

[illegible]

3. **Delivery System Diagram:** Indicate all major components and distances between components. Indicate weir size / ditch size / pipe I.D. as applicable.

See attached sheets, appendices, and figures:

XX Copy of USGS Quadrangle Attached showing location(s) of point(s) of diversion and place(s) of use (Figures 1 & 2).

___ Aerial Photo Attached (required for irrigation of 10+ acres).

XX Photos of Diversion and System Attached (Figures 3 and 4)

4.

Well or Diversion Identification No.*	Motor Make	Hp	Motor Serial No.	Pump Make	Pump Serial No. or Discharge Size
City Well #21	U.S. Electrical Motors 1785 rpm 3 phase	125	E06-AA88-8 E5 Model # AA-88	FloWay Pumps Mod # 14DKH 3 stages – full trim impellers	SN = 3-0067 10-inch discharge

*Code to correspond with No. on map and aerial photo

D. FLOW MEASUREMENTS

1.

Measurement Equipment	Type	Make	Model No.	Serial No.	Size	Calibration Date
McCrometer	Propeller		Model # MW-510	01-05515-10	10-inch	7-18-01
	w/ veins		Accurate 2% of range			
			0-3,000 gpm scale			
			641,279,000 gallons			

2. **Measurements:** Discharge measurements for this examination were made using the impeller flow-meter listed above (Figure 4). The minimum piping installation recommendations of the manufacturer (Attachment A) were met because more than 5 pipe diameters of straight-run pipe, without obstructions, are available upstream of the meter. The Model MW-510 meter does have integral straightening vanes which greatly compensate for any irregularities caused by turbulent flow. According to the Engineering Department at McCrometer, if turbulent flow (which could cause meter inaccuracy) was present within the flow stream, the instantaneous flow rate needle would fluctuate erratically and this was not observed. Because measured drawdown and specific capacity data agree with the readings and the pump performance curve, there are no reasons to suspect the instrument's accuracy. Water level measurements were obtained using a recently calibrated and disinfected "Powers" electric sounder. Line pressure was measured with a 4-inch, oil-filled Ashcroft gage in apparent good condition (Figure 5).

E. NARRATIVE/REMARKS/COMMENTS

The field examination for this permit was carried out on February 11, 2005 by Ed Squires and Loren Pearson of Hydro Logic, Inc. accompanied by Mr. Chip Hudson of the City of Meridian Water Department. The Meridian #21 well is housed inside of a 28-foot by 16-foot cinder block pump house (Figure 6). The 18-inch diameter, steel cased well is equipped with a FloWay Pump Company, Model 14DKKH deep well, water-lubricated, line-shaft turbine pump (Figure 7) set on 120-feet of 10-inch column with a 10-foot long pump/ intake assembly (Attachment B). The design point of the pump appears to be 1930 gallons per minute (gpm) at 192-feet of total dynamic head (Figure 7) at its highest efficiency of 84%. The motor is coupled to a Toshiba H3 adjustable speed drive (Figure 8) that can overspeed the motor by about 30 rpm. The pump is driven by a 125 hp, 480 volt, 1785 rpm, U.S. Electrical Motors – Inverter Duty motor (Figure 9). The 10-inch diameter discharge- piping is comprised of a series of 10-inch plumbing fittings and fixtures, including a swing-check valve, Dresser Coupler, flow-meter, and control valve (Figures 3 and 4) prior to exiting through the pump-house floor.

We arrived on-site about 10:30 A.M. The well pump was not operating and the motor was cold to the touch. The day was clear and crisp. According to Mr. Hudson, the well was automatically operated against system pressure which was 54 psi when we opened the pump house. The well is pumped directly to the water distribution system but also directly to the adjacent elevated reservoir. The water level in the well was measured at 17 feet below measuring point (bmp) a few minutes after we arrived and while the well remained off. Water-level measurements are facilitated through a 3-inch diameter vent pipe measuring port protruding from the concrete thrust block (Figure 8). An oil-filled pressure gage in the mainline was reading 54 psi system line pressure; a reading that was substantiated by an in-line digital pressure read-out on the variable frequency drive unit. The well pump was activated and the discharge turned into the distribution system. We took drawdown information in the well for the first fifteen minutes of pumping and during the last 10-minutes the well did not draw down appreciably (<1 ft). Using the pump performance curve (Figure 7), the specific capacity data (from pumping water level measurements), and assuming operating system pressures in the mid 50's psi range, the well and pump appear to be capable of producing the water right amount although the peak efficiency of the installed pumping plant is realized at pumping rates slightly less than the water right amount. The on-site measurements taken as a course of this examination demonstrate that the installed pumping plant is operating according to its design specifications and the pump curve with perhaps some amount of impeller wear after 3 years of heavy duty use. Also, it is apparent that the well, itself, is performing with the same specific capacity and water levels as measured 5 years earlier (Figure 10).

I essentially looked at the beneficial use from three different angles: 1) the observed on-site conditions, 2) the installed pumping plant performance curve and total dynamic head, and 3) from preexisting hydraulic test data available from the City of Meridian. I will discuss each in turn:

1) On-site Observed Data:

- a. I observed a maximum discharge rate of 1980 shortly after the pump was activated.
- b. The flow-meter fluctuated between 1850 gpm and 1950 gpm after the pump had been running.
- c. The well runs against system pressure demand.
- d. As the well was off when we arrived, we are assuming demand was low and pressure was high.
- e. The existing flow-meter has an accuracy of $\pm 2\%$ of range which is 39 gpm at 1950 gpm.

2) Installed Pumping Plant:

- a. This plant has a design point of 1930 gpm at 192 feet of Total Dynamic Head.
- b. The facility has an adjustable speed drive that allows discharges above and below the design point.
- c. To produce the water right, the pump performance curve shows a TDH condition of 180 feet.
- d. For the TDH to be 180 ft, a drop of system pressure of 2.5 psi from observed would be required.
- e. The water level in the Well #21 is at its annual peak in November; ~3 feet higher than in February.

3) Hydraulic Test-Data:

- a. The well was pump-tested at rates of 2,000 and 2,500 gpm in August of 2000.
- b. The well has a high specific capacity of 47 gpm/ft.
- c. The well is clearly capable of producing the water right.
- d. The measured pumping and static water levels in the well suggest no changes since 2000.

RECOMMENDATIONS:

With the installed pumping plant and well head plumbing configuration, the well appears to be able to be produced at a variable range between 300-to-2,020 gpm depending on the line pressure in the water mains and demand placed upon the water system. I observed a maximum discharge rate of 1980 gpm during my visit which, because the well was off, was assumed to be under higher pressure conditions. An inquiry to the flow-meter manufacturer determined that the error range on this flow meter is plus or minus 2% of range. At 1950 gpm an error of ± 39 gpm could result. Giving the applicant the benefit of the doubt, 39 gpm added to the observed maximum flow of 1980 gpm is coincidentally the same as the applied for water right amount. Given other variable unknowns of annual aquifer pressure variation, pump-wear, and system pressure while taking into account the measured parameters of specific capacity AND system pressure during the field examination, a very slight variation in any one of these parameters could result in the well being produced at the water right amount. It is also well documented that the well has been pumped at yields far exceeding the water right during testing. Thus the well is capable of producing more than the desired target yield which is also the design point maximum discharge of the pumping plant.

After review of the as-built details of well construction (Attachment C), and the 10 conditions of approval for Permit No. 63-12560 (Attachment D), I conclude that the conditions of the Permit have been met. Therefore, I recommend that the City of Meridian municipal water right No. 63-12560 be licensed for its requested diversion rate of 4.5 cfs (2019 gpm).

Have conditions of permit approval been met? X yes ___ no

F. FLOW CALCULATIONS

_____ Additional Computation Sheets Attached

Measured Method:

Instantaneous flow rates are based on field-observed readings of high-quality, relatively new (1st in service spring 2002), propeller-type flow-meter installed as recommended by the manufacturer. These readings are supported by: 1) discussions with the pump operators responsible for upkeep of the well, 2) by measured (this exam) operating conditions and pump performance curve, and 3) by the well-documented capacity of the City's #21 groundwater well during previous pumping tests. Using measurements I obtained during a six-hour, 2,000 gpm, constant-discharge pumping test (Figure 10), I calculated a specific capacity for the well of 47 gallons per minute per foot of drawdown. Using the short-term measured specific capacity of this examination, it is apparent that the capacity of the well may have increased significantly in the 4½ years since the well was first tested; a situation that is not surprising because newly completed wells are often observed to continue to develop with pumping once they are brought on line. Using the more conservative calculated specific capacity of 47 gpm/ft (after 7 hours of continuous pumping) the pumping lift at 2020 gpm should be about 60 feet below measuring point (total drawdown of 43 feet plus the depth to water of 17 feet). Using a reasonable system operating pressure range of 52-to-58 psi, the total dynamic head the Well #21 pump must operate against would be 183-to-200 feet. Dividing the TDH between the 3-stage pump yields about 61 feet per stage which equates to 2020 gpm on the pump performance curve (Figure 7). Given the high specific capacity of this well (47 gpm/ft) less than 1 foot of additional drawdown would be required, or about 2 psi less of system pressure, would be needed to produce the additional 39-to-60 gpm over the observed discharge rates of the field exam. Therefore, the observed, calculated, and recommended maximum flow rates for the well appear to be justified.

$$\text{Specific capacity} = \text{discharge/drawdown} = 2,000 \text{ gpm}/42 \text{ feet} = \mathbf{47 \text{ gpm/ft}}$$

$$\text{Drawdown (at flow rate)} = \text{flow rate/ specific capacity} = 2,019 \text{ gpm}/ 47 \text{ gpm/ft} = \mathbf{43 \text{ feet}}$$

$$\text{Total lift} = \text{drawdown} + \text{static water level} = 43 \text{ feet} + 17 \text{ feet} = \mathbf{60 \text{ feet}}$$

$$\text{System head} = \text{line pressure} \times 2.31 \text{ feet/psi} = 52 \text{ psi} \times 2.31 \text{ psi/ft} = \mathbf{120 \text{ feet}}$$

$$\text{Total dynamic head} = \text{pump lift} + \text{system pressure} + \text{column/pipe/fitting losses} = 60 + 120 + 6 = \mathbf{\sim 186 \text{ feet}}$$

$$\text{Total head per pump stage} = \text{total dynamic head} / \text{number of stages} = 186 / 3 = \mathbf{\sim 62 \text{ feet}}$$

From pump performance curve (Figure 7), flows would range between 1,840-to-2,020 gpm at system pressures between 52-to-58 psi at the rated constant speed of the installed pump. Over-speeding of the pump using the variable frequency drive could theoretically allows flows somewhat higher than 2,020 gpm in this well.

Water Level	Discharge Rate	Line Pressure
17 feet bmp	0 gpm	54 psi
44.8 feet bmp	1990 gpm	56 psi
47.5 feet bmp	1950 gpm	56 psi
47.8 feet bmp	1850-1950 gpm	56 psi

G. VOLUME CALCULATIONS

1. Volume Calculations for Irrigation:

$$V_{I.R.} = (\text{Acres Irrigated}) \times (\text{Irrigation Requirement}) =$$

$$V_{D.R.} = [\text{Diversion Rate (cfs)}] \times (\text{Days in Irrigation Season}) \times 1.9835 =$$

$$V = \text{Smaller of } V_{I.R.} \text{ and } V_{D.R.} =$$

B

2. Volume Calculations for Other Uses:

Not applicable to a municipal water right.

H. RECOMMENDATIONS

1. Recommended Amounts

Beneficial Use	Period of Use From	To	Rate of Diversion Q (cfs)	Annual Volume (afa)
<u>Municipal</u>	<u>Jan 1.</u>	<u>Dec. 31</u>	<u>4.50 cfs</u>	<u>N/A</u>
Totals:			<u>4.50 cfs</u>	<u>N/A</u>

2. Recommended Amendments

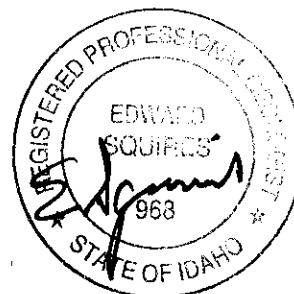
☐ Change P.D. as reflected above ☐ Add P.D. as reflected above ☒ None
☐ Change P.U. as reflected above ☐ Add P.U. as reflected above ☐ Other

I. AUTHENTICATION

Field Examiner's Name Edward Squires CWRE No. 05-125 Date February 21, 2005

Reviewer _____ Date _____

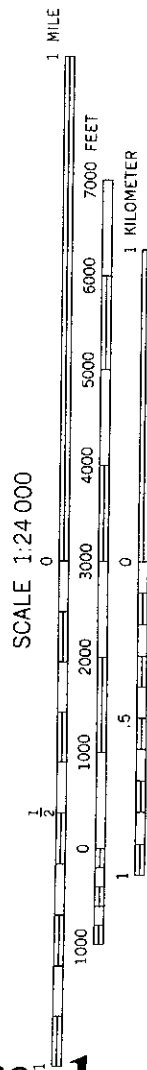
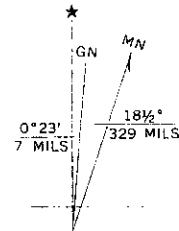
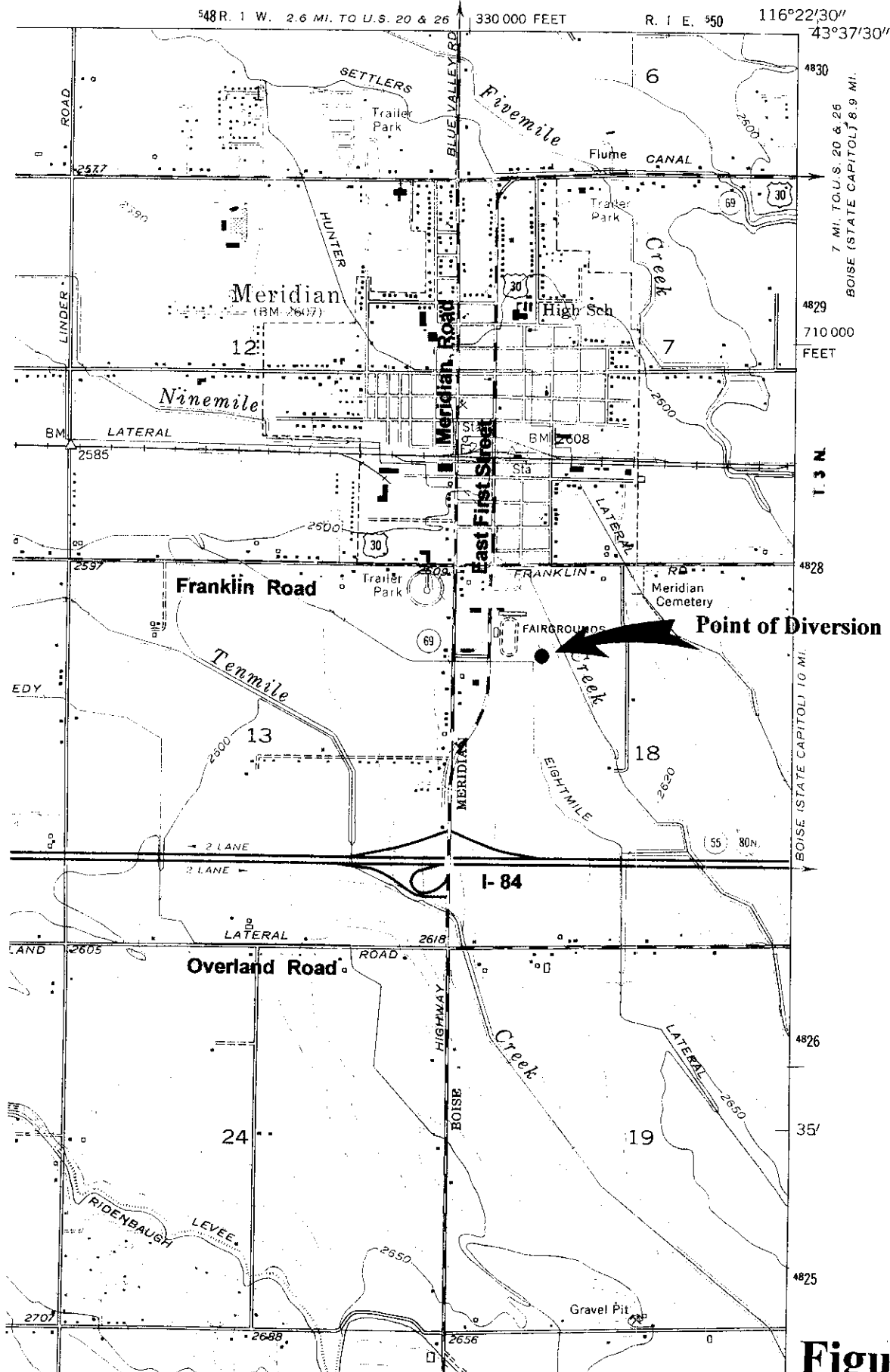
SEAL



FIGURES

MERIDIAN QUADRANGLE
IDAHO
7.5 MINUTE SERIES (TOPOGRAPHIC)

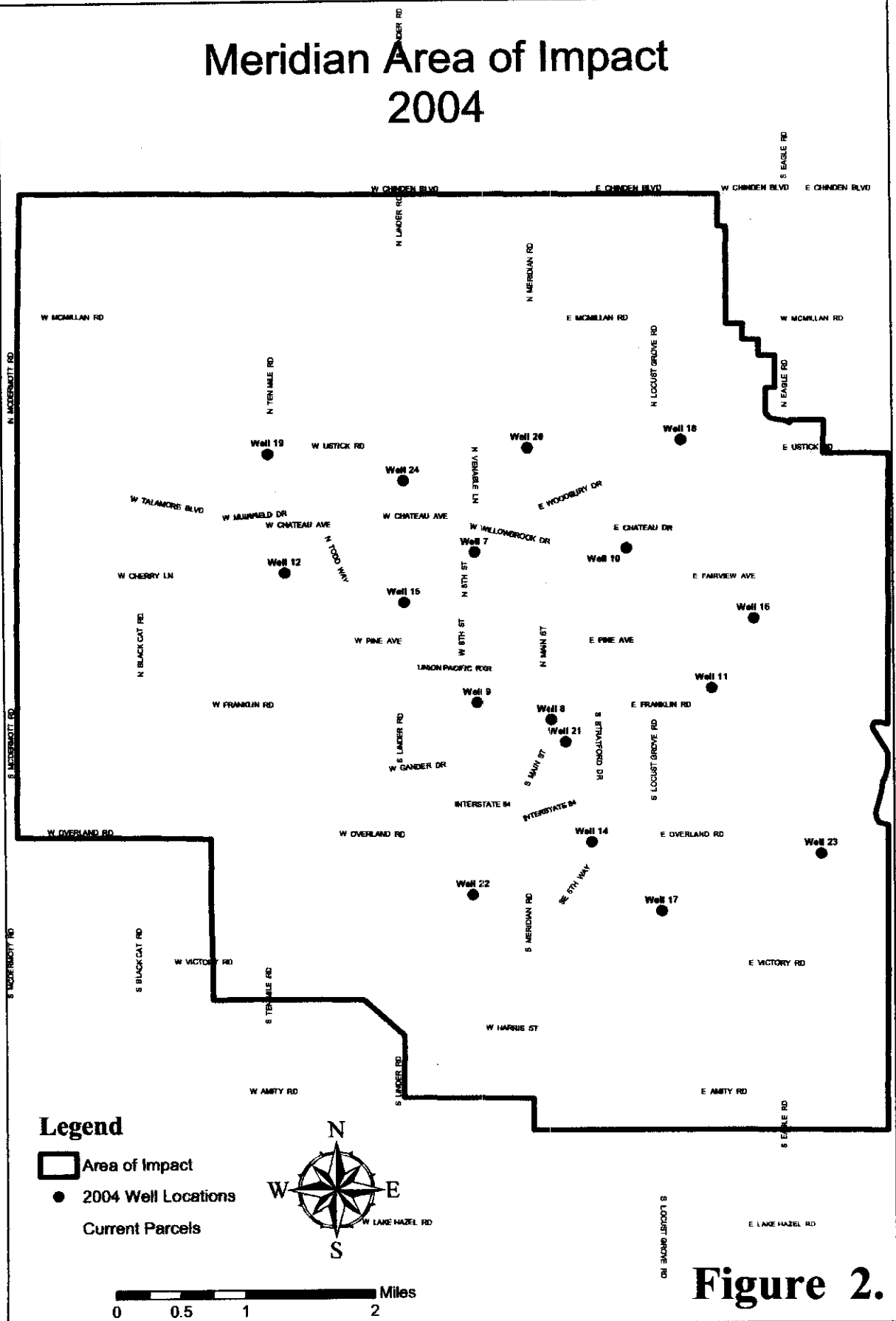
277' 11" NE
(EAGLE)



CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Figure 1.

Meridian Area of Impact 2004



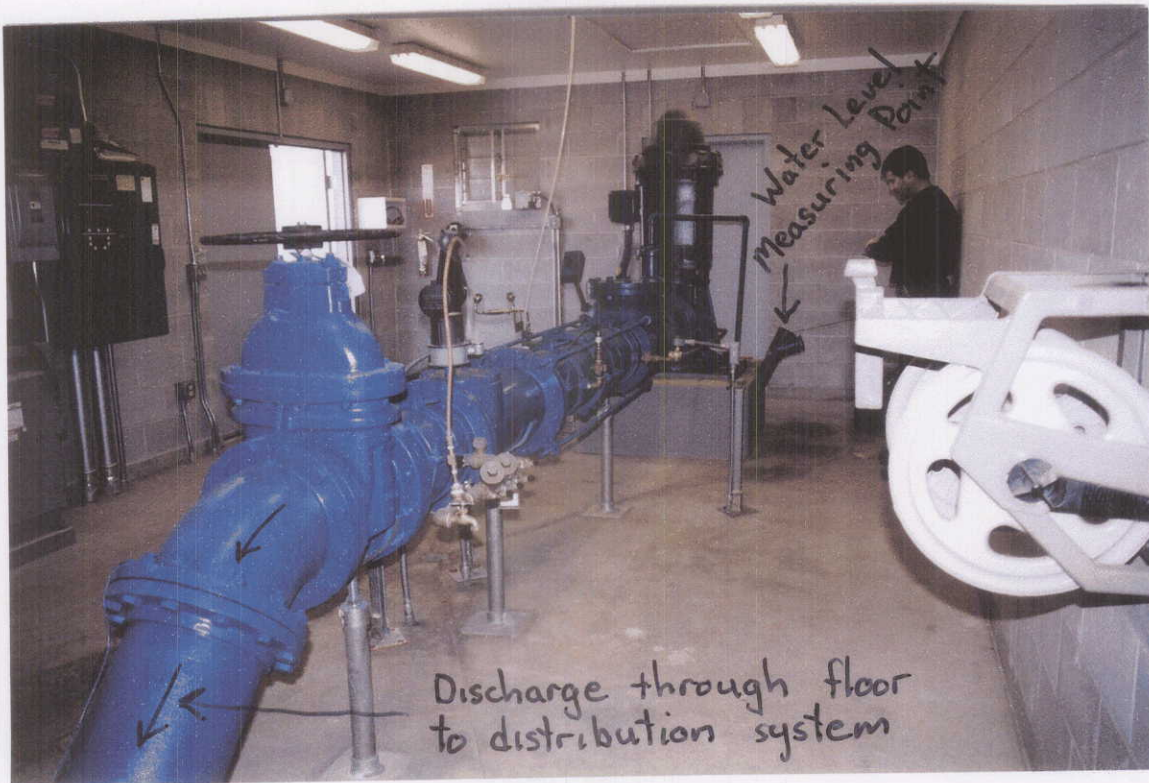


Figure 3. Photographs of the well head plumbing inside of the Meridian Well #21 pump house showing the configuration and specifications of the installed totalizing flow-meter.

Figure 3.



Figure 8. February 11, 2005 photographs of the Toshiba adjustable speed drive installed on the City of Meridian's #21 municipal water supply well (upper) and the Cummins 150 KW, natural gas powered electrical power generator for use in emergency power outages (lower).

Figure 8.

CITY OF MERIDIAN
WELL # 21

Figure 7. Pump performance curve for the installed pump in the Meridian Well #21. The pumping plant is coupled to Toshiba variable frequency drive that can regulate to discharge by varying the speed of the pump above and below the design point of this pump (1930 gpm). According to the pump supplier, the 3-stage pump was installed on 120 feet of 10-inch diameter column by PumpTech Co. in July of 2001.

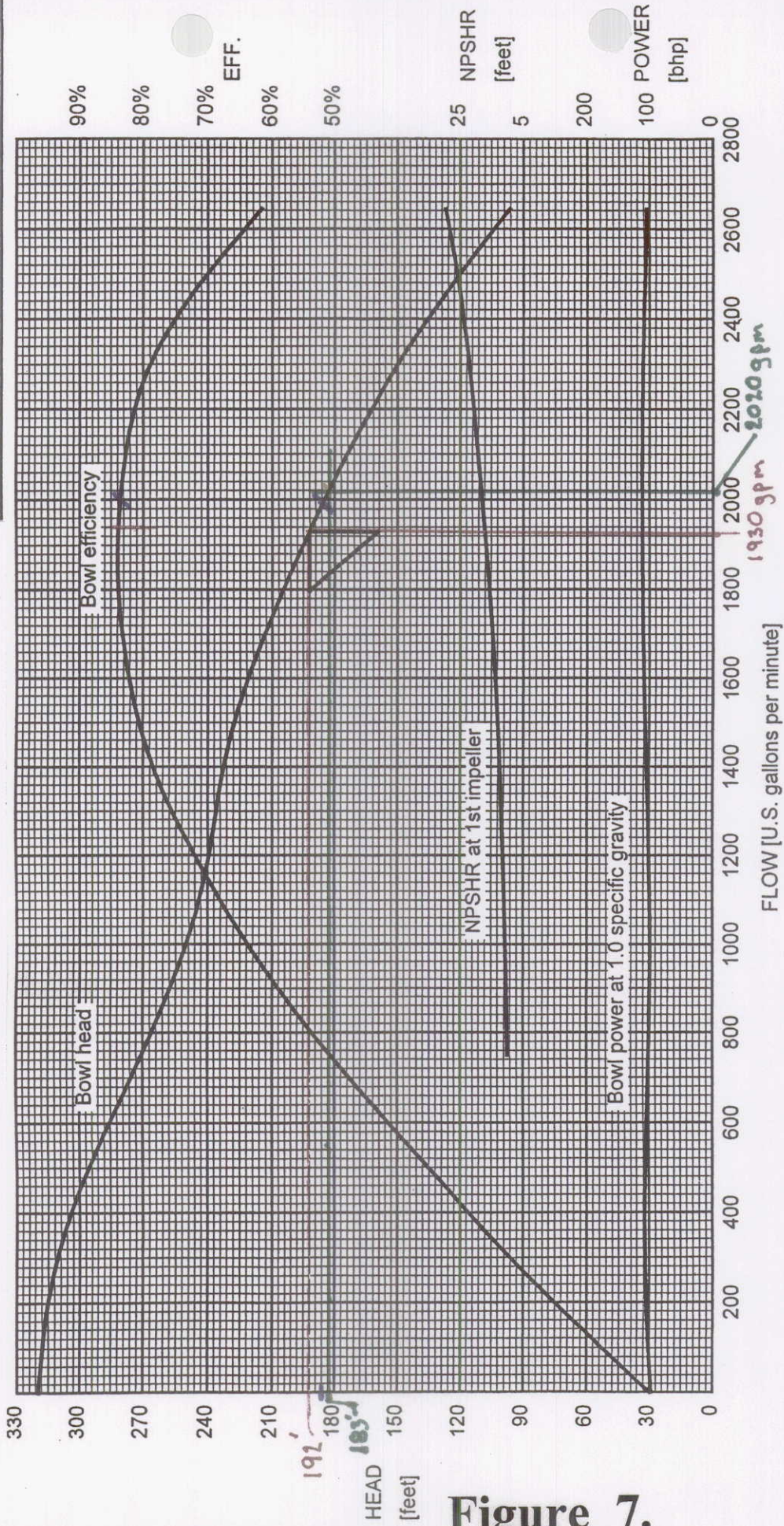


Figure 7.

PUMP TECH
IDAHO FALLS, ID

Flowway Pumps

FRESNO, CALIFORNIA

A **WEIR** COMPANY

TYPE: 14DKH
NO. OF STAGES: 3
R.P.M.: 1770
PUMP SERIAL NO.:

DWG. NO.

DWN. BY: rayc

DATE: 07/18/2001



Figure 6. February 11, 2005 photographs of the exterior of the 28' X 16' cinder block Meridian Well #21 pump house at 300 E. Watertower Lane. The upper view looks east at the west and south walls and the lower photo is to the west showing the north and west walls of the structure. Visible in the lower picture is the nearby elevated reservoir to which the Well #21 is pumped. The lower photo shows the back-up natural gas powered generator in case of emergency power outages.

Figure 6.

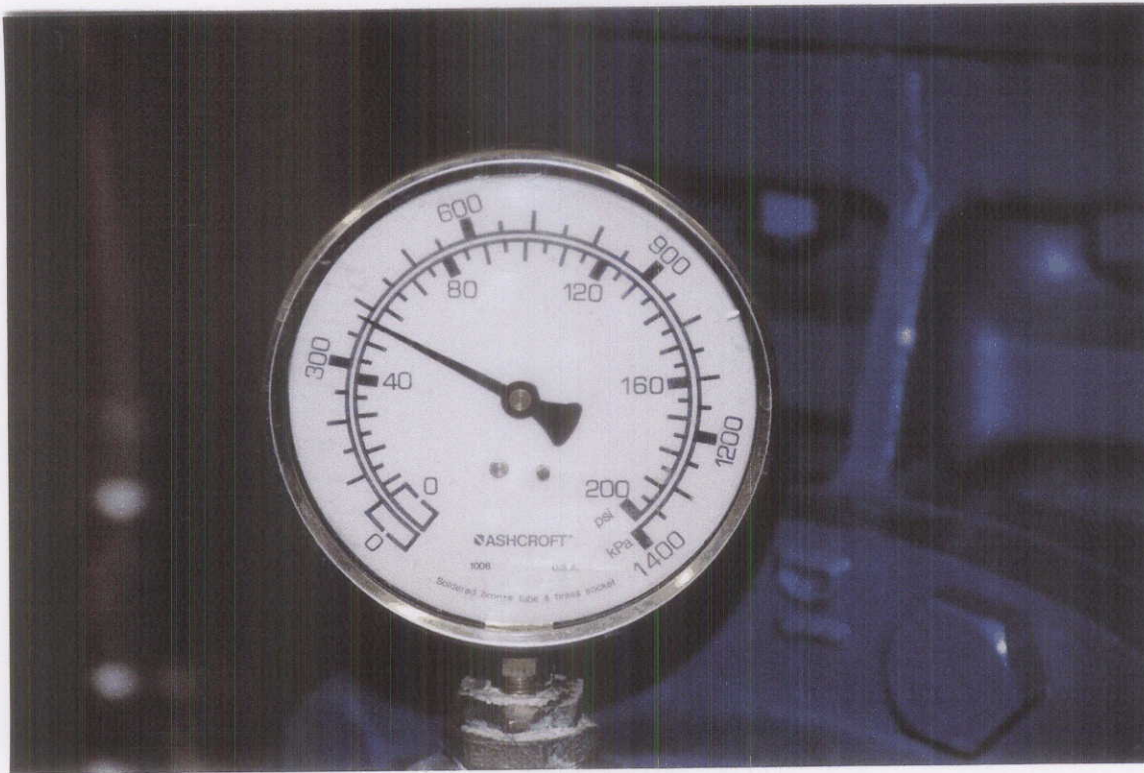
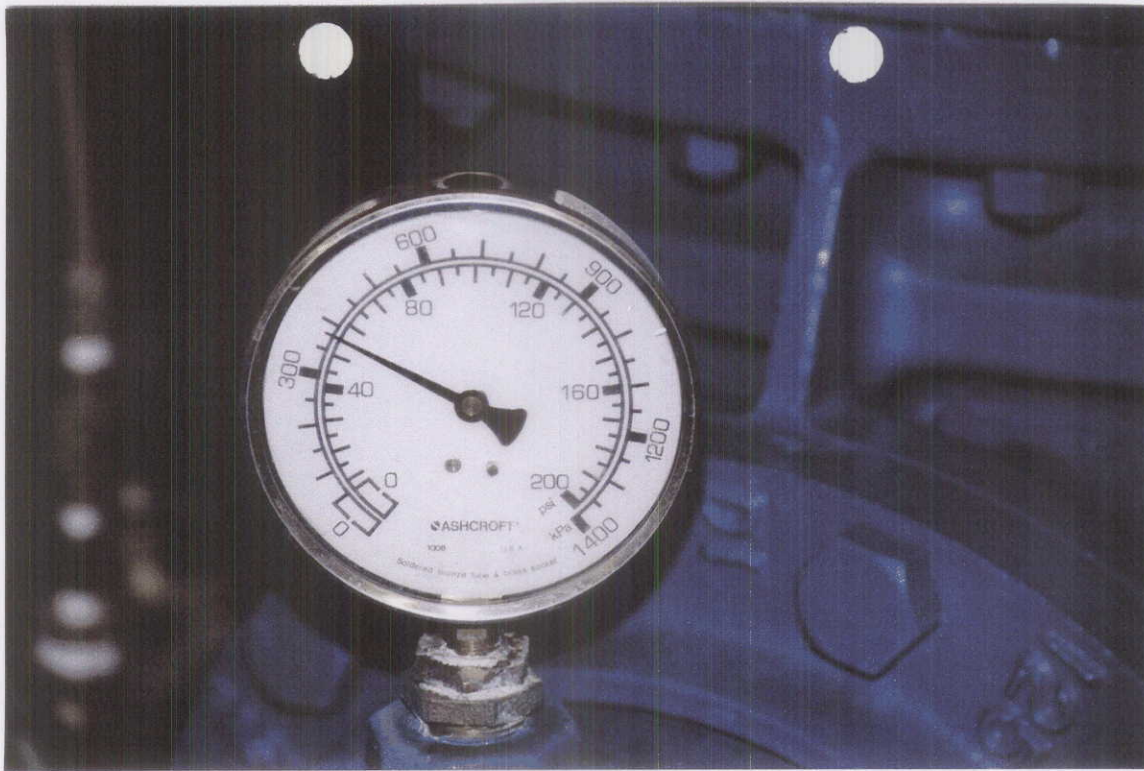


Figure 5. Photographs of the pressure gage use to indicate the distribution system line pressure of the Meridian Well #21 is completed and sealed. The installed gage was reading 54 psi with the well pump not operating (upper photo). The lower view depicts a pressure of 56 psi during pumping of the well at ~1950 gpm. The small change in pressure is because the well was pumping against the maximum design system pressure whereby the discharged water is pumped to the nearby elevated water reservoir.

Figure 5.

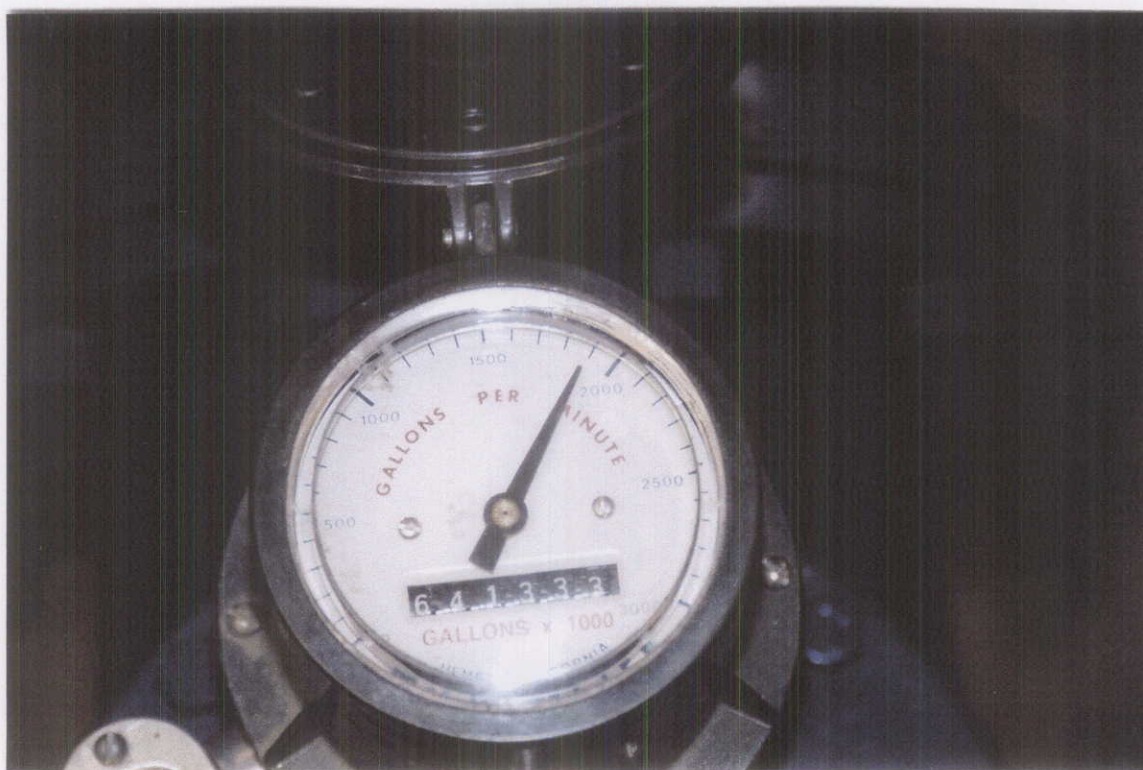


Figure 4. February 10, 2005 photograph of the McCrometer totalizing flow-meter installed on the City of Meridian's #21 municipal water supply wellhead plumbing. Upper view is of the flow-meter cover with meter serial number. The lower picture shows a discharge of about 1900 gpm after 15 minutes of pumping. The flow-indication needle fluctuated between 1850-to1950 gpm for the 30-minute pumping test of this examination with a maximum observed discharge of 1980 gpm.

Figure 4.

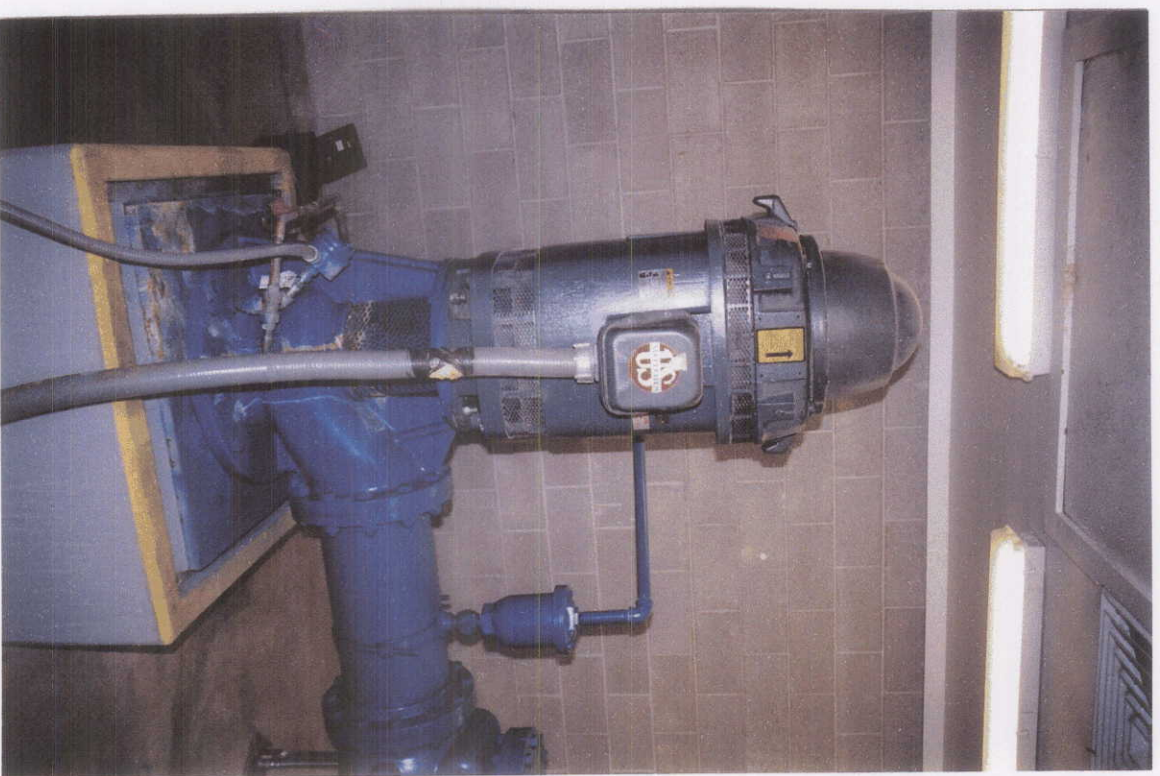


Figure 9. February 11, 2005 photographs of the 125 HP US Motors drive motor for the line-shaft deep well turbine pump installed in the City of Meridian's #21 municipal water supply well. Left view shows the 125 HP motor specification plate and water-level measuring point which is 2 feet above pump house floor. Right hand photo shows the 10-inch discharge head

Figure 9.

City of Meridian #21 supply well hydraulic testing

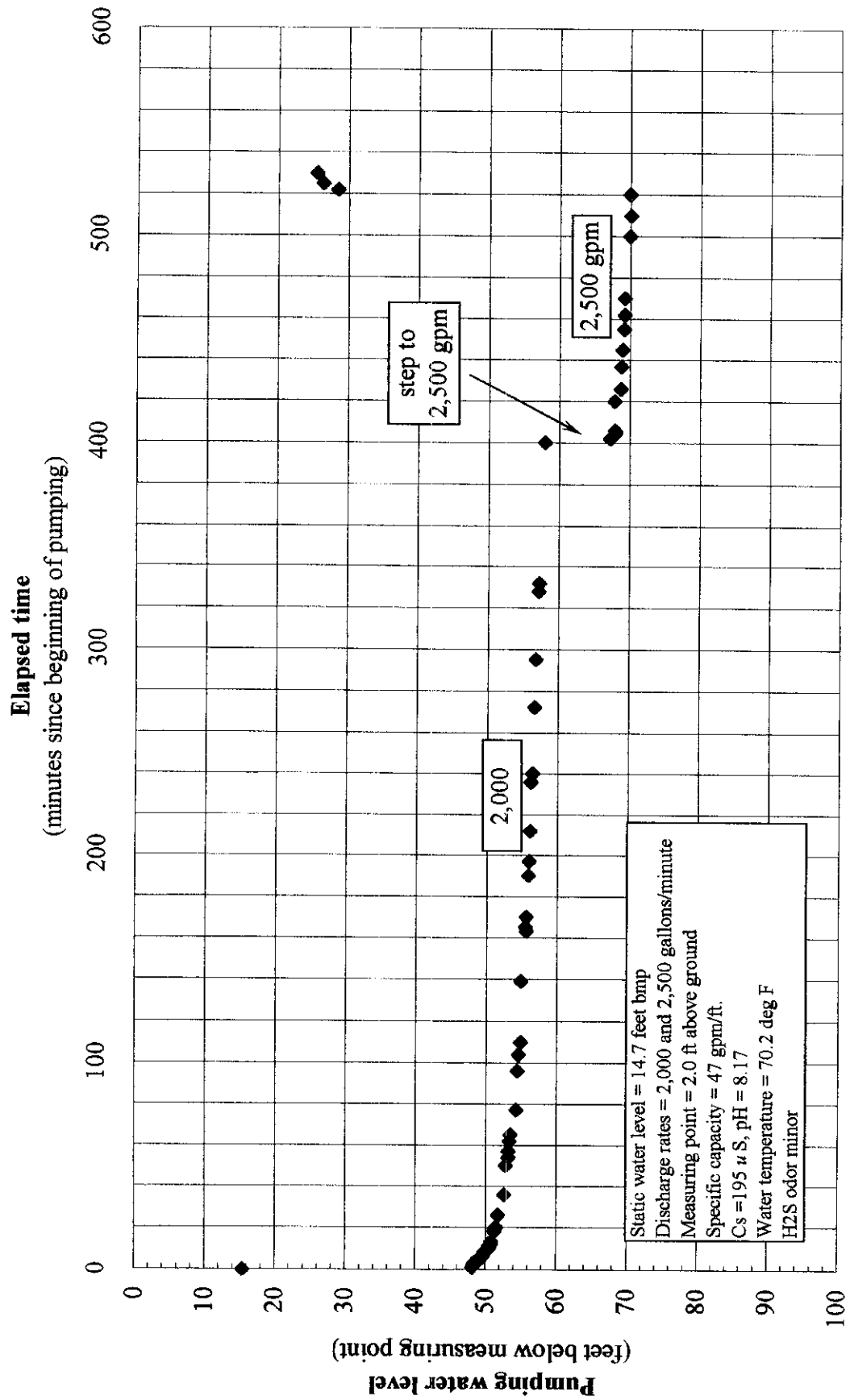
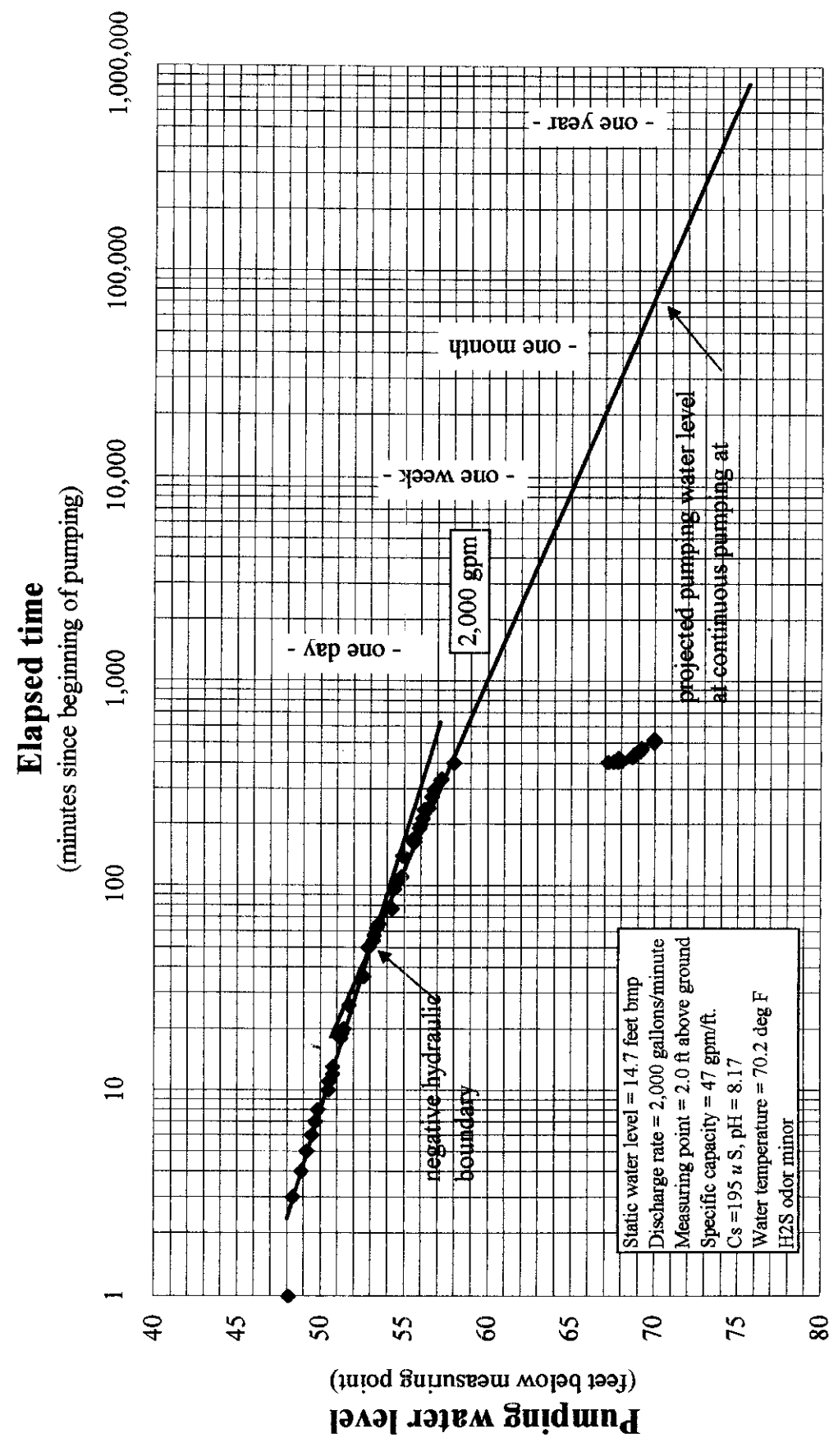


Figure 10.

City of Meridian #21 Supply Well Hydraulic Testing

Constant rate discharge test 8/9/00



ATTACHMENTS

Flowmeter Accuracy Rests On Proper Installation

Flow meters are becoming mandatory for agricultural irrigation systems in an increasing number of counties and states as stricter water management programs are implemented.

Adding flowmeters to systems designed originally without them is not difficult but requires consideration of a few important installation guidelines to assure the accuracy of the device.

Propeller flowmeters are most common in agriculture and are the subject of this article. While there are many technologies available for measuring flow, the propeller meter has cost and space advantages, especially when it is to be installed in an existing irrigation system.

Because the measuring element of this type of a flowmeter is a propeller positioned in the center of the flowstream, the pipe must be completely full and the flow of the water must not swirl. These basic conditions must be met to assure the accuracy of the flowmeter.

Upstream Disturbances

Flowmeters sense water velocity so they are vulnerable to certain upstream disturbances. Upstream obstructions, such as elbows, valves, pumps, and different sized pipe, can disturb the even flow of water through the meter. To solve these disturbances, the flowmeter should be installed downstream of obstructions on straight pipe at least five pipe diameters in length. For example, a flowmeter installed on eight-inch diameter pipe should be at least 40 inches ($5 \times 8''$) downstream of any obstruction. In addition, no obstruction should be located within one pipe diameter downstream of the flowmeter. The downstream pipe should be straight for this distance as well.

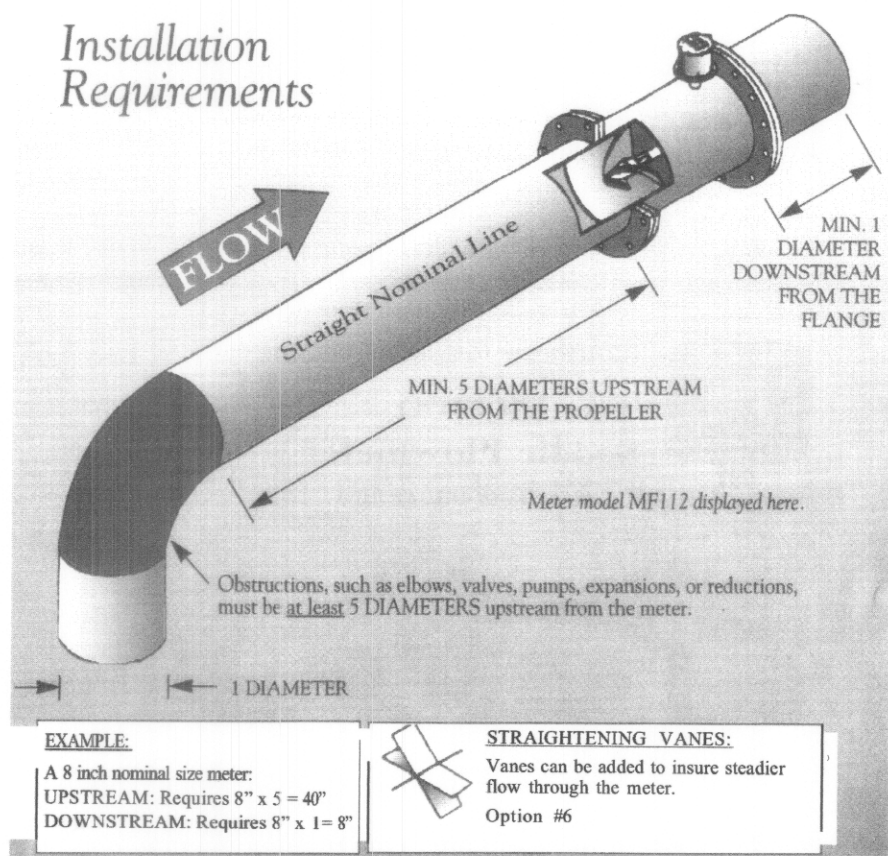
Certain conditions can cause

excessive swirling of the water flow. A centrifugal sand separator or two elbows in different planes are examples. Well-developed swirls created by either of these conditions can travel up to 100 pipe diameters downstream if unobstructed.

Since most installations have less than 100 diameters to work with, straightening vanes can be placed just ahead of the meter. The vanes will break up most swirls and ensure accurate measurement. Some flowmeters include vanes as a feature.

Gravity also conditions flow. Mounting the meter vertically to take advantage of gravity flow conditioning offers some slight advantages. It is important to specify the orientation of the meter when ordering.

Installation Requirements



Calculate Flow Range

Naturally, a flowmeter is most accurate when used within its design specifications. One of the most important is the range of flow rates. The irrigation manager must calculate the flow rates he needs for his irrigation system in order to select the right flowmeter. The range is typically very large and is expressed as the turndown of the meter. The turndown is the ratio of the maximum flow rate to the minimum flow rate and is often 15: 1. That means the meter would remain accurate up to 15 times it's minimum flow rate. For example, a meter with a minimum flow rate of 100 gpm and a turndown of 15:1 would remain accurate up to a flow of 1,500 gpm. Meters for smaller pipes tend to have lower turndowns and a narrower range of flow rates than larger pipes.

As long as the pipe is full, flowmeters will work within a wide range of pressure. Maximum pressure is the only limitation. Standard meters have a maximum pressure tolerance of 150 psi. This should cover most agricultural applications. If not, meters are available with higher pressure ratings.

The pressure loss caused by the meter (headloss) is minimal when the pipe and meter are sized properly for the flow. The greatest headloss occurs with smaller pipe at high water velocity. By sizing pipe and flowmeter to fit the needed volume of water at a reasonable velocity, headloss is less than one psi.

Propeller flowmeters have an average accuracy of

plus or minus two percent when operating within their designed flow range. This further supports the need for selecting the right flowmeter for the particular irrigation system.

Reading Flowmeters

Finally, flowmeters are available that provide totals in specific units, i.e. gallons, acre feet, acre inches, cubic feet etc. Be sure you select a flowmeter that reports and totals in the unit of measurement most appropriate in your area.

Some guidelines are helpful for reading totalizers on flowmeters. All totalizers on propeller meters have a "multiplier." For example, an eight-inch flowmeter that totalizes in gallons will have a multiplier of (X) times 100. That means that the last digit on the right of the six digit totalizer is not gallons, but hundreds of gallons. Usually two zeros are printed on the dial face to the right of the last digit to signify the multiplier.

Four-, six-, and eight-inch meters in gallons have multipliers of 100. Ten-, 12-, and 14- inch meters have multipliers of 1,000.

The same eight-inch flowmeter totalizing in acre feet will have a multiplier of .001. Now zeroes are not added to the reading but a decimal point is included after the first three digits. Usually the digits that signify fractions of acre feet are in a different color and/or X. .001 is printed below the totalizer. As the meter size goes up, the decimal point moves to the right. The person reading the meter must be careful to add the correct amount of zeroes or place the decimal point in the right place. The meter reading can be off by a factor of 10, 100, or 1000!

Flowmeters are an important tool in irrigation management and water conservation. Learn how to install them properly and read them accurately. •

Editor's Note: This article was prepared with the assistance of Glenn Voss of McCrometer in Hemet, California and appeared in "Irrigation Journal" April, 1992.

"The pipe must be completely full of water."



Flowmeter Recommendation

**The M0300
Saddle Flowmeter**

ask us about details.

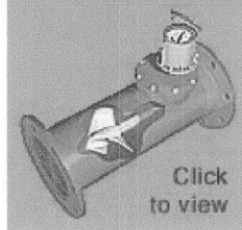
3255 W. Stetson Ave.
Hemet, CA 92545-7799
Tel 909 652-4811
Fax 909 652-3078

 **McCROMETER**

Part Number 24517-12
5M/GD/12-95


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Mc Propeller



Number One in the US

Clean and dirty flows

Accuracy of +/-2%

Repeatability of +/-0.25%

Self-cleaning design

Easy to install

Easy to operate

Unique Design for Clean and Dirty Flows

McCrometer has set the standard for propeller flowmeter technology in the agricultural and turf markets since 1955. Its uniquely-designed Mc Propeller line offers an economical and versatile flow measurement solution for a wide range of water applications, and is especially suited to dirty water flows.

Unlike traditional propeller meters, the Mc Propeller uses a flexible drive-train and sealed ball bearings, making it more easily serviceable in the field and lowering maintenance costs. Plus, there are no tight tolerances in the Mc Propeller, so it can handle solids suspended in water without clogging. Measurement accuracy is +/- 2% and repeatability is +/- 0.25%.

Applications for the Mc Propeller include agricultural and turf irrigation, HVAC, marine systems, and municipal water and wastewater. Because of its high accuracy, this flowmeter can also be used as a water management tool, helping to reduce water costs, preventing over-irrigation and reducing leaching of chemicals and fertilizers into the ground.

- Top-selling meter for irrigation
- Clean and dirty flows
- Easy to service in field
- Accuracy of +/-2%
- Repeatability of +/-0.25%
- Self-cleaning design
- Indicator-totalizer on every model



Now available with the advanced
Electronic Register for remote
installation. Click here for details.

Mc Propeller

[description](#)
[specifications](#)
[models](#)
[how it works](#)
[parameters](#)

Free
CD-ROM

[click here](#)

Have a
question...

[Inquire here](#)

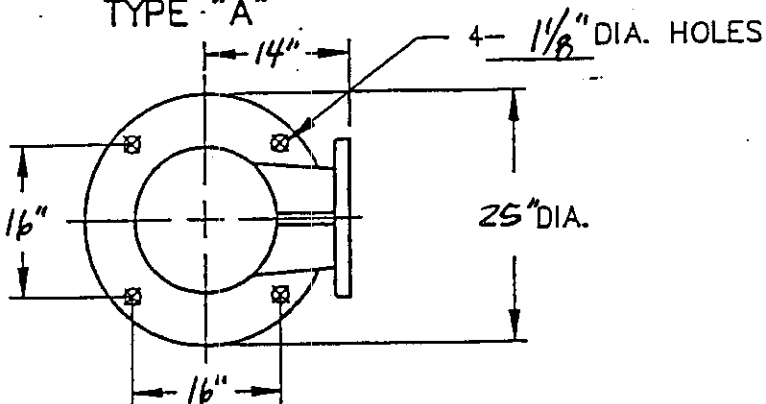
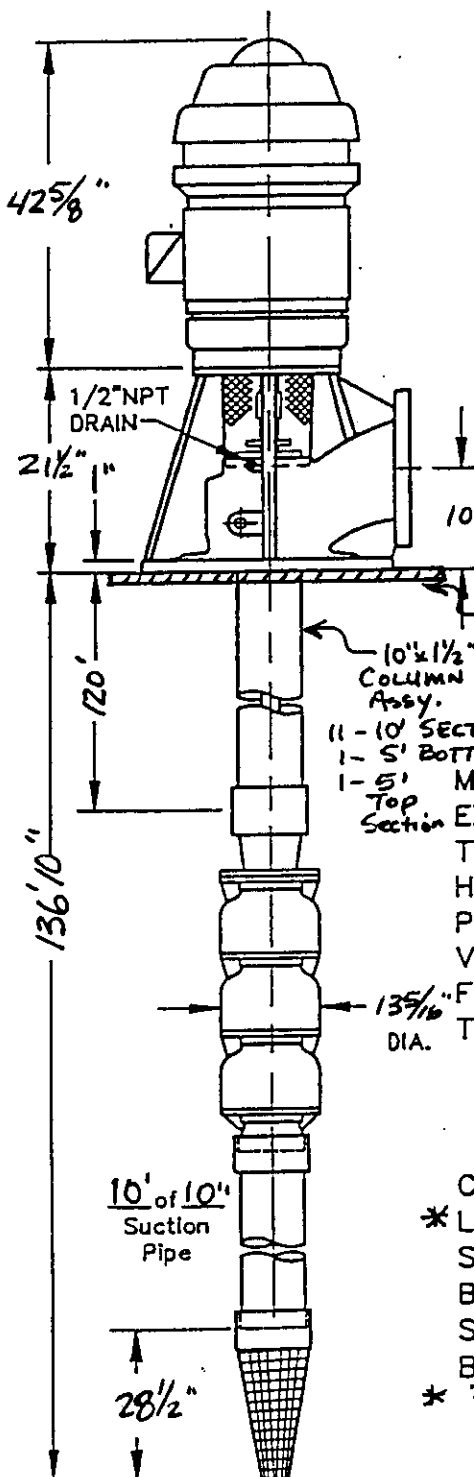
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VERTICAL TURBINE PUMP

TYPE "A"



DISCHARGE

10" 125# ANSI-FF FLG.
12- 1" DIA. HOLES *
14 1/4" DIA. BOLT CIRCLE
16" DIA. FLANGE

BOLT HOLES STRADDLE VERTICAL C

Base PLATE 1" Thick

MOTOR

PUMP

11- 10' SECTIONS
1- 5' BOTTOM SECTION
1- 5' Top Section

MAKE U.S. MOTORS
ENCLOSURE WP-1
TYPE VHS NRR Yes
HP 125 RPM 1800
PHASE 3 HERTZ 60
VOLTAGE 460
FRAME NO. 405TP
TYPE COUPLING THREADED

10" "A" C.I. DISCH HD.
1 1/2" LINE SHAFT 10" COL
SHAFT TUBE
PROD. LUBE X OIL LUBE
TYPE 14DKH STAGE 3
1930 GPM 192 TDH
IMPELLER Enclosed
STRAINER YES
WELL I.D. 18"

MATERIAL

COL PIPE STEEL
* LINE SHAFT C-1045 Steel
SHAFT TUBE -
BOWL SHAFT 416 SS
SHAFT SEAL Mechanical seal
BEARING RETAINER Bronze
* 304 SS Shaft Sleeve at Bearing Locations.

PUMP BOWL Cast Iron
IMPELLER Bronze
BEARINGS (BOWL) Bronze
BEARINGS (LINESHAFT) Rubber
STRAINER Galvanized
BOWL W/R -
IMPELLER W/R -

REMARKS
NO. UNITS REQ'D. 1
Base plate welded to well casing.

FLUID WATER
SPEC. GRAVITY 1.0
VISCOSITY -
TEMPERATURE 60°F
PH -

CUSTOMER City of Meridian, Idaho
Well #21

ORDER NO. -
SUPPLIER Pump Tech Co. Inc.
Idaho Falls, Idaho

DWG. NO. -
SERIAL NO. -

Attachment B.

By: DBC Date: 7-14-01

NOT TO BE USED
FOR CONSTRUCTION
UNLESS CERTIFIED

(NOTE: The Performance Data Worksheet should be completed at design condition to properly select required components and sizing of equipment – i.e., motor, shaft diameter, column, required pump efficiency, etc.)

[illegible]

- M. Pump efficiency = $\frac{A \times B}{3960 \times K}$
 N. Electric motor efficiency (from motor data sheet)
 P. Net electrical efficiency = $N \times (1.00 - L)$

- $$\begin{aligned} \text{R. HP input} &= \frac{K}{P} \\ \text{S. Overall efficiency} &= M \times P \\ \text{T. KW input} &= \frac{746 \times K}{P} \\ \text{U. KW hr. per 1000 gallons} &= \frac{D \times 0.00315}{S} \end{aligned}$$

NOTES: Change efficiency to decimal form before using

1. (CoI, B) Total head in feet developed by the pump includes head below datum and head above datum. Head above datum must include velocity head losses at point of head measurement.

2. Thrust bearing losses in HP per 100 RPM per 1,000 lbs. thrust:
- | FR. | 182TP-215TP - | FR. | 254TP - |
|-----|---------------------|-----|----------------------|
| | 256TP-258TP - .0085 | | 324TP -326TP - .0132 |
| | 364TP-365TP - .0148 | | 404TP -425TP - .0165 |
| | 444TP-505TP - .0170 | | Stacked Brgs. |
- Spherical roller and Kingsbury bearing - refer to factory.

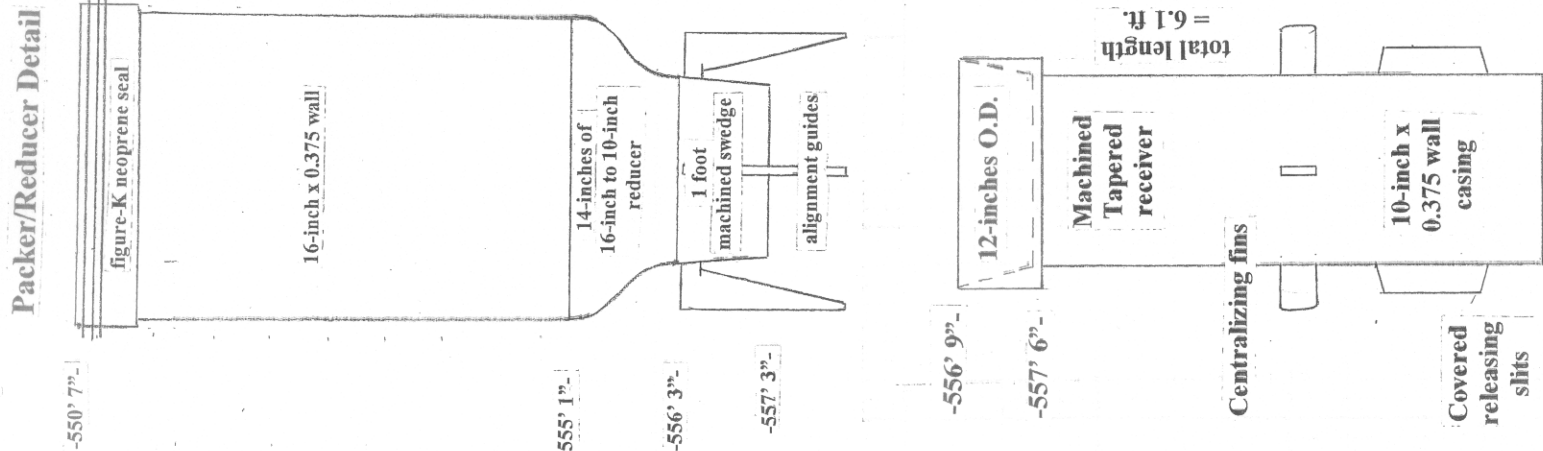
City of Meridian #21 Municipal Supply Well Attachment C.

Well Construction

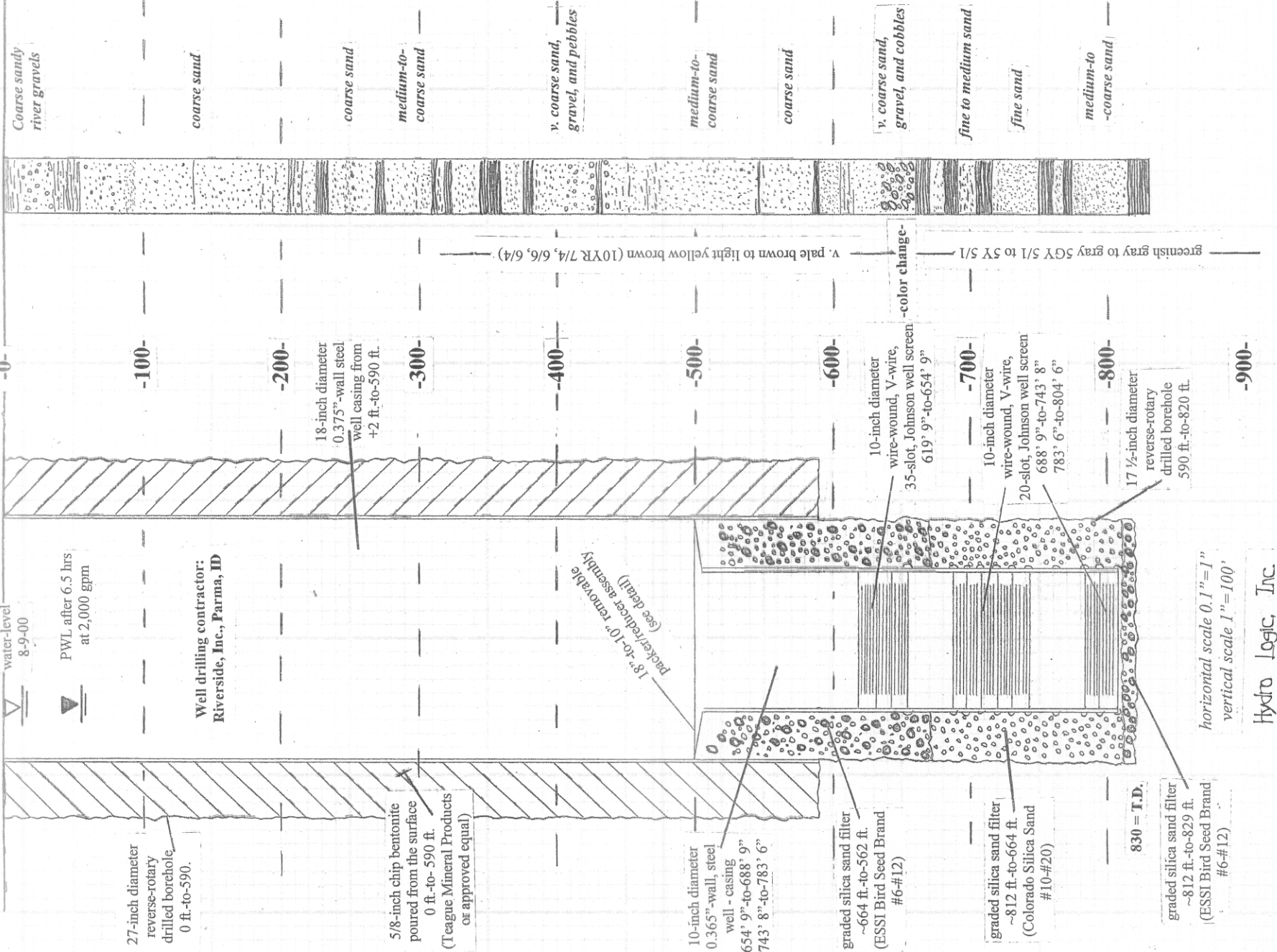
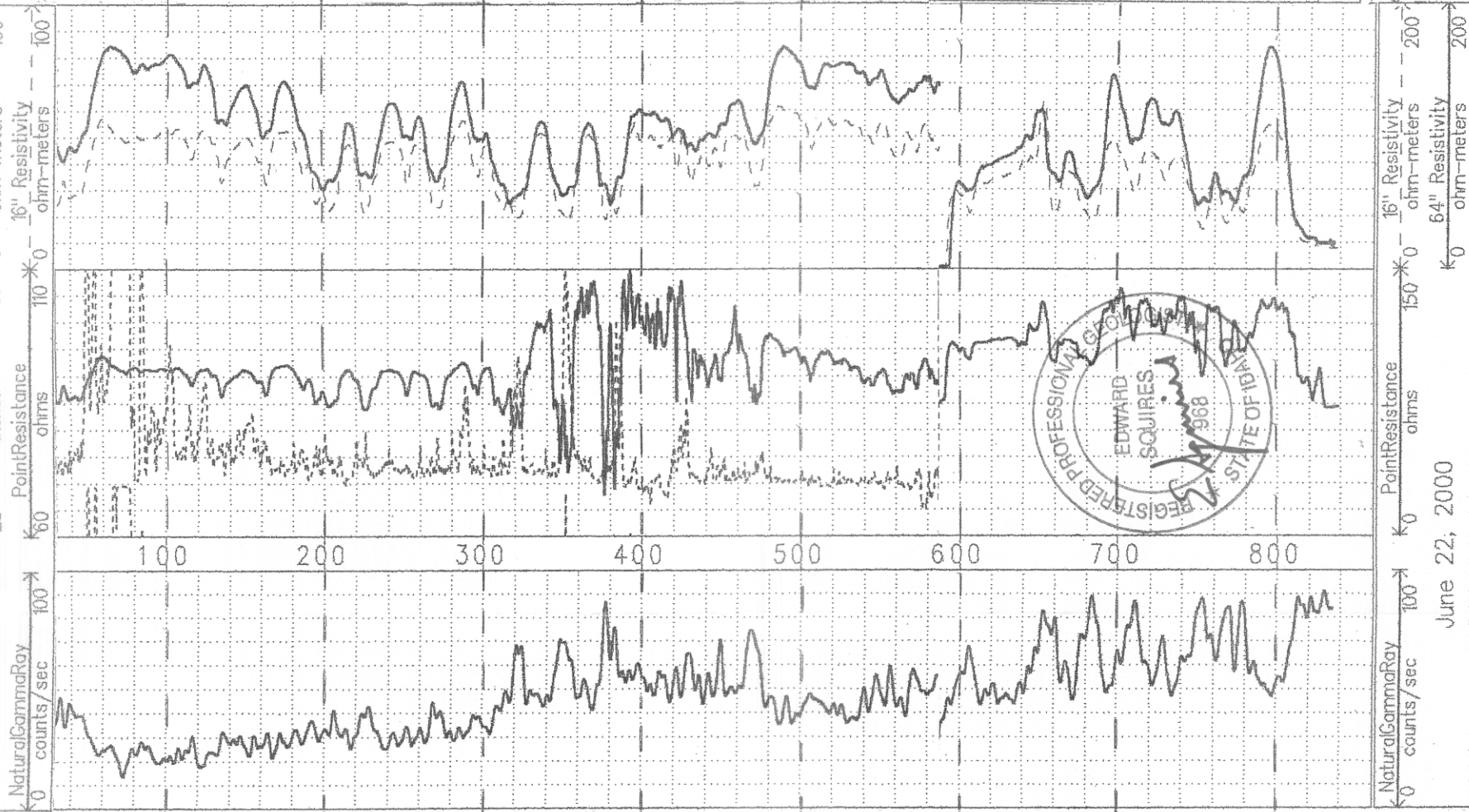
Lithology

Geophysics

Water Chemistry



Parameter (mg/l)	Well #21
Alkalinity	72.0
Aluminum	0.02
Ammonia as N	0.65
Antimony (furnace)	<0.002
Arsenic	<0.005
Barium	<0.10
Beryllium	<0.002
Cadmium	<0.007
Calcium	39.1
Chloride	3.08
Chromium	<0.02
Color (apparent)	2
Copper	<0.01
Corrosivity	-0.56
Cyanide (total)	<0.005
Fluoride	0.42
Hardness	50.6
Iron	0.06
Iron (diss.)	0.05
Lead	<0.002
Magnesium	2.80
Manganese (diss.)	0.14
Mercury	<0.002
Nitrate as N	<0.10
Nitrite as N	<0.01
Odor	<1
Potassium	1.67
Selenium (graphite)	<0.005
Silica	33.6
Silver	<0.002
Sodium	13.5
Sulfate	8.64
Sulphide	<0.05
Surfactant	<0.025
Thallium (graphite)	<0.006
Total Dissolved Solids	128
Total Phosphorus (P)	0.060
Zinc	0.001
pH (SU)	7.85
Field pH	8.09
Field Conductance μ S	195
Lab Conductance μ S	166
Field Temperature $^{\circ}$ F	70
Odor	<1
Gas (visible)	no
Chlorine Demand	0.34
VOC's	N/D



Geophysics and well design by
Hydro Logic, Inc.
Ed Squires and Brian Cavanagh

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Form 238-7
11/97

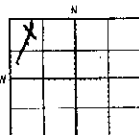
IDAHO DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORT

Office Use Only			
Inspected by _____			
Twp _____	Rge _____	Sec _____	
_____ 1/4	_____ 1/4	_____ 1/4	
Lat: _____		Long: _____	

1. WELL TAG NO. D 15031
DRILLING PERMIT NO. _____
Other IDWR No. 861539/764302

2. OWNER:
Name City of Meridian
Address 33 EAST IDAHO AVE
City MERIDIAN State ID Zip 83642

3. LOCATION OF WELL by legal description:
Sketch map location must agree with written location.



Twp. 3 North ☒ or South ☐
Rge. 1 East ☒ or West ☐
Sec. 18 SE 1/4 NW 1/4 NW 1/4
Gov't Lot _____ County ASB
Lat: N 89° 30' Long: E 100° 30' 33"
Address of Well Site 250' N. of Water Tower

150' E. of 8-Mile Lateral
(Show in sketch above or attach to this report)

LL. _____ Blk. _____ Sub. _____ Name OCT 2 - 2000

4. USE: ☐ Domestic ☒ Municipal ☐ Monitor ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other _____

5. TYPE OF WORK check all that apply (Replacement etc.)
☒ New Well ☐ Modify ☐ Abandonment ☐ Other _____

6. DRILL METHOD
☐ Air Rotary ☐ Cable ☐ Mud Rotary ☒ Other REVERSE

7. SEALING PROCEDURES

SEAL/FILTER PACK	AMOUNT	METHOD
Material From To	Back or Forward	
BENTONITE 0 570	78,000	Dry Pour

Was drive shoe used? ☒ Y ☐ N Show Depth(s) _____
Was drive shoe seal tested? ☐ Y ☒ N How? _____

8. CASING/LINER:

Diameter	From	To	Gauge	Material	Casing	Linear	Welded	Threaded
18"	12	590'	3/8"	Steel	☒	☐	☒	☐
10"	597	617 1/2	3/8"	Steel	☒	☐	☒	☐
10"	655 1/2	689 1/2	3/8"	Steel	☒	☐	☒	☐
10"	744 1/2	784 1/2	3/8"	Steel	☒	☐	☒	☐

Length of Headpipe _____ Length of Tailpipe _____

9. PERFORATIONS/SCREENS

Perforations Method _____
Screens Screen Type WIRE WEAVER S.S.

From	To	Slot Size	Number	Diameter	Material	Casing	Linear
617 1/2	655 1/2	35		10"	S.S.	☒	☐
689 1/2	744 1/2	35		10"	S.S.	☒	☐
784 1/2	805 1/2	20		10"	S.S.	☒	☐

10. STATIC WATER LEVEL OR ARTESIAN PRESSURE:

15'3" ft. below ground Artesian pressure _____ lb.
Depth flow encountered _____ ft. Describe access port or control devices: CITY WILL INSTALL ACCESS PORT

11. WELL TESTS:

Yield gal/min.	Drawdown	Pumping Level	Time
<u>2500</u>	<u>57'</u>	<u>72'</u>	<u>4 hrs</u>

Water Temp. 70° Bottom hole temp. _____
Water Quality test or comments: _____

12. LITHOLOGIC LOG: (Describe repairs or abandonment)

Bore Dia.	From	To	Remarks: Lithology, Water Quality & Temperature	Y	N
28"	0	10	Top Soil		
	10	35	COARSE GRAVEL, COBBLES		
	35	55	TAN SANDY CLAY		
	55	90	COARSE SAND + GRAVEL		
	90	98	FINE SAND		
	98	205	COARSE SAND		
	205	215	CLAY + GRAVEL		
	215	225	COARSE SAND		
	225	235	CLAY		
	235	270	COARSE SAND		
	270	278	BROWN-TAN CLAY		
	278	310	MED-COARSE SAND		
	310	345	SILTY CLAY		
	345	345	MED-COARSE SAND		
	345	360	BROWN-TAN CLAY		
	360	375	MED SAND		
	375	382	TAN CLAY		
	382	430	COARSE SAND, GRAVEL, PEBBLES		
	430	435	TAN CLAY		
	435	475	COARSE SAND + CLAY		
	475	585	MED-COARSE SAND		
	585	590	TAN CLAY		
	590	635	MED SAND + CLAY		
	635	660	COARSE SAND, GRAVEL, COBBLES		
	660	670	GRAY CLAY		
	670	680	MED SAND		
	680	690	GRAY CLAY		
	690	705	FINE-MED SAND		
	705	715	GRAY CLAY		
	715	750	FINE SAND		
	750	760	GRAY CLAY		
	760	815	MED-COARSE SAND		
	815	830	GRAY CLAY		

Completed Depth 805' (Measurable)
Date: Started 6-10-00 Completed 9-5-00

13. DRILLER'S CERTIFICATION

I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Company Name RIVERSIDE, INC Firm No. 333

Firm Official _____ Date _____
and _____
Driller or Operator _____ Date 9-28-00
(Sign only Firm Official & Operator)

FORWARD WHITE COPY TO WATER RESOURCES

Attachment C.

State of Idaho
Department of Water Resources **Attachment D.**
Permit To Appropriate Water

NO. 63-12560

Priority: January 5, 2000

Maximum Diversion Rate:

4.50 CFS

This is to certify, that CITY OF MERIDIAN
200 E CARLTON STE 100
MERIDIAN ID 83642

has applied for a permit to appropriate water from: GROUNDWATER

and a permit is APPROVED for development of water as follows:

<u>BENEFICIAL USE</u>	<u>PERIOD OF USE</u>	<u>RATE OF DIVERSION</u>
-----------------------	----------------------	--------------------------

MUNICIPAL	01/01 to 12/31	4.50 CFS
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LOCATION OF POINT(S) OF DIVERSION:

NWNW , Sec. 18, Township 03N, Range 01E
ADA County

PLACE OF USE: See Remarks

CONDITIONS OF APPROVAL AND REMARKS

1. Proof of application of water to beneficial use shall be submitted on or before March 1, 2005.
2. Subject to all prior water rights.
3. Project construction shall commence within one year from the date of permit issuance and shall proceed diligently to completion unless it can be shown to the satisfaction of the Director of the Department of Water Resources that delays were due to circumstances over which permit holder had no control.
4. Right holder shall comply with the drilling permit requirements of Section 42-235, Idaho Code.
5. The Director retains jurisdiction to require the right holder to provide purchased or leased natural flow or stored water to offset depletion of Lower Snake River Flows if needed for salmon migration purposes. The amount of water required to be released into the Snake River or a tributary, if needed for this purpose, will be determined by the Director based upon the reduction in flow caused by the use of water pursuant to this permit.
6. The issuance of this right does not grant any right-of-way or easement across the land of another.
7. After specific notification by the department, the right holder shall install a suitable measuring device or shall enter into an agreement with the department to determine the amount of water diverted from power records and shall annually report the information to the department.

PAGE 2

State of Idaho
Department of Water Resources**Permit To Appropriate Water**

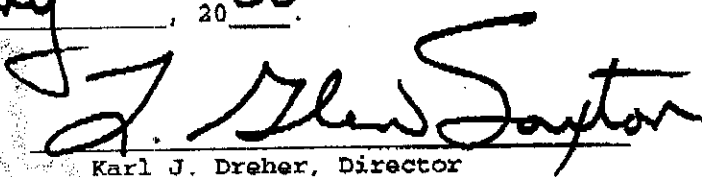
NO. 63-12560

CONDITIONS OF APPROVAL AND REMARKS

8. The right holder shall not provide water diverted under this right for the irrigation of land having appurtenant surface water rights as a primary source of irrigation water except when the surface water rights are not available for use. This condition applies to all land with appurtenant surface water rights, including land converted from irrigated agricultural use to other land uses but still requiring water to irrigate lawns and landscaping.
9. Water bearing zone to be appropriated is from 650 to 800 feet.
10. Municipal use is for the service area of the City of Meridian.

This permit is issued pursuant to the provisions of Section 42-204, Idaho Code.
Witness the signature of the Director, affixed at Boise, this

29th day of February, 2000.


Karl J. Dreher, Director

WR