mike w.

#18

DESIGN REPORT

FOR

Pumping level
North well (Spring Creek #4)
21 Apr 00 - 259.96
5 more mins - 260.06
5 more mins - 260.17
410 gpm

WATER SYSTEM IMPROVEMENT PROJECT

FOR

COUNTRYSIDE - SKY RANCH, NORTH SUBDIVISIONS

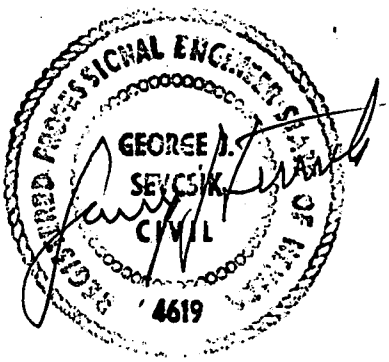
PREPARED FOR:

BROOKSIDE SAVINGS AND LOAN ASSOCIATION

FEBRUARY, 1988

BY:

TRANSWESTERN ENGINEERING CORP.
240 LINDEN STREET
RENO, NEVADA 89502



FEB 29 1988

February 26, 1988
Project No. 81-01-871

Mr. Michael S. Moers, President
Brookside Savings and Loan Association
1828 Sawtelle Blvd.
Los Angeles, CA 90025

Re: Design report for providing potable water facilities for Countryside - Sky Ranch, North Subdivisions.

Dear Mr. Moers:

As of your request in November 1987, we have prepared a design for the extension of existing water supply and distribution facilities for subject subdivisions located in the Spanish Springs Valley, see Figure 1.

BACKGROUND

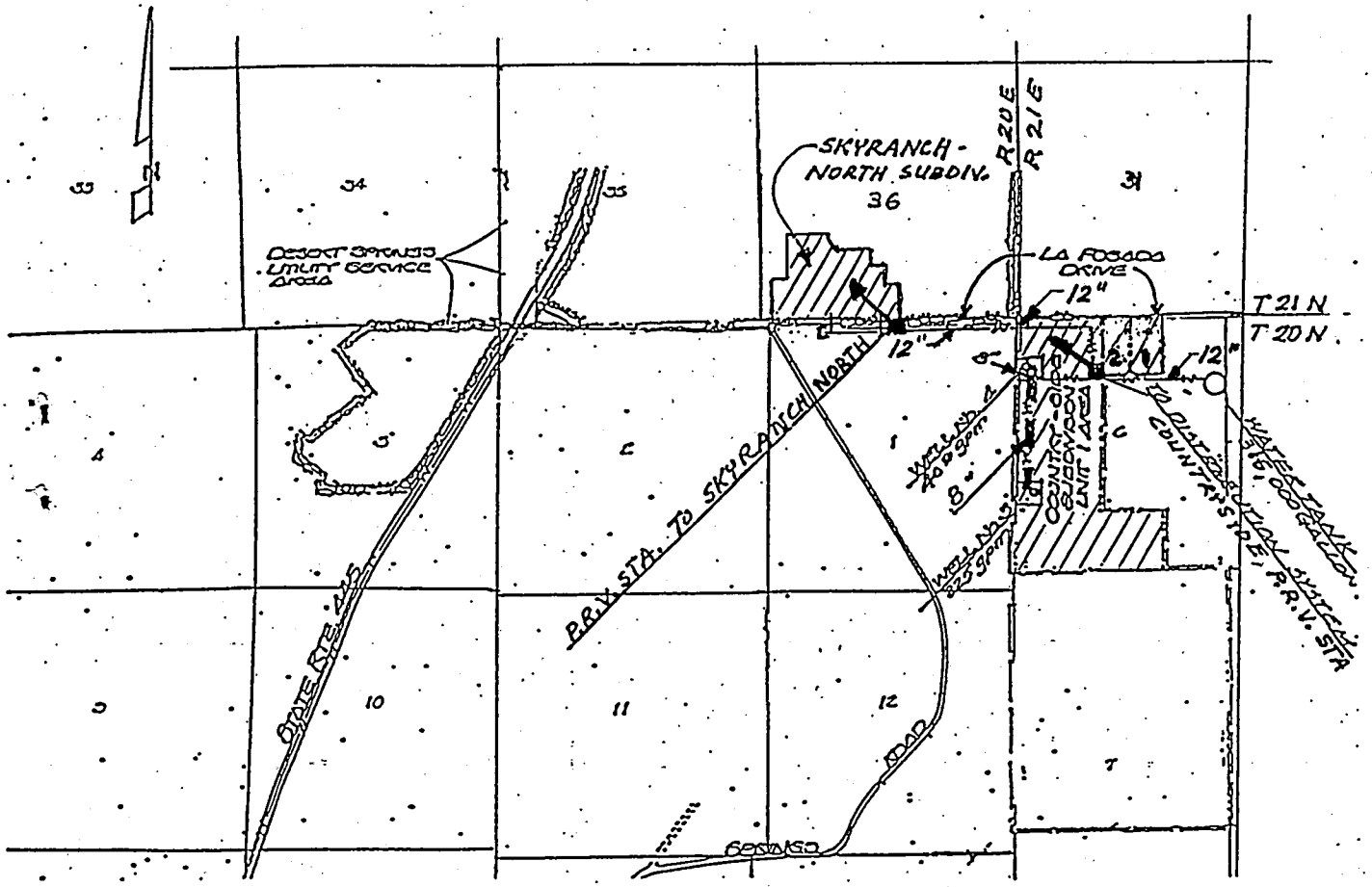
This report is an amendment to a report prepared by *TEC* and published on September 3, 1987 for the water system design of the Countryside/Spring Creek project. All findings and recommendations in that report stated for the Countryside area are valid and will not be re-evaluated herein. The following statements on "Proposed Facilities" are applicable to this project:

a) Redrill and develop well number 4 and equip wells number 3 and number 4 with pumps and housing for meter, chlorination, controls, instrumentation and telemetering equipment.

b) Connect wells number 3 and number 4 with an 8 inch water line.

c) Complete construction of the "Countryside" storage tank.

d) Connect the existing discharge main to existing "Countryside" storage tank (316,000 gallons) and provide a pressure regulating valve to the existing Countryside I subdivision water system.



SYSTEM MAP

TRANSWESTERN ENGINEERING CORP.
240 Linden Street
Reno, Nevada 89502
(702) 689-8610

FIGURE I

COUNTRYSIDE-SKY RANCH, NORTH
WATER SYSTEM

e) Pressure test existing transmission line and backfill the existing water line where needed.

PURPOSE

The purpose of this report is to determine the facilities needed for the connection of Sky Ranch - North subdivision to the existing and proposed units of Countryside water system.

REGULATIONS

Our design is based on: Nevada State Regulations Concerning Review of Plans for Subdivisions, Condominiums and Planned Unit Developments, Article 5: Water Supply, and on Design Criteria established by the Washoe County Utility Division.

EXISTING CONDITIONS

Dwelling Units: (Population)

At present the following subdivisions exist or are proposed in the subject project area, shown on Figure 1.

Countryside I, Unit 1	20 units
Countryside I, Unit 2	38 units
Countryside I, Unit 3	23 units
Parcel Maps 2*	8 units
Sky Ranch-North, Unit 1	61 units
Total	150 units

* The parcel maps are on lots #1 and #2 in Section 6, south of La Posada Drive.

WATER SUPPLY

The water is supplied from two wells, located within the Countryside I subdivision. Well No. 3 has approved capacity of 225 gpm. Well No. 4 is presently redrilled and developed. The recommended capacity of Well No. 4 is 330 gpm, see test results in Attachment 1.

TABLE 1

WATER QUALITY
(in milligrams per liter)

CONSTITUENT	STD. MAX LIMIT	#3	#4
Arsenic	0.05	.003	.005
Barium	1.	0.4	.6
Cadmium	0.010	<0.01	<0.01
Chromium	0.05	<0.02	<0.02
Lead	0.05	<0.05	<0.05
Mercury	0.002	<0.0005	<0.0005
Nitrate (as N)	10.	8.0	8.5
Selenium	0.01	<0.005	<0.005
Silver	0.05	<0.01	<0.01
Fluoride (60° F)	2.0	0.2	0.2
Chloride	250	11	10
Color (CU)	15	N/A	N/A
Copper	1.0	<0.02	<0.02
MBAS	0.5	N/A	N/A
Iron	0.3	0.17	0.11
Magnesium	125	3.7	5.3
Manganese	0.05	<0.02	<0.02
Odor (TON)	3	N/A	N/A
pH	6.5-8.5	7.9	8.0
Sulfate	250	13	14
TDS	500	168	178
Zinc	5	<0.01	<0.01

N/A = Not available

North Well Replacement
NW¼ NW¼ Sect 6
20N 28E
1988 Data February
(Document #18)

13 ~ 85¢/1000

WATER QUALITY

The water quality in both wells meets State of Nevada primary and secondary standards.

TRANSMISSION MAIN

The existing 12 inch transmission line extends between the existing storage tank site and the Countryside I and Sky Ranch-North subdivisions, ending at Cordoba Boulevard. The other part of the main extends to the west boundary line of Section 6, ending in the vicinity of Well No. 4.

STORAGE

The existing tank has 316,000 gallon capacity but it is not yet connected or tested. The storage tank has a high water level designed at 4,759.50 feet above sea level. The subdivisions have an average ground level of 4,450 to 4,550 feet above sea level. The static pressure will be above 100 psi on the distribution system and pressure reducing devices will be needed for both subdivisions.

PROPOSED PROJECT

In addition to the proposed facilities mentioned under the "Background" paragraph of this letter report, the following improvements shall be made for achieving a complete operating water system:

1) Construct a pressure regulating valve station at Benedict Drive and La Posada Drive intersection. Provide 12" diameter by-pass for future main in La Posada Drive.

2) Disconnect 12" main in Hercules Drive at Lot #1 an add flush valve assemblies to the end of the disconnected pipes.

3) Disconnect 10" main in Virgil Drive at Lot #15 and add a flush valve assembly to the end of the disconnected pipe.

4) Reconnect 12" main in Cordoba Boulevard and open 6" valve at Benedict Drive and La Posada Drive intersection.

SYSTEM CAPACITY

The water system described above has a capacity to serve 280 dwelling units based on the storage capacity criteria. Presently 150 units are planned or are approved for the project area. Additional capacity may be obtained by adding storage to the system. Ultimately the total well capacity will define the maximum number of dwelling units which can be connected to the system. In Attachment 1; Well No. 4 is rated at 330 gpm for a total well capacity of 555 gpm. The peak day demand, 1.46gpm/hu must be supplied by both wells flowing full. Based on this criteria, the number of dwelling units will need an additional storage capacity of 70,100 gallons. With these improvements the connectable housing units can be increased to 380 units. The design data are presented in Attachment 2.

We appreciate the opportunity to perform this service for you and look forward to help you in the subdivision development process. Please contact the undersigned if you have any questions or comments.

Sincerely,

TEC

George J. Sevcsik
Vice President

cc: Washoe County Utility Division

P. S. We enclose the Legal Description of the "Well and Pipeline Easements" in Attachment 3.

ATTACHMENT 1

1.Ø INTRODUCTON

A new well was drilled to replace an existing well at Countryside Estates, Unit 1 located in Spanish Springs Valley, Washoe County. The Brookside Savings North (replacement) Well, as it is referred to in this report, was drilled in the NW 1/4 NW 1/4 Section 6, Township 2Ø North, Range 2Ø East and is located approximately 5Ø feet north of the well it replaces. In fact, the North Well is the third well drilled at this locale. The previous two wells either did not yield sufficient quantities of ground water or produced unacceptable quantities of sand.

This report documents the drilling and testing of the North Well. Moreover, it suggests a yield rating for the well.

2.Ø WELL CONSTRUCTION SUMMARY

Pilot hole.

Drilling operations for the Brookside Savings North (replacement) Well commenced December 12, 1987. A nominal nine-inch diameter bore hole was drilled to a depth of 6Ø5 feet. This first phase was completed December 31, 1987 and was electric logged the same day. The nominal nine-inch diameter borehole fulfilled two roles. The first served to define the geologic materials penetrated by the well and provide a basis for final well design. Mechanical analyses of selected drill cuttings and an evaluation of the electric logs were used to design and select the gravel pack size and grading, screen slot size, and screened interval. The second principal role was that of a pilot hole for drilling of the production well bore, thereby assuring a straight and plumb well.

Geologic materials penetrated by the well bore are summarized below.

Depth interval (feet)	Description
Land surface - 19Ø	Sand and gravel with occassional clay beds or lenses.
19Ø - 49Ø	Thin medium fine to fine sand beds intercalated with gray-green clay and occassional gravel beds or lenses.
49Ø - 567	Andesitic mud flow breccia (lahar)
567 - 6Ø5	Andesitic lava flows (fractured).

Well design.

On the basis of the mechanical analyses of selected drill cuttings, an artificial gravel envelope comprising 6 x 12 mesh size Monterey sand was selected. This special gravel pack was engineered to retain the fine sand which plagued the previous well at this site. Continuous slot, shaped wire well screen with a slot opening of Ø.Ø65 inches was selected because of its compatibility with the gravel envelope size and gradation. Well screen was to be placed opposite most permeable zones below a depth of 21Ø feet. Blank casing was placed above 21Ø feet to reduce the potential for adverse affects caused by cascading water. A second section of blank casing was selected for the depth inter-

val 290 to 300 feet depth to house the production pump.

Production well construction.

The pilot hole was reamed to a depth of 603 feet to a diameter of 16 inches, except for the interval between the land surface and 60 feet which was reamed to a diameter of 20 inches in order to accommodate the cement sanitary seal. Reaming was completed January 18, 1988.

Well construction materials such as well casing, screen, and gravel, were assembled and stored on site during the reaming process. Installation immediately followed the completion of reaming operations in order to prevent potential collapse of the borehole.

Well construction details are summarized below and in the accompanying well construction diagram.

Bore hole diameter	Nominal 20-inch diameter, land surface to 60 feet; 18-inch diameter, 60 ft. to 603 ft.; 9-inch diameter, 603 to 605 ft.
Casing schedule	
Screen	12-inch pipe size 0.065-inch slot size, Roscoe Moss shaped wire, continuous slot well screen 210 to 290 feet, 300 to 480 ft., and 560 to 600 ft.
Blank	12 3/4-inch O.D. x 0.250-inch wall thickness ASTMA A 53B steel; 2 feet above L.S. to 210 ft., 290 to 300 ft., 480 to 560 ft, and 600 to 602 ft. (Note - Roscoe Moss spiral weld casing below 190 ft., and steel bull nose on bottom).
Centralizers	Three placed equally around the circumference of the casing on 50 foot intervals from bottom of casing string.
Gravel	6 x 12 mesh size Monterey sand.
Cement seal	Neat cement slurry, 56 feet depth to land surface.

Well construction activities were essentially completed January 23, 1988 with the completion of pouring the cement sanitary seal.

Well development.

The completed well was subjected to a variety of well development techniques. The purpose of well development is manifold and includes:

Removal of residual drilling fluids form the well bore,

Breakdown and removal of clay wall cake which builds up on the formation walls during drilling,

Restoration of formation damage which occurs as a result of the drilling process, and

Increase the effective radius of the well.

Well development actually commenced with dilution of the drilling fluid withclean water prior to installation of the gravel envelope. It began in earnest on February 2 with jetting the screened interval with a high-velocity jet of a water/mud dispersant mixture to remove the built-up wall cake. This was followed by jetting the screened interval with a high pressure air jet and air-lift pumping to remove the fine-sized formation material from the gravel pack and adjacent formation. Jetting was followed by alternately surging the well with a surge block to loosen the finest sized formation materials and bailing to remove accumulated fill from the well bore. Throughout the development process, the level of the gravel in the annular space was monitored and Monterey sand added as the gravel envelope settled. Development proceded until little additional formation fines could be loosened or removed and until gravel no longer settled.

Final well development was accomplished 2/15/88. This included alternately surging and pumping the well with the test pumping equipment. The status of well development was evaluated by the content of sand in the discharge after each surging episode as measured by a ROSSUM (T.M.) sand tester. Development was judged complete when little additional sand was produced after repeated surging episodes and sand content was reduced to acceptable levels.

3.0 WELL TESTING

Step-drawdown testing.

A step-drawdown pumping test was conducted 2/16-17/88. The test comprised four steps of six hours each. Test results are summarized below.

Static water level prior to testing was 53.65 feet below measuring point, M.P. (M.P. = top of stilling well). Test commenced 1000 hrs 2/16/88 and was terminated 1000 hrs 2/17/88. Step-drawdown data are plotted in Figure 2.

Step	Pumping rate Q (gpm)	Duration t (minutes)	Pumping water level (feet)	Drawdown s (ft)	Specific Capacity C_s (gpm/ft)
I	200	360	121.65	68.80	2.94
II	250	360	156.22	102.57	2.44
III	300	360	191.92	138.27	2.17
IV	350	360	242.96	189.31	1.85

Specific capacity and drawdown data for the step-drawdown test indicate that the well was fully developed prior to the start of the test (refer to Figure 3). This is further evidenced by the absence of significant amounts of sand discharged by the well during the test (refer to Figure 4).

The overall hydraulic efficiency of the well is depicted in Figure 5. Efficiency ranged from 84% at a rate of 200 gpm to 57% at 350 gpm. Data strongly suggest that well efficiency is influenced by the highly anisotropic nature of the aquifer (refer below, for discusssion)

Constant-discharge testing.

A constant-discharge test of 48-hours duration was scheduled. However, a potential problem with the drainage arose after more than a day into the test. Water discharged from the well began to impound near some residences due to inadequate drainage approximately one mile west of the well. To avoid the potential for damage, and at the request of one of the residents, the test was terminated prematurely, after 29 hours.

Water levels were monitored in the pumped well (North Well) and the two pre-existing wells. These are referred to as Observation Wells A and B.

Observation Well A - 371.4 feet east-northeast of North Well.

Observation Well B - 49.6 feet south of North Well.

Testing results for the North Well are summarized below.

Testing commenced 0930 hours 2/18/88. Pumping rate was held constant at 350 gpm. Static water level in the North (pumped) Well was 53.75 ft. below M.P. Testing was terminated at 1430 hours 2/19/88. Pumping water level at conclusion of the test was 250.40 ft. below M.P., a drawdown of 196.75 ft.

I would like to see the data & plots.

Drawdown and recovery data for the North Well and Observation Wells A and B are plotted in Figures 6 through 13.

A summary of the aquifer hydraulic characteristics derived from the test data is provided below.

Well	Data	Method	Transmissivity (GPD/ft)	Storage Coefficient Early	Storage Coefficient Late
North Well	Drawdown	Cooper-Jacob	3,624[1]		-
	Drawdown	Cooper-Jacob	10,227[2]		-
	Residual Drawdown	Cooper-Jacob	14,903		-
Well A	Drawdown	Theis [Boulton]	11,299	0.0013	(0.0022)
	Drawdown	Cooper-Jacob	12,657	0.0017	
	Residual Drawdown	Cooper-Jacob	12,658		-
Well B	Drawdown	Theis [Boulton]	11,142	0.0078	(0.02)
	Drawdown	Cooper-Jacob	14,215	0.0054	
	Residual Drawdown	Cooper-Jacob	12,721		-
		Average	11,494	0.0041	(0.021)

Notes - 1. Uncorrected drawdown.
2. DuPuit correction applied and drawdown adjusted for efficiency.

Test results are significant in that they serve to describe the aquifer in more detail than any previous testing conducted in this area. In general, the aquifer may be characterized as moderately transmissive. Average aquifer transmissivity, the overall ability of the aquifer to transmit ground water, is 11,494 gallons per day per foot width (GPD/ft).

The values for coefficient of storage indicate that the aquifer is semi-confined. The change (increase) in storage with time indicates delayed gravity drainage of water from the aquifer. It also suggests that the aquifer materials are vertically anisotropic. That is, they transmit ground water more readily horizontally than they do vertically. This "vertical resistance to flow" appears to be a probable cause for the moderate overall hydraulic efficiency of the well.

The consequence of these observations is that high yield wells, those with yields of more than a few hundred gallons per minute are not likely in this area.

4.Ø WELL RATING

Well yield.

Test results indicate that the well may be rated as high as 35Ø gallons per minute for peak use periods. However, continuous pumping at this rate is not recommended. If the well is pumped non-stop at a constant rate of 35Ø gpm, the pumping water level would approach the 3ØØ feet deep recommended pump setting within 9Ø days.

For purposes of selecting production pumping equipment, a more conservative rating of 33Ø gpm from 3ØØ feet is recommended. At this rate, the well could be pumped non-stop for more than a year before the pumping water level approaches critical depths. Bear in mind that this assumes zero recharge and continuous pumping.

In all likelihood, the well will not be pumped at this design rate of 33Ø gpm continuously. In reality, during much of the year it will pump intermittently, with some sustained pumping taking place for an unknown period in the summer. Under "normal" useage, then, the well will be expected to yield closer to 35Ø gallons per minute because of the lesser pumping lift the equipment must overcome, with the exact short-term peak yield dependant on the pumping equipment installed.

Sand content.

A principal goal of drilling the North Well was to construct a "sand-free" well. Sand-free typically refers to a sand content of one part per million (ppm) or less. Acceptable levels are generally less than five (5) ppm, depending upon water useage.

The North Well can be classified as sand-free. With the exception of initial discharge immediately following start up, the sand content is less than Ø.5 ppm the detection limit for the sand testing equipment (refer to Figure 4).

ATTACHMENT 2

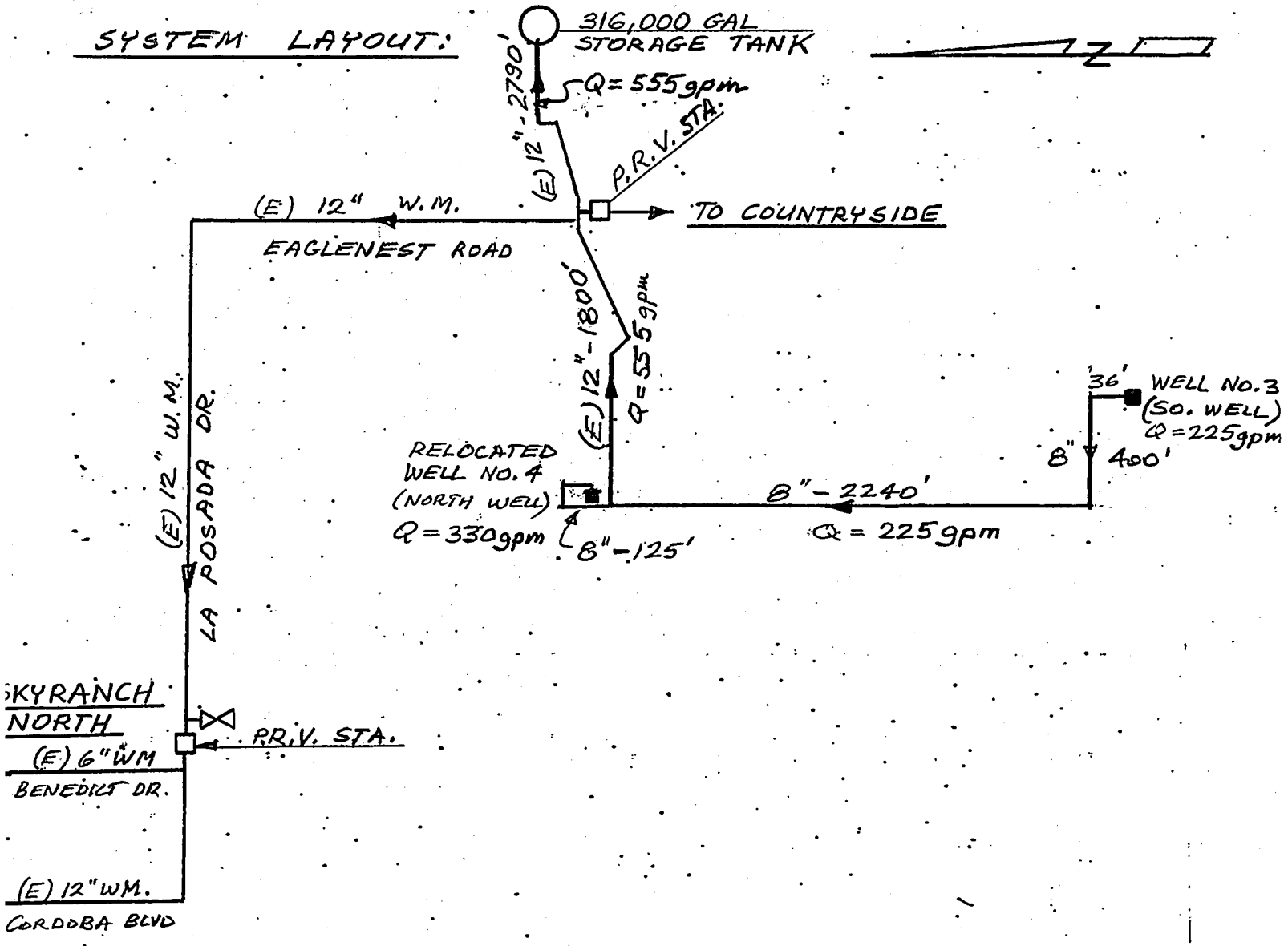
TRANSWESTERN ENGINEERING CORP.

JOB NO. 81-01-871 SHEET 1 OF 15

PROJECT COUNTRYSIDE - SKYRANCH NO. CALC. GJS. DATE 1-11-88

SUBJECT WATER SYSTEM IMPRDUEMENTS CHKD. JJS DATE 2-26-88

SYSTEM LAYOUT:



PUMP DESIGN:

NORTH PUMP:

CAPACITY: $Q = 330$ gpm.

HEAD:

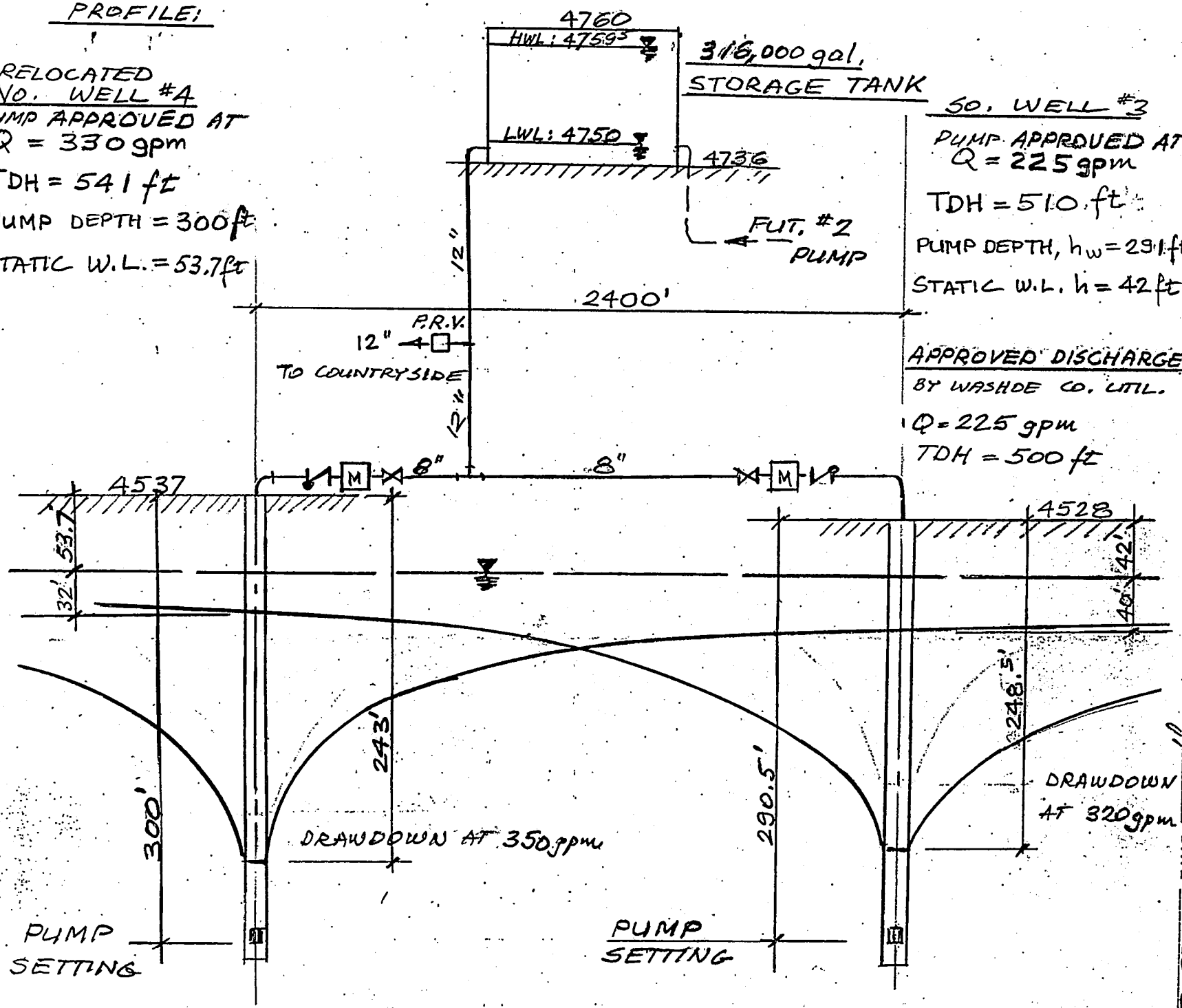
STATIC HEAD: $H_{ST} = 4759.5 - 4537 + 300' = 522.5$ ft

FRICTION LOSS:

(c = 100) IN COLUMN (6"ϕ): $h_f = 15.5/1000 \times 300' = 4.6$ ft

PROFILE:

RELOCATED
NO. WELL #4
PUMP APPROVED AT
Q = 330 gpm
TDH = 541 ft
PUMP DEPTH = 300 ft
STATIC W.L. = 53.7 ft



SO. WELL #3
PUMP APPROVED AT
Q = 225 gpm
TDH = 510 ft
PUMP DEPTH, h_w = 291 ft
STATIC W.L. h = 42 ft

APPROVED DISCHARGE
BY WASHOE CO. UTIL.
Q = 225 gpm
TDH = 500 ft

TRANSWESTERN ENGINEERING CORP.
SEE WORK & ASSOC. REPORT
PROJECT COUNTRYSIDE - SKYRANCH NO. CALC. GJS DATE 1-22-88 JOB NO. 81-01-87 SHEET 2 OF 15
SUBJECT COUNTRYSIDE #1 - WELLS CHKD. # GJS DATE 2-26-88

TRANSWESTERN ENGINEERING CORP.

JOB NO. 81-01-871 SHEET 3 OF 15

PROJECT COUNTRYSIDE - SKYRANCH NO. CALC. GJS DATE 1-11-88

SUBJECT WATER SYSTEM IMPROVEMENTS CHKD. GJS DATE 2-26-88

FRICTION HEAD CONT'D

(C = 120) 1 - 6" CHECK VALVE : 60'
7 - 6" 90° ELLS : 98'
1 - 6" TEE : 16'
1 - 6" PUMP CONT. VALVE : 300'
1 - 4" METER : 40'
1 - 6" GATE VALVE : 4'
6' - 4" PIPE : 124'
125' - 8" PIPE : 125'

$h_{f2} = 11.1'/1000' \times 767' = 9.1$ ft

(C = 120) 1 - 12" x 8" RED. - 5'
12" PIPELINE - 1800'
1 - 12" x 12" TEE - 56'
12" PIPELINE - 2790'
3 - 12" - 90° ELLS - 78'

Q = 555 gpm = 0.8 mgd

$h_{f3} = 1.00'/1000' \times 4729' = 4.7$ ft

USE FLOWAY 8LKM PUMP W/

TDH = 18.4 ft + 522.5 ft = 541 ft

SOUTH PUMP:

CAPACITY: 225 gpm

HEAD:

STATIC HEAD: $H_{st} = 4759.5 - 4528 + 250 = 481.5$ ft

FRICTION LOSS:

(C = 100) IN COLUMN (6"ϕ): $h_{f1} = 7.7/1000 \times 291 = 2.3$ ft

(C = 100) 1 - 6" CHECK VALVE : 60'
8 - 8" 90° ELLS : 144'
1 - 6" TEE : 16'
1 - 6" PUMP C.U. : 300'
1 - 4" METER : 40'
1 - 6" GATE VALVE : 4'
6' - 4" PIPE : 124'

$h_{f2} = 7.7/1000 \times 688' =$ 5.3 ft

USE 6 STAGES x 100' = 600ft > 541ft
"A" = 5.4" DIA. · 6 x 12 = 72hp < 75hp MOTOR

3500 RPM — ENCLOSED TYPE IMPELLER — 8LKM

NO. OF STAGES	EFF. CHANGE (NO. OF POINTS)
1	−3
2	−1
3	−0

HORSEPOWER WILL BE EFFECTED BY CHANGE IN EFFICIENCY

PERFORMANCE FOR:
Bowl Pattern No.: 546400-A-R1
Imp. Pattern No.: 546402-B-R0

PUMP DATA

Shaft Dia. (IN.)	1 3/16
Maximum Sphere (IN.)	½
Maximum Head (FT.)*	990
Min. Submergence (IN.)**	9
Impeller Wt. (LBS.)	4.5
Thrust Constant (K)	4.2
Bowl O.D. (IN.)	7½

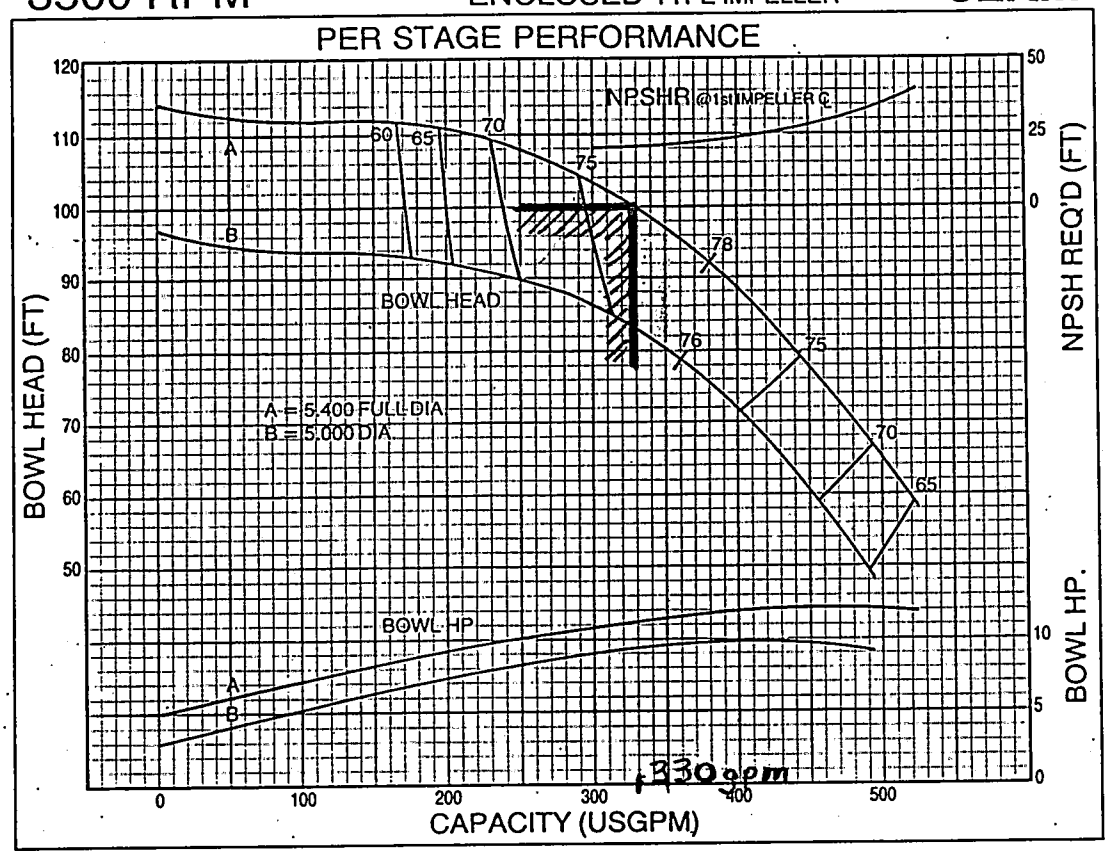
NOTES

Performance indicated based on cold water with a specific gravity of 1.0.

* Standard construction.

** Minimum submergence over lip of bell to prevent vortexing.

Efficiency improvements are available in certain instances. Please contact the factory.



3500 RPM — SEMI-OPEN TYPE IMPELLER — 8JOL

NO. OF STAGES	EFF. CHANGE (NO. OF POINTS)
1	−3
2	−1
3	−0

HORSEPOWER WILL BE EFFECTED BY CHANGE IN EFFICIENCY

PERFORMANCE FOR:
Bowl Pattern No.: 620000-B-R8
Imp. Pattern No.: 620048-A-R5

PUMP DATA

Shaft Dia. (IN.)	1 3/16
Maximum Sphere (IN.)	¾
Maximum Head (FT.)*	957
Min. Submergence (IN.)**	11
Impeller Wt. (LBS.)	3.8
Thrust Constant (K)	4.4
Bowl O.D. (IN.)	7¾

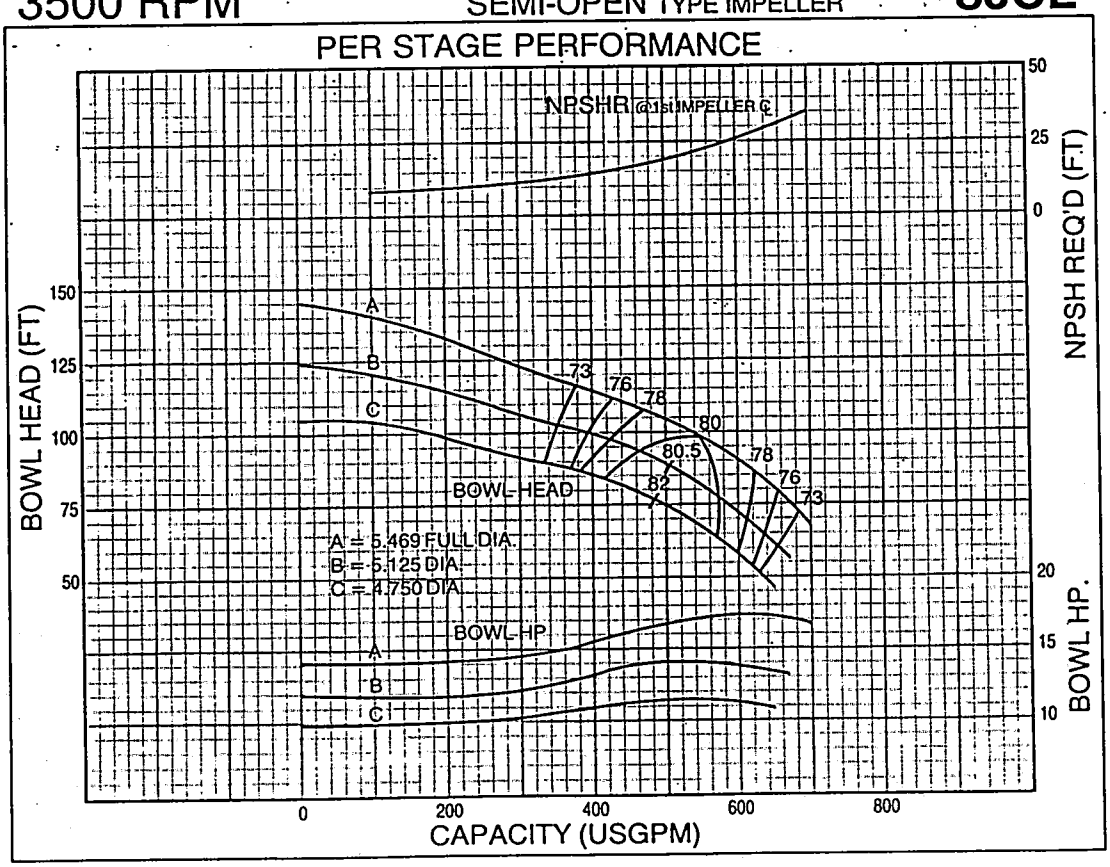
NOTES

Performance indicated based on cold water with a specific gravity of 1.0.

* Standard construction.

** Minimum submergence over lip of bell to prevent vortexing.

Efficiency improvements are available in certain instances. Please contact the factory.



TRANSWESTERN ENGINEERING CORP.

JOB NO. 81-01-871 SHEET 5 OF 15

PROJECT COUNTRYSIDE - SKY RANCH NO. CALC. GJS DATE 1-12-88

SUBJECT WATER SYSTEM IMPROVEMENTS CHKD. GJS DATE 2-25-88

FRICTION HEAD CONT'D

2780' - 8" PVC PIPE: (C = 120)

h_{f_3} = 2780' x 1.35'/1000' = 3.8 ft

h_{f_4} = 4729' x 1.06/1000' = 5.0 ft

WELL PUMP #3 - TDH = 497.9 ft ≅ 500 ft

USE FLOWAY 8XKH PUMP WITH 5 STAGES, SUBMERSIBLE MOTOR, 460 V, 3 ϕ, 60 Hz MOTOR AT 3550 rpm.