Army Corps of Engineers

APPENDIX C

TEST DRAWDOWN 1992 OF
LITTLE GOOSE AND LOWER GRANITE DAMS
SETTLEMENT GAGES

1. INTRODUCTION.

In accordance with recommendations contained in the Record of Decision for the 1992 Options Analysis Document/Environmental Impact Statement for the Columbia River Salmon Flow Measures, a test drawdown of Little Goose and Lower Granite Reservoirs was conducted during the period of 1 to 31 March 1992. The drawdown test enabled the Corps of Engineers to evaluate the effects and feasibility of conducting reduced reservoir water levels on a regular basis. The lowering of water levels within the reservoirs theoretically would increase instream velocities that would potentially move salmon smolts downstream at a faster rate, which would theoretically increase their survival.

Lowering reservoir levels lowers the factor of safety for slope stability by removing the laterial support from the reservoir and increasing the slope load factor (additional soil height and weight from undrained soil). Wave erosion (surface erosion) also reduces the factor of safety for slope stability by increasing slope angles. Settlement due to a reduction in bearing capacities and material consolidation, once buoyant forces are removed, was also a concern. Rebounding of the embankment materials when pressure is removed while the soil remains in contact with free water, or from swelling of overcompacted soil when pressures are removed, and piping of finer materials from excess pore pressures were also potential hazards.

Maintaining dam embankment stability is critical to the integrity and safety of the lower Snake River projects. In order to detect movement in the event of embankment instability, existing settlement gages were monitored for the Lower Granite, Little Goose, and Lewiston levee system embankments. Potential movement could result from slope failure, consolidation (or settlement), rebound, piping, or surface erosion. Movement was monitored daily in order to prevent excessive deformation of the embankments.

2. EQUIPMENT AND MONITORING SCHEDULE.

Settlement gage locations for Little Goose and Lower Granite Dams are shown on plates 1 and 7 respectively. A detailed drawing showing the settlement gage configuration at Little Goose Dam is shown on plate 2. The settlement gages are situated in the impervious core materials. No detailed drawing was found for gages located at Lower Granite Dam. The gages at Lower Granite Dam are believed to have the same configuration as those located at Little Goose Dam; however, the gages are located in the same

flush mount box as the piezometers. From reviewing field logs, it is believed that the piezometers were installed first. Plate 14 shows the location of the crossarm settlement gages for the West and North Lewiston levees. A detailed drawing showing the crossarm settlement gage configuration is shown on plate 15. For the Lewiston levee settlement gages three measurements were taken at different elevations for each gage location. The uppermost reading (N 0+00 and W 0+00) is situated within the gravel fill. The second reading (N Stop #1 and W Stop #1) is situated in the impervious core material with the third reading (N Stop #2 and W Stop #2) situated in the impervious cutoff.

Drawdown settlement gages monitoring schedules are shown on plates 3, 8, and 16 for Little Goose Dam, Lower Granite Dam, and the Lewiston levees respectively. For Little Goose Dam daily readings were not started until 16 March. For Lower Granite Dam and the Lewiston levees, daily readings were started at the beginning of March, and taken until mid-March, then readings were made on alternate days through the end of the month. All settlement gages had pre- and post-drawdown readings taken by the Corps survey crew. These readings were first-order class II accuracy. All other readings were taken by a contract survey crew and were third-order accuracy. Readings taken for the crossarm settlement gages for the Lewiston levees were done by steel tape and chain.

3. DRAWDOWN SETTLEMENT GAGE REACTION.

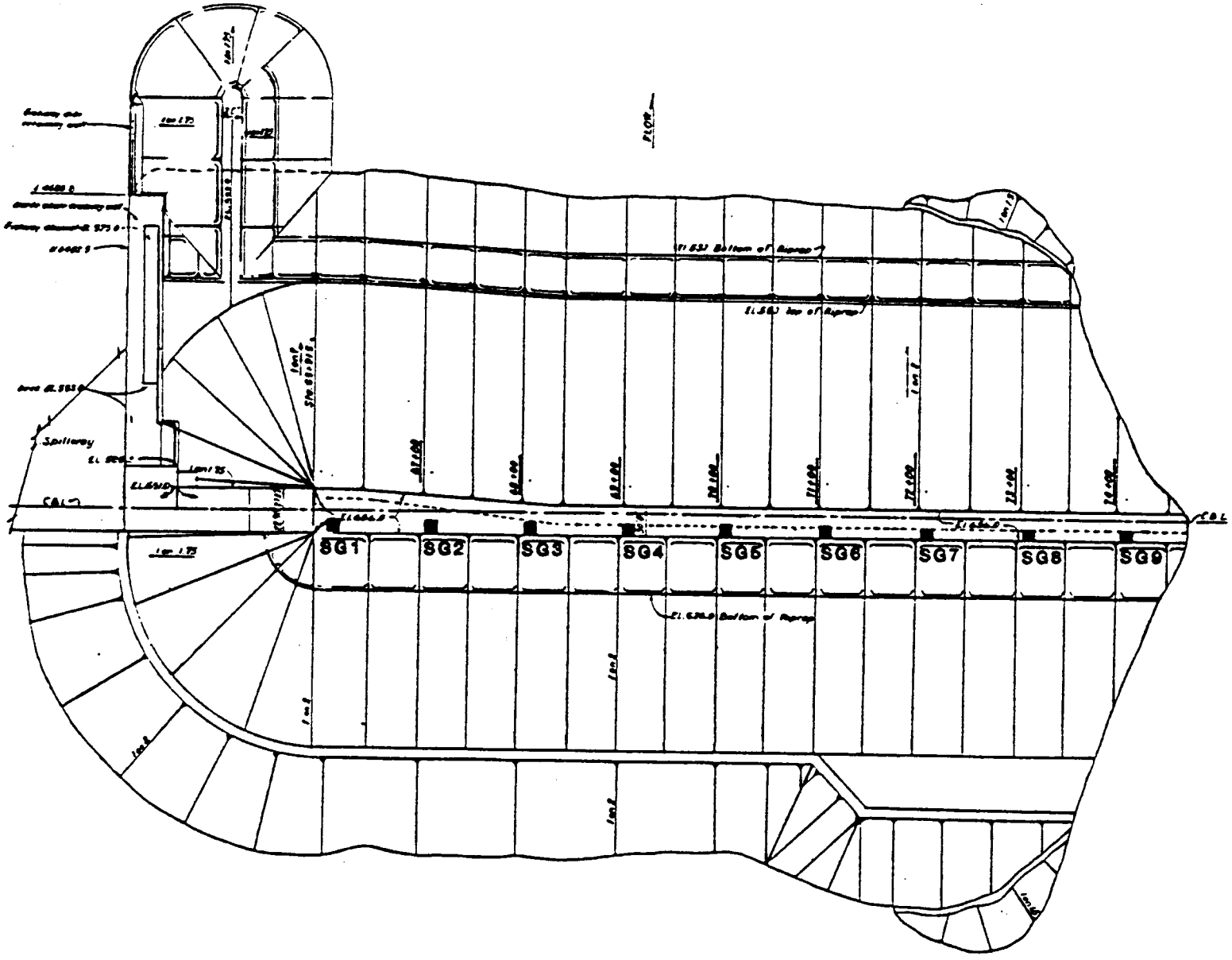
a. Little Goose Dam. Plates 4 and 5 show line graphs of the settlement gages readings for Little Goose Dam. The maximum differentials seen for the settlement gages at Little Goose Dam for the period of 30 January through 30 May fall between 0.006' and 0.013'. The accuracy for the survey is plus or minus 0.005'. After viewing the graphs it is believed that the apparent pattern seen can be attributed to equipment calibration and precision of the surveys. The maximum movement, after considering the accuracy of the survey, would be around 1/10 of an inch for SG-3.

b. Lower Granite Dam. Plates 9, 10, and 11 show line graphs of the settlement gages readings for Lower Granite Dam. The maximum differentials seen for the settlement gages at Lower Granite Dam for the period of 14 February through 15 May fall between 0.006' and 0.010'. The accuracy for the survey is plus or minus 0.005'. After viewing the graphs it is believed that the apparent pattern seen is mostly attributed to equipment calibration and precision of the surveys. The maximum movement, after considering the accuracy of the survey, would be around 1/16 of an inch for SG-2.

c. Lewiston Levees. Plates 17 through 23 shown line graphs of the crossarm settlement gages readings for the North and West Lewiston levees. The maximum differentials for the North levee gages for the period of 2 March through 2 April fall between 0.013' and 0.018'. The accuracy for the survey is plus or minus

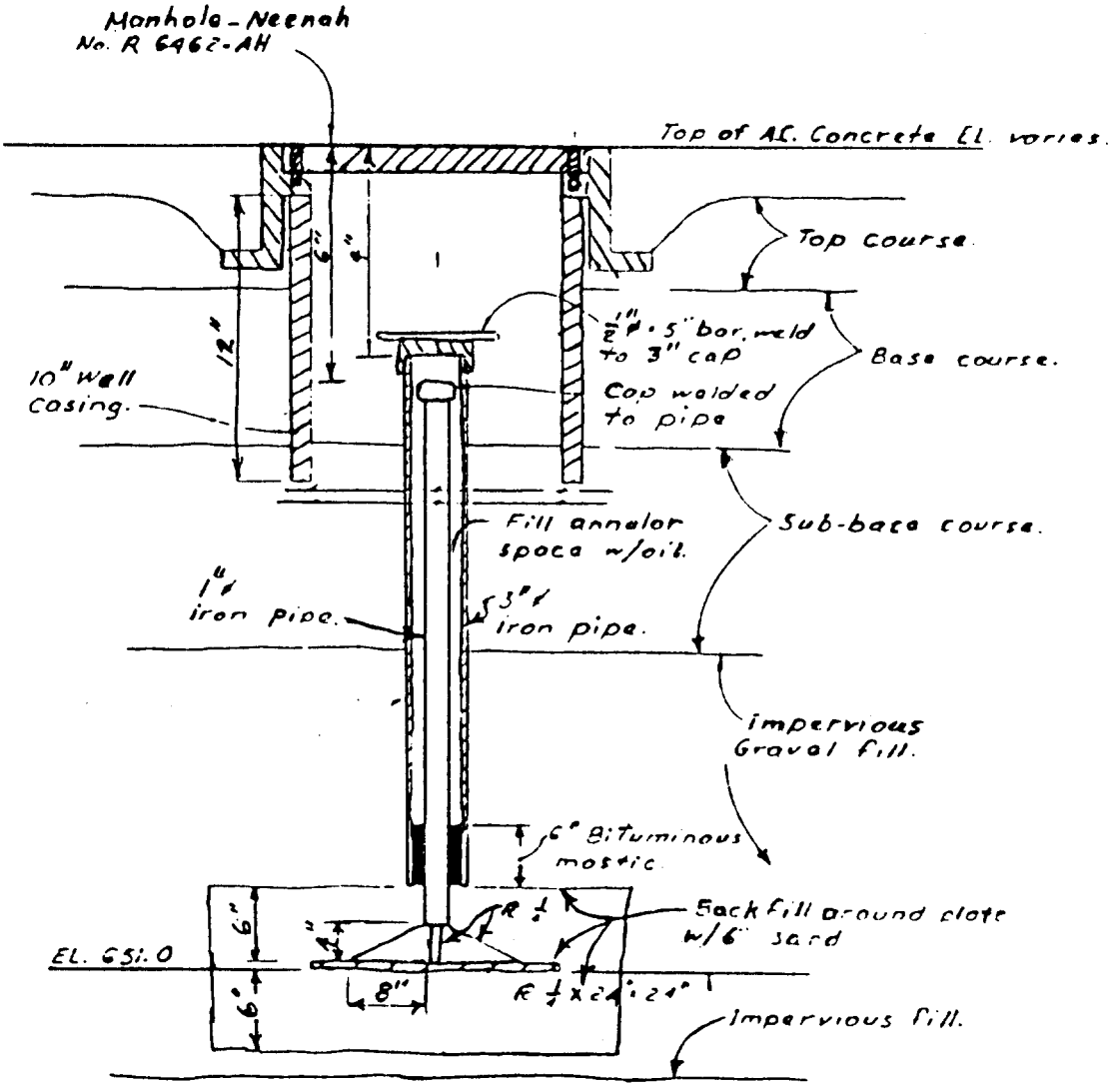
0.01'. After viewing the graphs it is believed that the apparent pattern following the drawdown water levels is attributed to the accuracy of the survey readings. The maximum differentials for the West levee gages for the same period fall between 0 .030' and 0.048'. The differential for the West levee readings can be attributed to lower readings taken on 3 and 4 March and higher readings taken on 13 and 14 March. Neglecting these readings, all other readings show negligible movement. The higher and lower readings, when compared to the water levels taken at the confluence, do not indicate any pattern.

In conclusion, no movement was detected for the Little Goose and Lower Granite Dam embankments, nor for the West and North Lewiston levee embankments. The preliminary summary indicated that there was some settlement and rebound. This report concludes that this movement can be attributed to equipment calibration and survey precision for all the monitored embankments.



LITTLE GOOSE LOCK AND DAM
NORTH EMBANKMENT
SETTLEMENT GAGES' LOCATIONS – PLAN VIEW

PLATE 1



LITTLE GOOSE LOCK AND DAM

SINGLE-POINT SETTLEMENT GAGE

SECTION VIEW

PLATE 2

DRAWDOWN SETTLEMENT GAGE MONITORING SCHEDULE

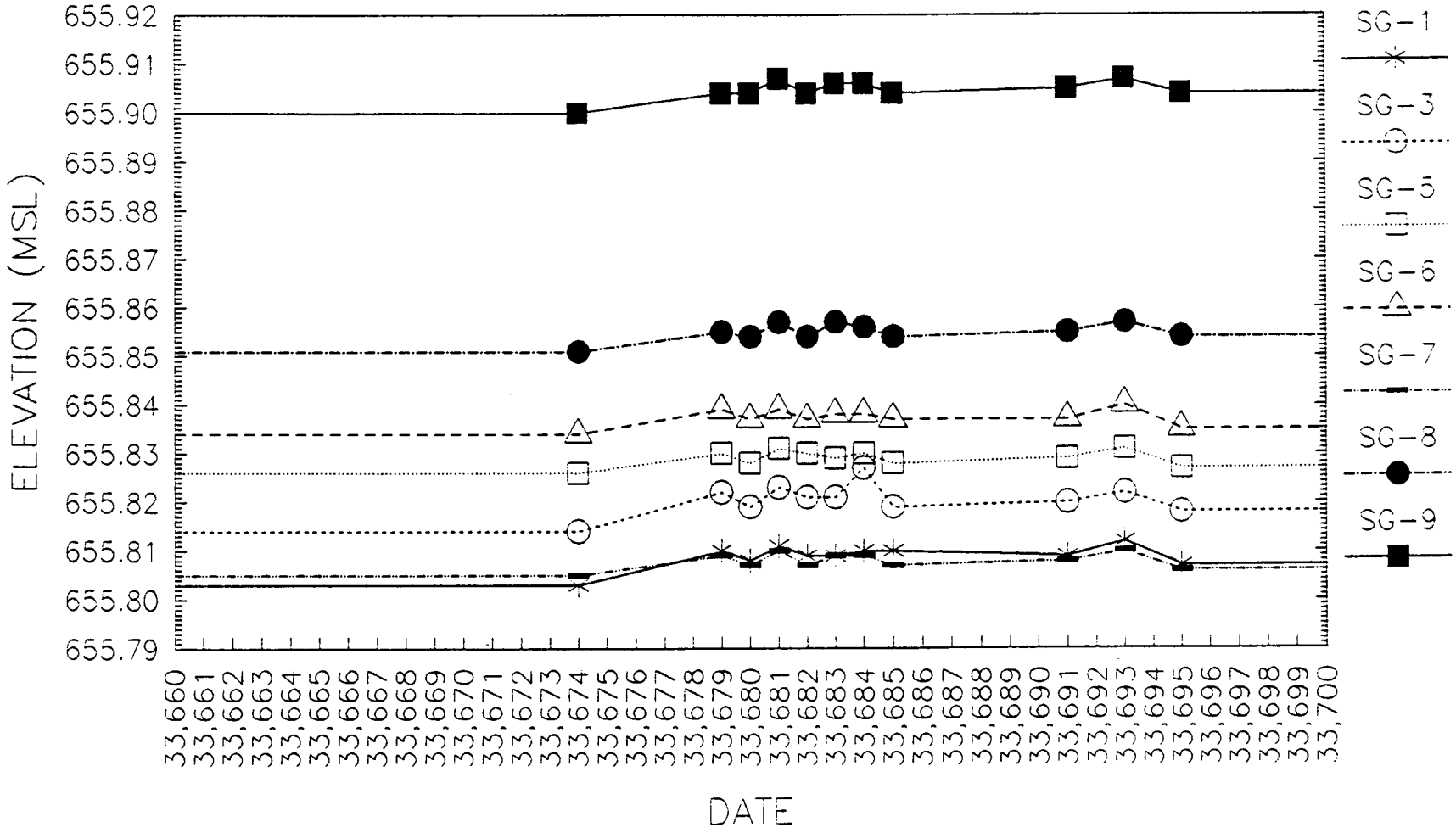
LITTLE GOOSE DAM

02/ /75	Baseline Survey by Corps
02/30/92	Baseline Survey by Corps
03/11/92	Daily Readings by Corps
03/16/92 through 03/22/92	Daily Readings by Contractor
03/28/92	Daily Reading by Contractor
03/30/92	Daily Reading by Contractor
04/01/92	Daily Reading by Contractor
05/30/92	Reading by Corps

Note: Readings by Corps are First-order Class II and readings by Contractor are Third-order.

LITTLE GOOSE DAM

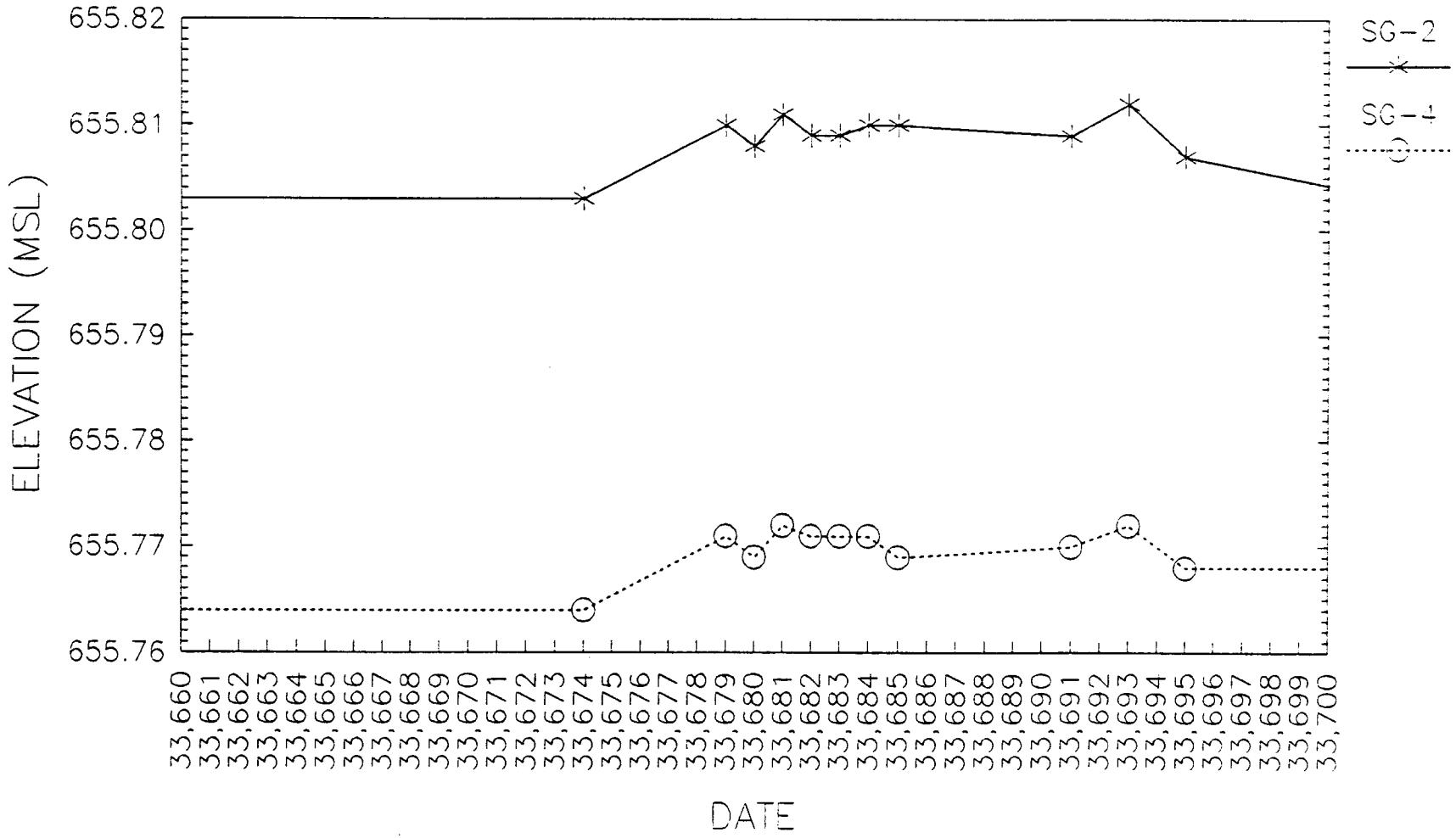
1992 DRAWDOWN SETTLEMENT GAGE READINGS



NOTE: Date numbers correspond to dates from January 1, 1990 (date number 1) through December 31, 2099 (date number 73,050). March 1, 1992 = 33,664 March 31, 1992 = 33,694

LITTLE GOOSE DAM

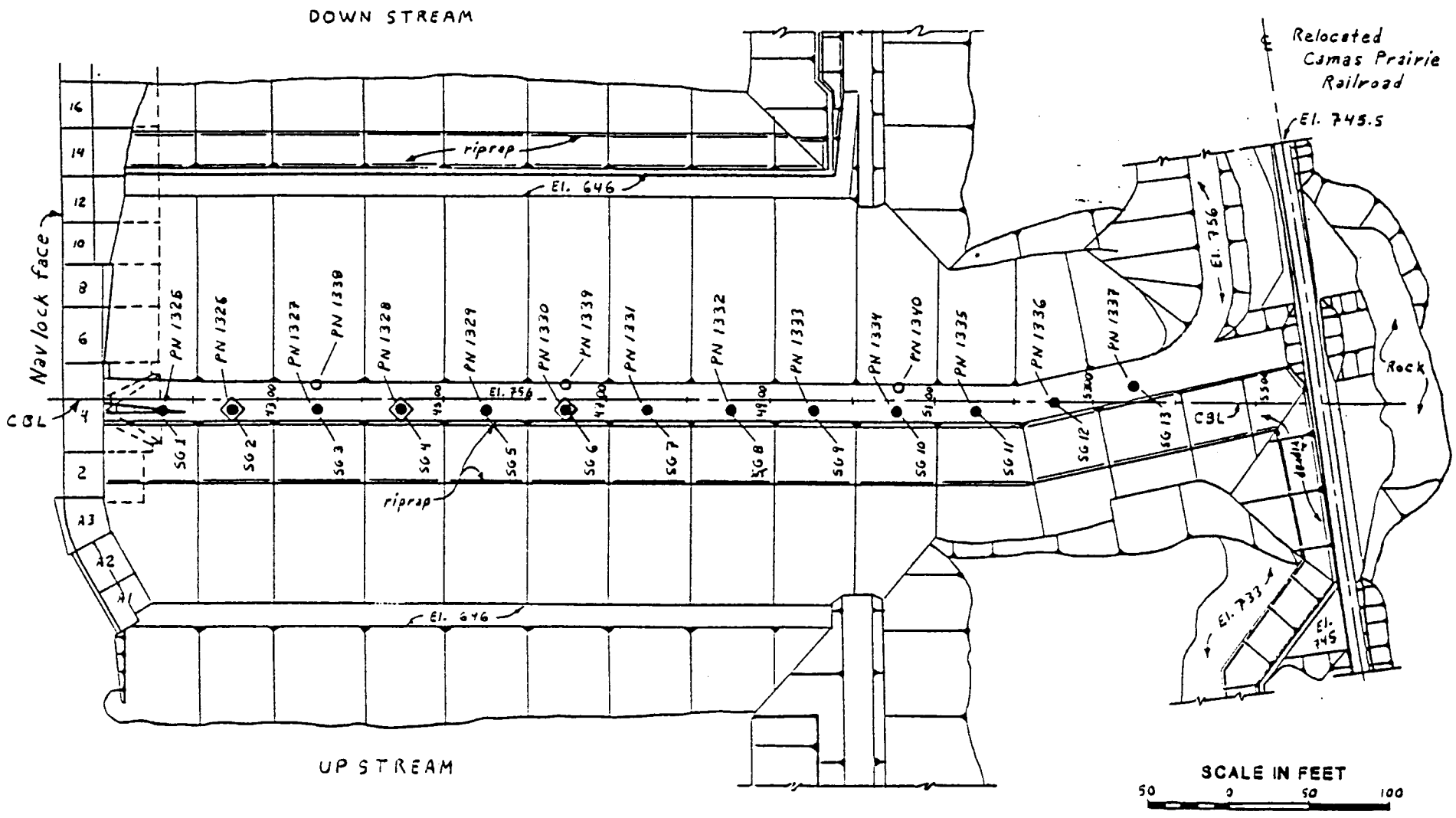
1992 DRAWDOWN SETTLEMENT GAGE READINGS



NOTE: Date numbers correspond to dates from January 1, 1990 (date number 1) through December 31, 2099 (date number 73,050). March 1, 1992 = 33,664 March 31, 1992 = 33,694

LITTLE GOOSE LOCK AND DAM - PRECISE LEVELS - EMBANKMENT

	30-Jan	11-Mar	16-Mar	17-Mar	18-Mar	19-Mar	20-Mar	21-Mar	22-Mar	28-Mar	30-Mar	01-Apr	30-May
	33633	33674	33679	33680	33681	33682	33683	33684	33685	33691	33693	33695	33754
SG-1	655.809	655.803	655.810	655.808	655.811	655.809	655.809	655.810	655.810	655.809	655.812	655.807	655.812
SG-2	655.772	655.767	655.775	655.772	655.776	655.774	655.775	655.774	655.774	655.774	655.776	655.771	655.775
SG-3	655.821	655.814	655.822	655.819	655.823	655.821	655.821	655.827	655.819	655.820	655.822	655.818	655.822
SG-4	655.768	655.764	655.771	655.769	655.772	655.771	655.771	655.771	655.769	655.770	655.772	655.768	655.772
SG-5	655.830	655.826	655.830	655.828	655.831	655.830	655.829	655.830	655.828	655.829	655.831	655.827	655.833
SG-6	655.836	655.834	655.839	655.837	655.839	655.837	655.838	655.838	655.837	655.837	655.840	655.835	655.839
SG-7	655.809	655.805	655.809	655.807	655.810	655.807	655.809	655.809	655.807	655.808	655.810	655.806	655.812
SG-8	655.853	655.851	655.855	655.854	655.857	655.854	655.857	655.856	655.854	655.855	655.857	655.854	655.857
SG-9	655.904	655.900	655.904	655.904	655.907	655.904	655.906	655.906	655.904	655.905	655.907	655.904	655.909



LEGEND:

- o - OPEN TUBE PIEZOMETER
- ⊡ - PORE PRESSURE METER
- ● - SETTLEMENT PIN LOCATED IN CONCRETE COLLAR AROUND HOLE CASING

LOWER GRANITE LOCK AND DAM
NORTH EMBANKMENT
INSTRUMENTATION LOCATIONS – PLAN VIEW

PLATE 7

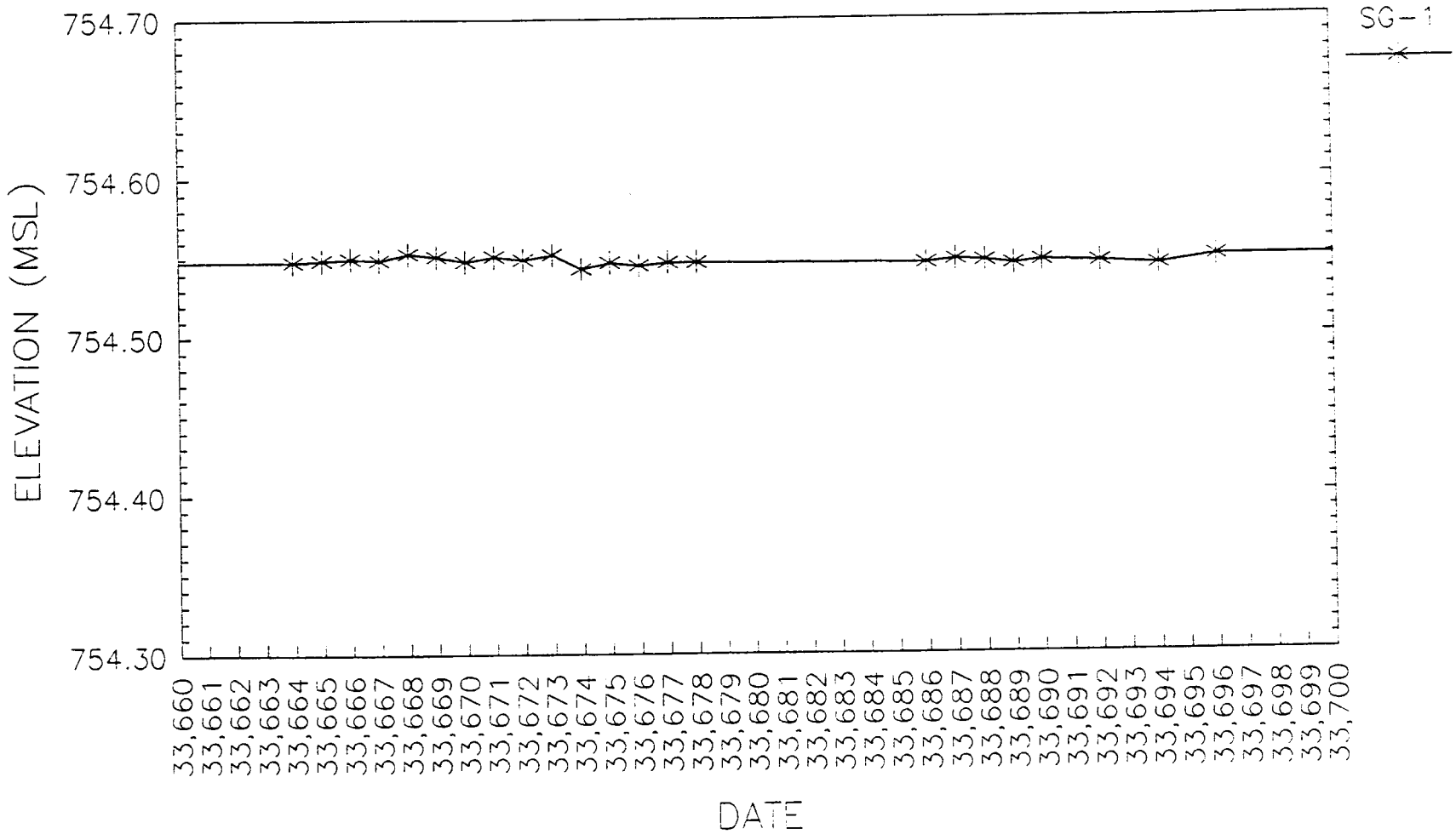
DRAWDOWN SETTLEMENT GAGE MONITORING SCHEDULE

LOWER GRANITE DAM

02/ /75	Baseline Survey by Corps
02/14/92	Baseline Survey by Corps
03/01/92 through 03/15/92	Daily Readings by Contractor
03/23/92 through 03/29/92	Daily Readings by Contractor
03/31/92	Daily Reading by Contractor
04/02/92	Daily Reading by Contractor
05/15/92	Reading by Corps

Note: Readings by Corps are First-order Class II and readings by Contractor are Third-order.

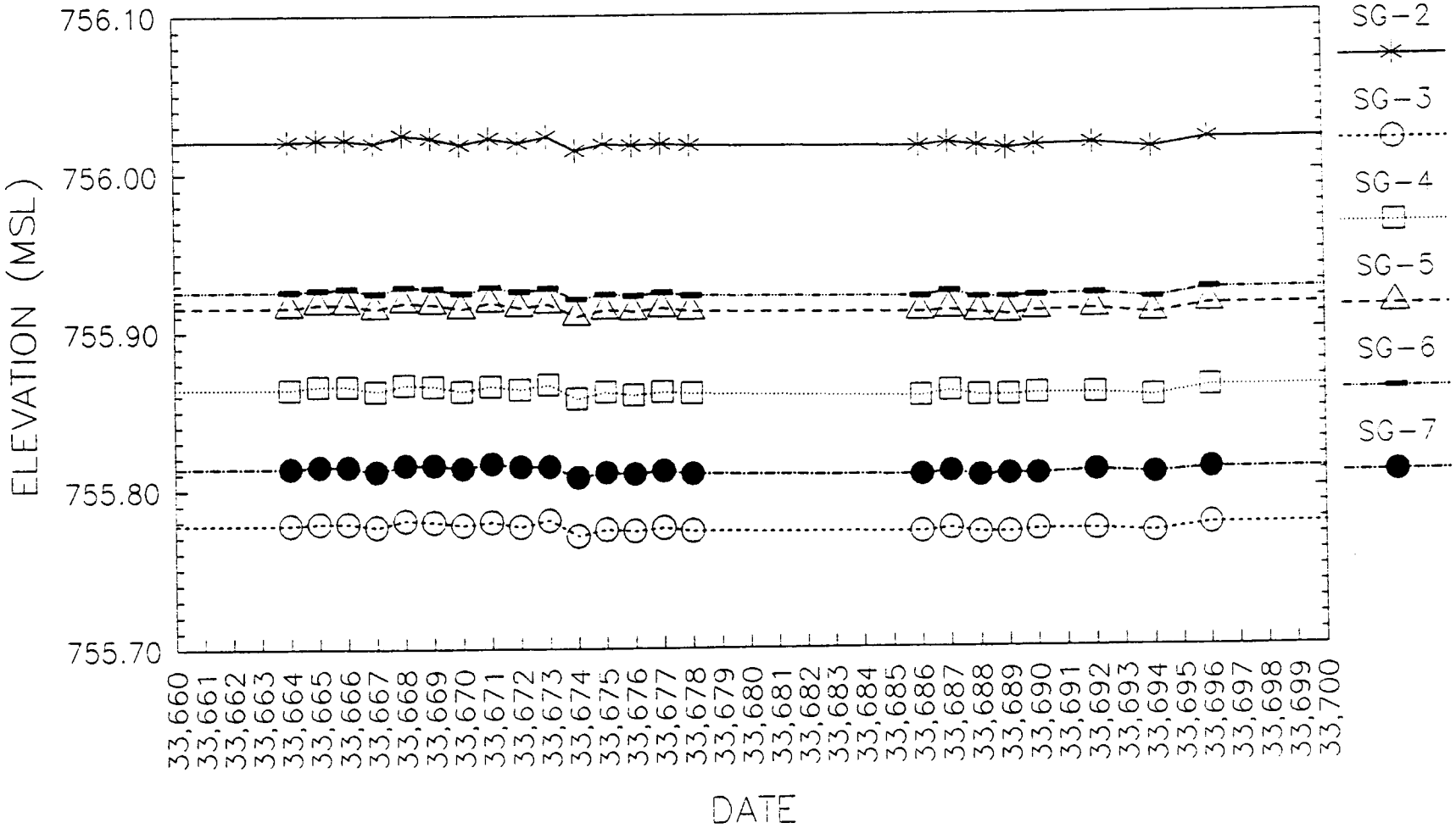
LOWER GRANITE DAM
1992 DRAWDOWN SETTLEMENT GAGE READINGS



NOTE: Date numbers correspond to dates from January 1, 1990 (date number 1) through December 31, 2099 (date number 73,050). March 1, 1992 = 33,664 March 31, 1992 = 33,694

LOWER GRANITE DAM

1992 DRAWDOWN SETTLEMENT GAGE READINGS



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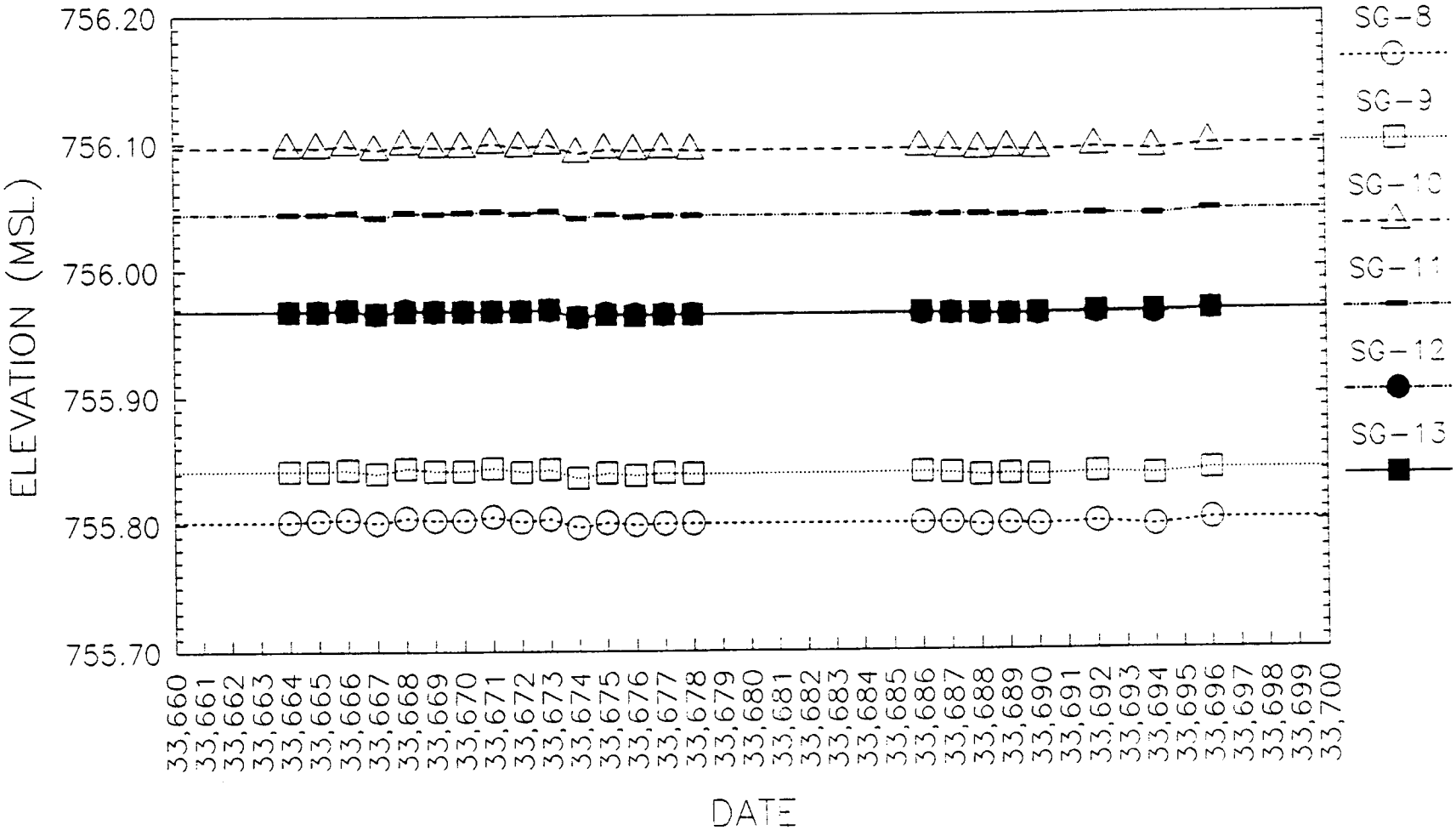
LOWER GRANITE DAM

1992 DRAWDOWN SETTLEMENT GAGE READINGS



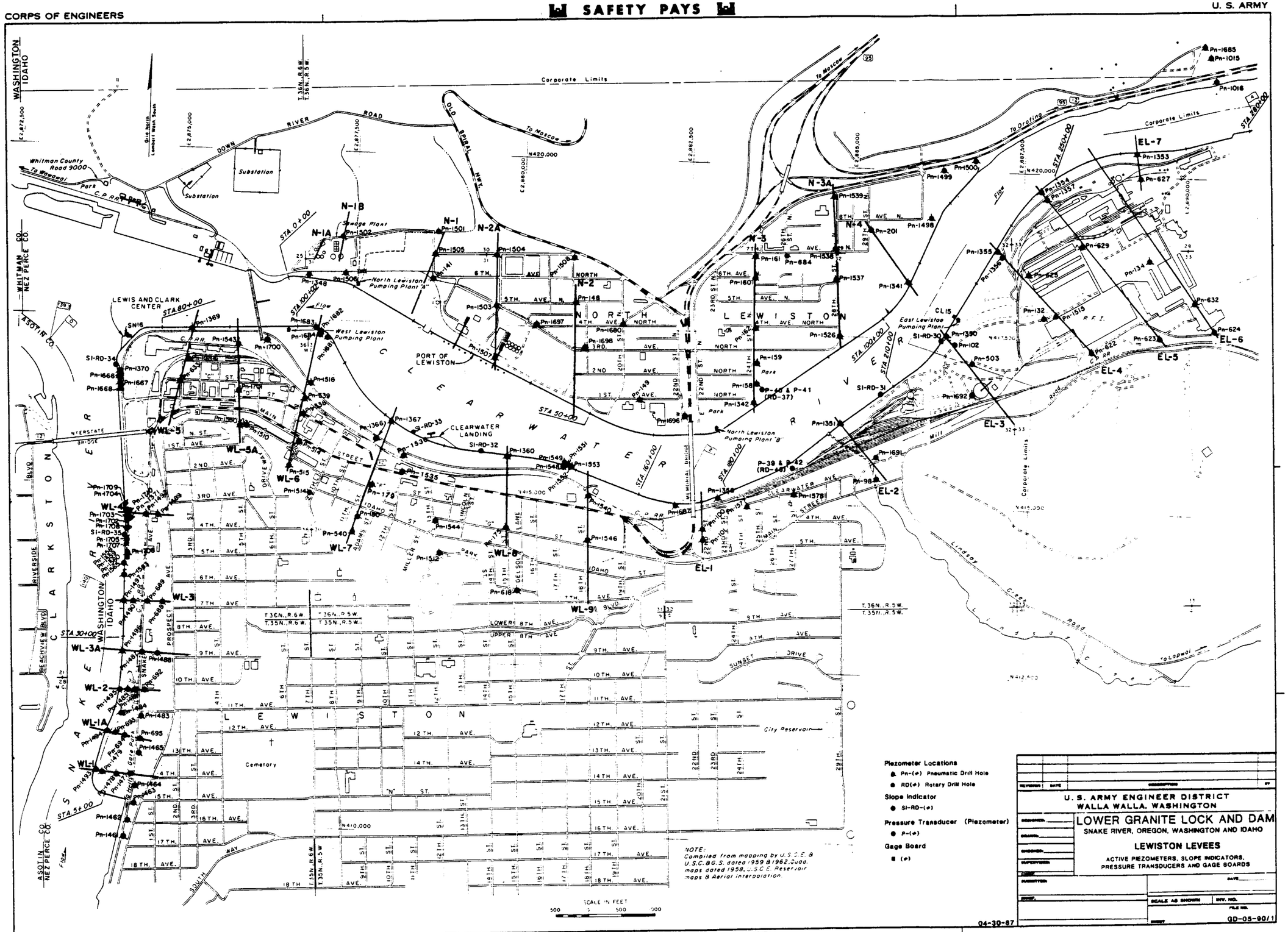
NOTE: Date numbers correspond to dates from January 1, 1990 (date number 1) through December 31, 2099 (date number 73,050). March 1, 1992 = 33,664 March 31, 1992 = 33,694

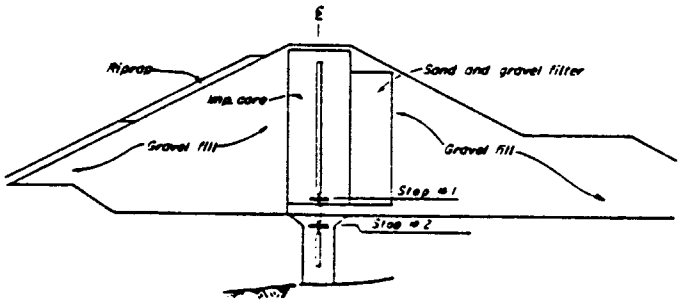
LOWER GRANITE LOCK AND DAM - PRECISE LEVELS - SETTLEMENT

	14-Feb	01-Mar	02-Mar	03-Mar	04-Mar	05-Mar	06-Mar	07-Mar	08-Mar	09-Mar	10-Mar	11-Mar	12-Mar	13-Mar	14-Mar	15-Mar	23-Mar	
	33648	33664	33665	33666	33667	33668	33669	33670	33671	33672	33673	33674	33675	33676	33677	33678	33686	
SG-1	754.549	754.548	754.549	754.550	754.549	754.553	754.551	754.548	754.551	754.549	754.552	754.543	754.547	754.545	754.547	754.547	754.546	[illegible]
SG-2	756.020	756.021	756.022	756.022	756.020	756.025	756.023	756.019	756.023	756.020	756.024	756.015	756.019	756.018	756.019	756.018	756.017	[illegible]
SG-3	755.778	755.778	755.779	755.779	755.777	755.781	755.780	755.778	755.780	755.777	755.781	755.771	755.775	755.774	755.776	755.774	755.773	[illegible]
SG-4	755.863	755.864	755.866	755.866	755.863	755.867	755.866	755.863	755.866	755.864	755.867	755.858	755.862	755.860	755.862	755.861	755.859	[illegible]
SG-5	755.917	755.916	755.918	755.918	755.915	755.919	755.918	755.915	755.919	755.916	755.918	755.910	755.914	755.913	755.915	755.913	755.912	[illegible]
SG-6	755.925	755.926	755.927	755.928	755.925	755.929	755.928	755.925	755.929	755.926	755.928	755.921	755.924	755.923	755.925	755.923	755.922	[illegible]
SG-7	755.816	755.814	755.815	755.815	755.812	755.816	755.816	755.814	755.817	755.815	755.815	755.808	755.811	755.810	755.812	755.810	755.809	[illegible]
SG-8	755.801	755.802	755.803	755.804	755.801	755.805	755.803	755.803	755.806	755.802	755.804	755.797	755.801	755.799	755.800	755.800	755.800	[illegible]
SG-9	755.842	755.842	755.842	755.843	755.840	755.844	755.842	755.842	755.844	755.841	755.843	755.836	755.840	755.838	755.840	755.839	755.840	[illegible]
SG-10	756.096	756.097	756.097	756.099	756.095	756.099	756.097	756.097	756.100	756.097	756.099	756.092	756.095	756.094	756.095	756.094	756.095	[illegible]
SG-11	756.045	756.045	756.045	756.046	756.042	756.046	756.045	756.046	756.047	756.045	756.047	756.041	756.044	756.042	756.043	756.043	756.043	[illegible]
SG-12	755.968	755.968	755.968	755.969	755.966	755.969	755.968	755.968	755.968	755.968	755.969	755.963	755.966	755.965	755.965	755.965	755.965	[illegible]
SG-13	755.969	755.968	755.968	755.969	755.966	755.968	755.968	755.968	755.968	755.968	755.969	755.963	755.965	755.964	755.965	755.965	755.966	[illegible]

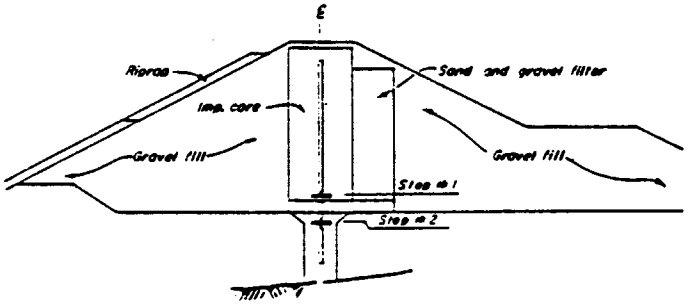
LOWER GRANITE LOCK AND DAM - PRECISE LEVELS - SETTLEMENT

	24-Mar	25-Mar	26-Mar	27-Mar	29-Mar	31-Mar	02-Apr	15-May
	33687	33688	33689	33690	33692	33694	33696	33739
SG-1	754.548	754.547	754.545	754.547	754.546	754.544	754.549	754.546
SG-2	756.019	756.017	756.015	756.017	756.018	756.015	756.021	756.016
SG-3	755.775	755.772	755.772	755.774	755.774	755.772	755.777	755.774
SG-4	755.862	755.859	755.859	755.860	755.860	755.858	755.864	755.858
SG-5	755.913	755.911	755.910	755.912	755.913	755.910	755.916	755.911
SG-6	755.925	755.921	755.921	755.922	755.923	755.920	755.926	755.921
SG-7	755.811	755.808	755.809	755.809	755.811	755.809	755.812	755.810
SG-8	755.800	755.798	755.799	755.798	755.800	755.797	755.802	755.797
SG-9	755.839	755.837	755.838	755.837	755.839	755.837	755.841	755.837
SG-10	756.094	756.093	756.094	756.093	756.095	756.093	756.097	756.091
SG-11	756.043	756.043	756.042	756.042	756.043	756.042	756.046	756.042
SG-12	755.965	755.964	755.964	755.964	755.965	755.964	755.967	755.962
SG-13	755.965	755.965	755.964	755.965	755.966	755.966	755.967	755.965

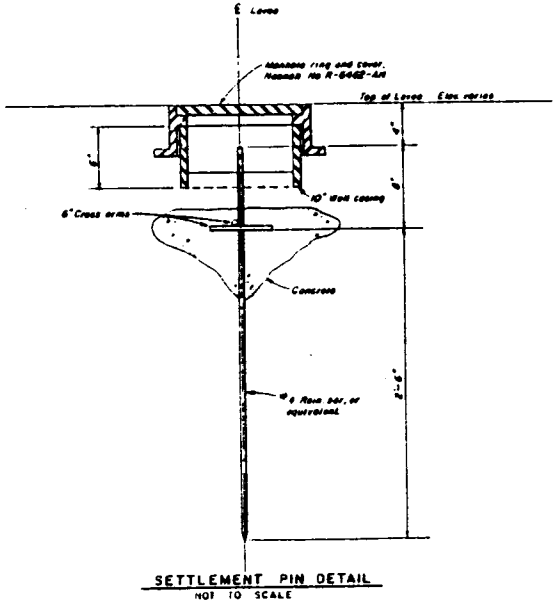

WASHINGTON
IDAHO
Corporate Limits
DOWN RIVER ROAD
Substation
Whitman County Road 9000
To Wawawai Park
C.P.R.R.
OLD SPIRAL HWY.
To Moscow
To Orofino
N-1B
N-1A
N-1
N-2A
N-2
N-3
N-3A
N-4
Sewage Plant
North Lewiston Pumping Plant "A"
West Lewiston Pumping Plant
PORT OF LEWISTON
LEWIS AND CLARK CENTER
CLEARWATER LANDING
North Lewiston Pumping Plant "B"
East Lewiston Pumping Plant
NORTH LEWISTON
CLEARWATER RIVER
SNAKE RIVER
CLARKSTON
LEWISTON
Cemetery
City Reservoir
Lindsay Creek Road
Lindsay Creek
To Lapwai
WHITMAN CO.
NEZ PERCE CO.
ASOTIN CO.
WL-1
WL-1A
WL-2
WL-3
WL-3A
WL-4
WL-5
WL-5A
WL-6
WL-7
WL-8
WL-9
EL-1
EL-2
EL-3
EL-4
EL-5
EL-6
EL-7
STA 0+00
STA 80+00
STA 100+00
STA 50+00
STA 160+00
STA 180+00
STA 210+00
STA 250+00
STA 280+00
STA 30+00
STA 5+00
SCALE IN FEET
500 0 500 1000
NOTE:
Compiled from mapping by U.S.C.E. & U.S.C.&G.S. dated 1959 & 1962. Quad. maps dated 1958, U.S.C.E. Reservoir maps & Aerial interpolation.
Piezometer Locations
Pn-(#) Pneumatic Drill Hole
RD(#) Rotary Drill Hole
Slope Indicator
SI-RD-(#)
Pressure Transducer (Piezometer)
P-(#)
Gage Board
(#)
04-30-87
U. S. ARMY ENGINEER DISTRICT
WALLA WALLA, WASHINGTON
LOWER GRANITE LOCK AND DAM
SNAKE RIVER, OREGON, WASHINGTON AND IDAHO
LEWISTON LEVEES
ACTIVE PIEZOMETERS, SLOPE INDICATORS, PRESSURE TRANSDUCERS AND GAGE BOARDS
SCALE AS SHOWN
GD-05-90/1



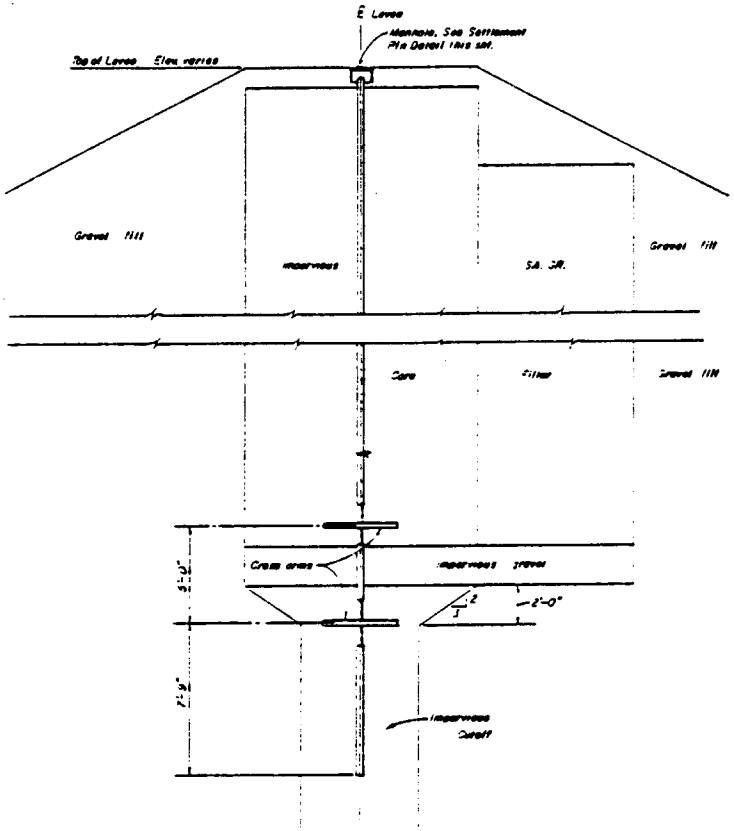
WEST LEWISTON LEVEE
STA. 34+00



NORTH LEWISTON LEVEE
STA. 101+00



SETTLEMENT PIN DETAIL
NOT TO SCALE



USBR INTERNAL SETTLEMENT DEVICE DETAIL
NOT TO SCALE

LEWISTON LEVEES
CROSS ARM SETTLEMENT GAGES
SECTION VIEWS

PLATE 15

DRAWDOWN SETTLEMENT GAGE MONITORING SCHEDULE

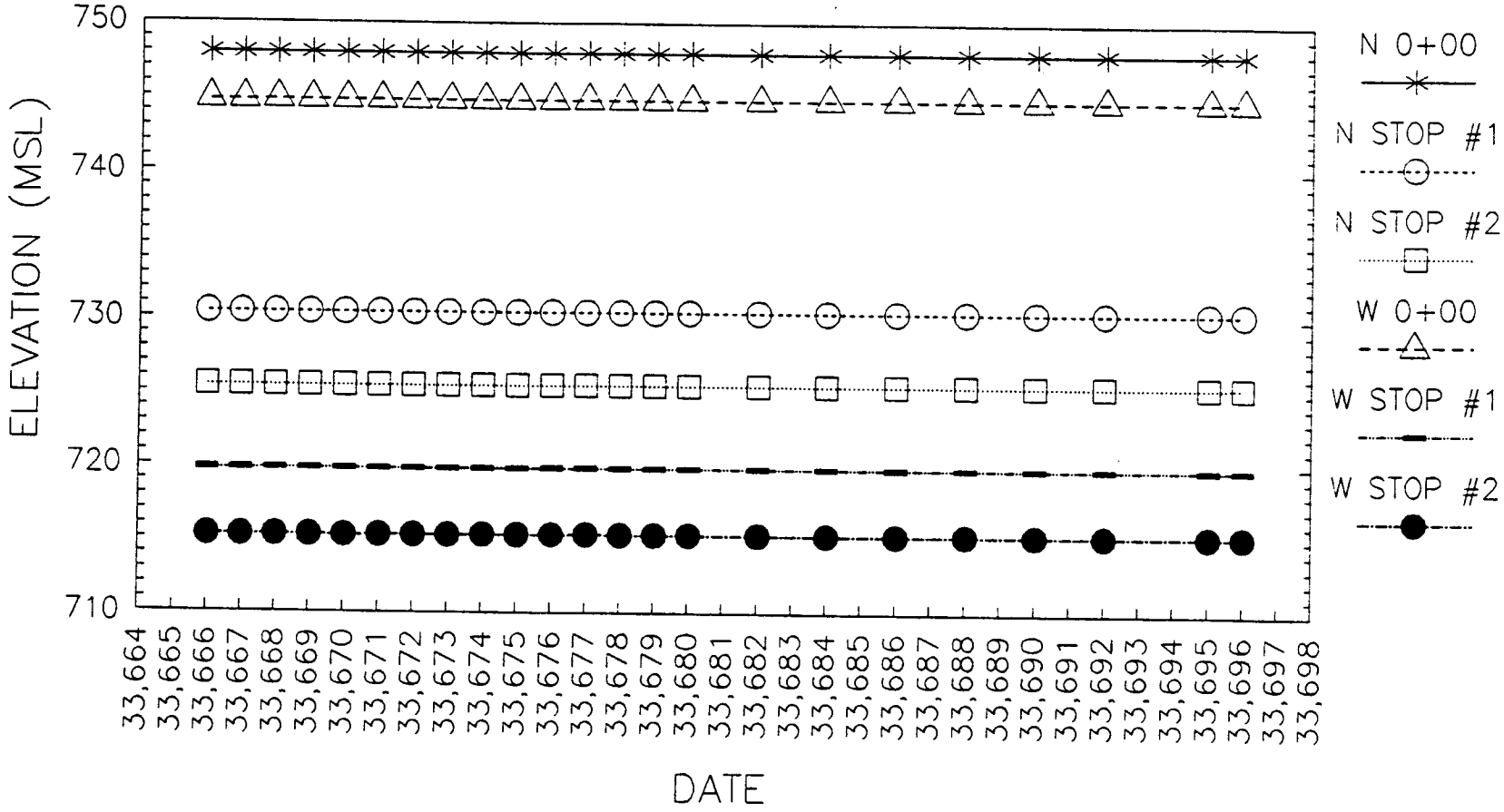
LEWISTON LEVEES

03/02/92	Baseline Survey by Contractor
03/03/92 through 03/17/92	Daily Readings by Contractor
03/19/92	Daily Reading by Contractor
03/21/92	Daily Reading by Contractor
03/23/92	Daily Reading by Contractor
03/25/92	Daily Reading by Contractor
03/27/92	Daily Reading by Contractor
03/29/92	Daily Reading by Contractor
03/31/92	Daily Reading by Contractor
04/02/92	Daily Reading by Contractor

Note: Measurements were taken by a steel tape and chain.

LEWISTON LEVEES

1992 DRAWDOWN CROSSARM SETTLEMENT GAGES

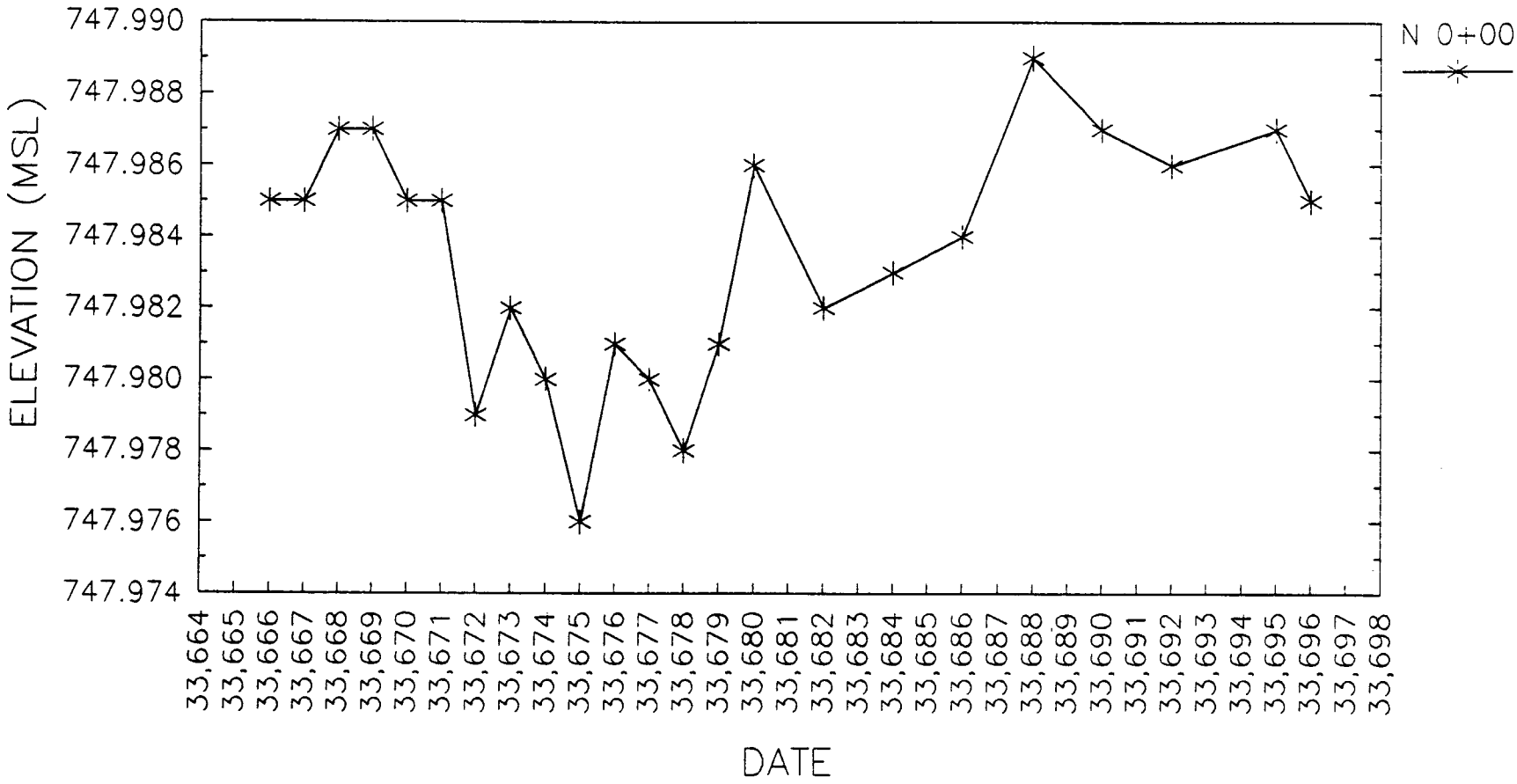


NLL STA. 101+00
WLL STA. 34+00

NOTE: Date numbers correspond to dates from January 1, 1990 (date number 1) through December 31, 2099 (date number 73,050). March 1, 1992 = 33,664 March 31, 1992 = 33,694

LEWISTON LEVEES

1992 DRAWDOWN CROSSARM SETTLEMENT GAGES

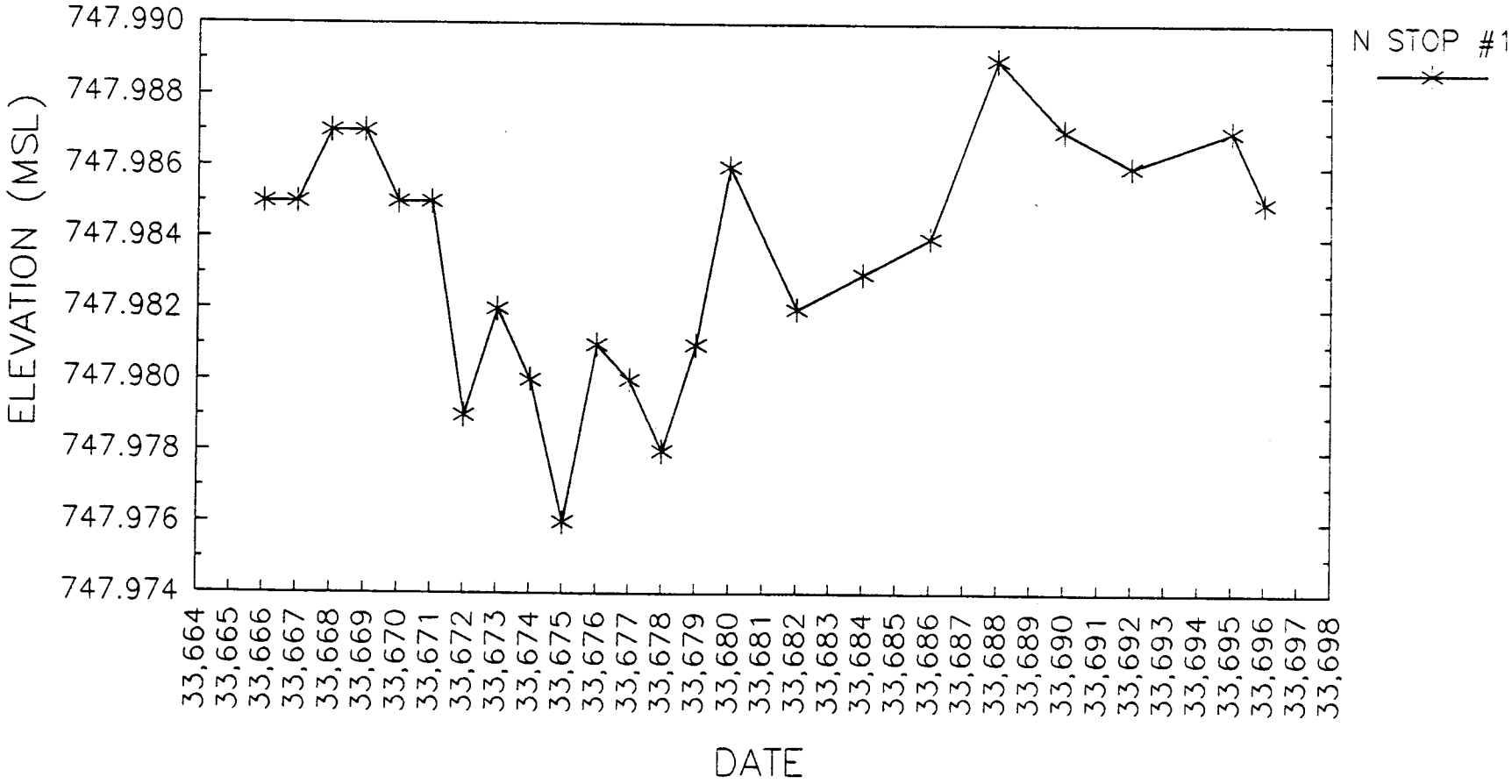


NLL STA. 101+00

NOTE: Date numbers correspond to dates from January 1, 1990 (date number 1) through December 31, 2099 (date number 73,050). March 1, 1992 = 33,664 March 31, 1992 = 33,694

LEWISTON LEVEES

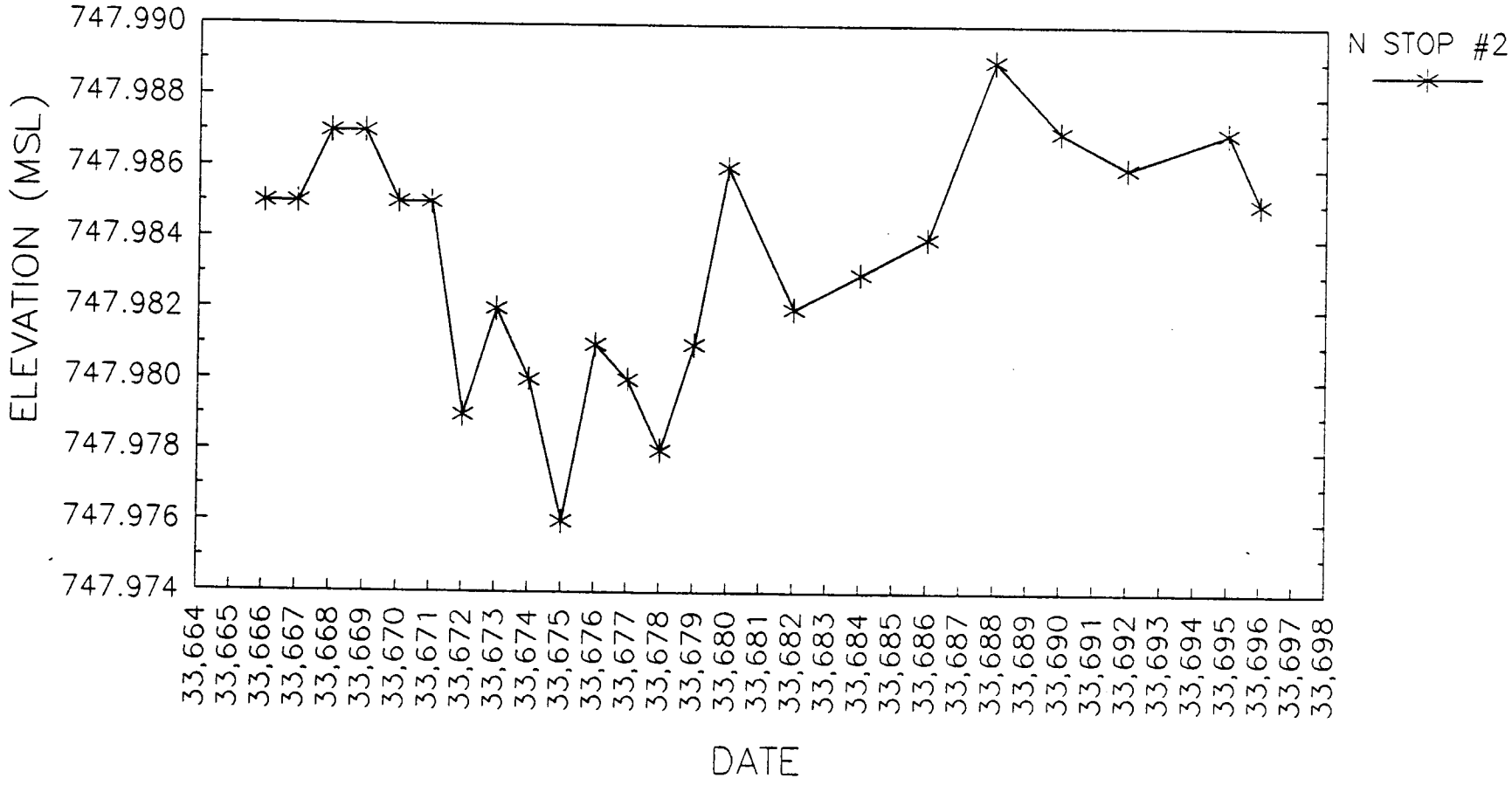
1992 DRAWDOWN CROSSARM SETTLEMENT GAGES



NLL STA. 101+00

NOTE: Date numbers correspond to dates from January 1, 1990 (date number 1) through December 31, 2099 (date number 73,050). March 1, 1992 = 33,664 March 31, 1992 = 33,694

LEWISTON LEVEES
1992 DRAWDOWN CROSSARM SETTLEMENT GAGES

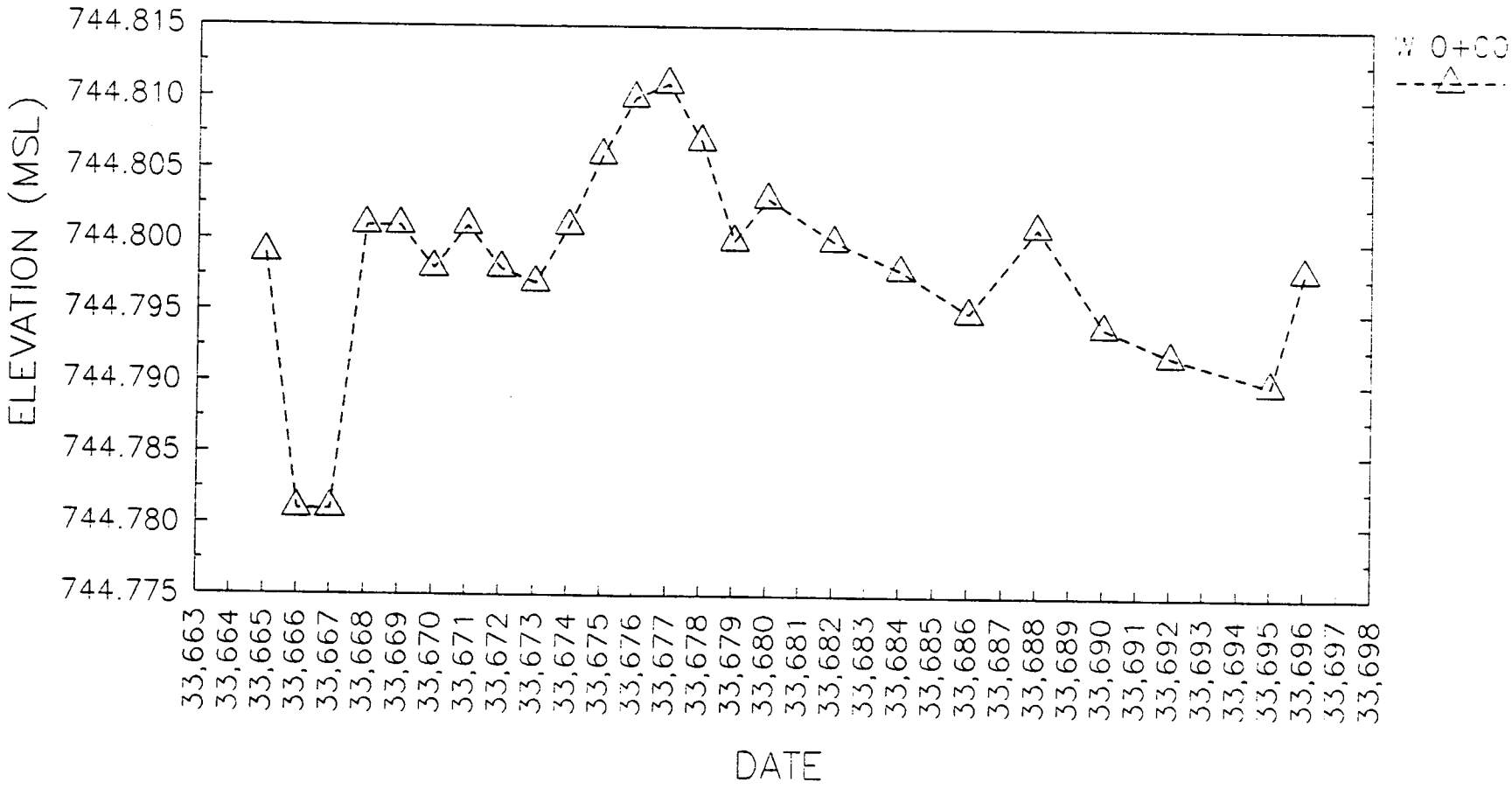


NLL STA. 101+00

NOTE: Date numbers correspond to dates from January 1, 1990 (date number 1) through December 31, 2099 (date number 73,050). March 1, 1992 = 33,664 March 31, 1992 = 33,694

LEWISTON LEVEES

1992 DRAWDOWN CROSSARM SETTLEMENT GAGES

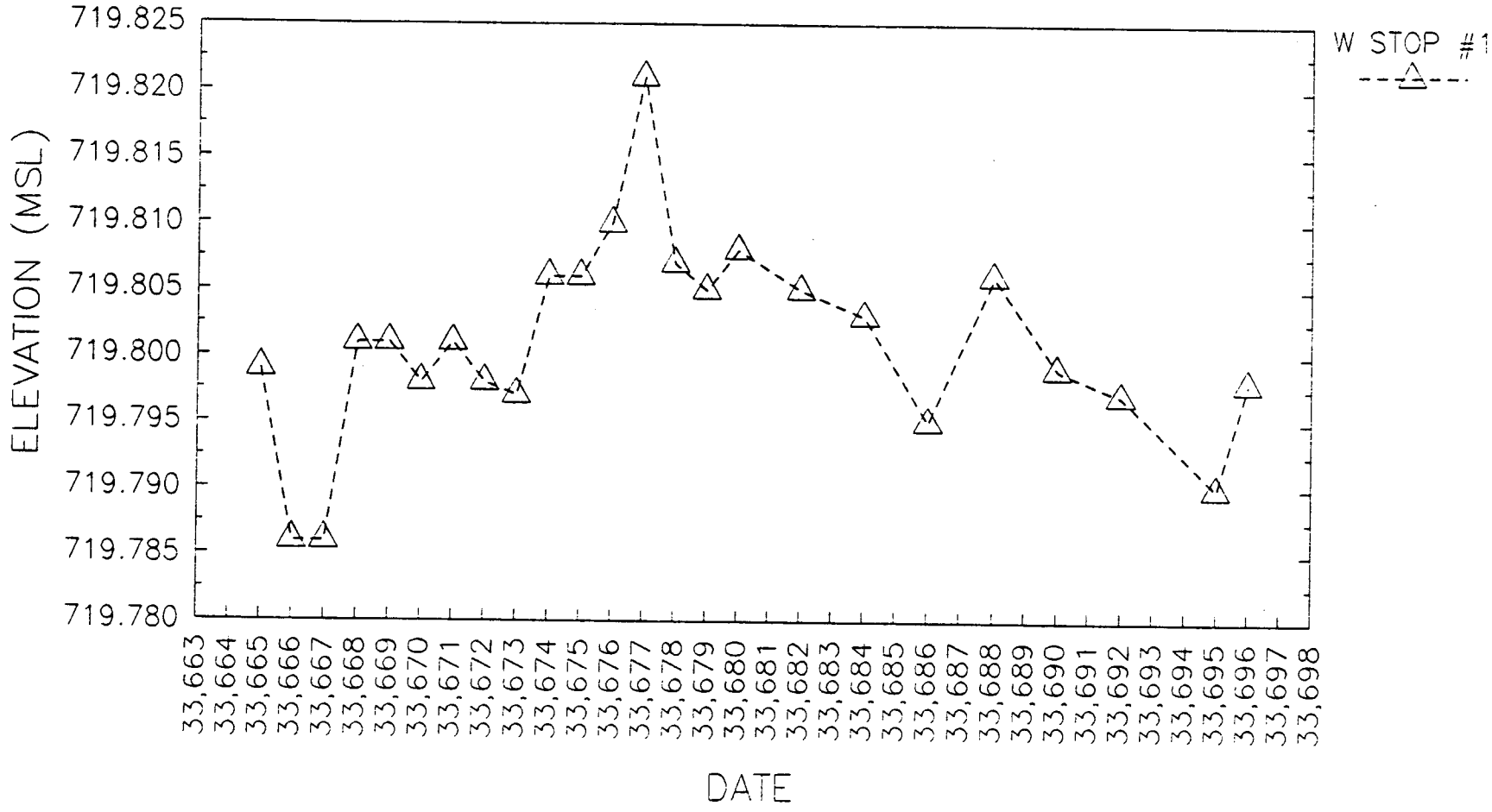


WLL STA. 34+00

NOTE: Date numbers correspond to dates from January 1, 1990 (date number 1) through December 31, 2099 (date number 73,050). March 1, 1992 = 33,664 March 31, 1992 = 33,694

LEWISTON LEVEES

1992 DRAWDOWN CROSSARM SETTLEMENT GAGES

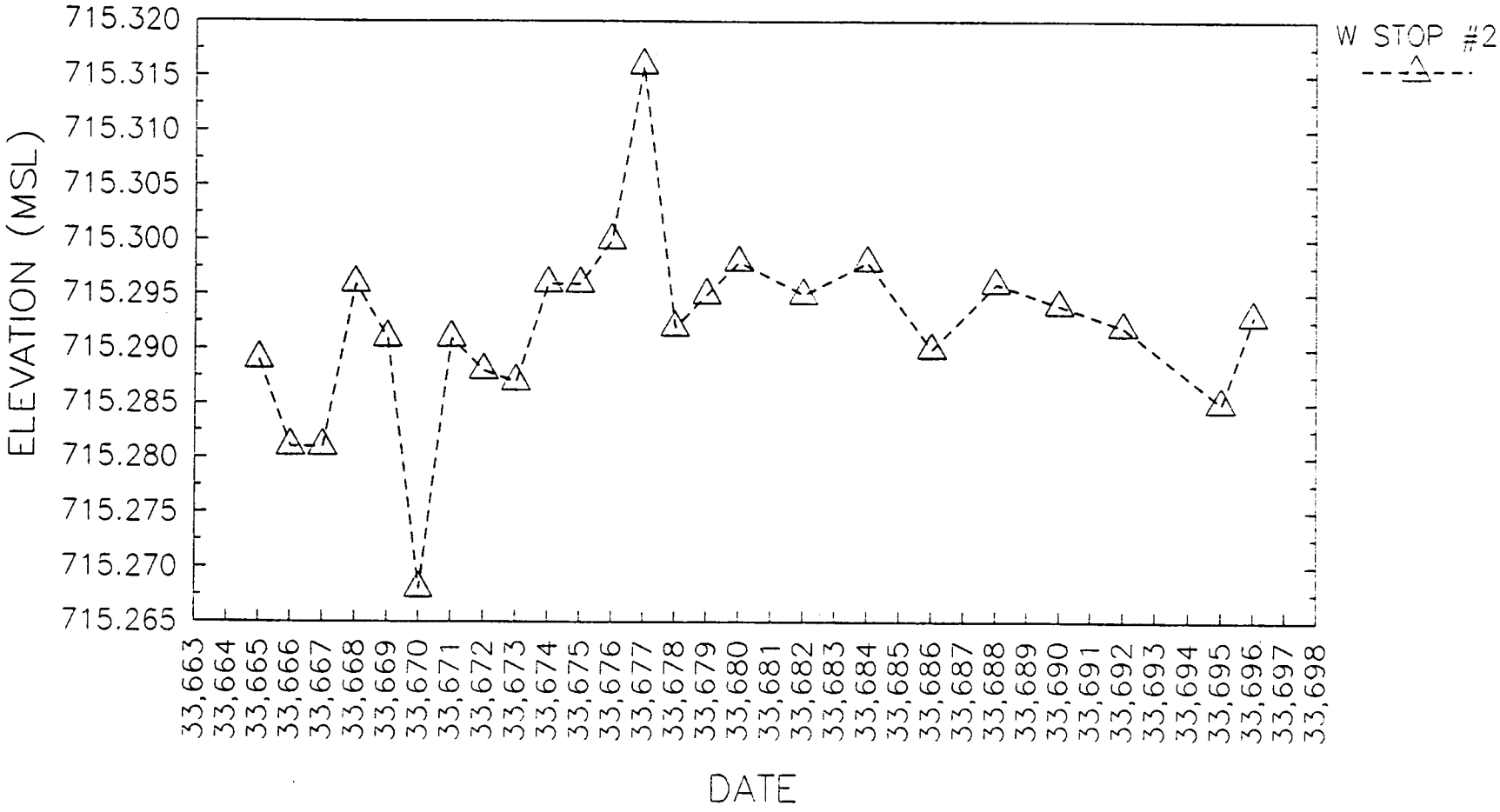


WLL STA. 34+00

NOTE: Date numbers correspond to dates from January 1, 1990 (date number 1) through December 31, 2099 (date number 73,050). March 1, 1992 = 33,664 March 31, 1992 = 33,694

LEWISTON LEVEES

1992 DRAWDOWN CROSSARM SETTLEMENT GAGES



WLL STA. 34+00

NOTE: Date numbers correspond to dates from January 1, 1990 (date number 1) through December 31, 2099 (date number 73,050). March 1, 1992 = 33,664 March 31, 1992 = 33,694

LEWISTON LEVEES - CROSSARM SURVEY DATA

	02-Mar	03-Mar	04-Mar	05-Mar	06-Mar	07-Mar	08-Mar	09-Mar	10-Mar	11-Mar	12-Mar	13-Mar	14-Mar	15-Mar	16-Mar	17-Mar	19-Mar	21-Mar	
	33665	33666	33667	33668	33669	33670	33671	33672	33673	33674	33675	33676	33677	33678	33679	33680	33682	33684	
N. 0+00	747.982	747.985	747.985	747.987	747.987	747.985	747.985	747.979	747.982	747.980	747.976	747.981	747.980	747.978	747.981	747.986	747.982	747.983	.013
N. Stop #1	730.412	730.415	730.415	730.417	730.417	730.415	730.415	730.409	730.412	730.410	730.411	730.416	730.410	730.408	730.411	730.416	730.412	730.413	.017
N. Stop #2	725.442	725.445	725.445	725.447	725.447	725.440	725.440	725.434	725.432	725.440	725.436	725.441	725.445	725.438	725.441	725.446	725.442	725.443	.018
W. 0+00	744.799	744.781	744.781	744.801	744.801	744.798	744.801	744.798	744.797	744.801	744.806	744.810	744.811	744.807	744.800	744.803	744.800	744.798	.037
W. Stop #1	719.799	719.786	719.786	719.801	719.801	719.798	719.801	719.798	719.797	719.806	719.806	719.810	719.821	719.807	719.805	719.808	719.805	719.803	.035
W. Stop #2	715.289	715.281	715.281	715.296	715.291	715.268	715.291	715.288	715.287	715.296	715.296	715.300	715.316	715.292	715.295	715.298	715.295	715.298	.016

LEWISTON LEVEES - CROSSARM SURVEY DATA

	23-Mar	25-Mar	27-Mar	29-Mar	01-Apr	02-Apr
	33686	33688	33690	33692	33695	33696
N. 0+00	747.984	747.989	747.987	747.986	747.987	747.985
N. Stop #1	730.414	730.419	730.417	730.416	730.417	730.425
N. Stop #2	725.444	725.449	725.447	725.446	725.446	725.450
W. 0+00	744.795	744.801	744.794	744.792	744.790	744.798
W. Stop #1	719.795	719.806	719.799	719.797	719.790	719.798
W. Stop #2	715.290	715.296	715.294	715.292	715.285	715.293