APPENDIX D

ELIMINATION OF COLOR FROM NORTH PLATTE RIVER BY ROBERT E. SEIVERS

Elimination of Color from North Platte River Water by Ozonization Following Filtration

Robert E. Sievers
Dept. of Chemistry
Univ. of Colorado
Boulder, Colorado 80309

Samples of North Platte River water which was severely discolored were treated with ozone generated by electrical discharge in a flowing stream of oxygen.

It was observed that samples became virtually colorless upon ozonization for periods of one to two minutes. Following is a description of the various samples, treatments made, and sample characteristics.

Sample 1 was untreated water taken from the Platte River water supply of the town of Saratoga, Wyoming by Barry Venn on June 2, 1977. Most of the tests were completed on the same day that the sample was taken, exceptions being measurements of total organic carbon which were not completed until 3 days later. The yellow-brown color was quite apparent to the naked eye and the Hach reading made by Mr. Venn was 58. The percent transmittance of light at 354 nm was 81.0%, at 360 nm was 84.0%, at 380 nm was 86.0% and at 554 nm was 97.2%. Throughout the treatments measurements made at several wavelengths with a spectrophotometer confirmed conclusions drawn from the Hach readings by Mr. Venn. Total organic carbon in Sample 1 was 10 ppm. Particles apparent to the naked eye were observed in the sample. Sample 2 was a 750 ml fraction of Sample 1 which was ozonized for one minute (no prior filtration). An oxygen stream was passed through an electrical discharge apparatus which, when activated, generated ozone. The stream was

then directed through a fritted glass sparger and allowed to bubble through a 10 cm. long cylinder of water and pass out into a fume hood. The flow rate of oxygen was adjusted with a needle valve to 200 ml per min. Prior calibration using iodide solutions and titrations allowed estimation of the ozone generated and delivered to the aqueous sample to be the equivalent of about 5 ppm ozone in one minute if half of the ozone became dissolved in the water. When the flow rate was adjusted, the electric discharge apparatus was activated for sixty seconds and at the end of this period it was turned off and the oxygen flow stopped. The color gradually faded during this treatment, but the sample still was quite yellow to the eye. The percent transmittance of light at 354 mu had risen to 88.2%, at 360 nm was 90.0%, at 380 nm was 91.2%, and at 554 nm was 97.0%. Transmittance measurements were made within 10 minutes of cessation of ozonization in every case. Color change, as seen by the eye, was only evident while the ozone was being passed through the sample. This suggests that long contact times should not be necessary. The Hach reading was 35. Total organic carbon was measured to be 7.2 ppm in Sample 2. Since Sample 2 was still quite colored, it was subjected to a second minute of ozonization, bringing the total concentration to approximately 10 ppm of ozone if half of that bubbled through became dissolved in the water. After ozonization for a cumulative total of two minutes, the product was labeled Sample 3. The percent transmittance of light at 354 nm was 90.6%, at 360 nm was 92.0%, at 380 nm was 92.2%, and at 554 nm was 97.5%. The total organic carbon content was 6.3 ppm.

During transport from Wyoming, part of the sample was lost. Because fairly large samples were needed by Mr. Richard Muther and Mr. Jack Turtle to test and demonstrate the diatomaceous earth filter made by Environmental Industrial Products, Inc., it was necessary to dilute the remaining sample with an equal volume of tap water from the Boulder Municipal Water Supply. The water supply used in the dilution is generally of quite high quality without any evidence of color. It comes from melted run-off of the Arapahoe glacier, from Barker Reservoir on Boulder Creek near Nederland and from a protected watershed west of Boulder. Therefore, it should be borne in mind that about half of any improvement seen in Samples 4 and 5 is due simply to dilution with relatively pure water. Nonetheless, some striking changes did occur. Sample 4 was the diluted Platte water after filtration through diatomaceous earth and activated charcoal. The percent transmittance of light at 354 nm was 92.0%, at 360 nm was 91.6%, at 380 nm was 93.0%, and at 554 nm was 99.0%. The total organic carbon was below the level of detection of the instrument, which is 4 ppm. The Hach reading was 20, and the sample was still quite highly colored to the eye. Bearing in mind that the sample was diluted, it seems unlikely that acceptable color reduction can be accomplished by filtration alone. The next experiments, however, demonstrated that combining ozonization with filtration is a highly effective treatment process and produced a product with acceptable color.

The filtered Sample 4 was treated with ozone for two minutes and labeled Sample 5. As with Sample 3 the estimated dose was 10 ppm, assuming that half of the ozone generated became dissolved in the water. As the ozone bubbled through, the color faded very

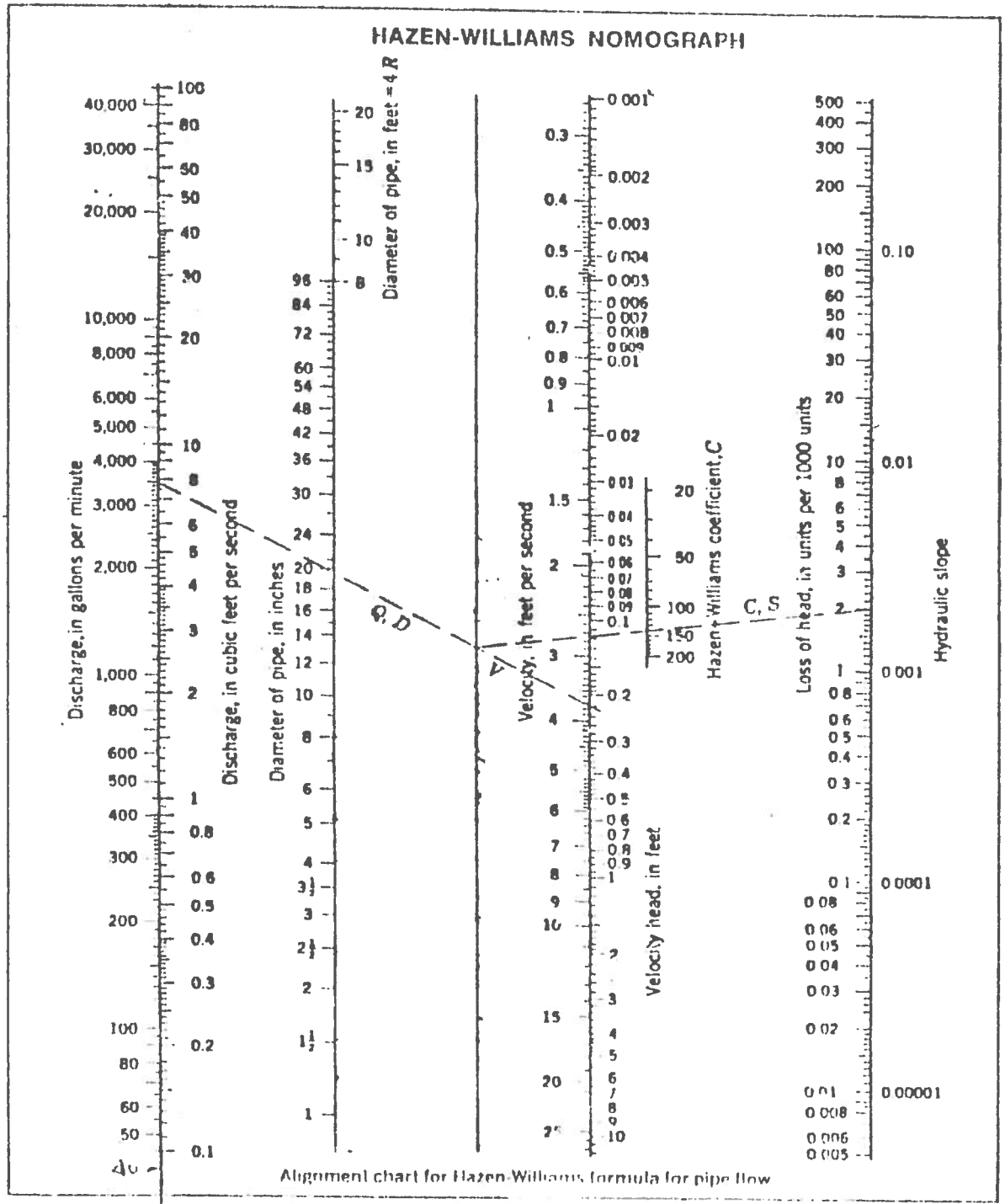
noticeably during the first minute and disappeared completely during the second minute. The Hach reading fell from 20 after filtration and dilution, but before ozonization, to less than 5 after ozonization. After ozonization the percent transmittance of light at all wavelengths measured was 99% or better. At 354 nm it was improved from 92.0 to 99.6% by ozonization, at 360 nm from 91.6% to 99.2%, at 380 nm from 93.0% to 99.0%, and at 554 nm the transmittance was 99.0% before and after ozonization. The total organic carbon content, as expected, was below the limit of detection of the instrument.

In conclusion, it would appear that the problem of coloration in the water supply of the municipality of Saratoga, Wyoming can be eliminated by filtration, followed by ozonization with contact times of about two minutes and dosing levels of about 10 ppm. More work might need to be done to identify the principal products formed upon ozonization in order to insure that toxic or carcinogenic compounds are not being generated. The more volatile products could probably be identified by glass capillary gas chromatography coupled with mass spectrometry. Some cities in Europe, e.g., Paris, have used ozone to treat drinking water for many years, without any identified problems. While it seems unlikely that there would be any problem with using ozone in the present case, it is clear that the compounds causing the deep brown color in the North Platte River Water are not present in the well water treated with ozone by the city of Paris. Consequently, at least some of the products of ozonization are likely to be different in Saratoga than in Paris.

APPENDIX E

TYPICAL NOMOGRAPH USING HAZEN-WILLIAMS FORMULA FOR PIPE FLOW

TYPICAL NOMOGRAPH USING HAZEN-WILLIAMS
FORMULA FOR PIPE FLOW



Alignment chart for Hazen-Williams formula for pipe flow

APPENDIX F

EXISTING RAW WATER PUMP CURVE DATA

VERTICAL

Type 9LA-1 Company City of Saratoga Loc. Saratoga Nat

Date 7/12/76 Co. P.O. Verbal 2250 W.P.O. 2275 Mfg. P.O. 05785

G.P.M. 500 T.D.H. 30 Eff. 78 Curve 2842909

Imp.# T-84323 DIA STD 6 11/16" MAT. Br Gr. I

Column Size 6" Length 10 ft Tube X Shaft 1" x 5'

Head 4X6X12 Seal Packing Fittings

Motor Mfg. Gen Elect HP 10 Volts 230 RPM 1800 Style O.D.P.

SN BD 10" CD 20 15/16 Bore 1" Coupling Self release

Remarks: Pump shaft 7' x 1" PI 12620

Peerless Pumps

Total Head in Feet for ____ Stages

Total Head in Feet per Stage

NPSH IN FEET

NPSH

BHP

U.S. GALLONS PER MINUTE

HEAD CAPACITY

CURVE NO.	IMPELLER NO.	IMPELLER DIA.	TAKEN FROM
1	T-84323	6 11/16" UNDERCUT ALL THE WAY	32525
2	T-84323	6 3/16" STANDARD FILING	27497
3	T-84323	6 3/16"	31374
4			

HYDRAULIC PERFORMANCE WARRANTY

Guaranteed at designated point only, and contingent on:

Proper flow to pump suction

Proper submergence

Fluid free of gas or abrasives

Proper mechanical setting of impeller

Customer: ____

Item No: ____

Peerless Ref. No: ____

Laboratory Performance

SIZE 9 LA RPM 1760 CURVE 2842

PUMP DESCRIPTION: Driver ____; Head ____; Column ____

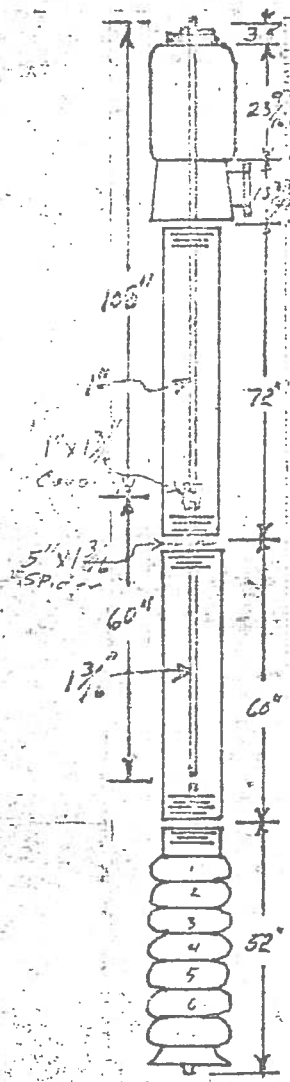
GUARANTEED FIELD PERFORMANCE: Capacity ____ gpm; Head ____ ft; Eff ____ %; BHP ____

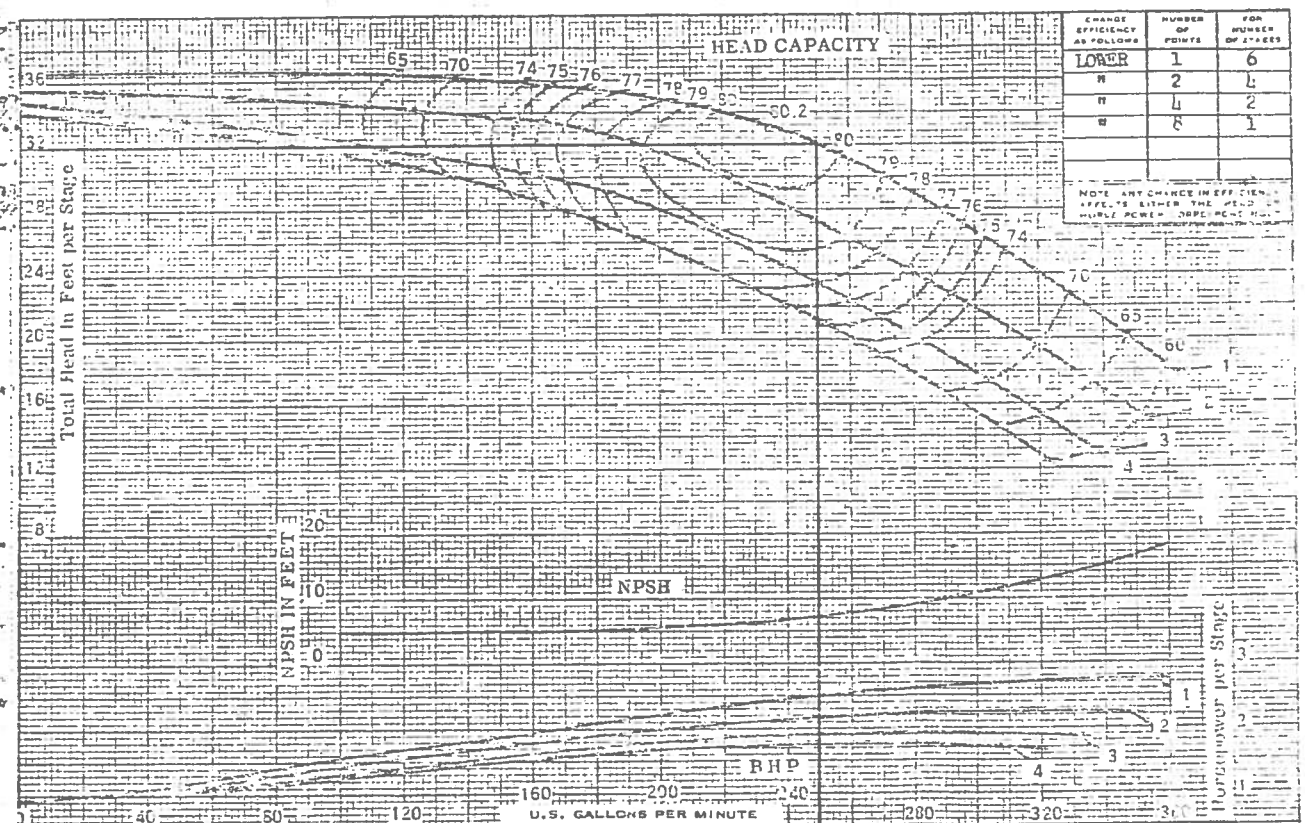
APPENDIX G

EXISTING HIGH SERVICE PUMP CURVE DATA

Type 8LB-7 Company City of Saratoga Loc. Saratoga Wy
Date 11/11/76 Co. P.O. W. D. Cornell M.P.O. Mfg. P.O.
T.P.M. 250 T.D.H. 224 Eff. 80% Curve 2831691
Imp.# 2616465 DIA full MAT. Brg Gr. A
Column Size 5" Length Tube Shaft
Head 6 X 6 X 12 Seal Packing 1" Fittings
Motor Mfg. G.E. HP 20 Volts 240 RPM 1800 Style O.D.P
BD 12 CD 23 9/16 Bore 1" Coupling Self release

Remarks:





CHANGE EFFICIENCY AS FOLLOWS	NUMBER OF POINTS	FOR NUMBER OF STAGES
LOWER	1	6
"	2	4
"	4	2
"	8	1

NOTE: ANY CHANGE IN EFFICIENCY AFFECTS EITHER THE HEAD OR HORSE POWER CORRESPONDING

HYDRAULIC PERFORMANCE WARRANTY

Guaranteed at designated point only, and contingent on:

Proper flow to pump suction
Proper submergence
Fluid free of gas, air & abrasives
Proper lateral setting of impeller

CURVE NO.	IMPELLER NO.	IMPELLER DIA.	TAKEN FROM
1	2616465	5 15/16"	35481
2	2616465	5 11/16" x 5 15/16"	37215
3	2616465	5 7/16" x 5 15/16"	37225
4	2616465	5 3/16" x 5 15/16"	37322

Customer _____

Item _____

Peerless Ref. No.

Laboratory Performance		BOWL 2616457 CIE
SIZE 8 LB	RPM 1760	CURVE 2831691

DESCRIPTION: Driver _____; Head _____; Column _____

NTEED BOWL☐ FIELD☐ PERFORMANCE: Capacity _____ gpm; Head _____ ft; Eff _____ %; BHP _____

SN _____ HD 10 CD 23/16 Bore [illegible] Coupling Self [illegible]

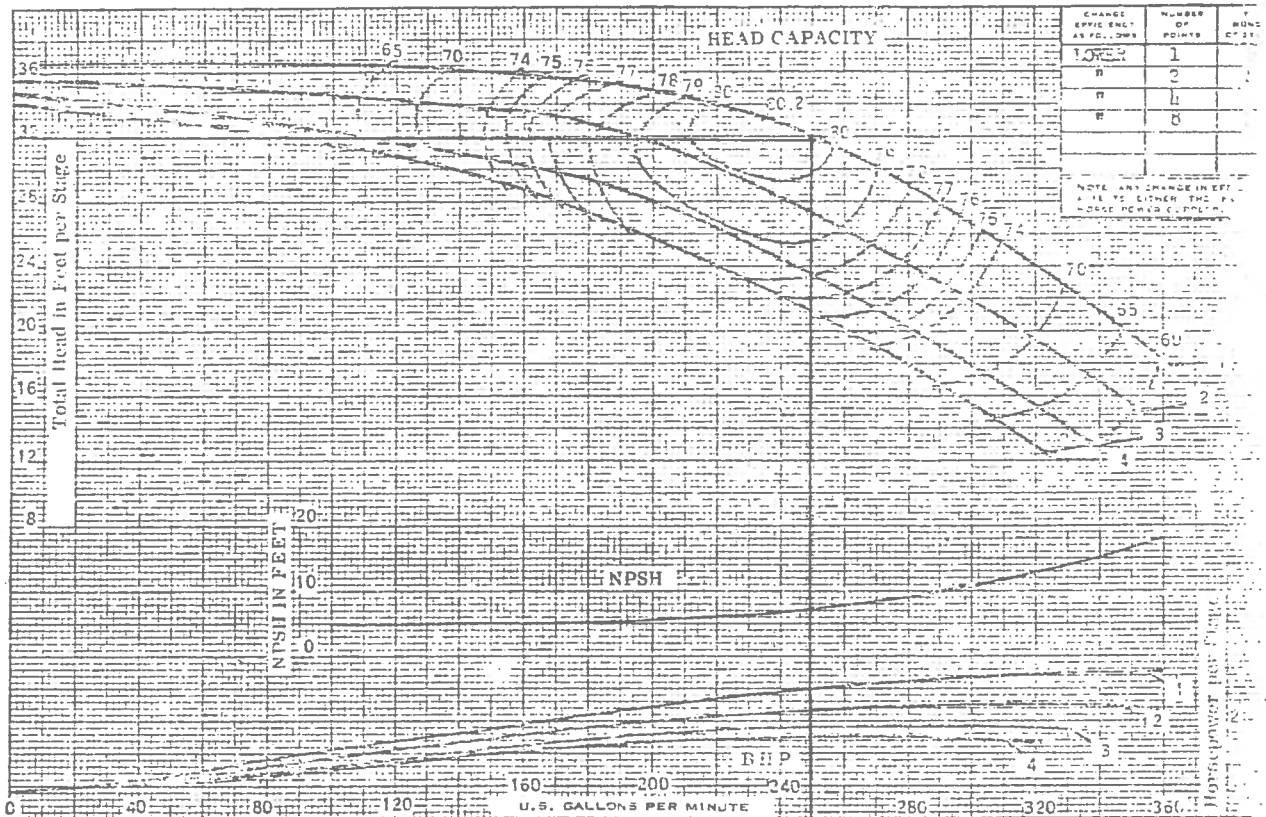
Remarks: The first five foot off pump has a 1 3/16" shaft and 5" x 1 3/16" spider a 1 3/16" x 1" coupling (110# of 1" shafting)

G1-06338
5-21-74

5 ft column
1 ft [illegible]

Peerless Pumps

Total Head in Feet for _____ Stages



HYDRAULIC PERFORMANCE WARRANTY	CURVE NO.	IMPELLER NO.	IMPELLER DIA.	TAKEN FROM
Guaranteed at designated point only, and contingent on.	1	2616465	5 15/16"	35481
Proper flow to pump suction	2	2616465	5 11/16" x 5 15/16"	37215
Proper submergence Fluid free of gas, air & abrasives	3	2616465	5 7/16" x 5 15/16"	37225
Proper lateral setting of impeller	4	2616465	5 3/16" x 5 15/16"	37322

Customer _____

Item _____

Peerless Ref. No: _____

Laboratory Performance | BOWL 2616457 C.E.

SIZE 8 LB | RPM 1760 | CURVE 2831691

PUMP DESCRIPTION: Driver _____; Head _____; Column _____

GUARANTEED BOWL ☐ FIELD ☐ PERFORMANCE: Capacity _____ gpm; Head _____ ft; Eff _____ %; BHP _____

APPENDIX H

VERTICAL CONTROL DATA BY THE COAST AND GEODETIC SURVEY

MARCH 1969

U.S. DEPARTMENT OF COMMERCE
ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION
COAST AND GEODETIC SURVEY

VERTICAL CONTROL DATA

by the
Coast and Geodetic Survey
SEA-LEVEL DATUM OF 1929

QUAD 411063 PAGE NO. 1
WYO
LATITUDE 41°00' TO 41°30'
LONGITUDE 106°30' TO 107°00'
DIAGRAM NK 13-7 RAWLINS

LINE 101
(Second-order)

The field work (L-2596) was done in the summer of 1934 by a party supervised by A. C. Thorson.

These elevations are based on a supplementary adjustment of 1960.

BENCH MARK	ADJUSTED (Meters)	ELEVATION (Feet)
K 75	2146.889	7043.585
L 75	2143.525	7032.548
M 75	2134.128	7001.718
N 75	2126.081	6975.317
P 75	2113.574	6934.284
Q 75	2116.321	6943.296
R 75	2112.317	6930.160
S 75	2100.389	6891.028
T 75	2080.789	6826.722
U 75	2070.009	6791.354
M 13 (USGS)	2068.967	6787.938
6785 (USGS)	2068.452	6786.246
V 75	2067.332	6782.572

LINE 102
(Second-order)

The field work (L-2594) was done in August 1934 by a party supervised by A. C. Thorson.

These elevations are based on a supplementary adjustment of 1960.

BENCH MARK	ADJUSTED (Meters)	ELEVATION (Feet)
M 2 (USGS)	3007.390	9866.745
9631.4 (USGS)	2935.876	9632.120
M 3 (USGS)	2858.673	9378.830
N 74	2854.316	9364.535
8957.6 (USBPR)	2730.648	8958.801
8572.35 (USBPR)	2613.591	8574.756
Q 74	2563.402	8410.095
8133.90 (USBPR)	2479.688	8135.443
R 74	2422.797	7948.793
7922.47 (USBPR)	2415.200	7923.869
7798.11 (USGS)	2377.179	7799.128

LINE 102
(Continued)

BENCH MARK	ADJUSTED (Meters)	ELEVATION (Feet)
S 74	2340.203	7677.816
7322 (USGS)	2232.070	7323.050
T 74	2227.448	7307.886
U 74	2200.629	7219.897
V 74	2175.188	7136.429
M 4 (USGS)	2175.258	7136.659
W 74	2198.810	7213.929
M 25 (USGS)	2210.756	7253.122
X 74	2204.060	7231.153
M 24 (USGS)	2237.764	7341.737
Y 74	2234.200	7330.038
7329.2 (USGS)	2233.951	7329.221
M 23 (USGS)	2222.103	7290.350
Z 74	2255.171	7398.840
M 22 (USGS)	2265.998	7434.355
A 75	2274.431	7462.029
M 21 (USGS)	2300.678	7548.141
B 75	2421.766	7945.411
M 20 (USGS)	2438.691	8000.939
M 19 (USGS)	2371.206	7779.532
C 75	2358.447	7737.671
M 18 (USGS)	2334.124	7657.872
D 75	2320.433	7612.954
M 17 (USGS)	2368.426	7770.411

H-1

MARCH 1969

U.S. DEPARTMENT OF COMMERCE
ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION
COAST AND GEODETIC SURVEY

VERTICAL CONTROL DATA
by the
Coast and Geodetic Survey
SEA-LEVEL DATUM OF 1929

QUAD 411063 PAGE NO. 2
WYO
LATITUDE 41°00' TO 41°30'
LONGITUDE 106°30' TO 107°00'
DIAGRAM NK 13-7 RAWLINS

DESCRIPTION OF BENCH MARK

Designation R 75 | State Wyoming | County Carbon
Nearest town Saratoga | County | Chief of party
Distance and direction from nearest town 6.2 miles south | | Leveling date
Character of mark | | Stamping
Established by
Detailed description

6.2 miles south along the Saratoga & Encampment Valley Railroad from Saratoga, 0.2 mile south of the siding at Davis, 0.1 mile south of a highway bridge at the beginning of a curve in State Highway 130, 60 feet west of milepost 30, 480 feet northwest of an irrigation ditch culvert under the highway, 43 feet northeast of the centerline of the highway, and 32 feet southwest of the centerline of the track. A standard disk, stamped "R 75 1934" and set in the top of a concrete post.

DESCRIPTION OF BENCH MARK

Designation S 75 | State Wyoming | County Carbon
Nearest town Saratoga | County | Chief of party
Distance and direction from nearest town 4.1 miles south | | Leveling date
Character of mark | | Stamping
Established by
Detailed description

4.1 miles south along the Saratoga & Encampment Valley Railroad from Saratoga, at the siding at Dahlstrom, about 560 feet west of the McPhail ranch house road, 34 feet northeast of the bank of an irrigation ditch, 18 feet south of a powerline, 34 feet southwest of the centerline of the track, and about 5 feet higher than the top of the rail. A standard disk, stamped "S 75 1934" and set in the top of a concrete post.

DESCRIPTION OF BENCH MARK

Designation T 75 | State Wyoming | County Carbon
Nearest town Saratoga | County | Chief of party
Distance and direction from nearest town 2.4 miles south | | Leveling date
Character of mark | | Stamping
Established by
Detailed description

2.4 miles south along the Saratoga & Encampment Valley Railroad from Saratoga, 3.5 mile southeast of the railroad water tank at Spring Creek, 39 feet northeast of the centerline of the track, 13 feet northwest of a fence corner, and 2 feet southwest of a fence. A standard disk, stamped "T 75 1934" and set in the top of a concrete post.

DESCRIPTION OF BENCH MARK

Designation U 75 | State Wyoming | County Carbon
Nearest town Saratoga | County | Chief of party
Distance and direction from nearest town At Saratoga | | Leveling date
Character of mark | | Stamping
Established by
Detailed description

At Saratoga, on the Saratoga & Encampment Valley Railroad, at the north one of two steel bridges over North Platte River, and in the top of the west end of the north concrete pier. A standard disk, stamped "U 75 1934."

DESCRIPTION OF BENCH MARK

Designation M 13 (USGS) | State Wyoming | County Carbon
Nearest town Saratoga | County | Chief of party
Distance and direction from nearest town At Saratoga | | Leveling date
Character of mark | | Stamping
Established by
Detailed description

At Saratoga, in the southwest portion of the town, at the grade school building, at the south entrance bearing the inscription "1928", and in the top of a slab east of the entrance. A U.S. Geological Survey standard disk, stamped "M 13 1934 6788"

Form 68SA (1-8-58) U.S. DEPARTMENT OF COMMERCE COAST AND GEODETIC SURVEY

RECOVERY NOTE, BENCH MARK R

Designation 6785 (USGS) | State Wyoming | County Carbon
Nearest town Saratoga | County Carbon | Chief of Party F.W. Seward (WHD)
Distance and direction from nearest town At Saratoga | | Recovery Date Dec. 1940
Character of mark Standard disk | | Stamping "6785 Laramie 1904"
Established by USGS
Present condition Good
Detailed report

At Saratoga, about 500 feet southeast of the Saratoga & Encampment Valley Railroad station, 200 feet east of a road crossing, in lot 10, block 1, of the Hot Springs Addition to the original town, 8 feet northeast of the northeast corner of the lot, and 16 inches west of a pole on the corner of the road leading to the State Bathhouse. A U.S. Geological Survey standard disk, stamped "6785 LARAMIE 1904" and set in the top of a concrete post.

Form 68SA (1-8-58) U.S. DEPARTMENT OF COMMERCE COAST AND GEODETIC SURVEY

RECOVERY NOTE, BENCH MARK R

Designation V 75 | State Wyoming | County Carbon
Nearest town Saratoga | County Carbon | Chief of Party P.G. Logan (USGS)
Distance and direction from nearest town At Saratoga | | Recovery Date Aug. 1959
Character of mark Standard disk | | Stamping "V 75 1934"
Established by C&GS
Present condition Good
Detailed report

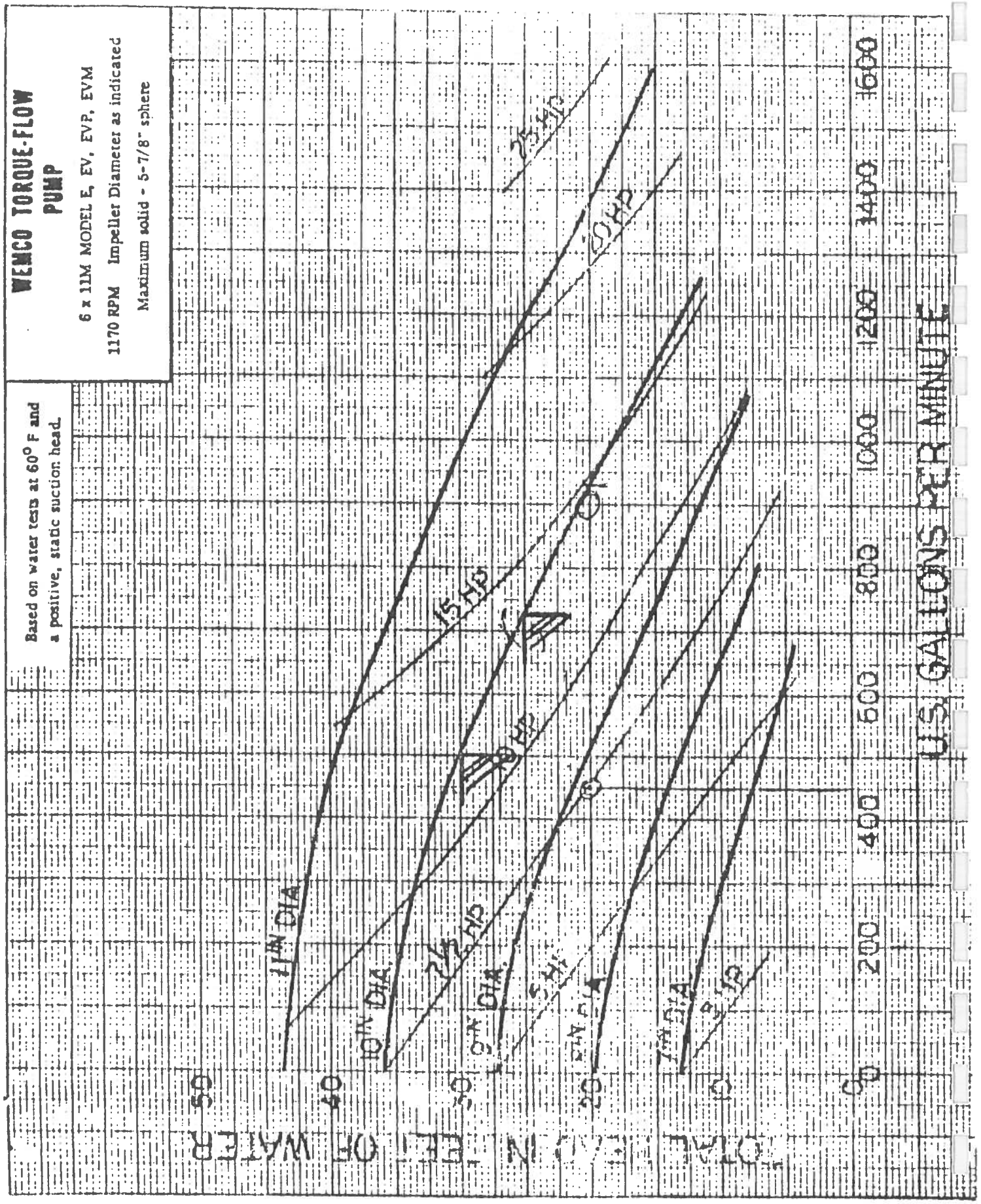
At Saracoga, on the Saratoga & Encampment Valley Railroad, 630 feet north of the station, 90 feet northeast of the point where a road crosses the main track, 69 feet east of the centerline of the main track, 10 feet south of the fifth pole north of the station, and in line with a row of power poles. A standard disk, stamped "V 75 1934" and set in the top of a concrete post.

USGS -1959 report: The mark is 90 feet northwest from the point where a road crosses the main track, and 77 feet west of the main track.

APPENDIX I

RENOVATED LIFT STATION
PUMP CURVE-1978

dated Nov. 15, 1968



This sheet is the property of Envirotech Corp., WEMCO Division, 721 North B Street, Sacramento, California, and is loaned under the express condition that it is not to be used in any manner directly or indirectly detrimental to

APPENDIX J

REPORT GROUNDWATER/HOT SPRINGS AND LEDGE ROCK INVESTIGATION, PROPOSED SEWER LINE - NORTH PLATTE RIVER

by

HOWARD·DONLEY ASSOCIATES

HOWARD • DONLEY ASSOCIATES

Consulting Engineers & Geologists
3190 Melendy Drive
San Carlos, California 94070
Phone: (415) 367-8744

March 10, 1978
Job No. 322-01

Town of Saratoga
c/o of Western Engineers
501 N. Sun Drive
Casper, Wyoming 82601

Attn: Barry Venn, Project Engineer

Gentlemen:

RE: Report
Groundwater/Hot Springs and
Ledge Rock Investigation
Proposed Sewer Line-North Platte River
Town of Saratoga

INTRODUCTION

This letter presents the results of our groundwater/hot springs and ledge rock investigation for the referenced, on-going sewer line construction project. The proposed sewer line is to cross the Platte River and its adjacent sloughs and creeks. The location of the proposed project is shown on the project Plan, Plate 1.

At the outset of the project the contractor encountered ledge rock at or above planned invert elevations along the proposed sewer alignment. The rock appeared so hard that there was some discussion of blasting to reach invert elevation. This possibility concerned the Town Council because of the proximity of the lines to the many Saratoga hot springs and in particular the Hobo Pool which is shown on Plate 1. Therefore, at your request we made a site inspection and conducted several geophysical tests to evaluate the existing problems. We also reviewed the contracts involved in the project and attended the Town Council meeting with you on Monday evening, February 20th.

FIELD INVESTIGATIONS

Prior to our arrival on site Sunday afternoon, the contractor had made a preliminary excavation at all of his manholes to ascertain whether or not he would encounter ledge rock at a particular location. Your field inspector recorded the depth to ledge rock if encountered. This information was provided to us upon our arrival.

Our associate, Jeremy C. Wire, performed several VLF electromagnetic soundings to evaluate the depth to bedrock. These locations are shown on Plate 2, Bedrock Contour-Elevation Map. The writer ran two pocket seismometer lines to evaluate the hardness and "ripability" of the ledge rock. The location of

these lines are also shown on Plate 2. Line 2 was run directly on the bedrock surface exposed in the trench running from MH #28-3 westerly towards MH #28-2.

We also ran two VLF electromagnetic traverses roughly perpendicular to the ridge or "nose" of the ledge rock mass. These traverses are shown on Plate 2.

The raw data and field plots of the data are contained in our respective files for reference. The interpretations of these data are presented below and summarized on Plate 2.

BACKGROUND DATA

Some very generalized geologic data was reviewed most of which concerned earlier regional geology associated with uranium prospecting in the 1940's and 1950's. Some faulting and hot spring activity was noted within 20 miles of the Town of Saratoga but no faulting was mapped within the Town itself. However, when mapped on a large scale map, the several hot springs in the Town do line up in a NNE to SSW direction.

In the recent past a local firm began mining sand and gravel aggregate in the vicinity of VLF-5. This apparently triggered a new hot water flow which in turn caused a measureable cooling of the Hobo Pool. The mining was terminated and the pool recovered within a matter of hours. Some river diversion activity connected with the new water treatment plant was conducted in this same area within the past several months but apparently has had no noticeable affect on the local hot springs.

Mr. Jerry Welch, State Hydrologist, who resides in Saratoga was very helpful with some background information. He has measured the Hobo Pool temperature and flow at various times in the past. Based on his recollection, the following table of data was prepared:

HOBO POOL FLOW

Condition	Flow, GPM (gal. per min.)
Normal Operation	95
Discharge pipe plugged & water level up to sidewalk grade.	0
Pumping several hundred gpm, 800± feet NNW:	
1. After 24 hrs.	70
2. After 48 hrs.	50
3. Turned off 3rd day.	Partial recovery in 4 hrs. Total recovery in 24 hrs.
Pumping from behind the Pool Bath House	No affect on pool flow [illegible]

At Mr. Welch's request we have called and written the State Engineer's Office for copies of Mr. Welch's reports and other data pertaining to the Saratoga Hot Spring area but have not received any data at the time of preparing this report.

DISCUSSION AND CONCLUSIONS

The bedrock contour data developed in this investigation suggested that a geologic structure such as a fault does exist as shown on Plate 2. The VLF electromagnetic traverses picked up two points of the structure in line 1 and one point in line 2. Using this data as background it was postulated that a hole near MI #28-2 (at VLF-3) could be excavated 16 feet deep without encountering ledge rock. This was confirmed by the contractor Monday morning.

It appears from examination of Plate 2 and studing the background data that the existing geologic structure is causing the subterranian hot water to surface easterly of, or along the easterly edge of the structure. Also, there may be a direct flow interconnection within the bedrock mass between the Hobo Pool and the Saratoga Inn. However, there seems to be little connection between the overburden above the ledge rock and the hot water flow and whatever connection may exist seems to be mitigated by replacing any overburden removed. It is therefore concluded that excavations made in the overburden above the ledge rock will not have a serious or lasting effect on the Hobo Pool. Also, any temporary affect will probably be in relation to the temperature and not the flow of the pool.

The ledge rock is too hard to permit removal without jack hammering (or other localized heavy force/impact method) or blasting. The ledge rock is bedded very nearly horizontally so would require only very small, well controlled time-delay blasting techniques to break out the necessary depth for the sewer line. Massive blasting would not be required nor desireable. It is our opinion that the small, well controlled time-delay type of blasting would not be detremental to the Hobo Pool. However, massive blasting could cause a localized structural shifting that might cause the subterranian hot water to surface elsewhere. There is always some risk in any blasting operation that some damage to local conditions may occur for which the contractor will be held responsible. However, we conclude that this risk is low utilizing an expert, experienced blasting company. Also, there is no risk if impact methods are used to fracture the ledge rock.

RECOMMENDATIONS

Although the contract documents advise the contractor to anticipate ledge rock throughout the project, his bid prices do not appear to anticipate this condition throughout the project. Also, the Town Council was not particularly receptive to the idea of the contractor incurring any risk from blasting which might affect the Hobo Pool. Therefore, we recommend that WEA Inc. realign the sewer line from MI #28-6 and extend it directly towards MI #28-2. A lift

station/manhole would be required at VLF-3 to pump sewerage into MH #28-2. If desired, an intermediate manhole could also be provided at VLF-5. This revised routing of the river crossing should be designed to provide an invert elevation within the top one foot above the bedrock or higher.

Desecisions pertaining to the rest of the originally planned alignment involve a number of considerations in addition to the geotechnical problem with the ledge rock. Therefore, the data concerning these areas has been provided to you but no recommendations are made by us at this time.

This report has been prepared in order to aid in the evaluation of the planning and development of the subject job. Our services consist of professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties either expressed or implied. If you have questions concerning the contents of this report please contact me.

The following plates are attached and complete this report:

Plate 1 - Project Plan

Plate 2 - Bedrock Contour-Elevation Map

We appreciate the opportunity to have been of service to you. If you have any questions about our findings or conclusions, please call.

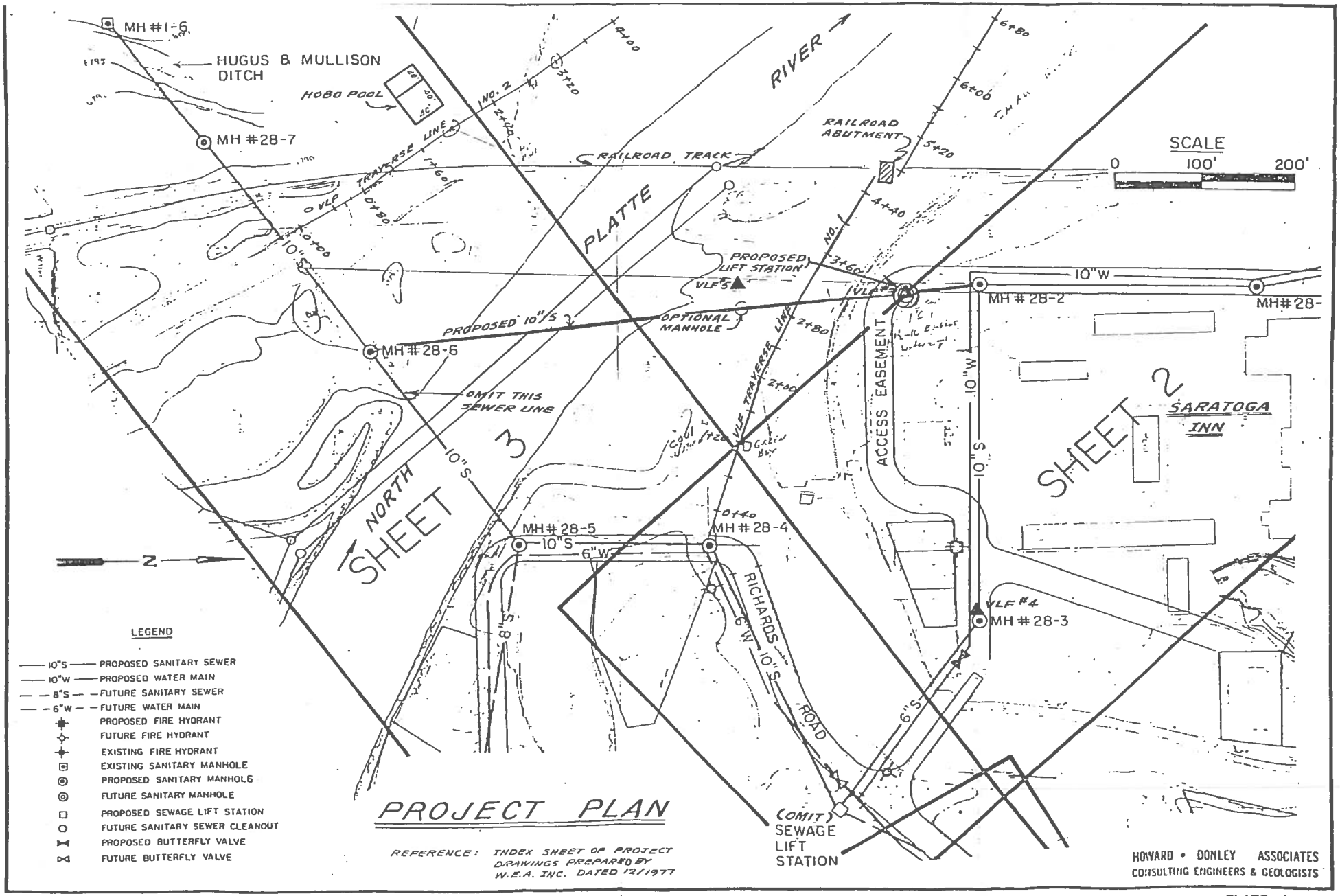
Yours very truly,

HOWARD·DONLEY ASSOCIATES, INC.

Howard F. Donley

Howard F. Donley, President
Wyo. P.E. 2213

HFD:clc



PROJECT PLAN

REFERENCE: INDEX SHEET OF PROJECT DRAWINGS PREPARED BY W.E.A. INC. DATED 12/1977

HOWARD • DONLEY ASSOCIATES
CONSULTING ENGINEERS & GEOLOGISTS

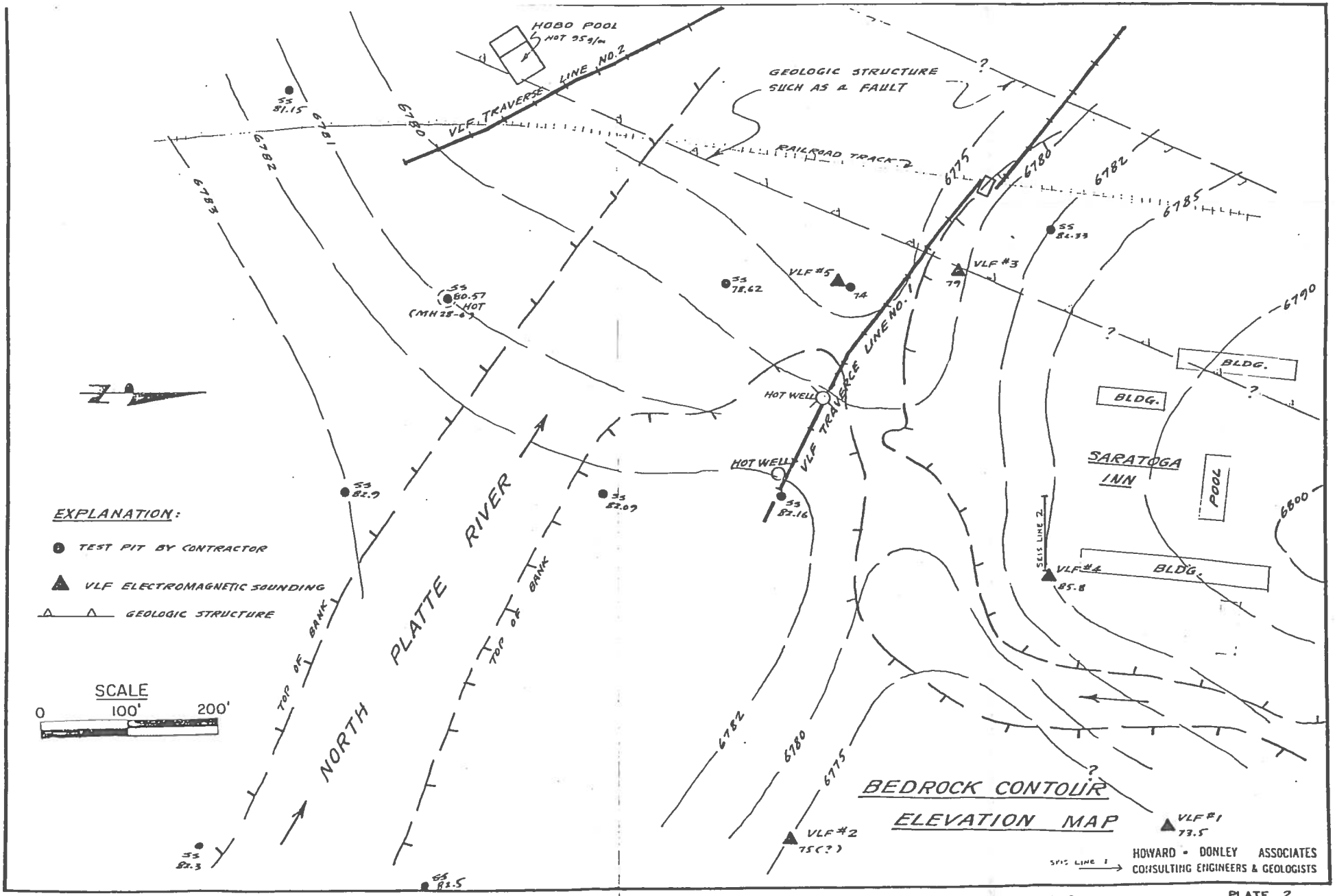

HOBO POOL
HOT 95 g/m
VLF TRAVERSE LINE NO. 2
GEOLOGIC STRUCTURE SUCH AS A FAULT
RAILROAD TRACK
VLF TRAVERSE LINE NO. 1
SS 81.15
SS 80.57 HOT (MH 28-67)
SS 78.62
SS 84.39
VLF #5 74
VLF #3 79
HOT WELL
HOT WELL
SS 82.16
SS 82.9
SS 82.07
SS 82.3
SS 82.5
NORTH PLATTE RIVER
TOP OF BANK
TOP OF BANK
BLDG.
BLDG.
SARATOGA INN
POOL
BLDG.
VLF #4 85.8
SEIS LINE 2
VLF #2 75(?)
VLF #1 73.5
6780
6781
6782
6783
6775
6785
6790
6800
EXPLANATION:
TEST PIT BY CONTRACTOR
VLF ELECTROMAGNETIC SOUNDING
GEOLOGIC STRUCTURE
SCALE
0 100' 200'
BEDROCK CONTOUR ELEVATION MAP
SEIS LINE 1
HOWARD • DONLEY ASSOCIATES
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PLATE 2

APPENDIX K

N.P.D.E.S. SEWAGE
DISCHARGE PERMIT