Water Supply Investigation for the City of Park River

Fordville aquifer

Walsh County, North Dakota

By

Jon C. Patch, P.E.

North Dakota Ground-Water Studies
Number 110
North Dakota State Water Commission

Prepared by the
North Dakota State Water Commission
In cooperation with the
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Introduction

The City of Park River currently obtains its municipal water supply from Homme Reservoir on the South Branch of the Park River. Due to EPA surface water treatment requirements, the city is faced with either the construction of a water treatment facility employing expensive water treatment methods to bring the water into compliance with EPA requirements or finding a ground-water source. The Fordville aquifer is located about 6 miles to the southwest of the city (figure 1). The City is considering the Fordville aquifer as an alternative to their existing source of supply from Homme Reservoir. They are in the process of obtaining the 10 production wells from the federal government that were formerly used by the Department of Defense. These wells would be the location of their proposed withdrawals from the Fordville aquifer.

The City of Park River entered into a cooperative agreement with the North Dakota State Water Commission (SWC) to investigate the ability of the Fordville aquifer to provide a ground-water municipal supply for the city of Park River. The University of North Dakota (UND) Geology Department was contracted to develop a steady-state computer model of the Fordville aquifer. The City of Park River and the State Water Commission shared the cost of the project equally.

Purpose

The purpose of this investigation is to determine the impact on water-levels in the Fordville aquifer resulting from additional annual withdrawal of 400 to 600 acre-feet by the City of Park River. The effect of water-level changes on well yield of prior permitted ground-water appropriators is evaluated.

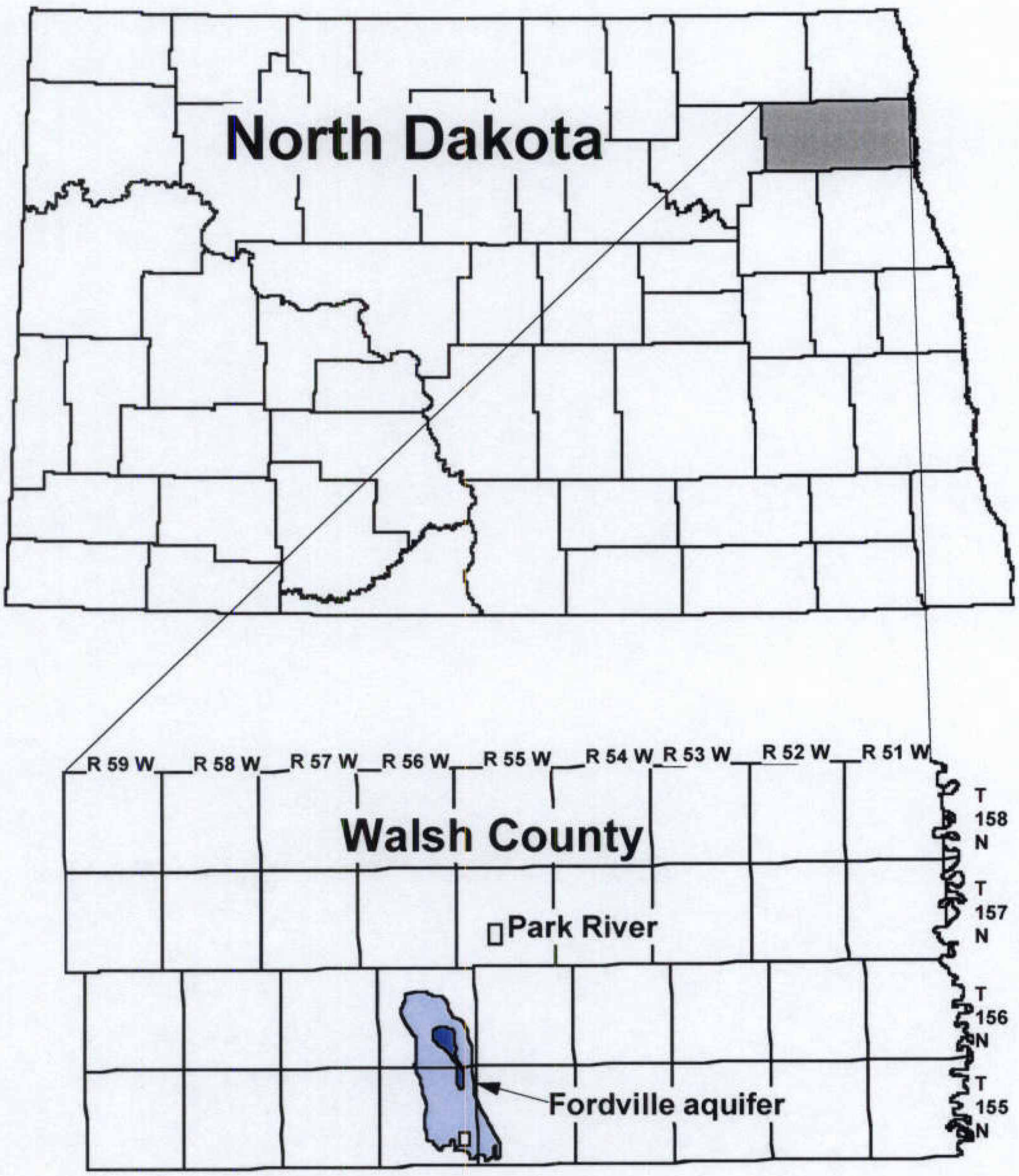

Figure 1. Location of the Study Area.

Objectives

The objectives for the investigation are:

1). Develop a comprehensive conceptual model of the Fordville aquifer.

2) Quantify the recharge-discharge relationships between the Fordville aquifer and the Forest River by installing a network of stream gaging stations.

3). Develop a steady-state ground-water flow model of the aquifer to evaluate the conceptual model and to provide a tool for assessing the impacts on water-levels resulting from additional ground-water withdrawals by the City of Park River.

Acknowledgements

Appreciation is expressed to Dr. Phil Gerla for his work on the data inventory, GIS preparation, and development of a preliminary steady-state model. Phil provided insight on the recharge and discharge mechanisms of the aquifer which led to a more complete understanding of the geohydrologic system. Much thanks to Robert Shaver for his critical review of this report.

Recognition of jobs well done is given to Gary Calheim and Jim Leuwer for their skill in test drilling and observation well installation; Kelvin Kunz for his acumen in stream gaging; Merlyn Skaley for his proficiency in water sample collection; and Albert Lachenmeier for excellent work on the installation of the protective well casings, water-level monitoring, and general upkeep on the wells.

Location-Numbering System

Locations in this report are numbered according to a system based on the location in the public land classification of the United Stated Bureau of Land Management (figure 2). The first numeral denoted the township north of a base line, the second numeral denoted a range west of the fifth principal meridian, and the third numeral denoted the section. Letters A, B, C, D designate, respectively, the northeast, northwest, southwest, and southeast quarter section, quarter-quarter section, and quarter-quarter-quarter section (10 acre-tract). For example, well 155-056-04ADD is in the SE1/4 SE1/4 NE1/4 Section 5, Township 155 North, Range 56 West. Consecutive terminal numerals are added if more than one well is located in a 10-acre tract.

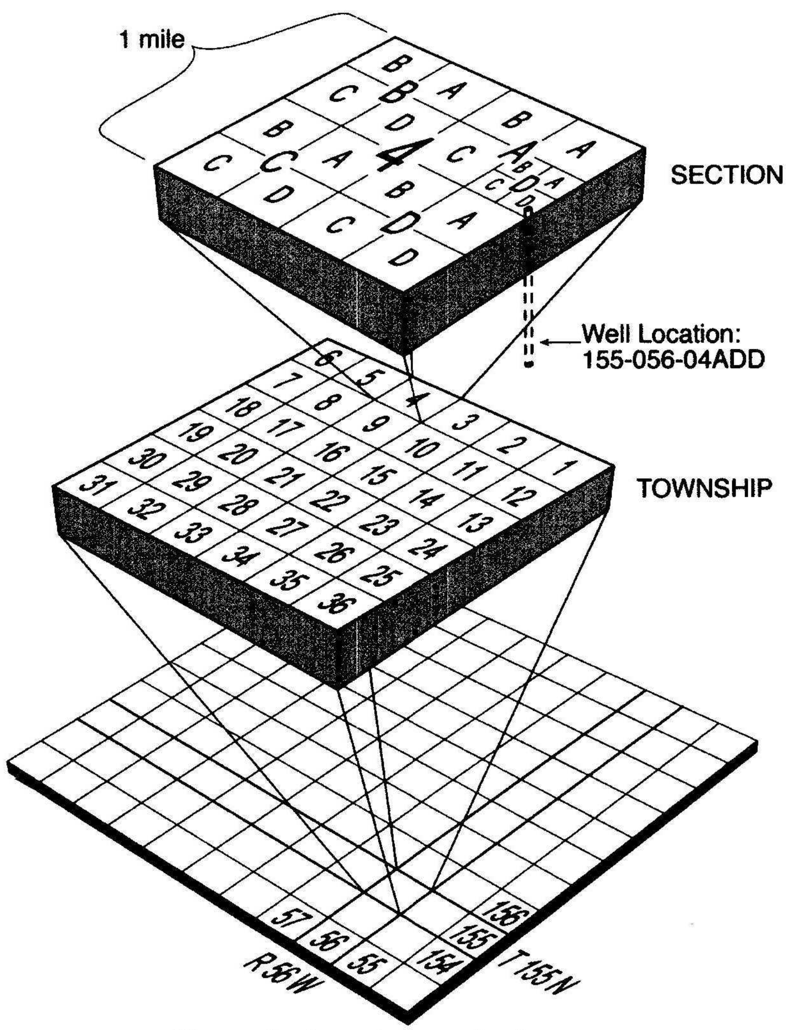

Figure 2. Location numbering system

Previous Work

The geology of Nelson and Walsh Counties was described by Bluemle (1973) as part of the county ground-water studies program. Downey (1971) compiled the ground-water data of Nelson and Walsh Counties, and Downey, (1973) described the ground-water resources of Nelson and Walsh Counties.

Schmid (1968) performed a 4,800 minute aquifer test on the Fordville aquifer using a 300 gpm production well and 7 observation wells. The results of the test are included in the Downey (1973) report and the basic data are stored in the State Water Commission aquifer test files.

Gerla and Patch (2002) submitted a paper entitled "Estimating Recharge and Discharge within a Riparian, Glacial-outwash Aquifer" to American Water Resources Association for publication in their journal. The paper was accepted and presented by Gerla at the AWRA conference in Denver, CO, in July, 2002. Publication of the compilation of the papers presented at the conference is pending.

Summary of Work

• Evaluate existing data to develop conceptual model of the Fordville aquifer

Existing geologic and geographic data was assembled. A geographical information system (GIS) project was initially developed by UND. Additional data gathering needs were then determined.

• Stream Gaging

Stream gaging sites at five locations along the North and Middle Branches of the

Forest River were established to quantify recharge-discharge relationships between the Fordville aquifer and the Forest River. Gages were installed and monitored by the SWC.

• Test Drilling and Observation Well Installation

As part of this investigation, 30 test holes were drilled totaling 2,010 feet. Test drilling was accomplished with a forward mud-rotary drill rig. Samples of the drill cuttings were collected and described by the project hydrogeologist. If significant saturated aquifer material was encountered, the test hole was completed as an observation well using 2-inch diameter polyvinyl chloride (PVC) screen and casing (figure 2).

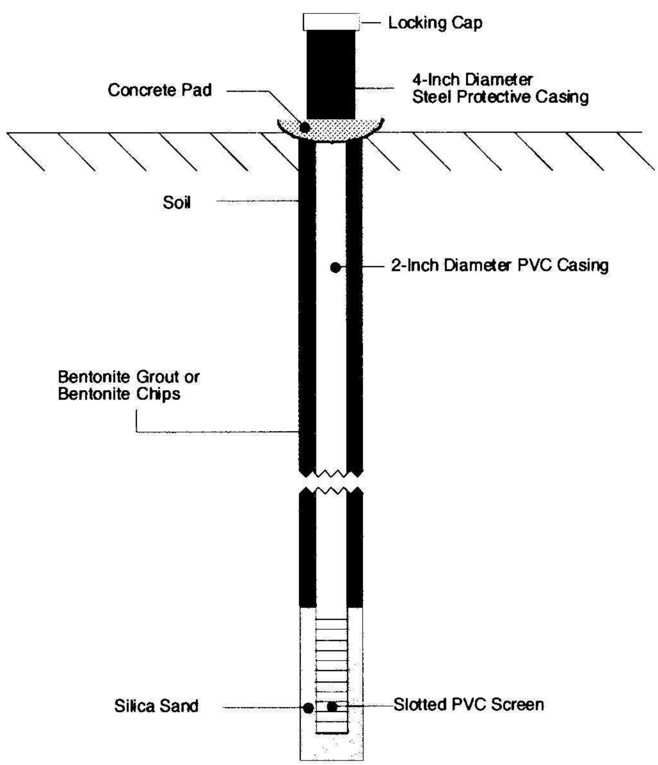

Figure 3. Well construction diagram

Eighteen observations wells were installed as part of this investigation. Observation wells typically ranged from about 30 to 50 feet deep. The length of well screen was typically 5 feet. Where possible, silica sand was placed in the annular space around the well screen to 1 foot above the top of the screen (figure 2). If silica sand placement was not possible, the wells were completed by collapsing the walls of the drill hole around the well screen. The annular space above the sand pack or collapsed material was filled with high-solids bentonite grout or bentonite chips.

Water was evacuated from the observation wells several times to make sure the wells were not plugged and transmitted sufficient quantities of water. Each observation well was secured at land surface with a 4-inch diameter protective steel or plastic casing set in concrete (figure 2). The bottom of the protective casing is set to a depth approximately 2 feet below land surface and the top of the casing is slightly above the top of the 2-inch observation well casing. Access to the well was secured by installing locking caps on top of the 4-inch diameter protective casings.

• Surveying

Elevations were determined for the top of the each observation well and at land surface. The elevation at the top of the casing is the reference for the ground-water level. Elevations were established to third order accuracy using differential leveling. Surveying was accomplished by SWC personnel.

• Water-Level Monitoring

Water levels in each observation well were measured periodically using a chalked steel tape and/or an electric monitoring tape. Water levels were recorded after measurement and eventually stored in the SWC relational database.

• Water Quality Analysis

Water samples for chemical analysis were collected from older and newly installed observation wells and production wells using either a bailer, a bladder pump or a centrifugal pump. The samples were transported to the North Dakota State Water Commission Laboratory where they were analyzed for major cations, anions and selected trace metals.

• Steady-State Model Development

A conceptual model of the Fordville aquifer was developed incorporating new hydrologic data collected specifically for this study. The conceptual model provided the basis for developing a steady model which was used to evaluate impacts on water levels due to increased pumping by the City of Park River. Transient model simulations were not conducted because water use, evapotranspiration, and recharge need to be calculated externally from the model from historical climate data. Ongoing work in the area of transient model development will continue in the future but will not be included in this report.

Description of the Study Area

The study area is located in south-central Walsh County, North Dakota. Specifically the area covers the four townships of T155-R55W, T156N-R55W, T155-R56, and T156N-R56W. The entire Fordville aquifer occurs within this four township region (figure 1).

Physiography and Climate

The study area is located along the western margin of the Red River Valley in Walsh County (figure 4). The Drift Prairie till plain occurs in the western part of the study area. Moving eastward, land surface drops slightly into the delta plain. The deposits of the delta plain occur along the western margin of glacial Lake Agassiz sediments. Along the eastern edge of the delta plain the prominent Edinburg moraine forms a topographic ridge separating the delta plain from the inter-beach and lake plain.

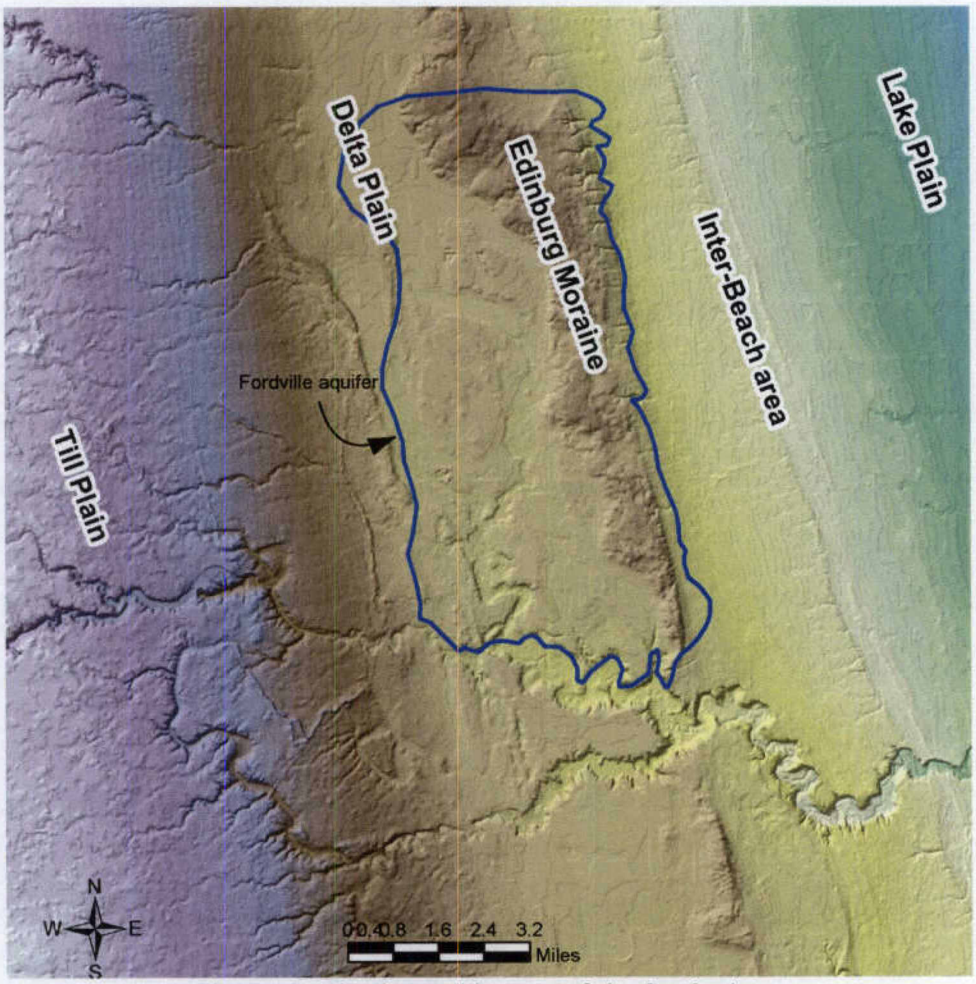

Figure 4. Physiographic map of the Study Area

Climate in the region is sub-humid with average annual precipitation of about 19 inches. Potential evapotranspiration is this area is about 30 inches per year.

Geology

The Fordville aquifer consists of deltaic and outwash deposits that accumulated along the west edge of Glacial Lake Agassiz during the Pleistocene epoch (Downey, 1973). The delta formed as eastern flowing drainage flowed into the western margin of the Glacial Lake Agassiz basin. Lake Agassiz is dated in the latter part of the Pleistocene epoch about 10,000 to 15,000 years before present (Hansen and Kume, 1970). The aquifer is underlain by glacial-drift deposits consisting primarily of clay-rich glacial till. The underlying till ranges in thickness from about 50-300 feet and is in turn underlain by Cretaceous shales of the Niobrara, Greenhorn and Carlile Formations.

The aquifer is bounded by the Pembina escarpment to the west and pinches out into the surrounding glacial drift deposits along the northern perimeter, and under the Edinburg moraine along the eastern perimeter. The aquifer is truncated by the Middle and North Branches of the Forest River along the southern perimeter which have incised the deltaic and outwash sands and gravels.

Two late Pleistocene advances of ice in the Red River Valley led to the formation of two units of the Fordville aquifer (figure 5): an early advance from the northwest, and a later advance from the northeast that led to the development of the Edinburg moraine, which overlies and confines the older, lower portion of the aquifer on the east (Gerla and Patch, 2002). The lower portion of the aquifer was formed by the deposition of shale-rich sediments transported from the west (figure 5, left). Coarser sediments with a greater crystalline fraction were derived from the later westward advance (figure 5, center). The eastern part of the aquifer was overridden by ice and clay till of the Edinburg moraine was deposited on top of the Fordville aquifer (figure 5, center). Downcutting into the underlying till by the Middle Branch and North Branch Forest River in the southern part of the aquifer has exposed the older sediments (figure 5, right).

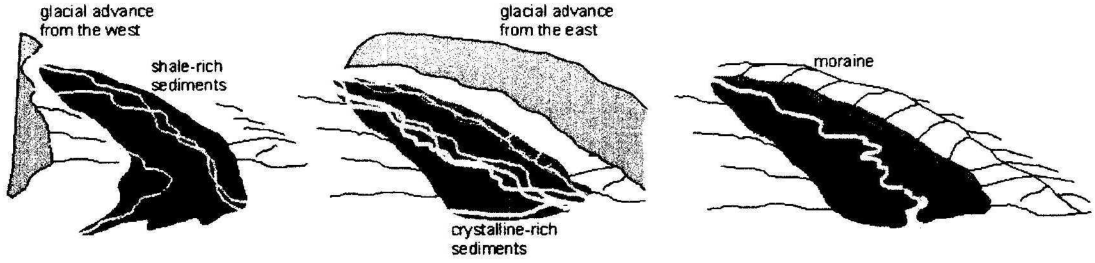

Figure 5. Sequence of Aquifer Development (from Gerla and Patch, 2002)

Soils overlying the aquifer are of the Walsh association which are moderately well-drained loams formed in the shaley alluvium and underlain by sand and gravel. Permeabilities range from 0.4 to 12.6 feet per day and available water-holding capacities range from 0.05 to 0.2 inches per inch in the top 60 inches of the soil profile. The relatively large permeability coupled with a relatively small water-holding capacity facilitates rapid deep infiltration of precipitation and snowmelt (recharge) to the underlying Fordville aquifer. Soils on the Edinburg moraine are generally loams of the Barnes-Buse association (Hetzler et al, 1972). Permeabilities range from 0.4 to 1.3 feet and available water-holding capacities range from 0.16 to 0.2 inches per inch in the top 60 inches of the soil profile. Lower permeabilities and higher available water-holding capacities are conducive to smaller recharge rates to the aquifer.

Hydrogeology of the Fordville aquifer

Aquifer geometry and composition

The Fordville aquifer was originally described in the Nelson-Walsh County Ground Water Study (Downey, 1973). For this current study, additional test holes were drilled along a series of east-west lines in the aquifer to develop eight geologic sections for mapping aquifer geometry (figures 6 through 14). Test drilling and water-level data indicate that the aquifer extends beneath the Edinburg moraine and pinches out as land surface drops off on the east side of the moraine. The aquifer covers approximately 44 square miles. Maximum thickness is approximately 55 feet but averages about 27 feet based on 61 test holes.

The aquifer is composed of very fine sand to coarse gravel. Finer-grained shale-rich sediment is found in the lower portions of the aquifer, whereas, coarser-grained, primarily crystalline rock and quartz are found in the upper portions of the aquifer.

Occurrence and Movement of Ground Water

The Fordville aquifer is for the most part unconfined. Although only a few observation wells were installed in the aquifer where it underlies the Edinburg moraine, the water levels are below the contact of the glacial till and the sand and gravel. The aquifer is essentially unconfined even though there may be 60 or more feet of till comprising the Edinburg Moraine above the sand and gravel.

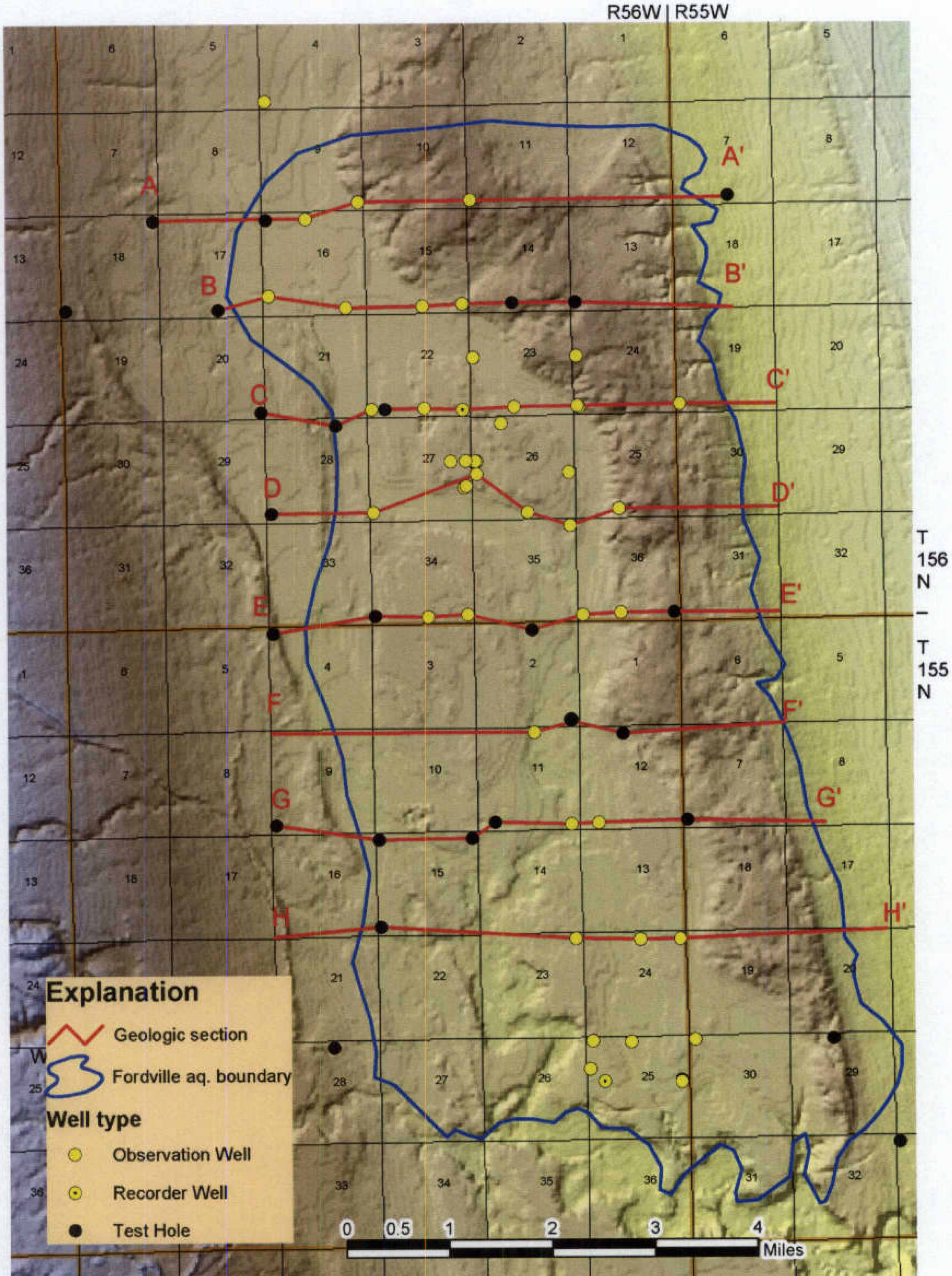

Figure 6. Location of wells, test holes, and geologic sections A-A' through H-H' in the Fordville aquifer study area.

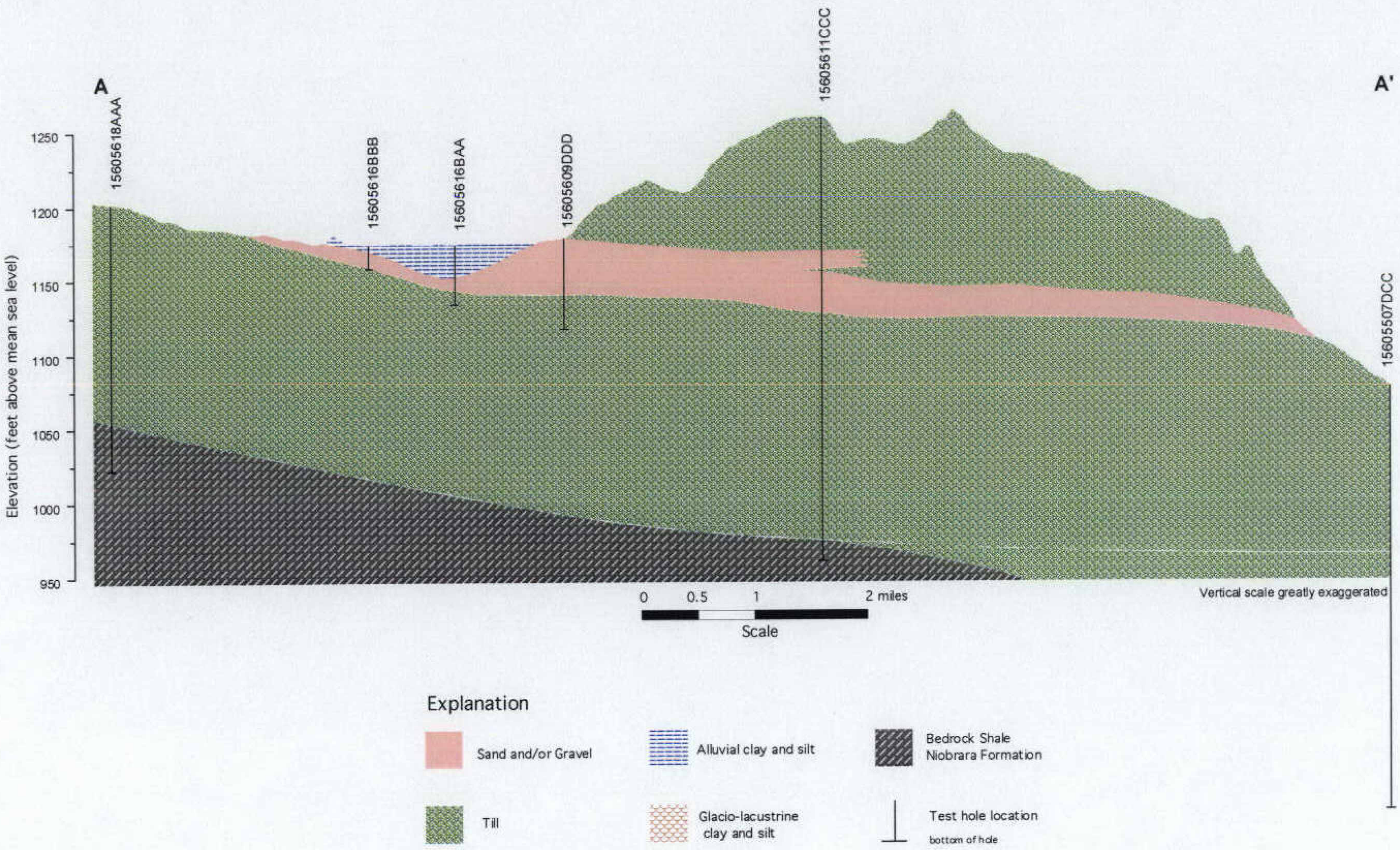

Figure 7. Geologic section A-A'

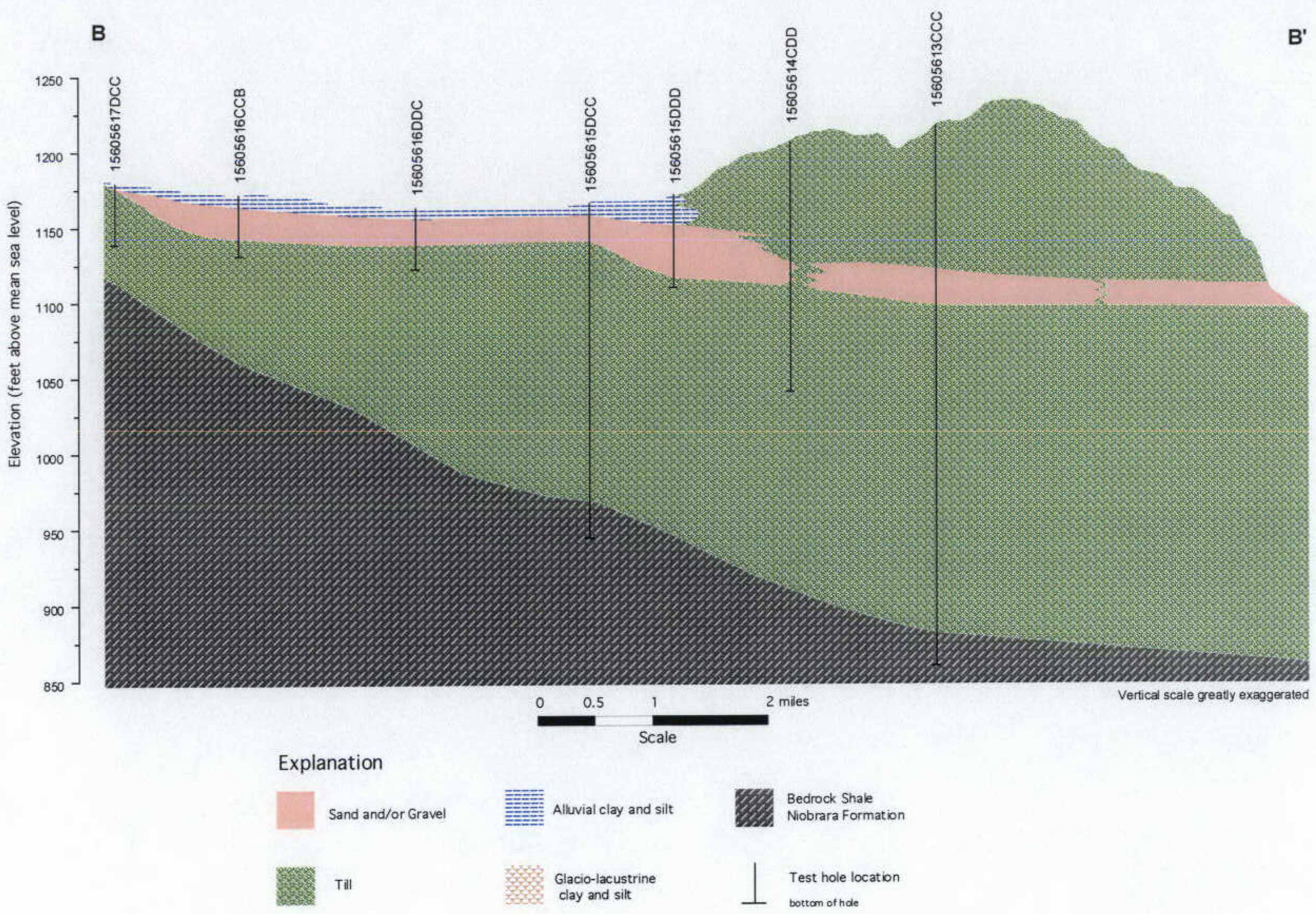

Figure 8. Geologic section B-B'

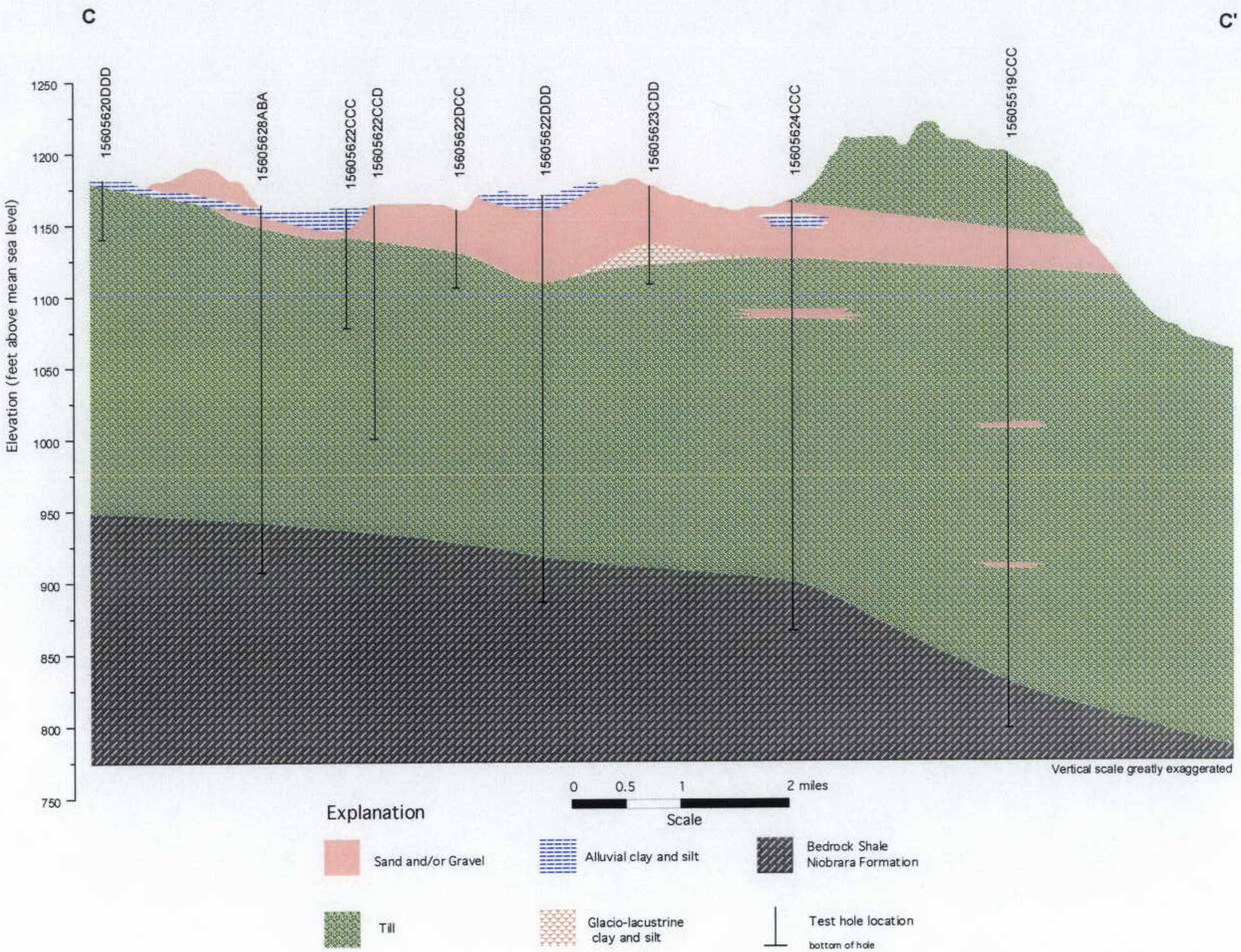

Figure 9. Geologic section C-C'

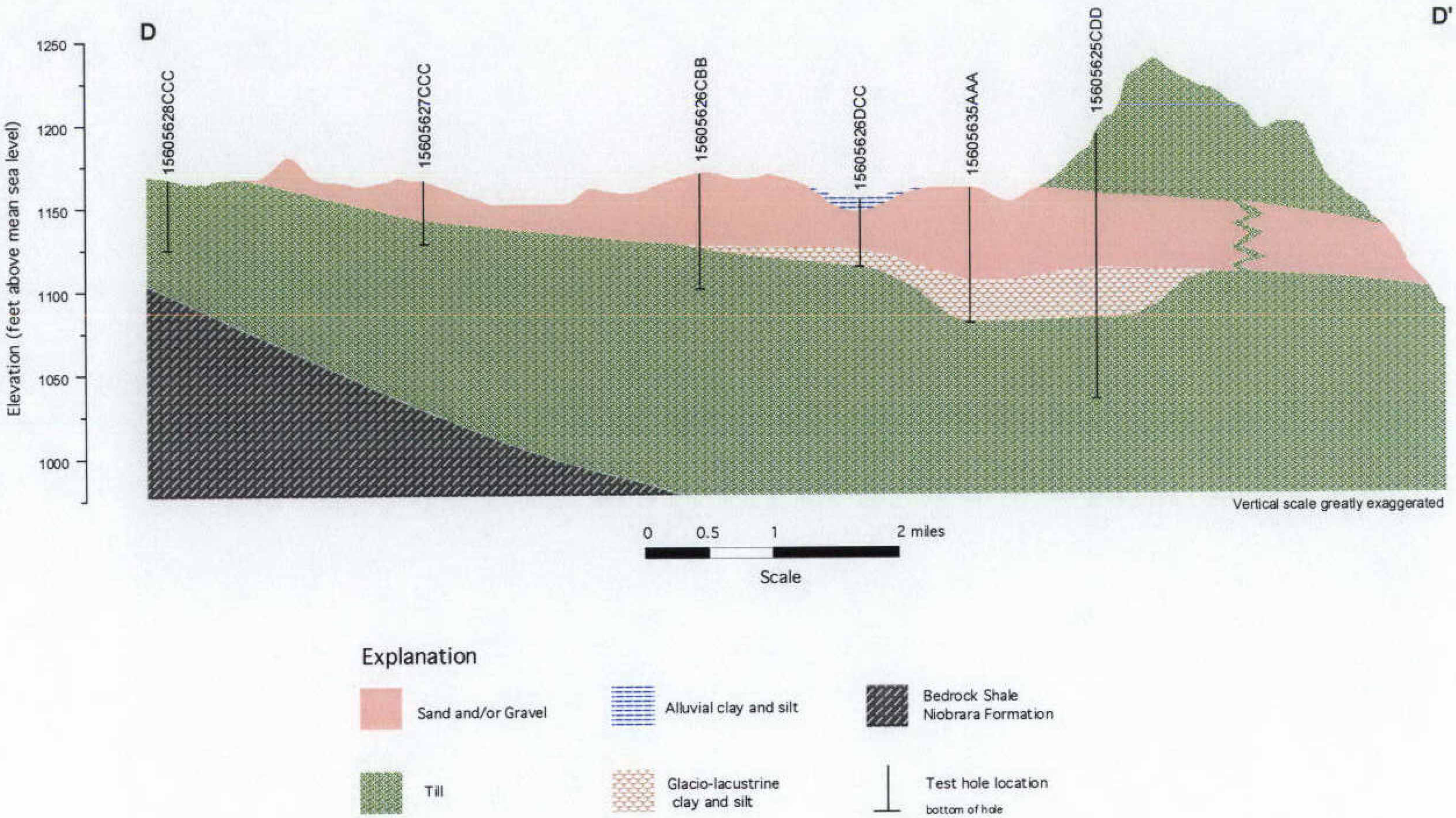

Figure 10. Geologic section D-D'

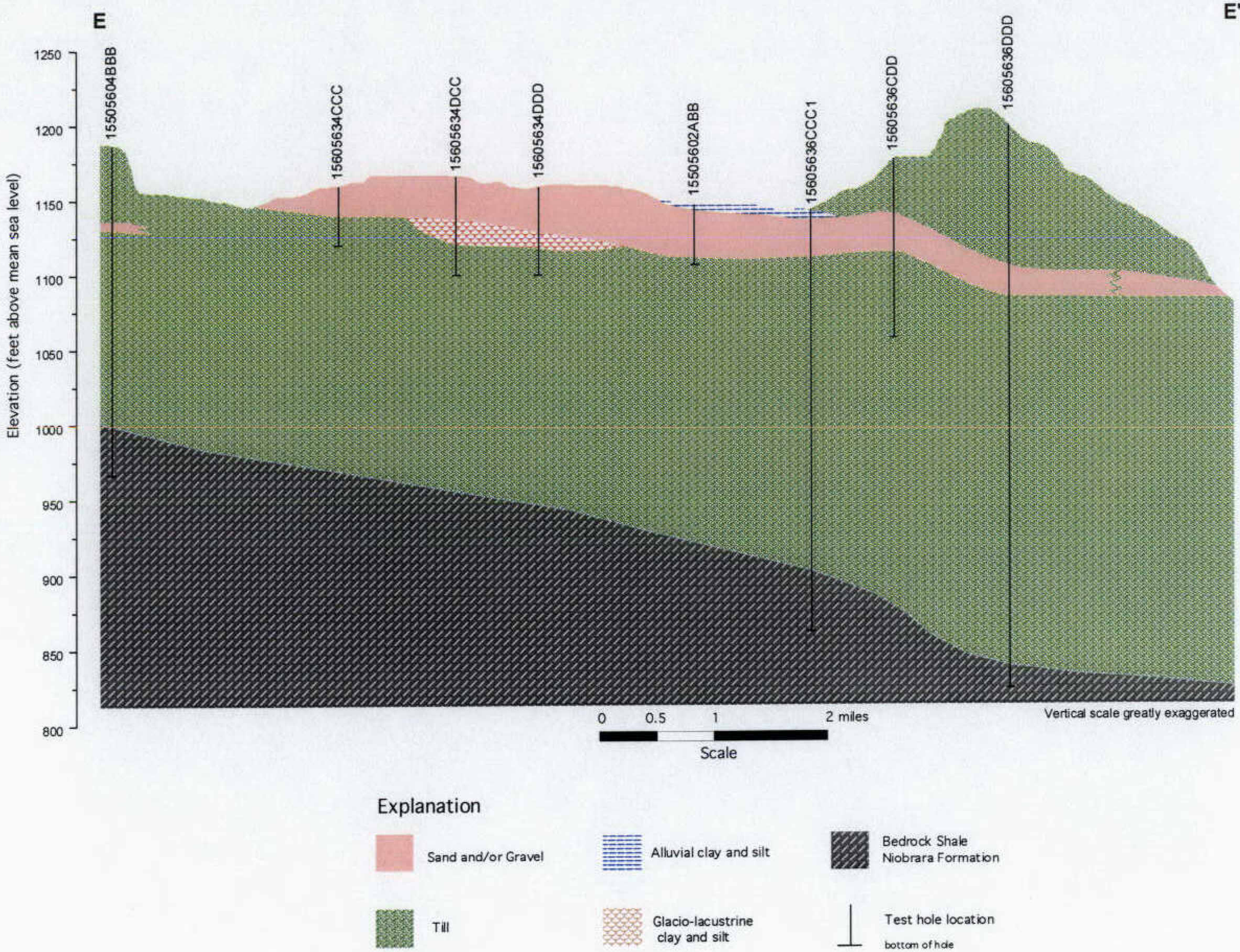

Figure 11. Geologic section E-E'

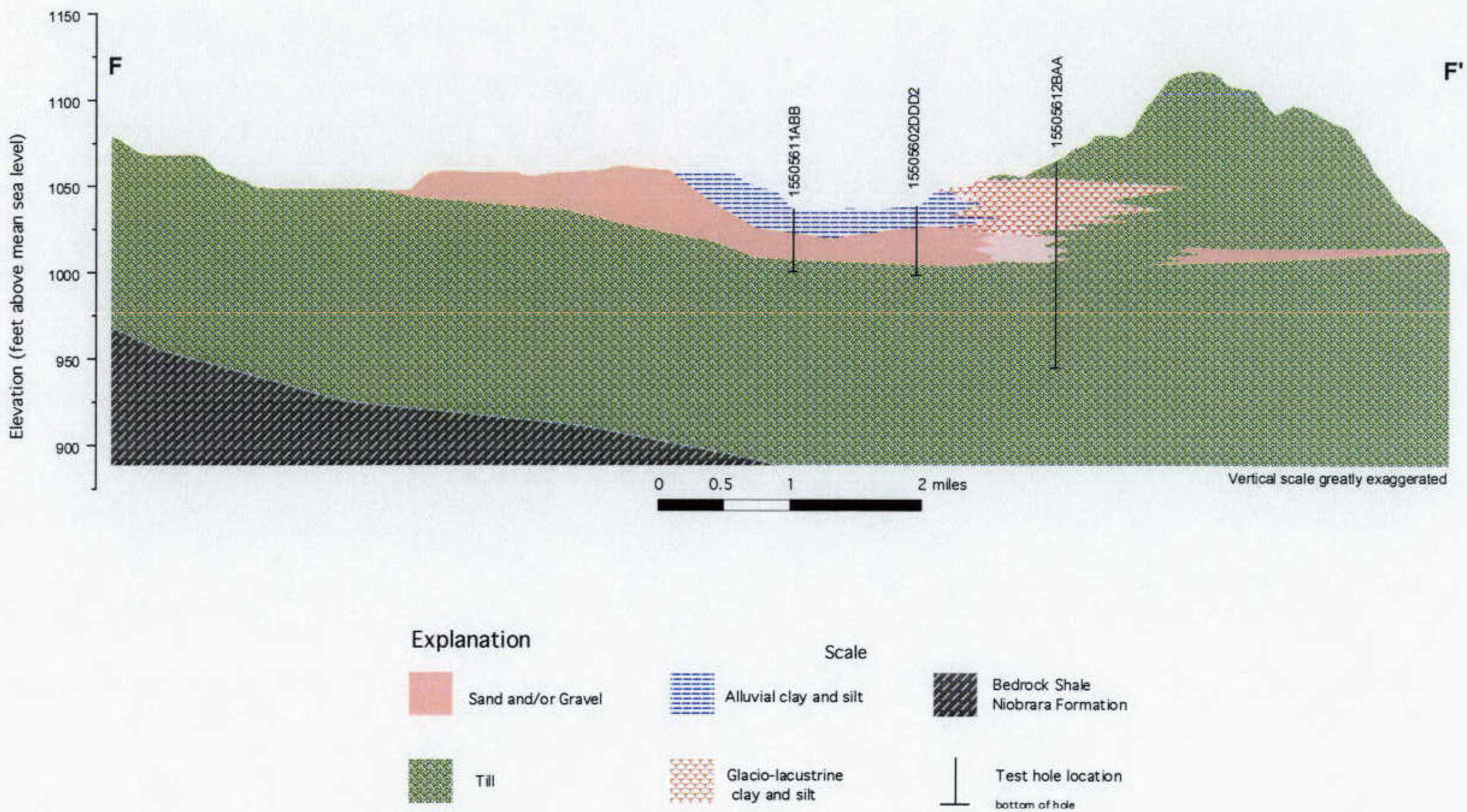

Figure 12. Geologic section F-F'

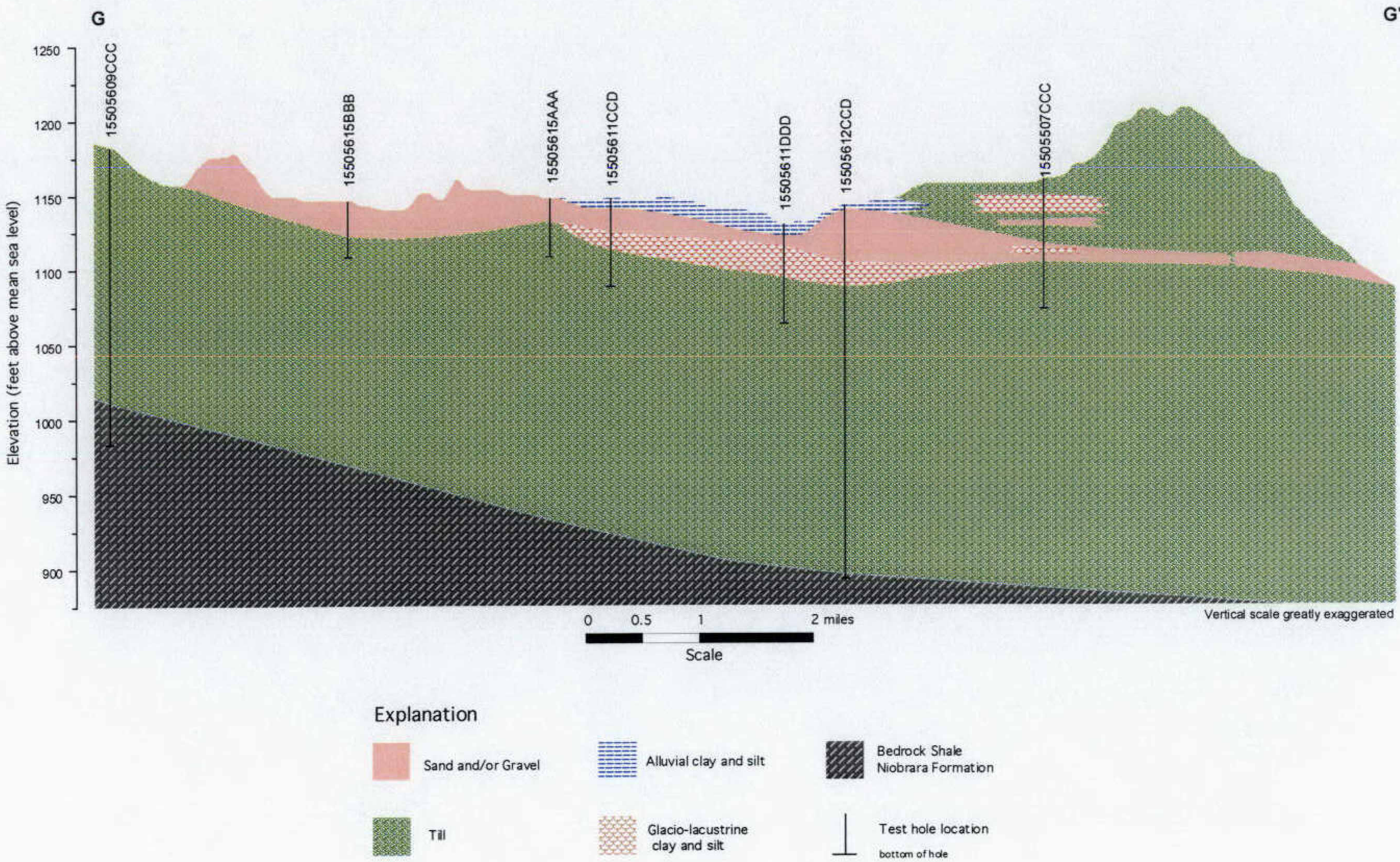

Figure 13. Geologic section G-G'

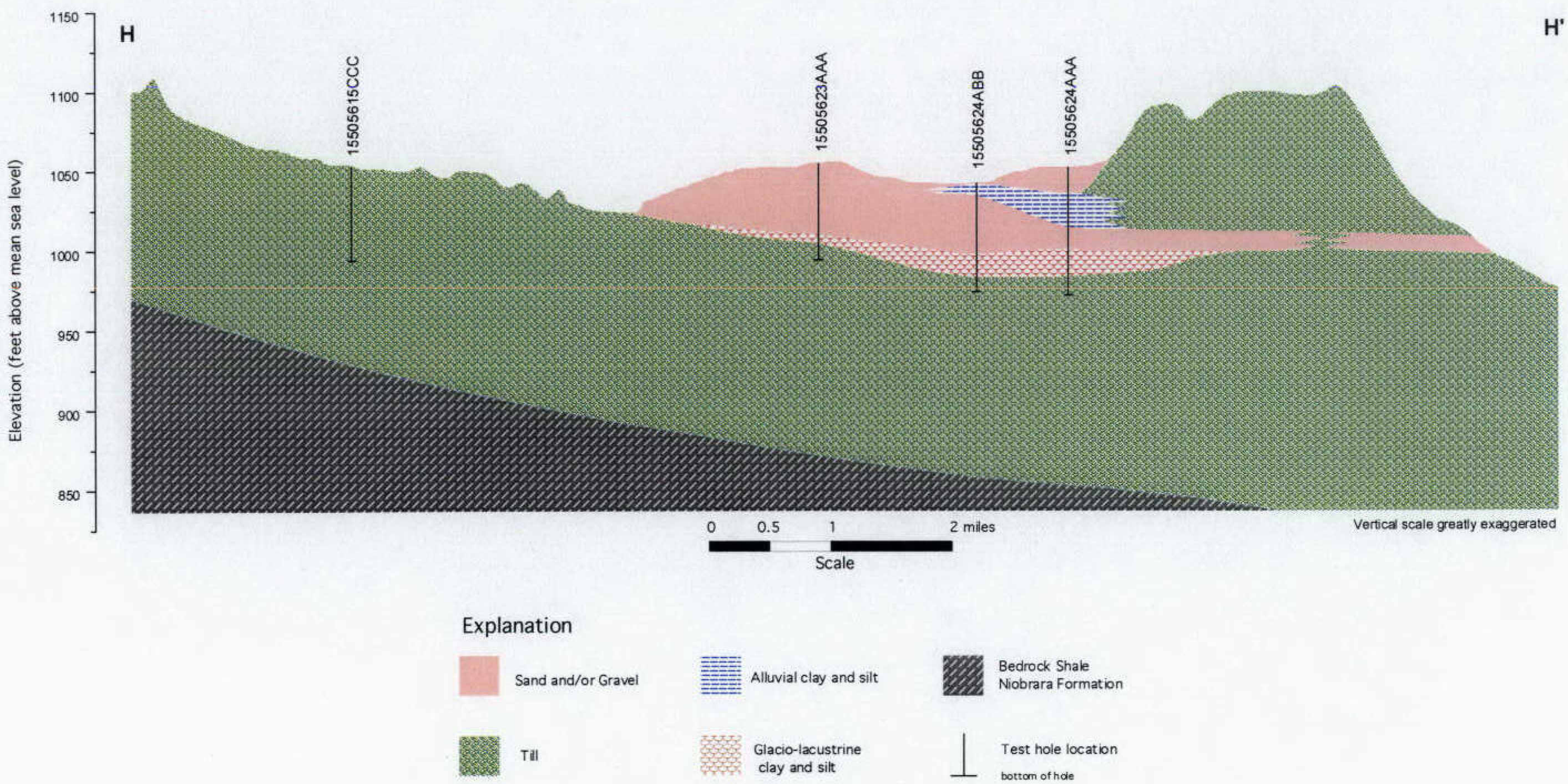

Figure 14. Geologic section H-H'

Water levels range from 5 feet to 30 feet below land surface in most areas of the aquifer which are not covered by the Edinburg moraine. Under the moraine, depth to water can be up to 85 feet. Based on 32 test holes, the average saturated thickness of the Fordville aquifer is about 20 feet.

In the north part of the Fordville aquifer, ground-water flow is east-southeast toward the Edinburg moraine (figure 15). This supports the concept that the Fordville aquifer extends eastward beneath the Edinburg moraine and eventually discharges along the eastern flank of the Edinburg moraine into the inter-beach area (figure 4). In the south part of the Fordville aquifer, ground-water flow generally is south toward the Middle Branch of the Forest River.

The North Branch of the Forest River traverses the aquifer from about Section 17, T156N-R65W to about Section 26, T155N-R56W where it flows out of the aquifer area and coalesces with the Middle Branch of the Forest River. The North Branch of the Forest River is a losing river in the upper reach from Section 17, T156N-R56W to about Sections 27 & 28, T156N-R56W, after which it becomes a gaining river for the rest of its length through the aquifer.

Observation well hydrographs for several selected wells which have been monitored for several years are shown in figure 16. Water levels in wells located near the north end of the aquifer (156-56-16CCB and 16DDC) where the North Branch of the Forest River enters the aquifer area show sharp rises in the spring when larger flows

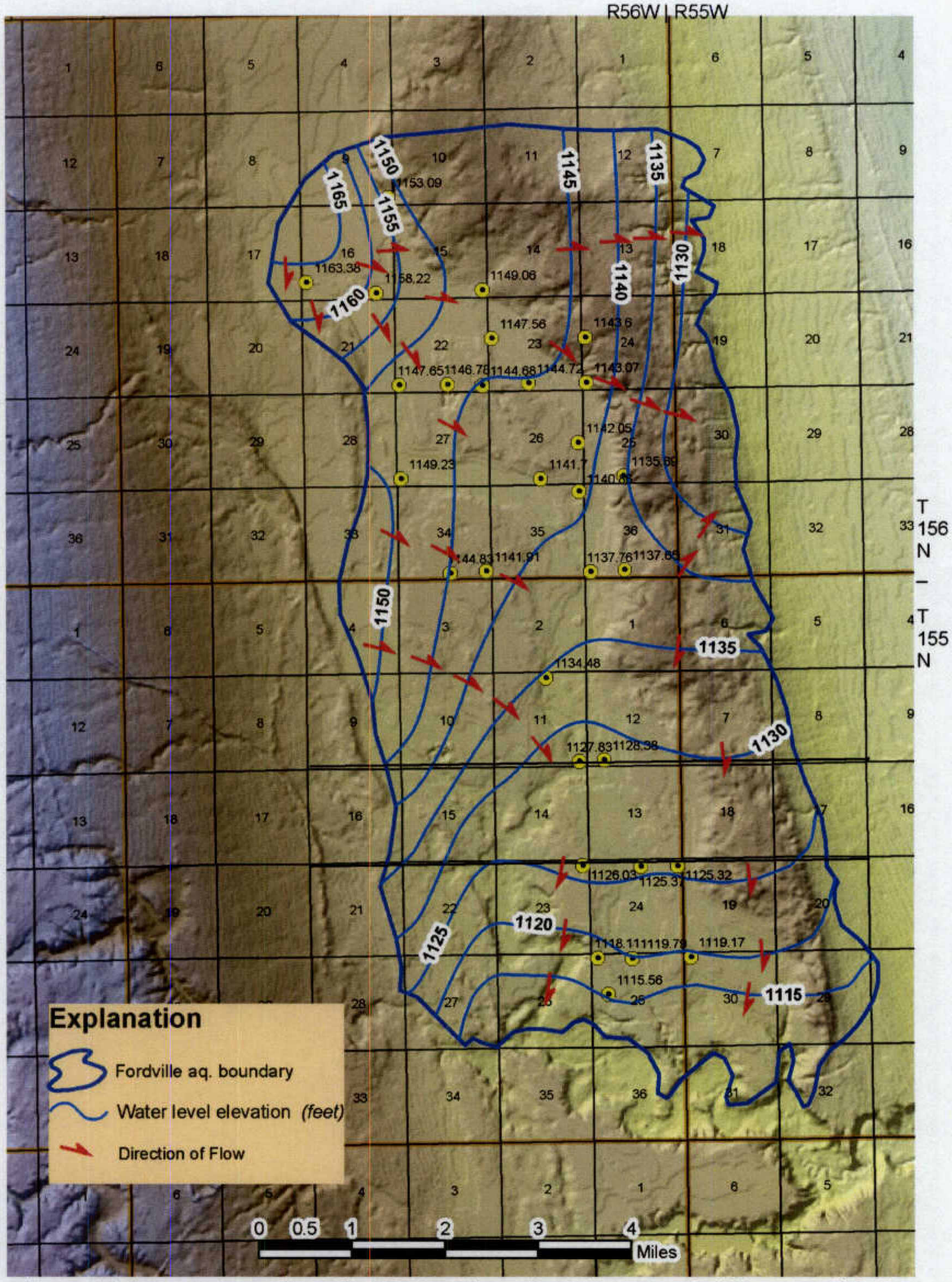

Figure 15. Water level elevation in the Fordville aquifer based on December, 2001 water level measurements.

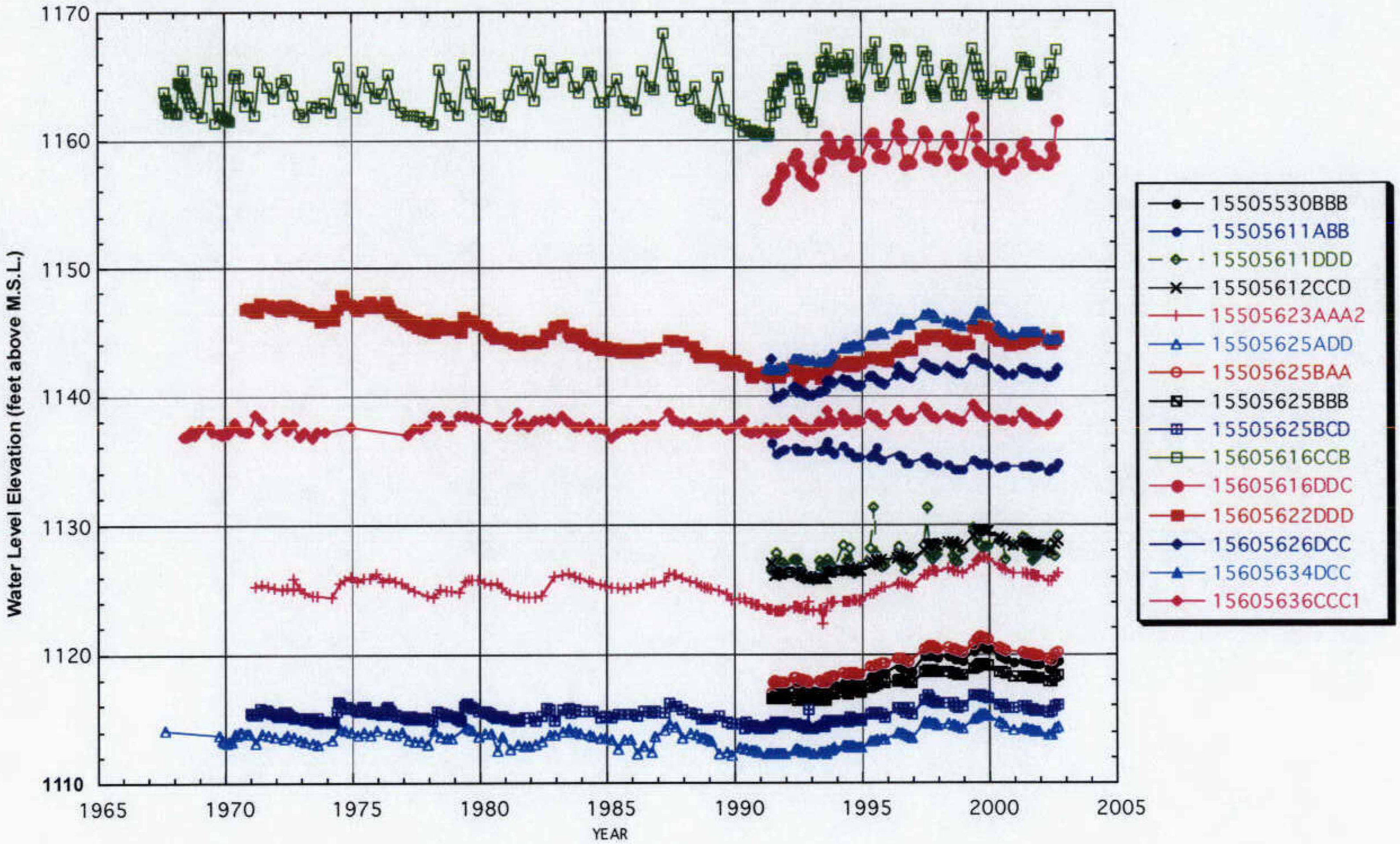

Figure 16. Hydrographs of observation wells in the Fordville aquifer.

occur in the river from snowmelt runoff. This supports the concept of the river being a losing stream in this area.

Generally, water levels in most parts of the aquifer fluctuate in response to variations in climate. Correlation with precipitation trends can be seen when comparing the 5-year moving average of the annual precipitation totals with ground-water levels. Figure 17 shows the 5-year moving average of the annual precipitation totals recorded at the "Adams 7 SSW" National Climate Data Center climate station (National Climate Data Center, 2002), located a few miles north west of the Fordville aquifer, with observation well hydrograph 155-56-23AAA2.

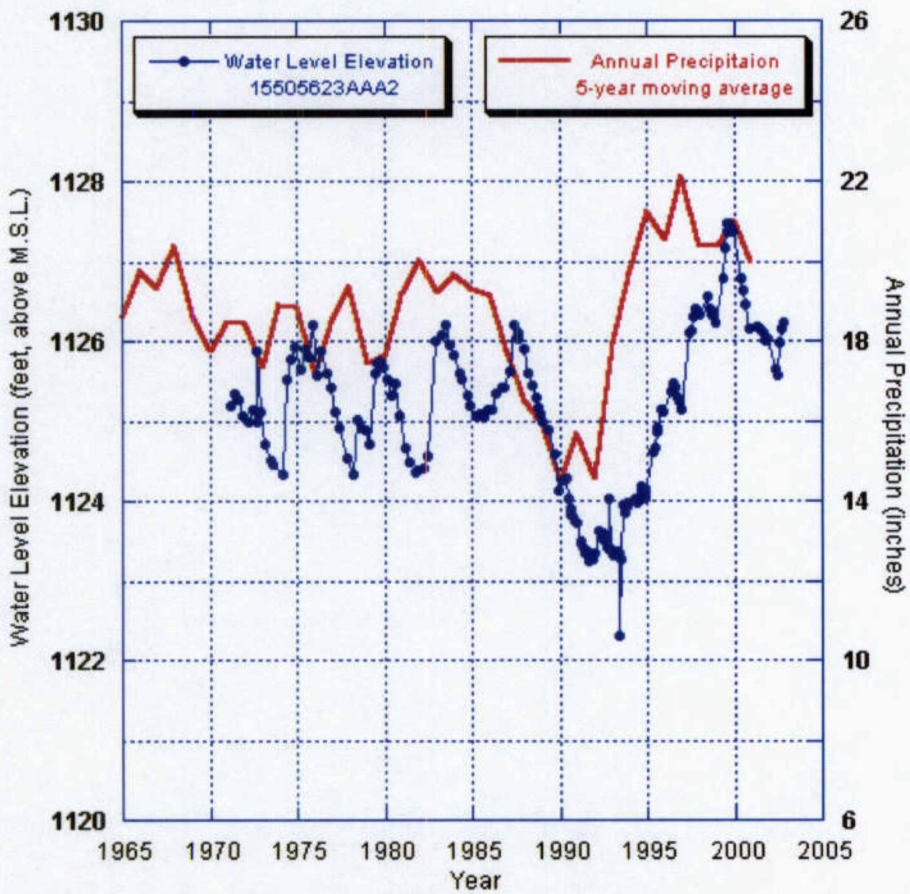

Figure 17. 5-year moving average of annual precipitation and observation well hydrograph.

Most of the hydrographs show a water level decline of 2 to 3 feet during the drought period of 1988 to 1992. The subsequent normal and above normal precipitation years through the rest of the 1990's caused a general water-level rise throughout the aquifer of about the same amount.

Observation well 156-56-22DDD (figure 16) is located adjacent to the Walsh Rural Water District water supply well field. A comparison of water levels recorded from this well were made with water-level measurements taken from a well located at 155-56-23AAA2, which has no major nearby water-supply developments. Figure 18 shows the residual difference between these two wells. The residual difference is caused primarily by pumping by Walsh Rural Water District. Water levels is this area show a general developmental decline of about three feet since pumping began in the mid-1970s to about 1985. After 1985, the trend has leveled out indicating no additional developmental decline has occurred.

Recharge

The primary sources of recharge to the Fordville aquifer are direct infiltration of rainfall and snowmelt and infiltration of water delivered to the area by runoff from the topographically higher adjacent areas and watersheds which feed the North Branch of the Forest River. Leakage from adjacent sediments probably contributes a small amount of water to the aquifer.

Soils overlying the most of the aquifer have relatively large permeabilities and small water-holding capacities which facilitates rapid deep infiltration of precipitation and snowmelt. Soils on the Edinburg moraine have lower permeabilities and higher available water holding capacities, resulting in lower recharge rates to the aquifer under the moraine.

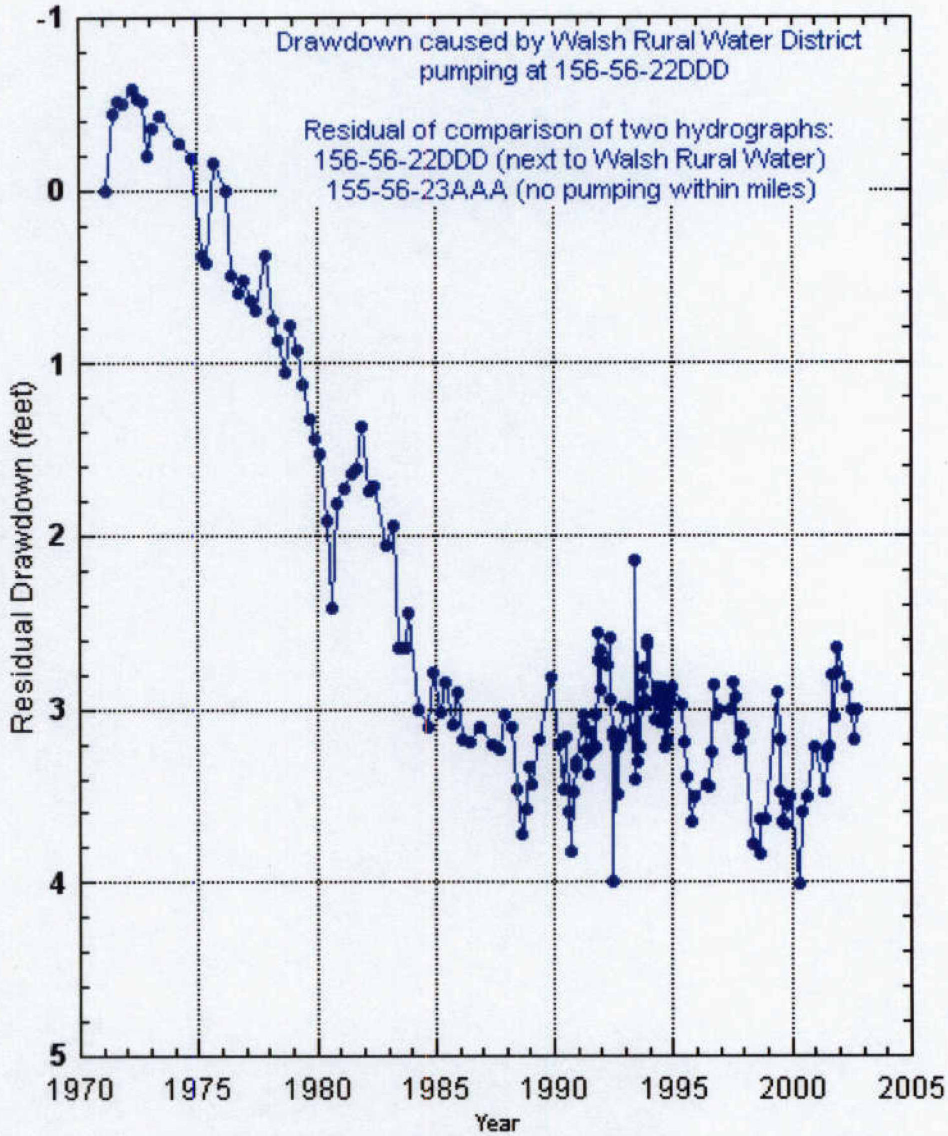

Figure 18. Developmental decline at 156-56-22DDD caused by Walsh Rural Water District.

Most of the aquifer if unconfined, although there are areas where thin silty clays are present just below the soil zone. This unit, which is probably a loess or alluvium, is highly weathered and oxidized and is characterized by fractures and scattered interlayered sands and gravels, as a result, the bulk hydraulic conductivity likely is relatively large thereby facilitating surface recharge to the underlying Fordville aquifer.

Recharge rates are estimated at 0.2 inches/year (in areas under the Edinburg Moraine) and up to 4 inches/year in areas with coarse textured soils and no impeding alluvial silty clay layer near the surface.

Discharge

The aquifer discharges ground water to the North Branch of the Forest River as it traverses the aquifer and to the Middle Branch of the Forest River on the southern edge of the aquifer through springs and seeps. Discharge also occurs through springs and seeps on the eastern side of the Edinburg moraine at the inter-beach area.

Stream gaging was performed at several locations along the North and Middle Branches of the Forest River to quantify discharge from the aquifer (figure 19). Table 1 lists the measured values at the specified locations. Site 4 is located on the Middle Branch upstream of the potential aquifer discharge. This site was chosen to measure baseflow in the river prior to entering the gaining reach of the Middle Branch of the Forest River. Site 1 overlies the aquifer near where the stream enters the Fordville boundary. This site was also chosen to determine if significant surface flow was being delivered to the region from outside the aquifer boundary during baseflow periods. Sites 2, 3, and 4 were chosen to assess the increase in baseflow derived from aquifer discharge. Site 6, the farthest downstream gage, represents the total baseflow from the aquifer less the flow at sites 1 and 4.

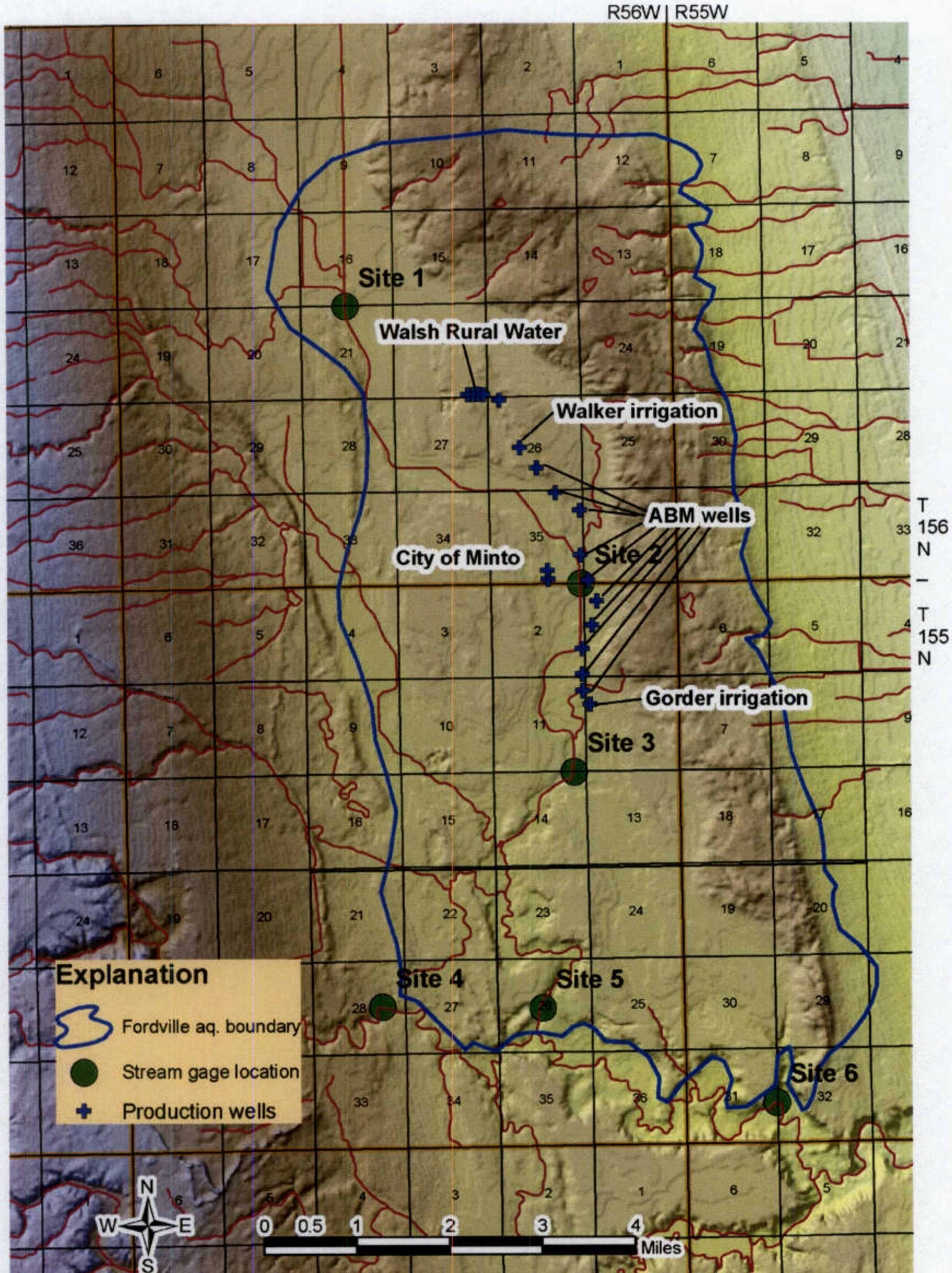

Figure 19. Stream gage locations on the North and Middle Branches of the Forest River and permitted water users in the Fordville aquifer.

Table 1. Stream-flow measurements along the North and Middle Branches of the Forest River in the Fordville aquifer study area (cubic feet per second).

		8/29/00	9/14/00	9/28/00	10/11/00	10/24/00	8/29/01	9/13/01	9/26/01	10/10/01	11/8/01
Site 1	156-56-16CCD	dry	dry	dry	dry	dry	dry	dry	dry	dry	dry
Site 2	155-56-02AAA	0.831	0.737	1.43	0.591	0.65	1.074	0.979	0.861	1.001	1.046
Site 3	155-56-14AAA	2.248	2.005	2.029	1.935	2.062	2.601	2.221	2.44	2.331	2.707
Site 4	155-56-28ADC	0.563	0.063	0.135	0.194	0.236	0.138	dry	trickle	0.115	0.818
Site 5	155-56-26CAA	--	--	2.822	3.201	2.415	2.755	2.138	2.786	3.875	4.087
Site 6	155-55-31DDB	4.297	beavers	beavers	beavers	beavers	4.224	2.906	3.89	6.47	7.25

Discharge from the Fordville aquifer also occurs from pumping large-capacity wells for municipal, rural water, and irrigation purposes. Figure 20 is a graph of the reported annual water use from large-capacity wells in the Fordville aquifer.

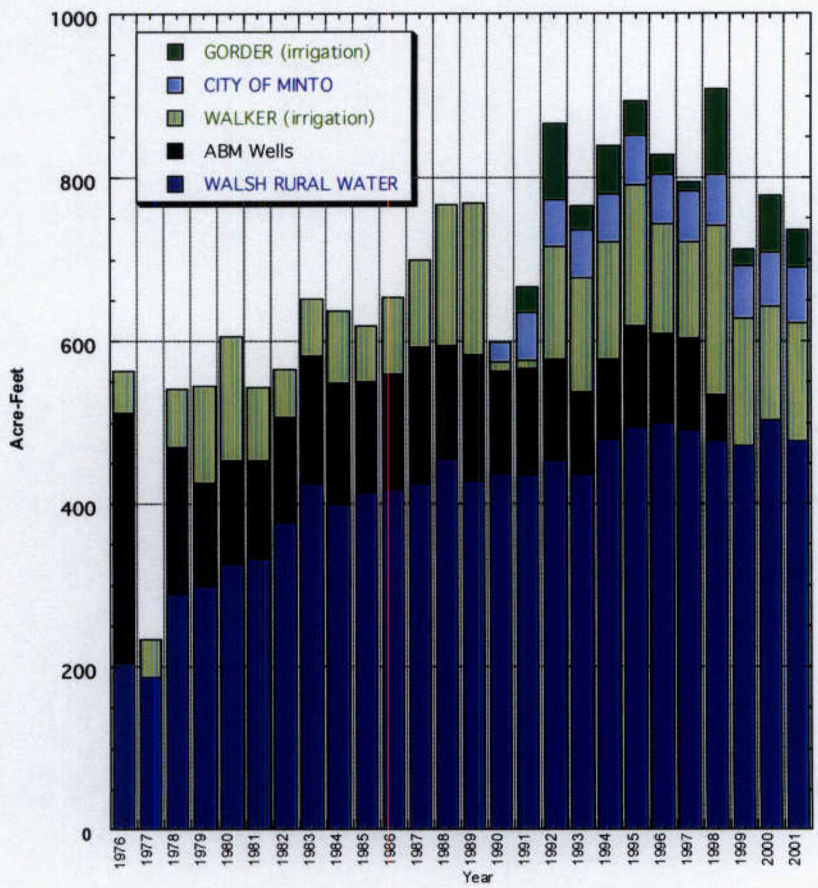

Figure 20. Reported water use from the Fordville aquifer.

Ground-Water Quality

Discussion of Chemical Properties and Major Ions

The physical properties and mineral constituents that affect the water's suitability for human consumption and for irrigation purposes as determined for this study are described below. Dissolved mineral constituents in water are usually reported in milligrams per liter (mg/l) or micrograms per liter (µg/l). A milligram per liter is one-thousandth (0.001) of a gram of dissolved material per liter of solution. At low concentrations one milligram per liter is similar to one part per million. A microgram per liter is one-thousandth of a milligram per liter or one-millionth (0.000001) of a gram of dissolved material per liter of solution. At low concentrations one microgram per liter is similar to one part per billion. Milligrams per liter can be converted to grains per gallon by dividing milligrams per liter by 17.12 (Hem, 1970, p.81).

Specific conductance, reported in micromhos per centimeter at 25^{o} Celsius, is a measure of the ability of water to conduct an electric current. At low concentrations the dissolved solids concentration of a sample in milligrams per liter is about 65-70% of the specific conductance (in micromhos); however, this relation is not constant and will vary with the chemical composition of the water (Hem, 1970).

Hydrogen-ion concentration, (field pH), is a measure of the solvent capacity of water. The hydrogen-ion concentration affects the corrosiveness of water. A pH of 7.0 indicates the water is neutral, neither acidic nor basic. Readings progressively lower than 7.0 denote increasing acidity, and those progressively higher than 7.0 denote increasing alkalinity.

Temperature of water will influence the concentration of dissolved gases and mineral matter. Water temperatures presented in this report were measured immediately after collection and are expressed in degrees Celsius (Centigrade). Degrees Celsius can be converted to degrees Fahrenheit using the following equation: Degrees Fahrenheit = (9/5) degrees Celsius + 32.

Hardness is principally caused by dissolved calcium and magnesium. Hard water requires greater quantities of soap to produce a lather and forms a scale on fixtures. Hardness equivalent to alkalinity is called carbonate hardness, and any excess is called noncarbonate hardness. The carbonate hardness is the quantity that will contribute scale on heating, and the noncarbonate hardness is the quantity of hardness that will remain after removal of the carbonate hardness. Water with calcium and magnesium hardness (as CaCO3) of 60 mg/l or less is considered soft, 61-120 mg/l as moderately hard, 121-180 mg/l as hard, and over 180 mg/l as very hard.

Sodium-adsorption ratio (SAR) relates to the degree water enters into cation-exchange reactions with soil. Sodium-adsorption ratio is expressed by the equation:

$$SAR = \frac{Na^+}{\sqrt{\frac{[Ca^{++}] + [Mg^{++}]}{2}}}$$

where the concentrations of the ions are expressed in milli-equivalents per liter. The sodium-adsorption ratio of water indicates its usefulness for irrigation of different crops on different types of soil.

Residual sodium carbonate (RSC) is twice the amount of carbonate or bicarbonate a water would contain after subtracting an amount equivalent to the calcium plus the magnesium, that is, $RSC = 2(HCO_3 + CO_3 - Ca - Mg)$, in milliequivalents per liter. It is useful for evaluating irrigation/soil compatibility.

Percent sodium is the percentage of cations in milliequivalents per liter that are sodium. The displacement of calcium and magnesium by sodium in soils is slight unless the percent sodium is considerably higher than 50.

Calcium and Magnesium (Ca and Mg) ions commonly are derived from the dissolution of carbonate (limestone and dolomite) rocks. Calcium and magnesium cause water hardness and form scale.

Sodium and Potassium (Na and K) are present in many rocks. Sodium dissolves readily and when brought into solution it tends to remain in solution. Potassium is dissolved with greater difficulty and exhibits a stronger tendency to be reincorporated into solid weathering products, especially clay minerals. In most natural water, the concentration of potassium is much lower than the concentration of sodium. Water that contains a large proportion of sodium salts may be unsatisfactory for irrigation on certain types of poorly drained soils. The presence of several hundred milligrams per liter of sodium in water can make it unsuitable for use in sodium-restricted diets (North Dakota State Department of Health, 1962).

Iron (Fe) is a widespread constituent in rocks and is easily leached by ground water under reducing conditions or in acidic water. Water containing more than 0.3 mg/l of iron, after exposure to air, may become discolored. Reddish-brown stains on porcelain or enamelware and fixtures and on fabrics washed in the water result from the oxidized iron.

Manganese (Mn) in concentrations as low as 0.2 mg/l may when exposed to oxygen cause a dark-brown or black stain on fabrics and porcelain fixtures. Ground water that contains high concentrations of iron may also have considerable amounts of manganese.

Fluoride (F) in ground water probably is derived from solution of fluorite, apatite, and hornblende minerals. High fluoride content may cause mottling of tooth enamel in children's teeth during calcification.

Bicarbonate and Carbonate (HCO_3 and CO_3) ions are the major cause of alkalinity in most water. The significance of alkalinity to the domestic, agricultural, and industrial user is usually dependent upon the nature of the cations (Ca, Mg, Na, and K) associated with it. However, moderate amounts of alkalinity do not adversely affect most uses. Alkalinity can be calculated from water analyses by using the formula: Alkalinity (as $CaCO_3$) = 0.82 (HCO_3) + 1.67 (CO_3).

Sulfate (SO_4) ions may be converted from metallic sulfide minerals upon weathering or with bacterial action. Sulfate also may be dissolved from beds of gypsum and deposits of sodium sulfate and other sulfosalts.

Chloride (Cl) is present in all natural waters, but the concentrations usually are low. Important sources of chloride are sedimentary rocks that were deposited under marine conditions. Chloride concentrations of 400 mg/l impart a noticeable salty taste for most people.

Nitrate (NO_3) concentrations at high levels in shallow ground water has been attributed to leaching in feedlots or to fertilizer from cropland fields where nitrogen compounds have been applied. High nitrate content is undesirable in drinking water because of its bitter taste and it has been reported to cause methemoglobinemia (blue babies) in infants (Comly, 1945).

Total dissolved solids (TDS) is calculated from the weight of residue on evaporation at 180^{O} Celsius from a known volume of water (TDS Determined) or by a summation of the analytes (TDS Calculated). TDS Calculated values were used in this study.

General Water Chemistry of the Fordville Aquifer

Several processes in nature affect the ground water from its inception to the subsurface flow system to the time it is discharges from the system. To gain a better understanding of the ground-water flow system and to determine suitability for use, water samples were collected for chemical analysis from 32 monitoring wells within the study area. The analyses include determinations of specific conductance, pH, temperature, hardness, sodium-adsorption ratio, residual sodium carbonate, percent sodium; mineral concentrations of magnesium, potassium, sodium, iron, manganese, fluoride, bicarbonate, carbonate, sulfate, chloride, nitrate; and the total dissolved-solids concentration. Summary results of the analyses are shown in Table 2. Individual analyses for the 32 monitoring wells are listed in the Table 7 of the Appendix.

Ground water in the Fordville aquifer is predominantly a calcium-bicarbonate type (figure 21). Some of the samples have significant sulfate proportions but none are over 50% of the total anions which would cause them to be classified as a "dominant" ion. Total dissolved solids (TDS) concentrations ranged from 298 to 760 mg/l and averaged 458 mg/l (Table 2). The range and absolute mean values of calcium, magnesium, sodium, chloride, sulfate, and bicarbonate is shown in figure 22.

The conceptual model of ground-water chemistry must account for the generally low dissolved solids concentration throughout the flow system. It must also account for calcium and bicarbonate as the dominant ions. A relatively low dissolved solids, calcium-bicarbonate type water with lesser amounts of sulfate, magnesium and sodium is explained by the following geochemical processes (Moran and others, 1978):

1) Oxidation of organic carbon in the soil producing carbon dioxide (CO_2).
2) Carbon dioxide dissolves in downward infiltrating ground-water recharge which becomes acidic due to the production of carbonic acid (H_2CO_3).

Table 2. Summary of the chemical analyses from samples collected from 32 monitoring wells within the study area.

	Average	Min	Max	MCL*
Fe (mg/l)	0.24	0.02	3.10	0.30[2]
Mn (mg/l)	0.60	0.03	4.20	0.05[2]
Ca (mg/l)	90	57	160	--
Mg (mg/l)	30	15	48	--
Na (mg/l)	26	8	60	--
K (mg/l)	4	2	21	--
HCO3 (mg/l)	320	248	454	--
SO4 (mg/l)	137	21	300	250[2]
Cl (mg/l)	8	0	22	250[2]
F (mg/l)	0.25	0.10	0.50	4/2[1/2]
NO3 (mg/l)	5	0	63	45[1]
TDS (mg/l)	458	298	760	500[2]
Hardness as CaCO3 (mg/l)	348	220	600	--
NCH (mg/l)	88	0	220	--
% Na	14	4	36	--
SAR	0.63	0.20	1.70	--
Conductivity (μmhos)	684	513	992	--

*MCL based on US EPA dinking water standards (http://www.epa.gov/safewater/mcl.html)
[1] Primary drinking water standard
[2] Secondary drinking water standard

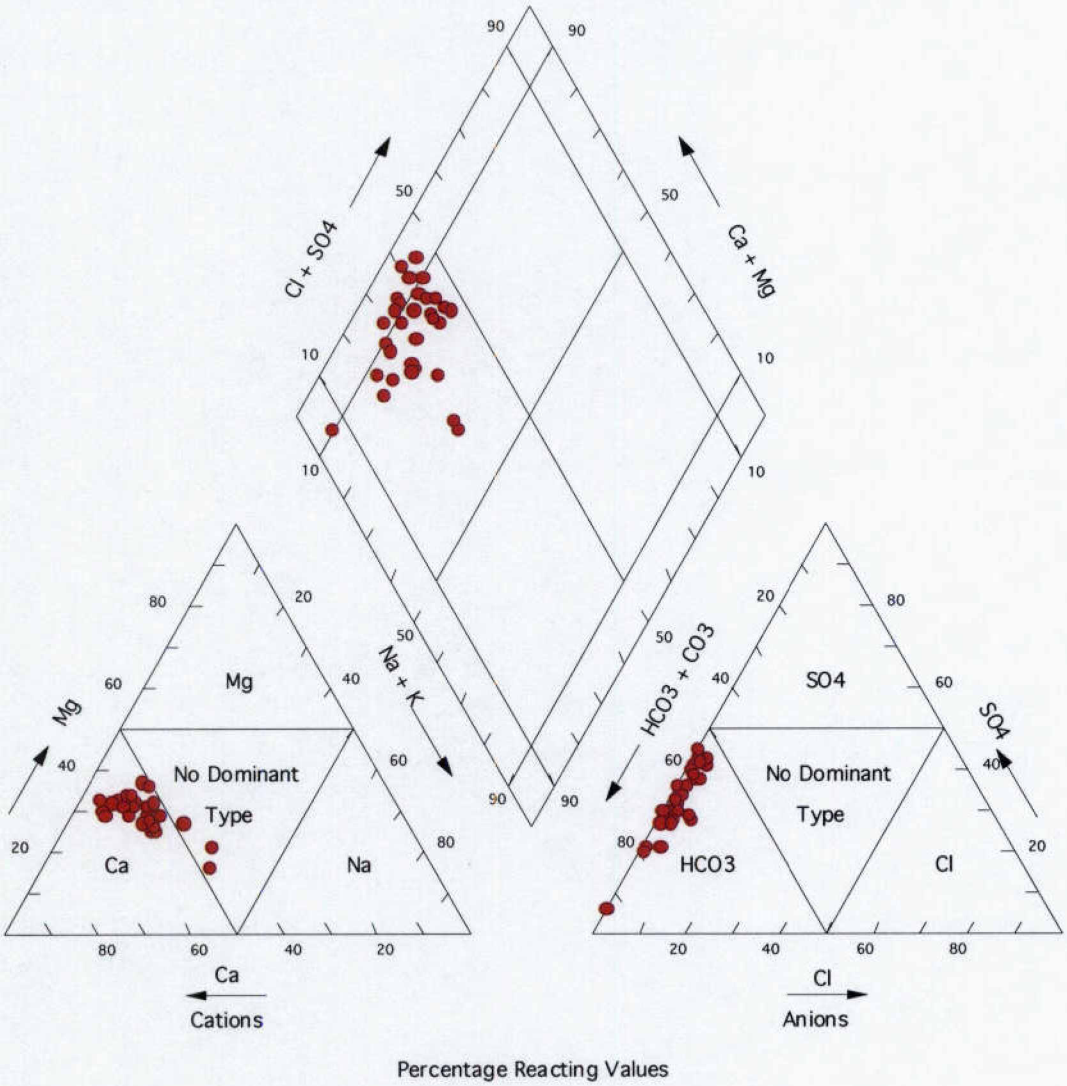

Figure 21. Relative distribution of major ions in ground water from the Fordville aquifer.

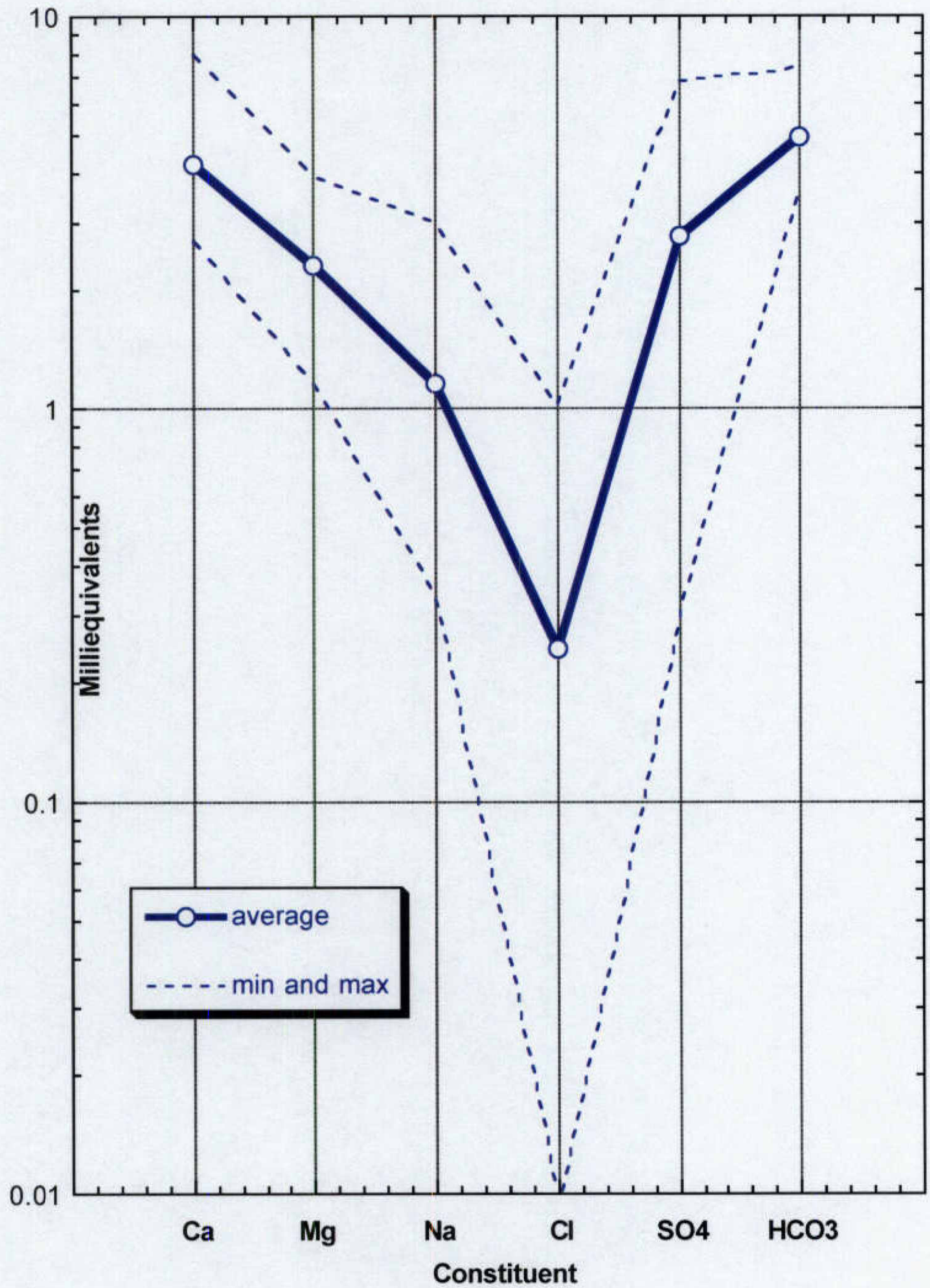

Figure 22. Mean, maximum, and minimum absolute concentrations of major ions in ground water from the Fordville aquifer.

3) The acidic ground-water dissolves carbonate minerals calcite and dolomite thereby introducing calcium (Ca^{2+}), magnesium (Mg^{2+}), and bicarbonate (HCO_3^-) ions downward infiltrating ground-water. Calcite and dolomite are ubiquitous in glacial drift throughout North Dakota. These minerals are moderately soluble in slightly acidic water and dissolution to saturation usually occurs within a matter of days (Rauch and White, 1977).

4) Sources of sulfate may be oxidation of organic sulfur or pyrite and dissolution of gypsum that may be deposited by evapotranspiration in the unsaturated zone and dissolved during subsequent recharge events.

5) Sodium is introduced by cation exchange of Ca^{2+} for Na^+ in montmorilinitic clays.

Based on the above, it is likely that much of the ground-water chemistry signature is established in the unsaturated zone prior to reaching the water table.

Spatial distribution for several constituents are shown in figures 23 through 26. Calcium concentrations (figure 23) and sulfate concentration (figure 24) increase near and under the Edinburg moraine. This supports the conceptual model that significant recharge to the Fordville aquifer occurs through the overlying till of the Edinburg moraine. As previously described, the water levels in the Fordville aquifer beneath the Edinburg moraine are below the contact between the base of the till and the top of the aquifer. It is likely that fractures (probably desiccation) occur in the overlying till. Other investigators (Grisak and others, 1976 and Patch and Knell, 1988) indicate the common occurrence gypsum deposits lining fractures in tills throughout the Interior Plains Region of North America. In the unsaturated zone gypsum deposition along fractures may be

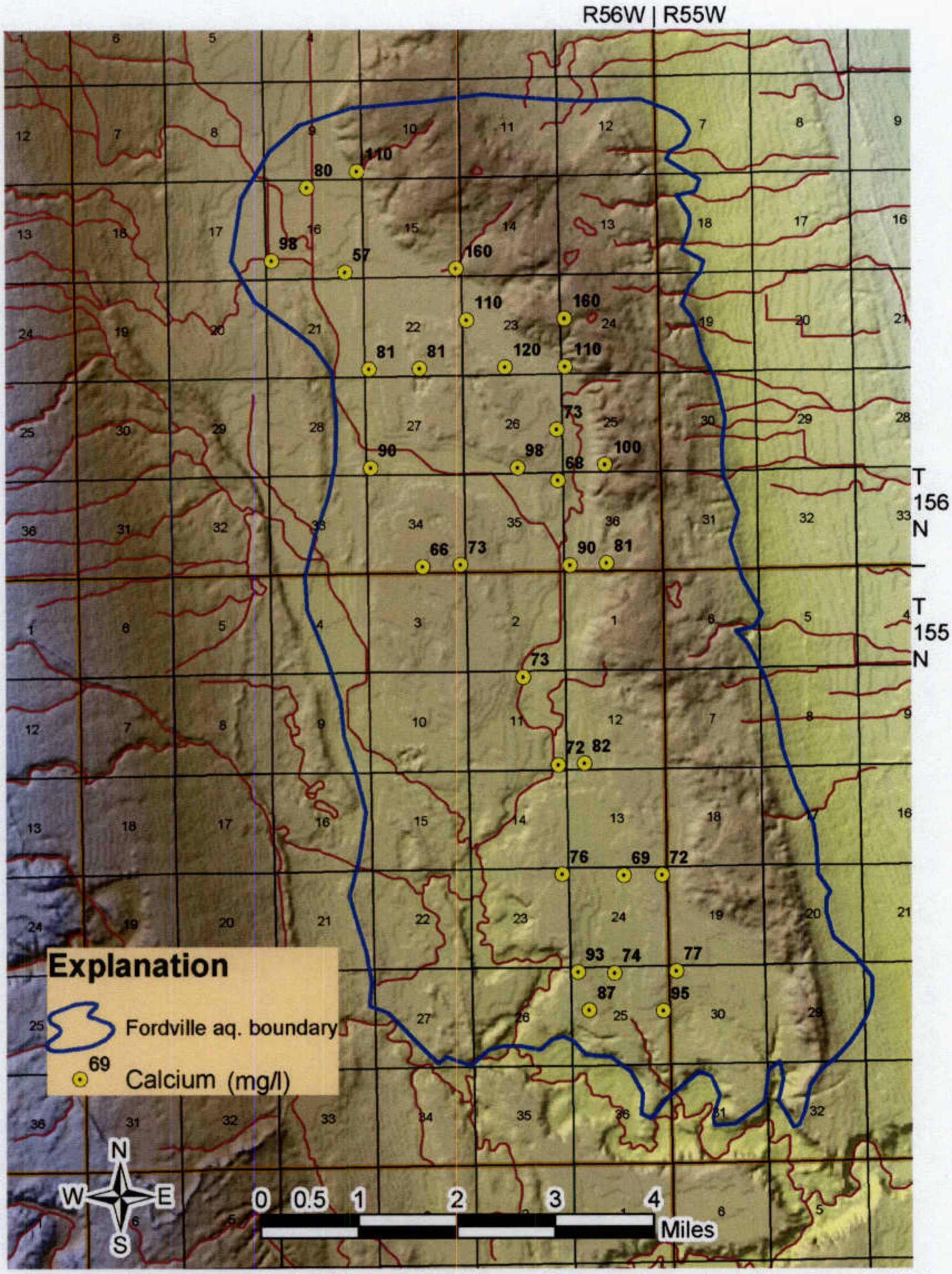

Figure 23. Spatial distribution of Calcium in the Fordville aquifer. Samples collected in October, 2001.

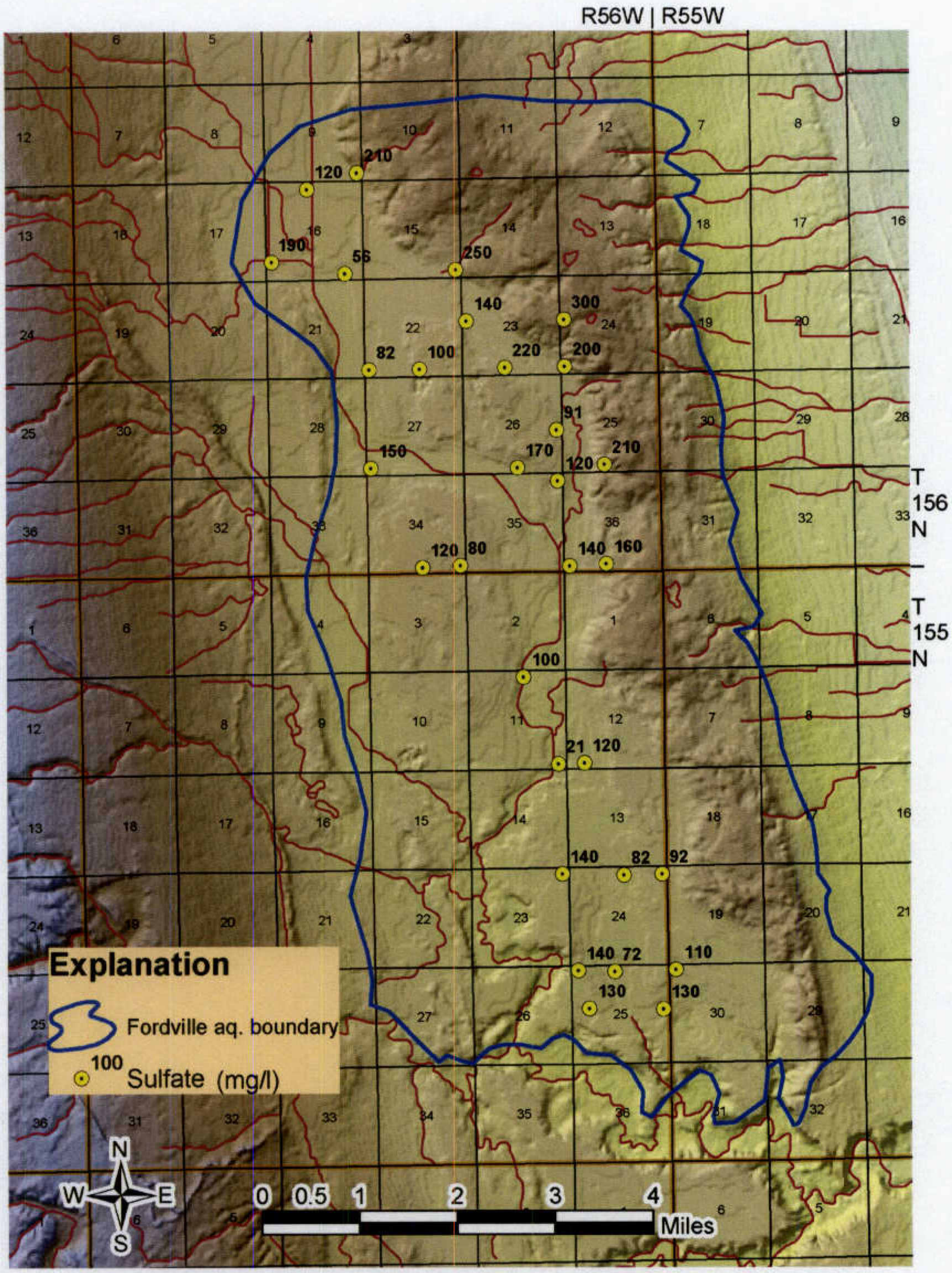

Figure 24. Spatial distribution of Sulfate in the Fordville aquifer. Samples collected in October, 2001.

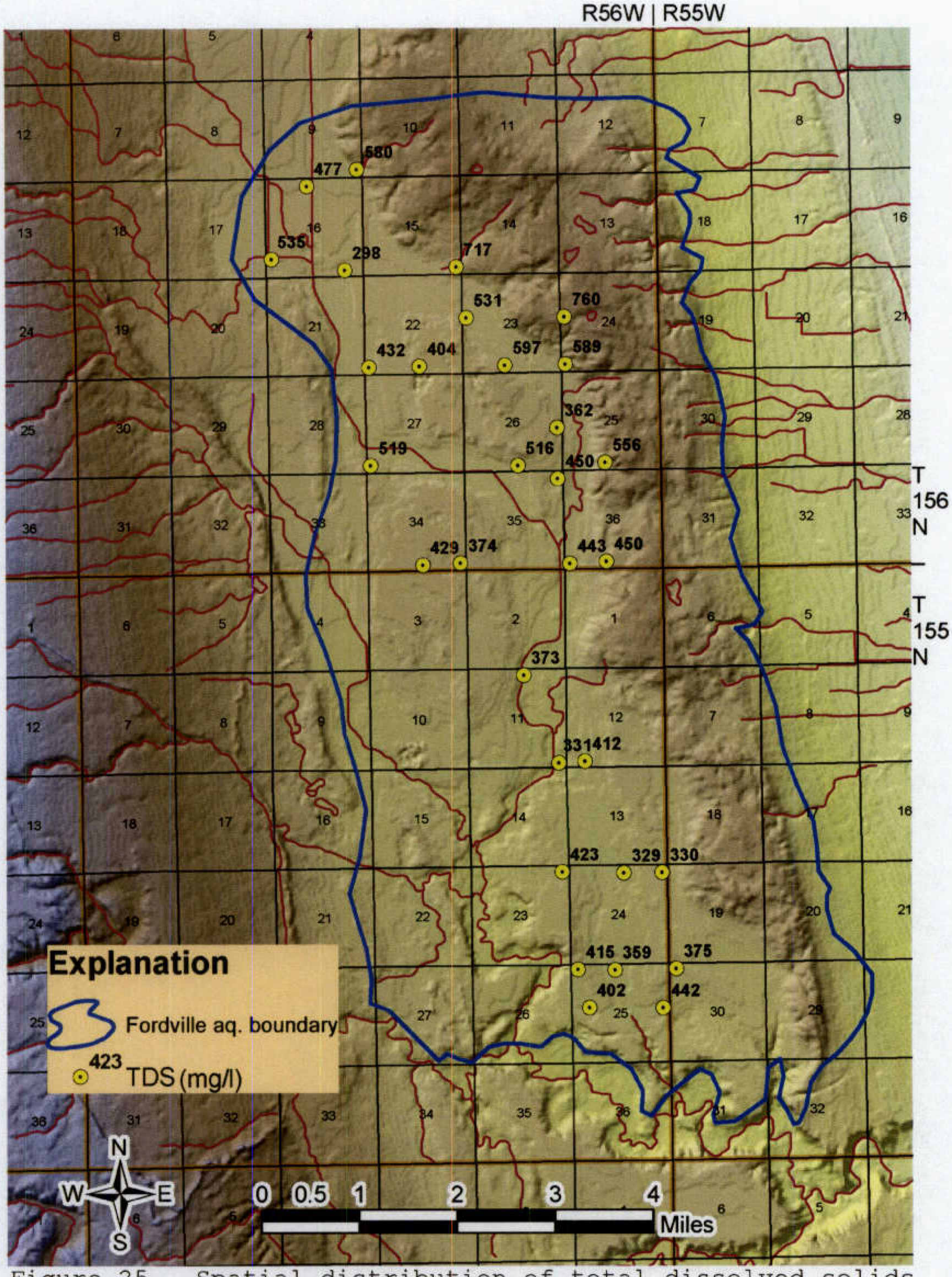

Figure 25. Spatial distribution of total dissolved solids (TDS) in the Fordville aquifer. Samples collected in October, 2001.

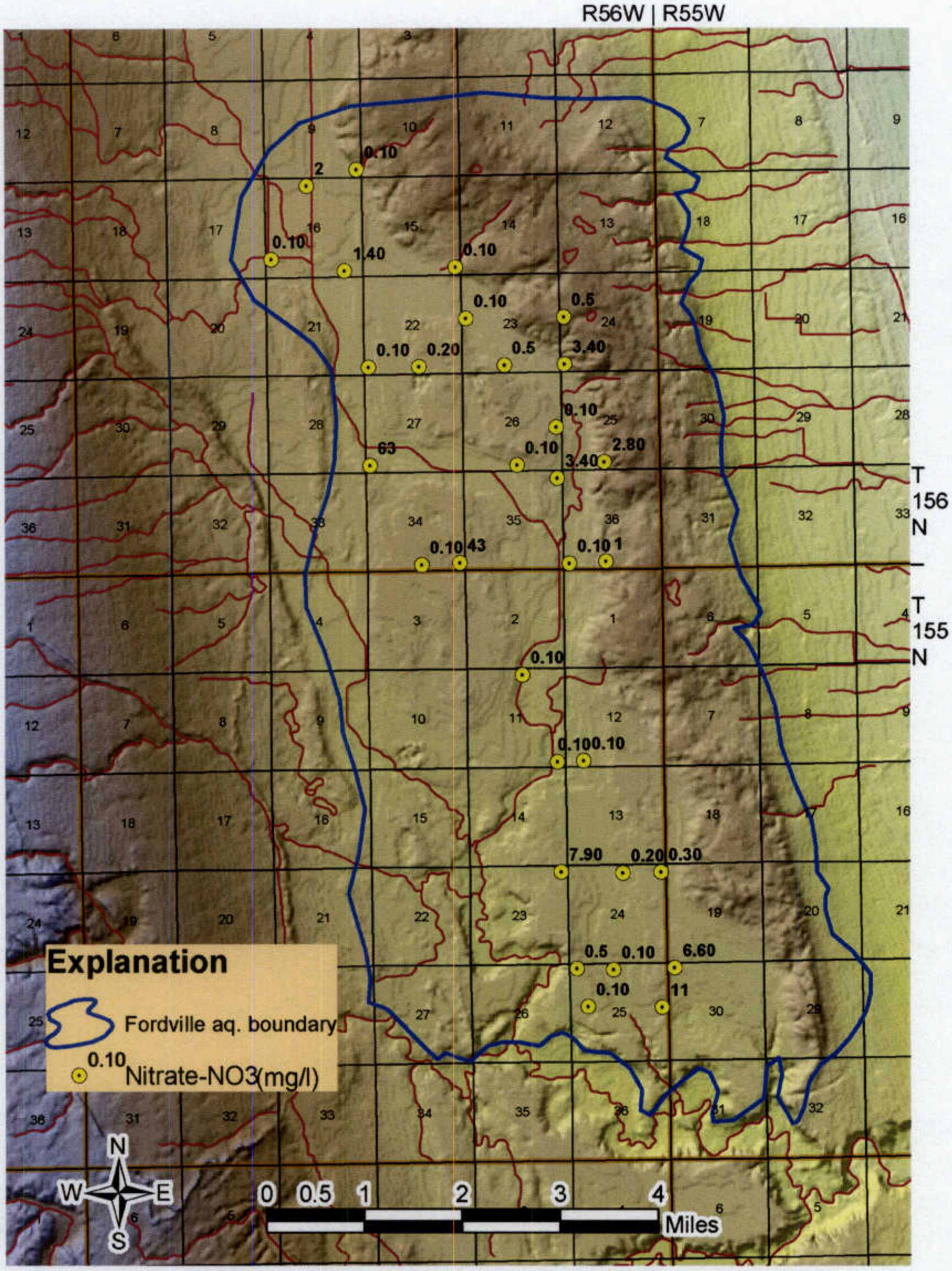

Figure 26. Spatial distribution of Nitrate in the Fordville aquifer. Samples collected in October, 2001.

due to evapotranspiration. During recharge events gypsum likely is dissolved and ground water enriched in Ca^{2+} and SO_4^{2-} is delivered to the Fordville aquifer underlying the till. The steady-state model (described later in this report) required significant recharge through the till of the Edinburg moraine to achieve the best fit between measured and simulated water levels.

Spatial distribution of nitrate in the Fordville aquifer is shown in figure 26. Except for the nitrate analysis from observation well 156-56-34DDD, all nitrate analyses are below the USEPA MCL of 45 mg/l as NO_3. The water level at this site is close to the top of the screened interval of this well and hence is likely drawing water from the upper portion of the aquifer where higher nitrate concentrations are common (Patch and Padmanabhan, 1994).

High nitrate concentrations can occur from a variety of sources: natural release from the soil zone due to tilling, over-application of nitrogen based fertilizers, and domestic septic-system leakage. The types of ground water environments that are most susceptible to nitrate contamination are the relatively shallow, unconfined aquifer systems, such as the Fordville aquifer. However, elevated nitrate levels in the upper zones and diminished levels with depth are common in water table aquifers. This is primarily due to denitrification, which permanently removes nitrate at or near the water table (Korom, 1991).

Discussion of Trace Elements

Concentrations of seven 'trace' elements were determined from the 32 observation wells in the Fordville aquifer. Summary results of the trace analyses are shown in Table 3. Individual analyses for the 32 monitoring wells are listed in the Table 8 of the Appendix.

Table 3. Summary of the trace element analyses from samples collected from 32 monitoring wells within the study area (concentrations in micrograms per liter, μg/l)

	Mean	Max	Min	MCL*
Arsenic	4.4	22	0	10
Lead	0.4	8	0	15
Mercury	0.0	0.6	0	2
Selenium	0.5	4	0	50
Lithium	34.3	60	20	--
Molybdenum	2.3	9	0	--
Strontium	300.3	590	200	--

*Primary MCL based on US EPA dinking water standards (http://www.epa.gov/safewater/mcl.html)

Arsenic: is a trace element of concern due to the recent lowering of the USEPA drinking water standard from 50 μg/l to 10 μg/l. Samples from three wells exceed the new standard at the following locations: 155-56-11ABB, 156-56-34DCC, and 156-56-35AAA. Concentrations at all other location are below the 10 μg/l level. The overall average of all samples is 4.44 μg/l. Spatial distribution of arsenic is shown in figure 27.

Arsenic accumulates in body tissues. In high concentrations, arsenic can damage the digestive tract, heart and circulation. Studies suggest that arsenic is associated with skin cancer. Studies also indicate that arsenic in small amounts may be an essential element for normal human development. High arsenic contamination of water is commonly caused by leachate from solid waste landfills, or from use of pesticides.

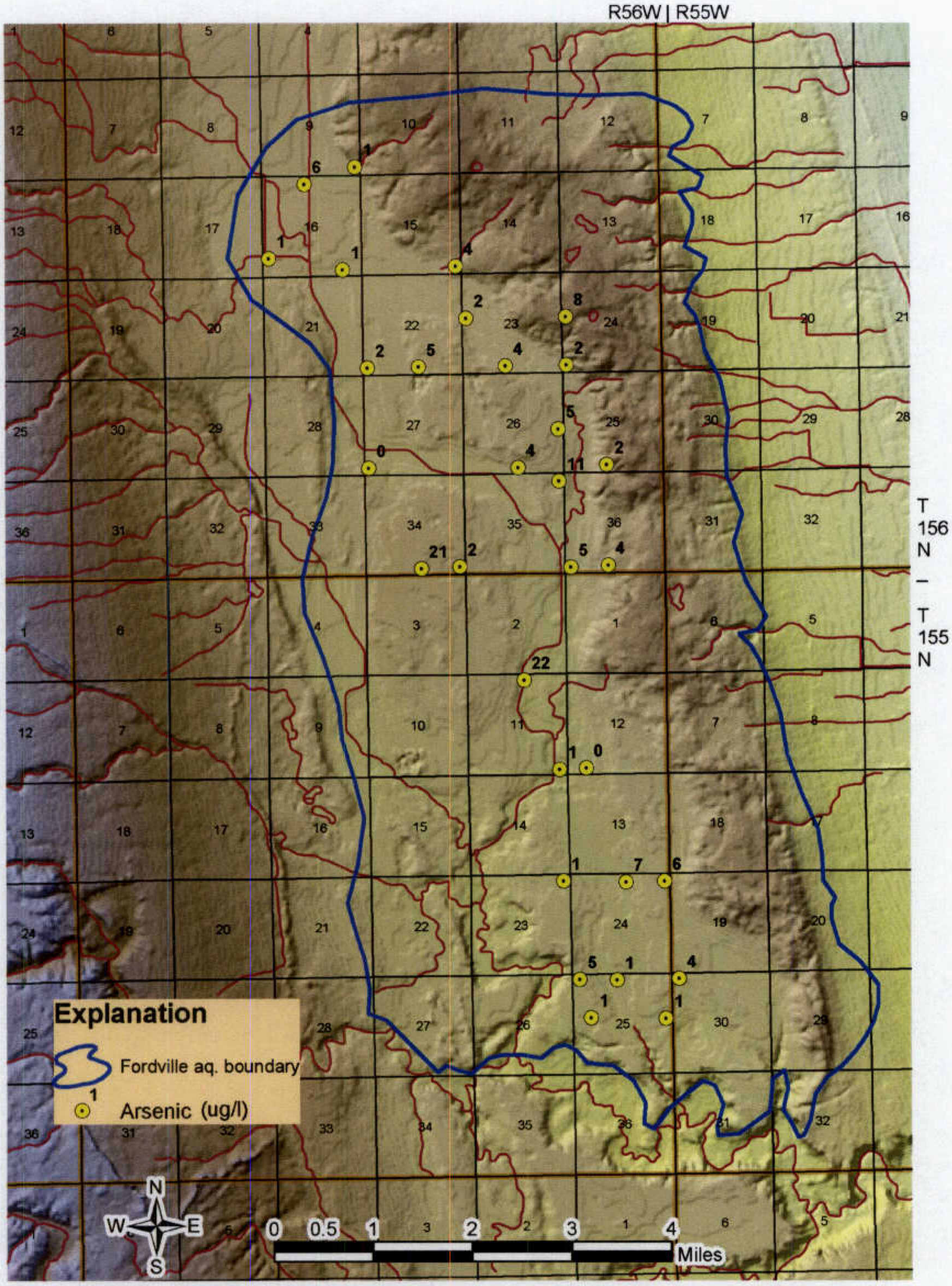

Figure 27. Spatial distribution of Arsenic in the Fordville aquifer. Samples collected in October, 2001.

Lead: Lead in amounts over the primary drinking water standard of 15 μg/l may cause nervous system disorders and brain or kidney damage. Since lead accumulates in body tissue, it is especially hazardous to the fetus or to children under three years old. Most lead contamination of drinking water occurs when soft acidic water corrodes lead or galvanized pipes or corrodes solder used in pipe fittings. Lead is used in insecticides and in high octane gasolines. Lead contamination may be present in water from industrial waste disposal or landfill leachate. There was no MCL exceedance of lead in this investigation.

Mercury: The primary drinking water standard for mercury is 2 μg/l. Mercury can cause acute poisoning in a large dose. Since mercury accumulates in body tissues, it can cause chronic effects to the nervous system, kidney or intestines at low doses over a long period of time. Mercury compounds become concentrated in the tissues of fish in lakes and streams. Mercury contamination of water is caused by industrial or agricultural wastes. There was no MCL exceedance of mercury in this investigation.

Selenium: Selenium in small amounts is beneficial to health. Levels over the primary drinking water standard of 50 μg/l may cause nervous system disorders, skin problems and in extreme cases may be fatal. Selenium occurs naturally in groundwater and in some soils. It can also form in higher concentrations as a by-product of copper refining. There was no MCL exceedance of selenium in this investigation.

Lithium, Molybdenum, and Strontium: do not have drinking water standards established.

Modeling Approach

Groundwater flow modeling involves representing the physical system in a digital form. The process begins by translating the "conceptual model" or idealized representation of the physical system into a numerical characterization of the ground water system. The numerical model should represent the physical groundwater system to an adequate level of confidence thereby providing a predictive scientific tool for determining aquifer response to changes in natural and anthropogenic inputs and outputs.

The US Geological Survey model, MODFLOW (McDonald and Harbaugh, 1988), was used to simulate ground-water flow in the Fordville aquifer. MODFLOW is based on block-centered, finite-difference equations that simulate the flow of water through a porous medium.

Conceptual Model of Groundwater Flow in the Aquifer

Initially, the conceptual model of the aquifer divided the aquifer into three layers with six possible profile configurations as shown in the figure 28. This model accounted

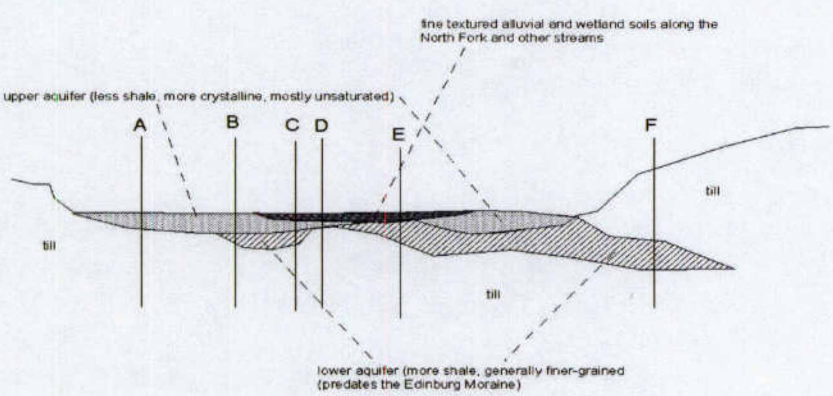

Figure 28. Profile showing possible configurations for the initial three-layer model.

for the textural differences between the lower finer-grained shaley sand and the upper coarser-grained more crystalline sand and gravel. Till of the Edinburg moraine and the fine-textured alluvial soils along the North Branch of the Forest River and were included in Layer 1. As the modeling study progressed, it was recognized that most of Layer 1 was either unsaturated sand, weathered alluvium, or glacial till which could be omitted and simply modeled by adjusting the recharge parameter. Water levels in the underlying aquifer are below the aquifer/aquitard contact and as a result, the aquifer is unconfined. Layer 3 which was either absent or consisted of the lower finer-grained sand was combined with Layer 2 into a single sand and gravel unit by developing a variable hydraulic conductivity array. A one-layer model was settled upon. Recharge to the model is through direct infiltration of precipitation and snowmelt and from runoff of the topographically higher regions to the west delivered to the aquifer by the North Branch of the Forest River in the northwestern part of the aquifer. Discharge from the model is through pumping wells and through springs and seeps along the North Branch of the Forest River as it crosses the central southern portion of the aquifer, along the southern edge of the aquifer into the valley formed by the Middle Branch of the Forest River, and on the eastern edge of the aquifer as it emerges from underneath the Edinburg moraine and is exposed at the topographically lower area to the east.

Simulation of Groundwater flow

Layers and Grid

A rectangular, finite-difference grid was superimposed on a map of the aquifer to discretize the hydrogeologic properties (figure 29). The unconfined deltaic and outwash

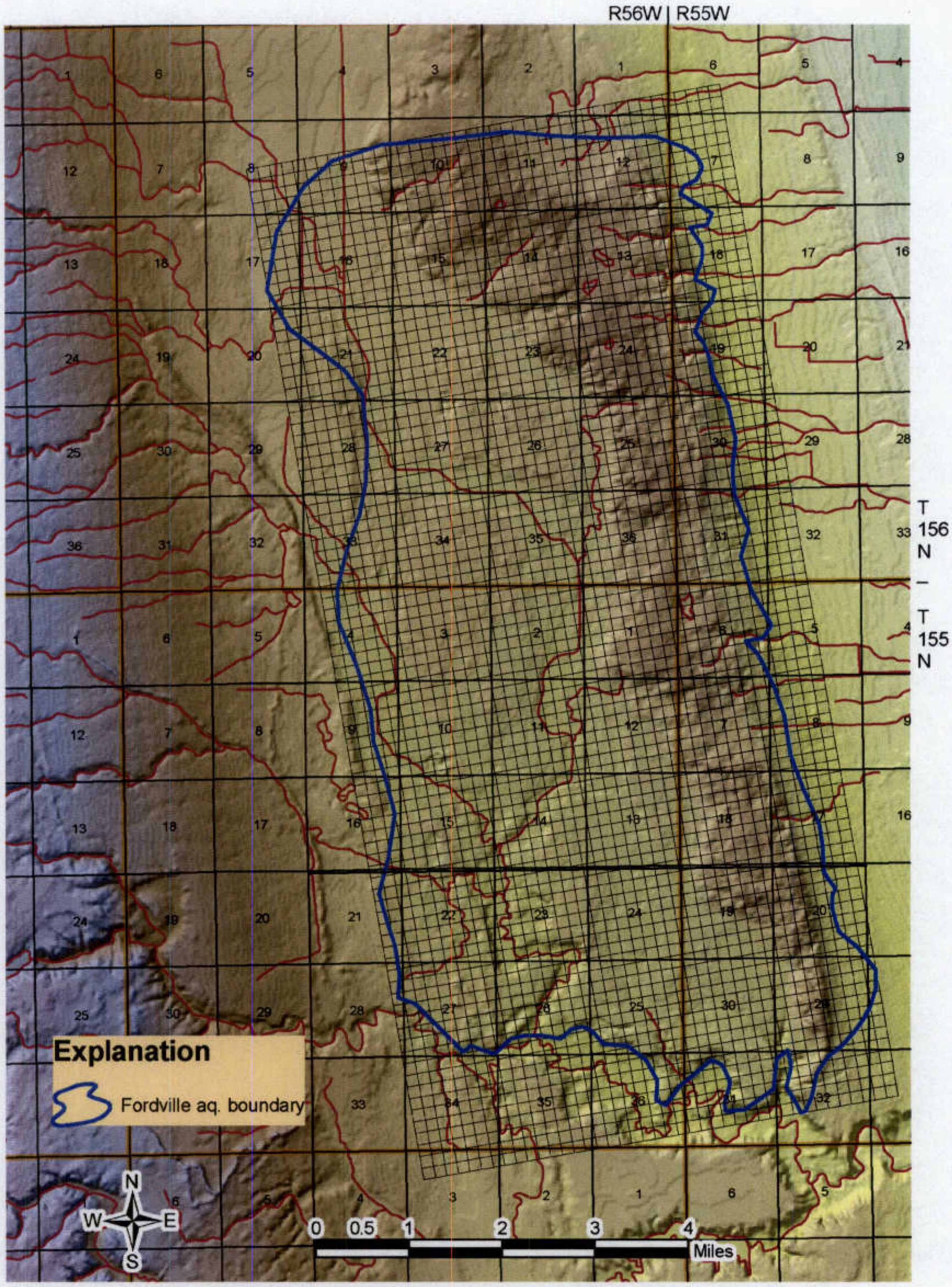

Figure 29. Finite-difference grid used to discretize the aquifer for modeling.

deposits of the Fordville aquifer are represented in the model as one layer. The model area was discretized into 3,567 cells each with a length and width of 660 feet. The finite-difference grid consists of 87 rows and 41 columns. The model encompasses an area of 56 square miles and contains a total of 2,735 active cells.

Model Parameters and Modules

The natural sources and sinks of the Fordville aquifer were simulated by MODFLOW with following modules: recharge, GHB (general head boundary), drain, river, and well packages. Evapotranspiration (ET) was not simulated because the depth to water is typically greater than the extinction depth for nearly all of the active area of the model.

Recharge Package

The recharge package simulates the primary source of water delivered to the model through the direct infiltration of precipitation. Recharge values used in the model ranged from 0.21 inches per year to 4 inches per year (figure 30). The primary determination of the recharge value at each cell was the soil type and the presence of fine-grained sediment above the water table which reduces recharge to the aquifer.

GHB package

The general head boundary package was used in conjunction with the drain package to simulate discharge from the model. The parameters and equations used in the GHB and drain packages are identical, with the exception that the GHB package allows for bi-direction flow whereas the drain package allows only one-way flow. The GHB

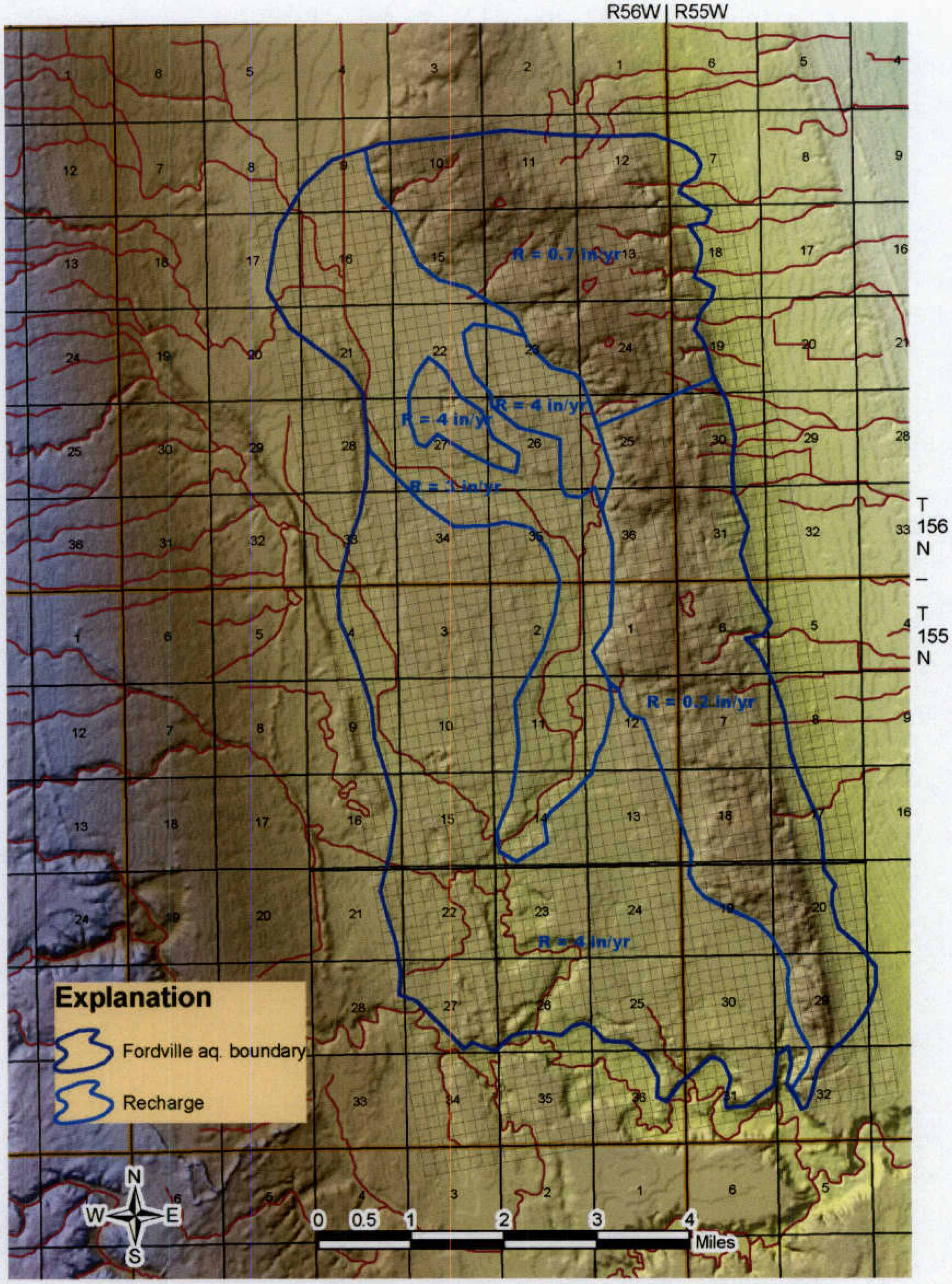

Figure 30. Recharge parameters used in the Fordville aquifer model.

package was employed primarily to simulate the amount of flow leaving the aquifer along its eastern boundary east of the Edinburg moraine (figure 31).

Drain package

The drain package was used to simulate the loss of water from the Fordville aquifer to surface discharge along the southern edge of the aquifer where it is truncated by the Middle Branch of the Forest River (figure 31). Stream-flow measurements indicate that the Middle Branch is a gaining river in this area.

River Package

The river package simulates the flow of the North Branch of the Forest River (figure 31). The river transitions from a losing stream to a gaining stream in the vicinity of Section 28, T156N-R56W.

Well package

The well package simulates the pumpage from high capacity wells completed in the Fordville aquifer. There are 19 high capacity wells which are located in 17 cells of the mode (figure 31). Discharge rates of these wells were based on historical data reported to the State Engineer on annual water use forms.

Hydraulic Conductivity Parameter

Horizontal hydraulic conductivity was assigned to each active model cell of the model (figure 32). The values were assigned based on estimates from the lithologic data and through trial and error during the calibration process.

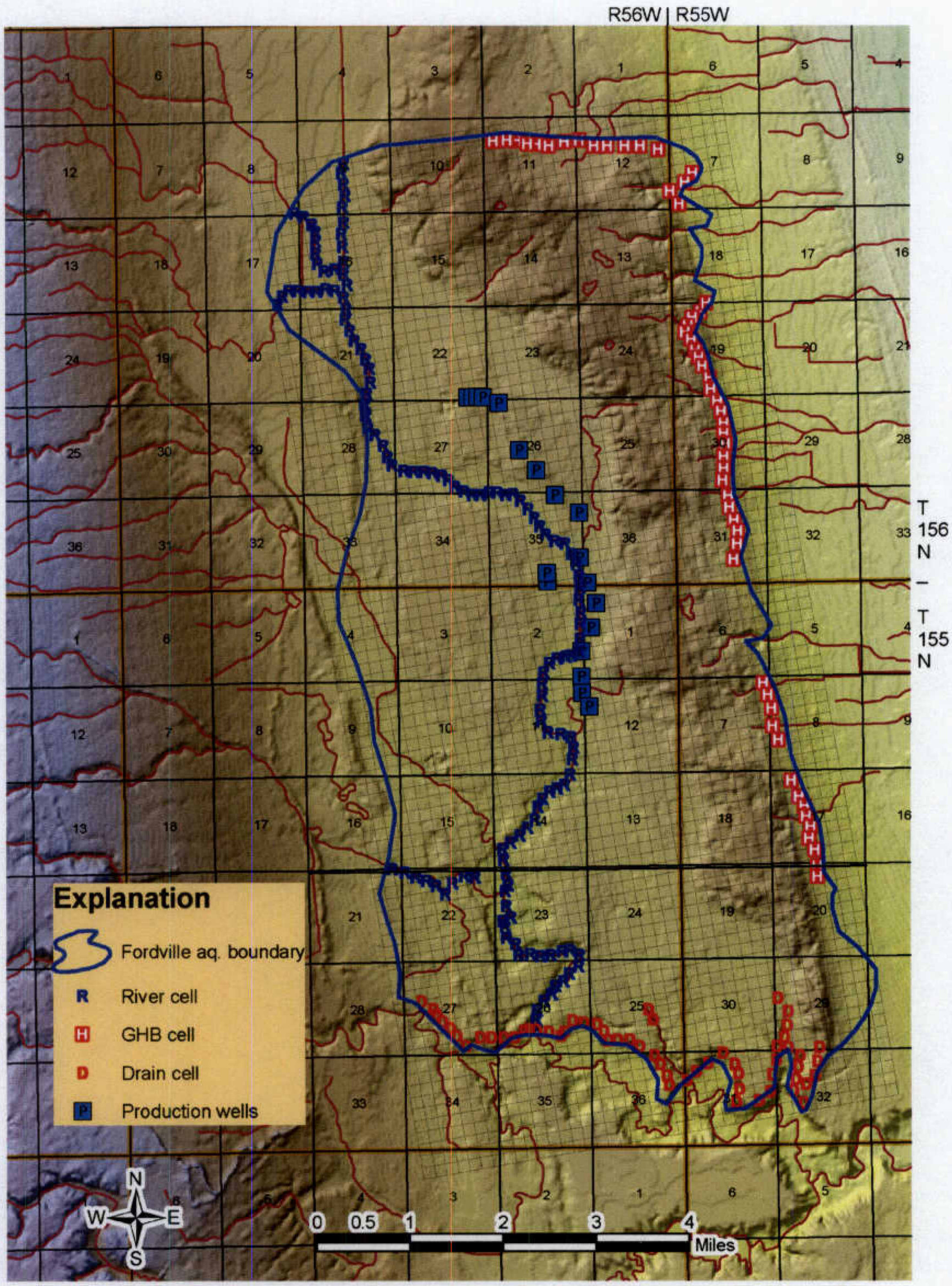

Figure 31. Parameters used in the Fordville aquifer model.

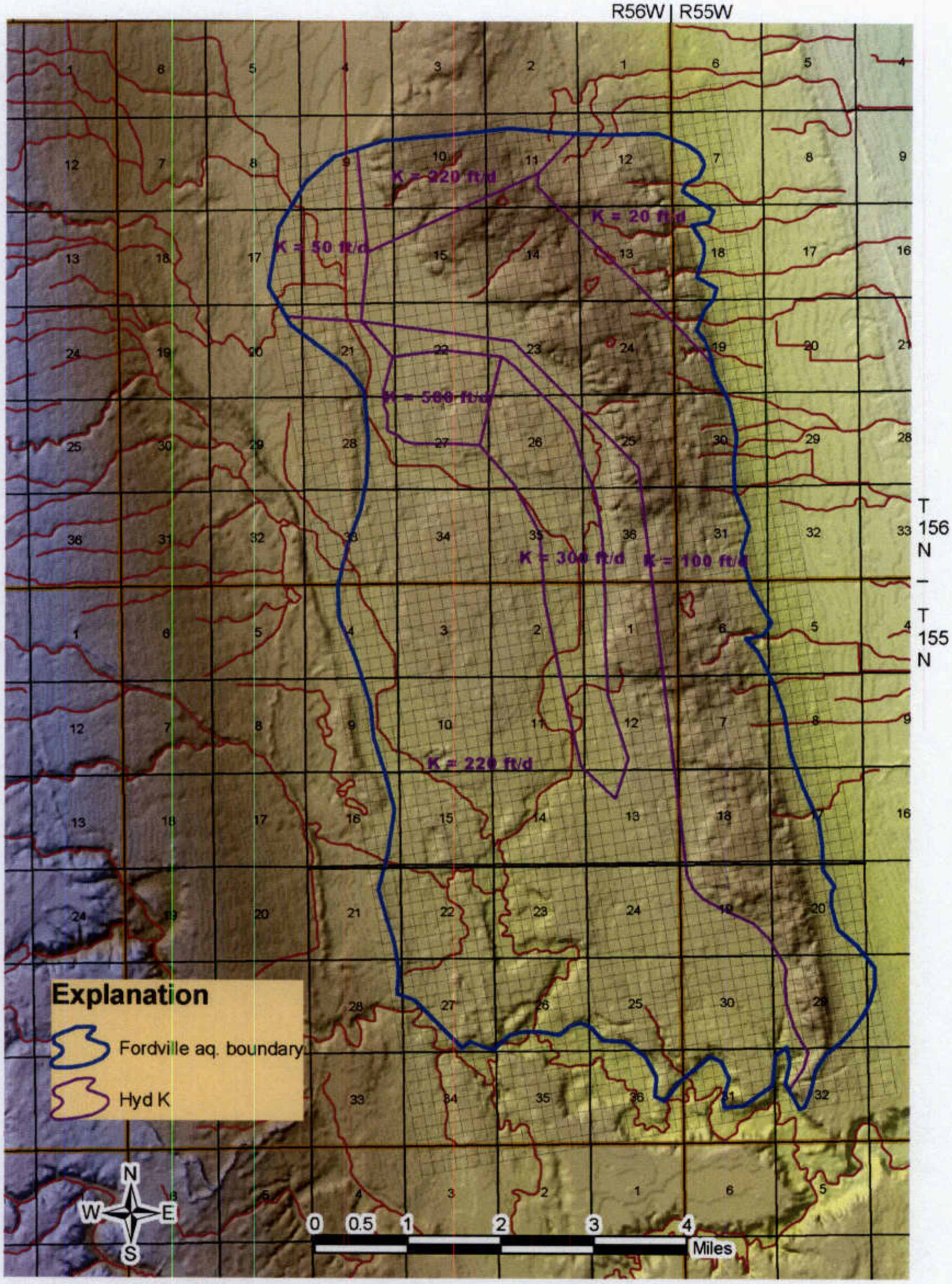

Figure 32. Horizontal Hydraulic Conductivity used in the Fordville aquifer model.

Model Calibration

The model was calibrated through trial and error by making reasonable estimates of parameters, running the model, identifying significant differences between measured and simulated values, adjusting parameters and re-running the model until the simulated values matched measured values within a preestablished range. Acceptance of the model was made after the absolute mean difference between the measured and simulated water levels values was less than 1 foot in the vicinity of the production wells and the root mean squared (RMS) error of differences between the 30 observation wells and the simulated values was less than 5% of the total head difference in the modeled area (Anderson and Woessner, 1992). Total head difference in the model is about 60 feet, therefore, the RMS error acceptance is 3 feet or less. The accepted model resulted in an absolute mean difference between the measured and simulated water levels of 0.92 feet and an RMS error of 1.30 feet or about 2.2% of the total head difference in the model. Figure 33 shows the difference between the simulated water levels and the measured water levels (based on December, 2001 measurements) at the 30 observation wells. A regression analysis of simulated water levels verses measured water levels is shown in figure 34. The correlation coefficient (R) is 0.995.

Figure 33. Results of the accepted model showing the difference between the modeled and actual heads (based on December, 2001 measurements).

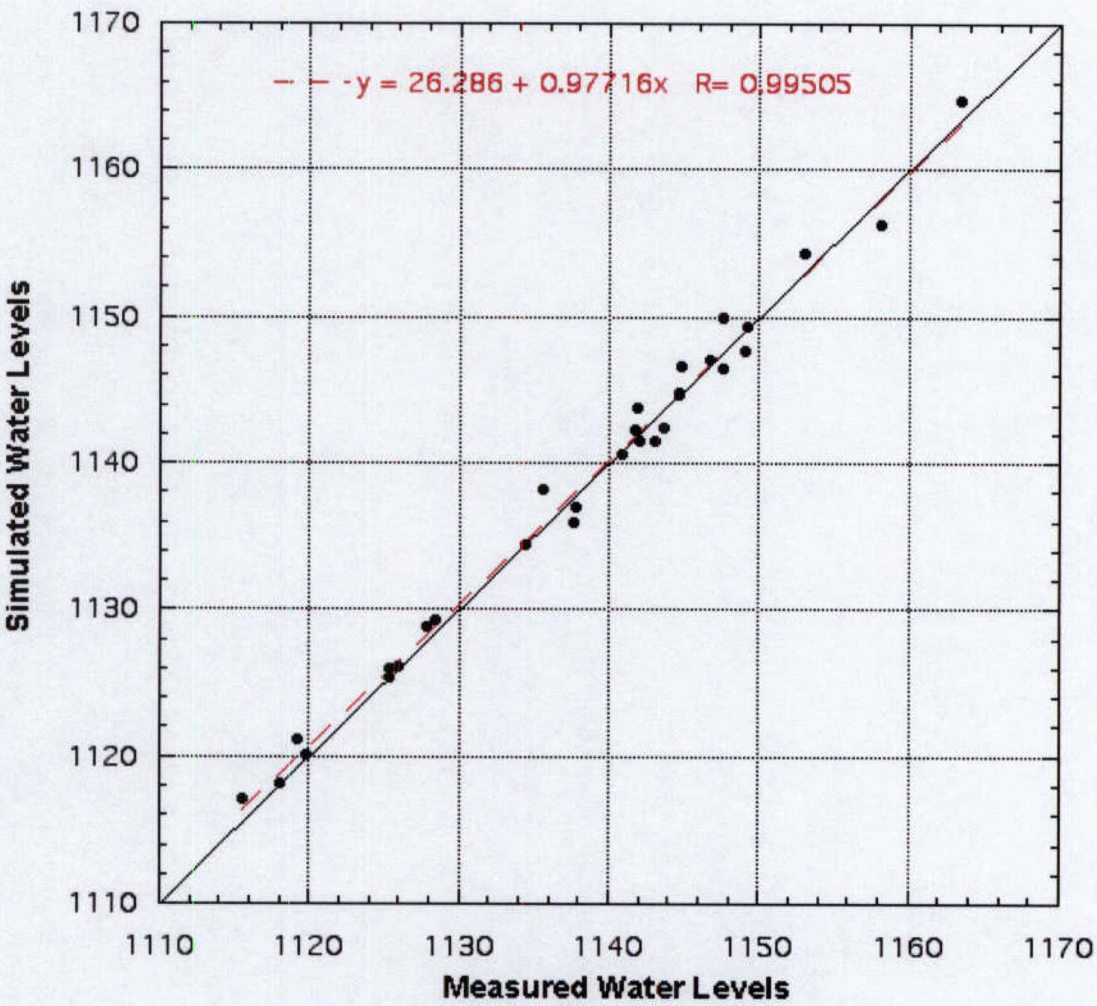

Figure 34. Comparison of the simulated water levels verses the measured water levels in the aquifer at the 30 observation well nodes in the final calibrated model.

Further calibration of the model was achieved using stream-gaging data which was collected at various locations within the study area. Two stream gage locations: site 5 and site 6 (figure 19), were used to determine how much water is being discharged to the North and Middle Branches of the Forest River, respectively. Stream measurements at these locations are nearly identical to the results of the final calibrated model (Table 4). The mass balance budget for the accepted steady-state model is shown in Table 5.

Table 4 Comparison of measured stream flow with modeled discharge along the North and Middle Branches of the Forest River.

Location:	**Measured - 8/29/01 (CFS)**	**Modeled (CFS)**
Gage site 5 (discharge from the North Branch of the Forest River)	2.75	2.66
Gage site 6 (discharge from the North Branch of the Forest River plus the drain along the southern edge of the aquifer)	4.22	4.06

Table 5 Mass balance budget for the accepted steady state model of the Fordville aquifer (units are ft^3/day)

In:			
	River leakage (northern part of North Branch Forest River)	29,425	
	Recharge (direct infiltration of precipitation)	602,749	
Total			**632,174**
Out:			
	Wells	93,076	
	Drains (discharge along southern end of the aquifer)	120,840	
	River leakage (southern part of North Branch Forest River)	229,757	
	GHB (discharge along eastern side of the aquifer)	188,490	
Total			**632,165**
Percent error			**0.001**

Model Sensitivity

Sensitivity analyses were conducted to determine how sensitive the model is to variation in the model parameters. Various parameters of the model were changed one at a time by a multiplication factor and the difference between the calculated and measured water levels was compiled at the 30 observation well locations. Figure 35 shows the sensitivity analysis for recharge rate, horizontal hydraulic conductivity, the conductance values for the drains, the conductance values for the River Bed, and the conductance values for the general head boundary nodes. The final calibrated model resulted in root mean square of difference between the calculated and measured water levels of 1.30 feet (multiplication factor equal to 1 in Figure 35). All other multiplication factors resulted in RMS errors greater than 1.30 feet. Results of the sensitivity analysis indicate that recharge and hydraulic conductivity had relatively large effects on the simulated water levels, whereas the conductance values for the drains, river bed, and general-head boundaries had a smaller effect on simulated water levels.

Model Results and Application

To assess the potential effects of additional pumping from the aquifer, water-level output from the accepted model was used as the starting water levels in two subsequent model runs which simulated increasing pumping to 400 and 600 acre-feet per year from the 10 ABM wells. Additional drawdown caused by these increases are shown spatially in Figures 36 and 37. Table 6 shows the potential effects of the additional pumping on each of the existing municipal, rural water and irrigation wells in the Fordville aquifer.

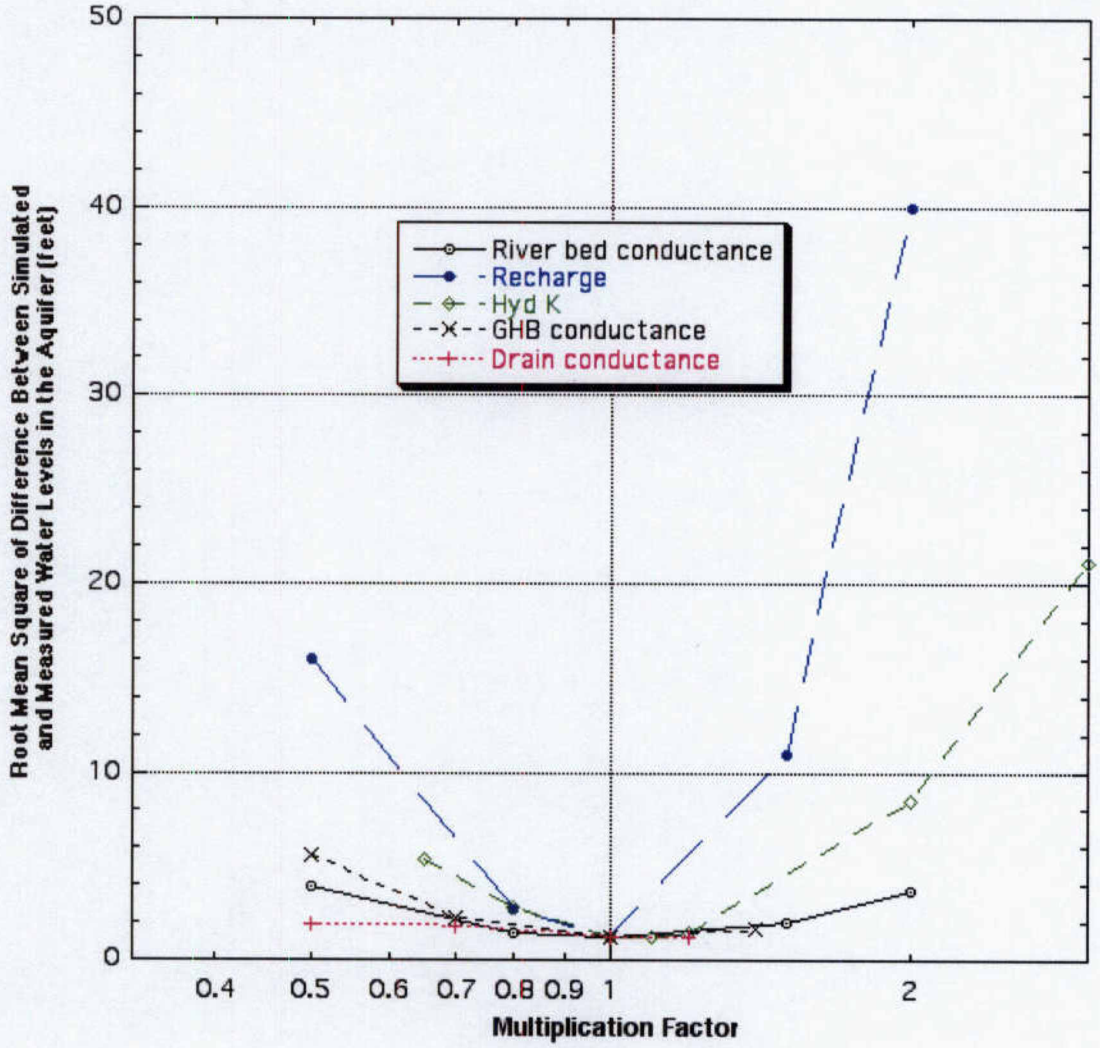

Figure 35. Results of the sensitivity analysis of the model.

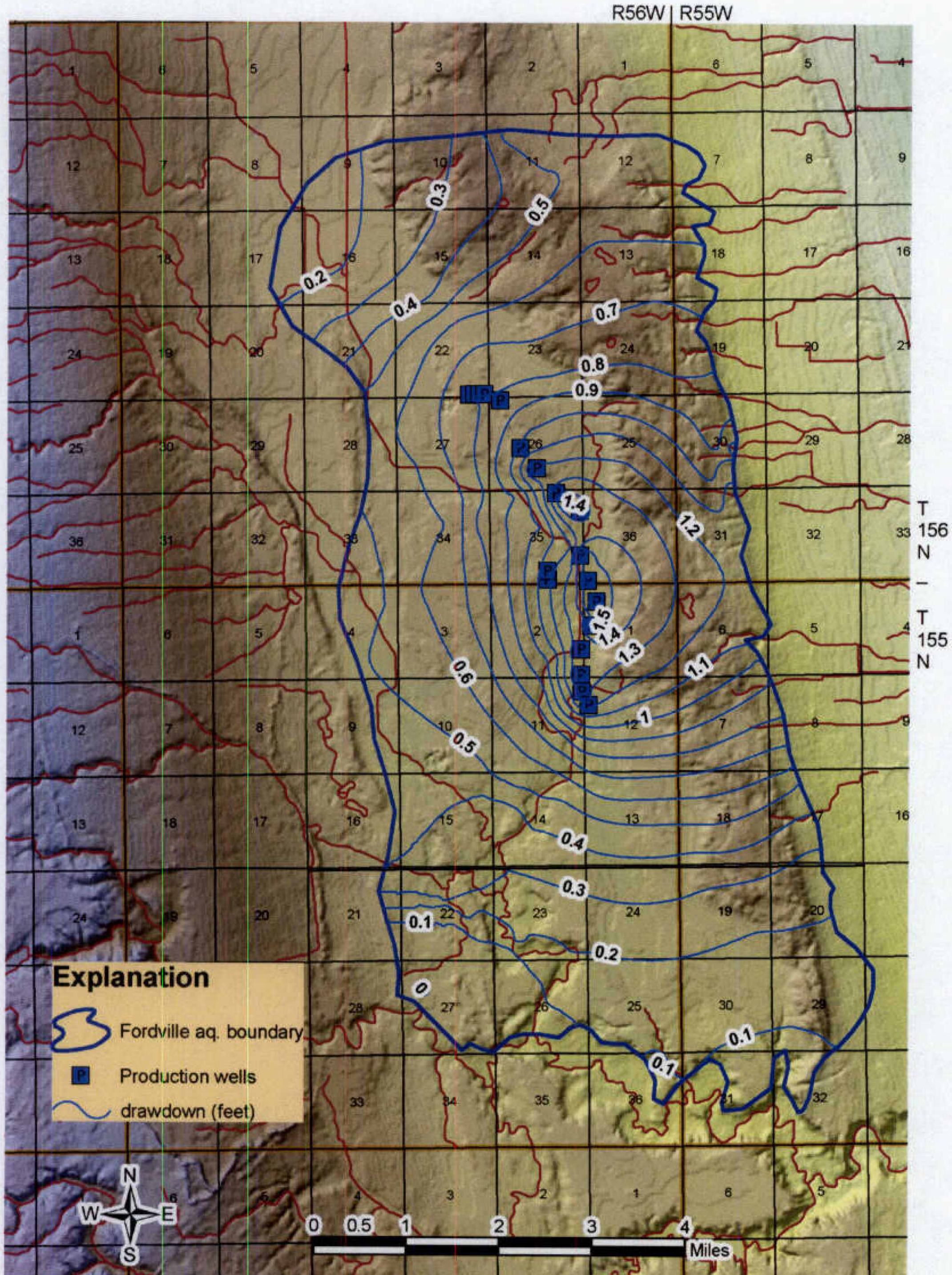

Figure 36. Additional drawdown expected as a result of increasing pumping to 400 acre-feet per year from the former ABM wells.

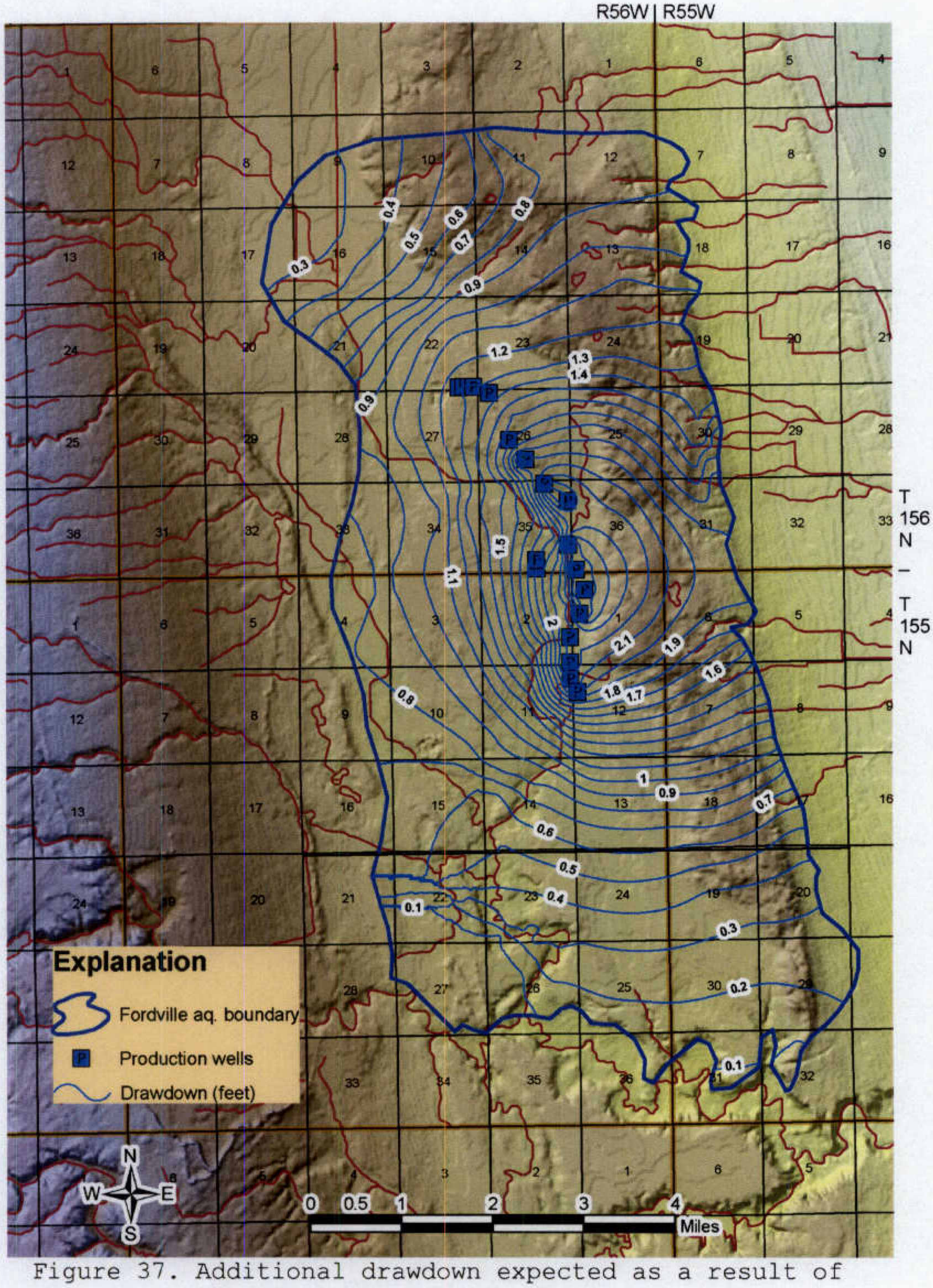

Figure 37. Additional drawdown expected as a result of increasing pumping to 600 acre-feet per year from the former ABM wells.

Table 6. Potential effects of the additional pumping on each of the existing municipal, rural water and irrigation wells in the Fordville aquifer (units are in feet).

Well Location	Name	Top of Screen	Bottom of Screen	Static Depth to Water	Saturated Thickness	Available Head Above Screen	Model Water Level Elevation	Additional Drawdown (400 acre-feet)	Additional Drawdown (600 acre-feet)
156-56-22DDD1	Walsh RW	30	59	26	33	4	1144.76	0.80	1.31
156-56-22DDD2	Walsh RW	38	49.5	31	18.5	7	1144.75	0.80	1.31
156-56-22DDD3	Walsh RW	35	50	23	27	12	1144.90	0.80	1.31
156-56-22DDD4	Walsh RW	35	50	22	28	13	1144.90	0.80	1.31
156-56-26BAB	Walker fill	40	50	30	20	10	1143.73	0.93	1.53
156-56-26BDD	Walker IR	37	52	30	22	7	1143.16	0.98	1.60
156-56-26DBC5	ABM 1	45	55	31	24	14	1143.12	1.31	2.16
156-56-35ABA	ABM 2	32	42	18	24	14	1140.99	1.49	2.45
156-56-35DAA	ABM 4	20	30	14	16	6	1138.13	1.60	2.63
156-56-35DCD	Minto 2	26.5	36.5	10	26.5	16.5	1138.96	1.18	1.93
156-56-35DCD	Minto 1	27.5	37.5	10	27.5	17.5	1138.38	1.22	1.98
156-56-36CCD	ABM 5	22	32	10	22	12	1137.04	1.66	2.73
155-56-1BBC	ABM 6	25	35	14	21	11	1136.08	1.64	2.70
155-56-1BCD	ABM 7	26	36	11	25	15	1135.17	1.61	2.63
155-56-2DAD	ABM 8	23	33	10	23	13	1134.45	1.37	2.23
155-56-2DDD2	ABM 9	24	34	13	21	11	1133.58	1.44	2.36
155-56-11AAD	ABM 10	25	35	16	19	9	1132.50	1.35	2.21
155-56-12BD	Gorder IR	22	29	6	23	16	1131.66	1.14	1.86

The potential drawdowns shown in Table 6 are based on continuous pumping of the ABM wells and each well pumping at the same rate. Variable pumping rates and discontinuous pumping will result in different potential drawdowns at each of the site-specific locations of the wells listed in Table 6. However, these differences will be minor.

Based on the model simulations, the Fordville aquifer should be able to support additional sustained withdrawals of 400 to 600 acre-feet per year. However, because it is a relatively thin, surficial, unconfined system which derives most of its recharge from infiltration of precipitation and snow-melt, climate variability plays a key role in controlling water-levels. Long-term drought conditions such as those of the 1930s may cause a natural lowering of the water table which may reduce the yield of the existing wells.

Summary and Recommendations

The Fordville aquifer is a relatively thin, coarse-grained surficial aquifer with a complicated depositional history. The aquifer consists of deltaic and outwash deposits that accumulated along the west edge of Glacial Lake Agassiz during the Pleistocene epoch. Two late Pleistocene advances of ice in the Red River Valley led to the formation of two units of the Fordville aquifer: a lower shale-rich deposit and an upper coarser-grained sediment composed primarily of crystalline rock fragments. Where both units are present, they are contiguous. In many areas, the upper unit is unsaturated and is locally mined for sand and gravel. The aquifer is predominantly unconfined but there are areas where a thin alluvial clay occurs at land surface. The aquifer water level typically is below the bottom of this surficial clay and silt deposit. The Edinburg moraine was formed by a glacial advance which occurred between the deposition of the two units of the aquifer. Where the moraine is present, it overlies the lower unit of the Fordville aquifer. The water level in the aquifer is below the bottom of the moraine, hence, beneath the Edinburg moraine the aquifer is still essentially unconfined.

Recharge to the aquifer is primarily through direct infiltration of precipitation and snowmelt. Recharge also is delivered to the aquifer from nearby watersheds through the

North Branch of the Forest River and other small unnamed tributaries. The amount of water the aquifer receives as recharge from these sources is only about five percent of the recharge to the aquifer.

Discharge from the aquifer is primarily through springs and seeps. These springs and seeps occur along the North Branch of the Forest River as it traverses from north to south in the central and southern part of the aquifer, on the east side of the Edinburg moraine as land surface drops off into the lake plain, and along the southern margin where the aquifer has been incised by the Middle Branch of the Forest River. Discharge also occurs by pumping high capacity rural water, municipal, and irrigation supply wells. Well pumping accounts for about 15 percent of the total discharge of the aquifer.

Overall, the general water quality in the Fordville aquifer meets all of the primary and secondary drinking water standards set by the US EPA and the ND State Health Department. The water is predominantly a calcium-bicarbonate type. Total dissolved solids (TDS) concentrations range from 298 to 760 mg/l and average 458 mg/l. Three of the samples collected for trace-element analysis had arsenic concentrations which exceed the maximum contaminant level (MCL), however, the overall average of the samples collected was well under the MCL.

A digital ground-water flow model was developed to evaluate the conceptual model of the aquifer. The model was also used to evaluate the impacts on water levels from additional ground-water withdrawals. The model was calibrated to achieve an RMS criteria of less than 5 percent between measured and simulated water levels. The effect on water levels due to pumping an additional 400 to 600 acre-feet per year from the 10 former ABM wells was evaluated by additional model simulations. The largest drawdown occurred at the model nodes (660 foot X 660 foot area) in which the ABM wells were located. Drawdown at these nodes ranged from 1.31 to 1.66 feet for the 400 acre-ft analysis and 2.16 to 2.73 feet for the 600 acre-ft analysis. The potential effect on the Walsh Rural Water wells was 0.80 feet and 1.31 feet for the 400 and 600 acre-ft simulations, respectively. The potential effect on the Walker wells was 0.93 to 0.98 feet and 1.53 to1.60 feet for the 400 and 600 acre-ft simulations, respectively. The potential effect on the Minto well field was well was 1.18 feet to 1.22 feet and 1.93 to1.98 feet for the 400 and 600 acre-ft simulations, respectively. The potential effect on the Gorder irrigation wells was 1.14 feet and 1.86 feet for the 400 and 600 acre-ft simulations, respectively.

Based on the model simulations, the Fordville aquifer should be able to support additional sustained withdrawals of 400 to 600 acre-feet per year. However, because it is a relatively thin, surficial, unconfined system which derives most of its recharge from infiltration of precipitation and snow-melt, climate variability plays a key role in controlling water levels. Long-term drought conditions such as those of the 1930s may cause a natural lowering of the water table which may reduce the yield of the existing wells.

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Appendix

Lithologic logs

155-055-07CCC
NDSWC 14805

Date Completed:	10/09/2001	Purpose:	Test Hole
L.S. Elevation (ft):	N/A		
Depth Drilled (ft):	80		

Lithologic Log

Depth (ft)	Unit	Description
0-4	TOPSOIL	Black
4-17	SILT AND CLAY	Sandy, yellow-brown, moderately soft no inclusions
17-22	SAND AND GRAVEL	Medium sand and very course gravel, oxidized
22-25	CLAY	Silty, sandy, pebbly, moderately soft, yellow-brown, oxidized (till)
25-36	CLAY	Silty, sandy, pebbly, medium gray, moderately firm, sand and gravel inclusions in clay matrix, (till); unoxidized
36-40	SAND	Very fine to fine, well sorted, predominately shale, rounded to sub-rounded grains
40-44	SILT	Clayey, sandy, smooth, soft
44-49	SAND AND GRAVEL	Fine sand to very course gravel
49-80	CLAY	Silty, sandy, pebbly, medium gray, medium firm, inclusions, (till)

155-055-26BBB
NDSWC 5025

Date Completed:	07/02/1968	Purpose:	Test Hole
L.S. Elevation (ft):	N/A		
Depth Drilled (ft):	260		

Lithologic Log

Depth (ft)	Unit	Description
0-21	CLAY	silty, sandy, pebbly, yellowish-brown, calcareous (till)
21-26	CLAY	silty, sandy, pebbly, olive-gray, calcareous (Till)
56-100	CLAY	silty, pebbly, olive-gray, calcareous (till)
100-128	CLAY	sandy, silty, pebbly, olive-gray, calcareous (till)
128-198	CLAY	silty, sandy, pebbly, olive-gray, calcareous (till)
198-255	CLAY	sandy, silty, pebbly, olive-gray, calcareous (till)
255-260	SHALE	brownish-gray, fossiliferous, slightly calcareous, isolated white specks

155-055-29BAA
NDSWC 5033

Date Completed:	07/11/1968	Purpose:	Test Hole
L.S. Elevation (ft):	N/A		
Depth Drilled (ft):	340		

Lithologic Log

Depth (ft)	Unit	Description
0-5	GRAVEL	sandy, grayish-brown
5-30	CLAY	silty, sandy, pebbly, yellowish-brown, (till)
30-40	CLAY	sandy, silty, pebbly, olive-gray, calcareous, (till)
40-70	SILT	clayey, sandy, yellowish-brown (lake-deposit)
70-75	CLAY	silty, sandy, pebbly, olive-gray, calcareous, (till)
75-80	GRAVEL	fine to coarse
80-124	SILT	clayey, sandy, olive-gray, very calcareous, (lake deposit)
124-148	CLAY	silty, sandy, pebbly, olive-gray, calcareous, (till)
148-160	GRAVEL	sandy
160-177	CLAY	silty, sandy, pebbly, olive-gray, calcareous, (till)
177-180	BOULDER	sandstone, calcareous
180-200	CLAY	silty, sandy, pebbly, olive-gray, moderately calcareous, (till)
200-207	CLAY	silty, sandy, pebbly, olive-gray, calcareous, (till)
207-213	GRAVEL	clayey
213-268	CLAY	silty, sandy, pebbly, olive-gray, moderately calcareous, (till)
268-280	GRAVEL	fine to coarse
280-284	CLAY	silty, sandy, pebbly, olive-gray, calcareous, (till)
284-300	GRAVEL	clayey, sandy
300-305	CLAY	silty, sandy, pebbly, olive-gray, calcareous, (till)
305-310	GRAVEL	sandy
310-314	CLAY	silty, sandy, pebbly, olive-gray, calcareous, (till)
314-323	GRAVEL	clayey, sandy
323-330	CLAY	silty, sandy, pebbly, cobbly, olive-gray, calcareous, (till)
330-340	SHALE	grayish-brown, slightly calcareous, isolated white specks

155-055-30BBB
NDSWC 12737

Date Completed:	1991	Purpose:	Observation Well
L.S. Elevation (ft):	1145.22	Well Type:	2in. - PVC
Depth Drilled (ft):	80	Aquifer:	Fordville
Screen Int. (ft.):	29-34	Data Source:	SWC

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	
1-4	CLAY	silty, soft, yellow to brown, oxidized
4-31	SAND & GRAVEL	fine sand to 10mm gravel, poorly sorted, predominantly coarse to very coarse sand, subangular to round, predominantly sub-round, 30% shale, 20% carbonates, 30-40% quartzose and rock fragments
31-68	CLAY AND SILT	silty clay to clayey silt, very soft, slightly cohesive, very smooth drilling, no inclusions
68-80	TILL	clayey, silty, sandy, pebbly inclusions, medium gray moderately firm

155-055-33BBB
NDSWC 5026

Date Completed:	07/02/1968	Purpose:	Test Hole
L.S. Elevation (ft):	N/A		
Depth Drilled (ft):	300		

Lithologic Log

Depth (ft)	Unit	Description
0-7	SAND	grayish-brown, fine to coarse
7-13	SILT	clayey, yellowish-brown, calcareous, (lake deposit)
13-80	SILT	clayey, olive-gray calcareous (lake deposit)
80-124	CLAY	silty, sandy, pebbly, olive-gray, calcareous, (till)
124-140	CLAY	very silty, olive-gray, very calcareous, (lake deposit)
140-268	CLAY	silty, pebbly, olive-gray, calcareous, (till)
208-300	SHALE	brownish-gray, fossiliferous, slightly calcareous
268-280	CLAY	silty, sandy, gravelly, olive-gray, calcareous, (till)

155-056-02ABB
NDSWC 14797

Date Completed:	10/04/2001	Purpose:	Test Hole
L.S. Elevation (ft):	N/A		
Depth Drilled (ft):	40		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Black
1-4	CLAY	Silty, slightly sandy, yellow-brown, soft, (alluvium)
4-36	SAND AND GRAVEL	Fine sand to very coarse gravel poorly sorted, oxidized, taking much water, used 15 bags of mud in top 24 feet, 2 bags of cotton seed hulls, 2 bags of grout, rough drilling, difficult tomaintain circulation, washing, poor sample recovery, could not determine oxidized or unoxidized boundary, stem plugged off, hole abandoned
36-40	CLAY	(till), poor sample recovery

155-056-04BBB
NDSWC 2938

Date Completed:	05/23/1968	Purpose:	Test Hole
L.S. Elevation (ft):	N/A		
Depth Drilled (ft):	200		

Lithologic Log

Depth (ft)	Unit	Description
0-2	TOPSOIL	Clayey, sandy, silty, gravelly, brownish-black
2-24	CLAY	Silty, sandy, olive gray with a few light olive gray laminations, slightly to moderately cohesive, moderately plastic, calcareous, (lake sediment)
24-51	CLAY	Pebbly, sandy, silty, olive gray, moderately cohesive, moderately plastic, calcareous, numerous limestone and shale fragments, (till)
51-57	GRAVEL	Sandy approximate 35 to 45% very coarse to coarse-grained, angular to sub-rounded sand, fine to coarse, fair sorting, predominantly limestone and shale with some granite rock, mudstones andsandstone; taking some water and caving slightly
57-70	CLAY	Sandy, silty, gravelly in places, olive gray, moderately cohesive to cohesive, moderately plastic, calcareous, (till)
70-188	CLAY	Sandy, silty, gravelly, olive gray to 118 feet medium dark gray, cohesive to moderately cohesive, moderately plastic, calcareous, numerous limestone, shale, lignite grains and granules present, (till)
188-220	SHALE	Brownish black, fossiliferous, indurated, slightly calcareous, parts along horizontal cleavage plains; Niobrara Formation

155-056-09CCC
NDSWC 2940

Date Completed:	05/24/1968	Purpose:	Test Hole
L.S. Elevation (ft):	N/A		
Depth Drilled (ft):	200		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Sandy, gravelly, brownish-black
5-10	CLAY	Sandy, silty, gravelly, olive gray, moderately cohesive, moderately plastic, (till)
10-12	SAND AND GRAVEL	Layered, fine to coarse, angular to sub-rounded gravel, sub-angular to rounded fine to very coarse grained sand; caving and taking water
12-140	CLAY	Sandy, silty, pebbly, olive gray, cohesive at 128 feet to moderately cohesive, moderately plastic, numerous limestone, shale, mudstone and granitic fragments (till); rough drilling due to cobble size material
140-157	CLAY	Sandy silty, pebbly, olive gray to medium dark gray, moderately cohesive, semi-plastic, numerous cobbles and boulders (till)
157-158	BOULDER	Limestone, hard drilling
158-173	CLAY	Pebbly, sandy, silty, olive gray, moderately cohesive, moderately plastic, calcareous, (till)
173-200	SHALE	Brownish-black, indurated, fossiliferous,(white specks), slightly calcareous to calcareous, parts along horizontal cleavage plains when dry; Niobrara firm

155-056-11ABB
NDSWC 12741

Date Completed:	1991	Purpose:	Observation Well
L.S. Elevation (ft):	1137.99	Well Type:	2in. - PVC
Depth Drilled (ft):	34	Aquifer:	Fordville
Screen Int. (ft.):	23-28	Data Source:	SWC

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	
1-9	CLAY	silty, slightly sandy, yellow-brown, oxidized
9-11	TILL	clayey, inclusions, gray
11-12	SAND & GRAVEL	very coarse, angular
12-16	CLAY	slightly silty, very cohesive, soft, slighlty greasy

16-29	SAND & GRAVEL	medium sand to 25+ mm gravel, predominantly 3 to 5 mm, very coarse, clean, 30% shale, 30% carbonates, 40% rock fragments, angular to subround
29-34	TILL	as above

155-056-11CCD
NDSWC 14802

Date Completed:	10/09/2001	Purpose:	Test Hole
L.S. Elevation (ft):	N/A		
Depth Drilled (ft):	60		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Black
1-8	CLAY AND SILT	Yellow-brown, oxidized, possibly slightly laminated, (alluvium)
8-24	SAND AND GRAVEL	Fine sand to coarse gravel, poorly sorted, predominately very course sand, 25% shale, 30 to 40% granitic rock fragments, 20% carbonate rock fragments, quartz sand round to sub-angular, oxidized grains
24-36	SILT	Clayey, sandy, smooth drilling, slightly firm, fast easy quiet drilling
36-60	CLAY	Silty, sandy, pebbly, medium gray, moderately firm, un-oxidized, sand and gravel inclusions in clay matrix, matrix becomes highly shale about 41 feet15505612BAA

155-056-11DDD
NDSWC 12740

Date Completed:	1991	Purpose:	Observation Well
L.S. Elevation (ft):	1133.1	Well Type:	2in. - PVC
Depth Drilled (ft):	68	Aquifer:	Fordville
Screen Int. (ft.):	11-16	Data Source:	SWC

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	
1-7	CLAY	silty, yellow to black, moderatly firm to moderately soft, oxidized
7-11	CLAY	silty, moderately soft, medium gray
11-16	SAND & GRAVEL	medium sand to 20mm gravel, mostly very coarse sand to 3mm gravel, 30% shale, 30% carbonates, 30% quartzose rock fragments
16-38	SILT AND CLAY	moderately soft, moderately cohesive, gray
38-68	CLAY	silty, sandy, pebbly, inclusions, medium gray, moderately firm, (Till)

155-056-12BAA
NDSWC 14806

Date Completed:	10/09/2001	Purpose:	Test Hole
L.S. Elevation (ft):	N/A		
Depth Drilled (ft):	120		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Black
1-11	CLAY AND SILT	Sandy, yellow-brown, oxidized, probably till
11-60	CLAY AND SILT	Yellow-brown oxidized, no inclusions, massive to mottled; sand from 46 to 49 feet
60-120	CLAY	Silty, sandy, pebbly, medium gray, moderately firm, sand and gravel inclusions in clay silt matrix (till); sand from 60 to 61 feet; layers of gravel from 76 to 82 feet

155-056-12CCD
NDSWC 2935

Date Completed:	1968	Purpose:	Observation Well
L.S. Elevation (ft):	1144.61	Well Type:	1.25in. - ABS
Depth Drilled (ft):	250	Aquifer:	Fordville
Screen Int. (ft.):	32-35		

Remarks: Well is at land surface 65 ft east of steel building and 18 ft north of road

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Sandy, silty, brownish-black
1-3	CLAY	Very silty, sandy, moderate, yellowish-brown, slightly cohesive, moderately plastic, oxidized, (till)
3-38	SAND	Gravelly (approximately 15-25% fine to medium, angular to sub-rounded gravel), fine to very coarse, angular to rounded, moderately well sorted, mostly quartz, shale and limestone with some granitics, taking water; mixed 1/2 bag of mud
38-55	CLAY	Very silty, sand, olive gray, cohesive, plastic, calcareous, (lake sediment?)
55-85	CLAY	Sandy, silty, gravelly, olive gray, moderately cohesive, moderately plastic, calcareous, numerous cobbles and boulders present, (till)
85-105	CLAY	Very silty, sandy, olive gray, very cohesive, plastic, calcareous; numerous cobbles and boulders
105-114	CLAY	Sandy, silty, gravelly, olive gray to medium gray, slightly to moderately cohesive, moderately plastic to slightly plastic, calcareous (till)
114-116	BOULDERS	limestone

116-246	CLAY	Same as above, gravelly (till)
246-250	SHALE	Interbedded with light gray limestone, indurated, calcareous, fossiliferous; Niobrara firm

155-056-15AAA
NDSWC 14801

Date Completed:	10/09/2001	Purpose:	Test Hole
L.S. Elevation (ft):	N/A		
Depth Drilled (ft):	40		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Black
1-17	SAND AND GRAVEL	Fine sand to very coarse gravel, oxidized, poorly sorted, predominately fine gravel to very coarse sand
17-40	CLAY	Silty, sandy, pebbly, medium gray, moderately firm, un-oxidized, (till)

155-056-15BBB
NDSWC 14800

Date Completed:	10/09/2001	Purpose:	Test Hole
L.S. Elevation (ft):	N/A		
Depth Drilled (ft):	40		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Brown
1-6	GRAVEL AND SAND	Poorly sorted, very coarse, cobbles and boulders present
6-8	CLAY AND SILT	Oxidized, yellow-brown, slightly cohesive, alluvium
8-26	SAND AND GRAVEL	Fine sand to very coarse gravel, poorly sorted, primarily 2-5 mm gravel, increasing shale content with depth, oxidized
26-40	CLAY	Silty, sandy, pebbly, medium gray, un-oxidized moderately firm, inclusions of sand and gravel in clay matrix

155-056-15CCC
NDSWC 5701

Date Completed:	06/15/1970	Purpose:	Test Hole
L.S. Elevation (ft):	N/A		
Depth Drilled (ft):	60		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Silty, sandy, clayey, black
1-8	SAND	Clayey, slightly gravelly, very fine to very coarse grained, fair sorting, sub-angular to sub-rounded, mostly quartz and shale, oxidized throughout, no water loss
8-60	CLAY	Silty, slightly sandy, pebbly, occasional cobbles and boulders, olive gray, moderately cohesive, moderately plastic, calcareous, (till)

155-056-23AAA2
NDSWC 5700

Date Completed:	6/1970	Purpose:	Observation Well
L.S. Elevation (ft):	1154.52	Well Type:	1.25in. - ABS
Depth Drilled (ft):	60	Aquifer:	Fordville
Screen Int. (ft.):	37-40		
Remarks:	200 ' WEST OF ROAD		

Lithologic Log

Depth (ft)	Unit	Description
0-2	TOPSOIL	Sandy, silty, clayey, brownish-black
2-45	SAND	Slightly gravelly, very fine to very coarse grained, angular to rounded, moderately well sorted, approximately 40% quartz and feldspar, 30% shale, 30% siliceous rock fragments, slightly lignitic, oxidized to about 25 feet below land surface, taking water rapidly, mixed 2bags bentonite, not caving in
45-50	CLAY	Very silty, olive gray, cohesive, very plastic, highly calcareous (lacustrine sediment)
50-60	CLAY	Silty, slightly sandy, pebbly, olive gray, moderately cohesive, moderately plastic, calcareous (till)

155-056-24AAA
NDSWC 14804

Date Completed:	10/09/2001	Purpose:	Observation Well
L.S. Elevation (ft):	1151.29	Well Type:	2in. - PVC
Depth Drilled (ft):	80	Aquifer:	Fordville
Screen Int. (ft.):	45-50	Data Source:	J.Patch

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	black
1-17	SAND	Fine sand to fine gravel, poorly to moderately sorted, predominately coarse sand, mostly shale content, rounded tablets to sub rounded, oxidized; gravels at 16 to 17 feet
17-20	CLAY	Silty sandy pebbly inclusions, (till); oxidized yellow brown
20-38	CLAY	(till), as above, un-oxidized, medium gray, medium firm
38-51	SAND AND GRAVEL	Poor sorted, medium sand to coarse gravel, 40% shale, 40% granular crushed rock
51-68	SILT	Clay, slightly sandy, smooth, massive, fast easy drilling
68-80	CLAY	Silty, sandy, pebbly, inclusions, medium gray, moderately firm, sand and gravel, inclusions in clay matrix (till)

155-056-24ABB
NDSWC 14803

Date Completed:	10/09/2001	Purpose:	Observation Well
L.S. Elevation (ft):	1143.46	Well Type:	2in. - PVC
Depth Drilled (ft):	70	Aquifer:	Fordville
Screen Int. (ft.):	42-47	Data Source:	J. Patch

Lithologic Log

Depth (ft)	Unit	Description
0-3	TOPSOIL	Black
3-9	CLAY AND SILT	Yellow-brown, soft to slightly firm, no inclusions, some cuttings appear to have laminations
9-30	SAND AND GRAVEL	Fine sand to very coarse gravel, poorly sorted, predominately very course sand, 30% shale, 20% carbonates, 40% granitic crystalline rock fragments, also quartz sand, oxidized grains
30-47	SAND AND GRAVEL	Fine sand to medium gravel, poorly sorted, predominately very course sand, unoxidized 40% shale sand, rounded to subrounded grains
47-61	SILT	Clayey, slightly sandy, medium to light gray, slightly soft to slightly firm, smooth fast quiet

61-70	CLAY	Silty, sandy, pebbly, medium gray, moderately firm, sand and gravel inclusions in clay matrix

155-056-25ADD
NDSWC 2782A

Date Completed:	1967	Purpose:	Observation Well
L.S. Elevation (ft):	1136.95	Well Type:	4in. - PVC
Depth Drilled (ft):	280	Aquifer:	Fordville
Screen Int. (ft.):	30-33		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Silty, sandy, grayish black
1-8	CLAY	Silty, sandy, dark yellowish-brown, moderately cohesive, plastic, calcareous, a few limestone grains and granules present, oxidized
8-33	GRAVEL	Sandy, approximately 10 to 20% coarse to very coarse sand, angular to sub-rounded, oxidized, gravel portion is fine to medium coarse, sub-angular to sub-rounded, fair sorting, compositionestimate 35 to 45% limestone (very pale orange to grayish orange), dolostone (grayish orange with black dendrite oxidized areas), remainder being shale (grayish black), light colored granitics
33-46	CLAY	Silty, olive gray, very cohesive and plastic, calcareous, a few angular to sub-angular limestone and shale grains and granules present in clay matrix, lake sediment
46-93	CLAY	Silty, sandy, olive gray to dark greenish gray, cohesive, non-plastic, numerous angular to sub-angular limestone and shale grains, granules and a few pebbles present in clay matrix, (till)
93-246	CLAY	Silty, sandy, gravelly in places, olive gray to medium dark gray, cohesive and plastic, calcareous, (till)
246-280	SHALE	Dark greenish gray to dark gray, calcareous, indurated, drills steady but hard, a few white specks (grains) in upper section (limestone and gypsum), cretaceous; marine; undifferentiated

155-056-25BAA
NDSWC 12738

Date Completed:	1991	Purpose:	Observation Well
L.S. Elevation (ft):	1142.25	Well Type:	2in. - PVC
Depth Drilled (ft):	46	Aquifer:	Fordville
Screen Int. (ft.):	30-35	Data Source:	SWC

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	
1-4	CLAY	silty, yellow-brown, soft, oxidized
4-32	SAND & GRAVEL	medium sand to 15mm gravel, poorly sorted, oxidized, predominantly very coarse sand to 3mm gravel
32-43	CLAY AND SILT	clayey silt to silty clay, very soft, smooth, slightly cohesive, medium gray
43-46	TILL	clayey, silty, sandy, pebbly, medium gray, moderately firm, inclusion (Till)

155-056-25BBB
NDSWC 12739

Date Completed:	1991	Purpose:	Observation Well
L.S. Elevation (ft):	1140.22	Well Type:	2in. - PVC
Depth Drilled (ft):	80	Aquifer:	Fordville
Screen Int. (ft.):	25-30	Data Source:	SWC

Remarks:
Well will not pump, had to bail for sample 1995.

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	
1-24	SAND & GRAVEL	medium sand to 20-25 mm gravel, poorly sorted, median size about 2mm gravel, oxidized to 24 feet, round to subangular, predominantly subround, 30% shale, 30% carbonates, 30-40% quartose and rock fragments
24-27	SAND & GRAVEL	as above, unoxidized
27-36	CLAY	silty, very soft, smooth, slightly cohesive, no inclusions
36-80	TILL	clayey, silty, sandy, pebbly inclusions, medium gray moderately firm

155-056-25BCB
NDSWC 5699

Date Completed:	06/15/1970	Purpose:	Observation Well
L.S. Elevation (ft):	N/A	Well Type:	1.25in. - PVC
Depth Drilled (ft):	240	Aquifer:	Undefined
Screen Int. (ft.):	25-28		

Lithologic Log

Depth (ft)	Unit	Description
0-2	TOPSOIL	Sandy, silty, clayey, brownish-black
2-28	SAND	Slightly clayey and silty, gravelly about 30% fine to coarse gravel, very fine to very coarse grained mostly medium to coarse grained, moderately well sorted, sub-angular to sub-rounded, about 50% quartz and feldspar, 40% carbonates, 10% siliceous rock fragments, oxidized throughout, taking water, mixed 2 bags of bentonite, not caving
28-47	CLAY	Very silty, olive gray to medium dark gray, cohesive, plastic, (lacustrine sediment)
47-225	CLAY	Silty, moderately sandy, pebbly, occasional cobbles and boulders, olive gray, moderately cohesive, moderately plastic, (till) rough drilling
225-233	GRAVEL	Clayey, fine to coarse, angular, poorly sorted, approximately 70% carbonates, remainder siliceous rock, granitics, metamorphics
233-240	SHALE	Clayey, medium gray to medium dark gray with numerous small brownish-gray concretions and white specks, moderately calcareous, indurated

155-056-25BCD
NDSWC 5698

Date Completed:	6/1970	Purpose:	Observation Well - Recorder
L.S. Elevation (ft):	1139.84	Well Type:	6in. - PVC
Depth Drilled (ft):	50	Aquifer:	Fordville
Screen Int. (ft.):	33.5-35		
Remarks:	Recorder well. MAP ON BACK		

Lithologic Log

Depth (ft)	Unit	Description
0-2	TOPSOIL	Sandy, pebbly, silty, brownish-black
2-35	SAND	Moderately gravelly (about 30% fine to coarse gravel), very fine to coarse grained (mostly medium to coarse grained), angular to rounded, moderately well sorted, approximately 40% carbonates, 50% quartz, 10% shale and siliceous rock fragments, oxidized to about 30 feet bellow land surface, mixed 2 bags of bentonite, taking water rapidly, not caving
35-50	CLAY	Very silty, sandy, medium gray to light olive gray, slightly cohesive, plastic, highly calcareous, fluvial sediment

155-056-28ABB
NDSWC 2941

Date Completed:	05/24/1968	Purpose:	Test Hole
L.S. Elevation (ft):	N/A		
Depth Drilled (ft):	105.5		

Lithologic Log

Depth (ft)	Unit	Description
0-1	CLAY	sandy, gravelly, silty, brownish-black, (topsoil)
1-2	CLAY	silty, sandy, pebbly, moderate-yellowish-brown, oxidized, (till)
2-6	GRAVEL	fine to coarse, poorly sorted, mostly limestone and shale
6-30	CLAY	sandy, silty, pebbly, cobbly, moderate-yellowish-brown, oxidized, (till)
30-36	CLAY	silty, sandy, pebbly, olive-gray, (till)
36-52	CLAY	silty, sandy, pebbly, olive-gray, calcareous, numerous granite and limestone cobbles, (till)
52-54	SAND	silty, angular to subround, poorly sorted
54-105	CLAY	sandy, pebbly, silty, olive-gray, numerous cobbles, (till)
105-105.5	BOULDER	ganite, pinkish, very hard

155-056-32BBB
NDSWC 5035

Date Completed:	07/15/1968	Purpose:	Test Hole
L.S. Elevation (ft):	N/A		
Depth Drilled (ft):	280		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Sandy, silty, clayey, brownish-black
1-18	CLAY	Silty, sandy, slightly pebbly, yellow to moderately yellowish-brown, slightly cohesive, slightly plastic, oxidized (till)
18-68	CLAY	Silty, slightly sandy, very slightly pebbly, olive gray to medium dark gray, slightly cohesive, slightly plastic, calcareous, shale and limestone fragments in clay matrix (till)
68-128	CLAY	Very silty, olive gray to dark greenish gray, slightly to moderately cohesive, moderately plastic, very calcareous, (fluvial or lacustrine sediment)
128-158	CLAY	Very silty, slightly sandy, olive gray, slightly to moderately cohesive, slightly plastic, very calcareous, laminations and thin bedding (seasonal) present, a few white specks (fluvial sediment)

158-215	CLAY	Silty, slightly sandy, brownish gray with light brownish gray laminations, occasional sandy laminations, slightly to moderately cohesive, slightly plastic, very calcareous, (fluvial sediment)
215-246	CLAY	Very silty, olive gray to medium gray, cohesive, slightly plastic, very calcareous, thinly laminated, (fluvial sediment)
246-280	SHALE	Brownish-black with a few thin dark greenish-gray limestone layers, fossiliferous, numerous white specks, indurated to moderately indurated, slightly calcareous to non-calcareous, a few light brownish-gray concretions, (cretaceous undefined) (possibly Niobrara Formation)

156-055-06AAA
NDSWC 2928

Date Completed:	05/16/1968	Purpose:	Test Hole
L.S. Elevation (ft):	N/A		
Depth Drilled (ft):	280		

Lithologic Log

Depth (ft)	Unit	Description
0-1	CLAY	sandy, silty, brownish-black, (topsoil)
1-15	CLAY	silty, sandy, pebbly, moderate-yellowish-brown, plastic, oxidized, numerous lignite and shale fragments, (till)
15-100	CLAY	sandy, silty, gravelly, cobbly, olive-gray, plastic, calcareous, (till)
100-122	CLAY	sandy, silty, gravelly, olive-gray, plastic, calcareous, numerous limestone, shale, and lignite fragments present, very sandy in places, (till)
122-140	CLAY	sandy, silty, pebbly, plastic, very calcareous, numerous limestone and shale fragments, (till)
140-238	CLAY	sandy, silty, gravelly, olive-gray, plastic, numerous limestone and shale fragments in clay matrix, (till)
238-280	SHALE	silty, brownish-black, fossiliferous, indurated, (Niobrara Formation)

156-055-07DCC
NDSWC 5376

Date Completed:	08/08/1969	Purpose:	Test Hole
L.S. Elevation (ft):	1071		
Depth Drilled (ft):	280		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Clay, silty, black
1-4	SAND	fairly well sorted, oxidized
4-6	CLAY	silty, light-yellow, plastic, oxidized (lake deposit)
6-126	CLAY	silty, sandy, pebbly, olive-gray, plastic, calcareous; occasional cobbles (Till)
126-134	SAND	clayey, silty; mostly quartz grains
134-260	CLAY	silty, sandy, pebbly, olive-gray, calcareous; few cobbles (Till)
260-280	SHALE	clayey, brownish-gray, indurated, calcareous; numerous white specks, (Niobrara Formation)

156-055-15CCC
NDSWC 5024

Date Completed:	07/02/1968	Purpose:	Test Hole
L.S. Elevation (ft):	N/A		
Depth Drilled (ft):	220		

Lithologic Log

Depth (ft)	Unit	Description
0-1	CLAY	silty, sandy, brownish-black (topsoil)
1-9	CLAY	silty, sandy, pebbly, moderate-yellowish-brown, plastic, oxidized, calcareous, (till)
9-50	CLAY	silty, sandy, pebbly, olive-gray, plastic, calcareous, (till)
50-163	CLAY	silty, pebbly, olive-gray, calcareous, limestone and shale fragments in clay matrix, (till)
163-210	CLAY	silty, sandy, gravelly, light-olive-gray, plastic, calcareous, limestone and shale fragments in clay matrix, (till)
210-220	SHALE	brownish-gray, fossiliferous, indurated, calcareous, white specks, (Niobrara Formation)

156-055-19CCC
NDSWC 2936

Date Completed:	05/23/1968	Purpose:	Observation Well
L.S. Elevation (ft):	1190	Well Type:	1.25in. - PVC
Depth Drilled (ft):	400	Aquifer:	Undefined
Screen Int. (ft.):	72-75		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Clay, sandy, silty, brownish black
1-30	CLAY	silty, sandy, pebbly, moderate-yellowish-brown, oxidized, (till)
30-53	CLAY	silty, sandy, pebbly, olive-gray, calcareous, (till)
53-56	SAND	clayey, silty, well-sorted, oxidized
56-80	SAND	clayey, silty, gravelly, fine to very coarse, fairly well sorted
80-124	CLAY	silty, sandy, olive-gray, calcareous, (lake deposit)
124-195	TILL	silty, sandy, pebbly, olive-gray, calcareous, numerous limestone and shale fragments in clay matrix, (till)
195-197	GRAVEL	fine to coarse, poorly sorted
197-250	TILL	silty, sandy, gravelly, olive-gray, calcareous, numerous limestone and shale fragments in clay matrix, (till)
250-260	CLAY	silty, sand, olive-gray, plastic, calcareous, (lake deposit)
260-286	TILL	sandy, gravelly, silty, olive-gray, calcareous, numerous limestone and shale fragments, (till)
286-291	GRAVEL	fine to coarse
291-340	CLAY	silty, sandy, pebbly, olive-gray, calcareous, numerous limestone and shale fragments in clay matrix, (till)
340-366	CLAY	silty, sandy, pebbly, medium-gray, (till)
366-400	SHALE	brownish-black, fossiliferous, indurated, calcareous, interbedded with thin light-gray limestone layers (Niobrara Formation)

156-056-04CCC
NDSWC 2784

Date Completed:	8/1967	Purpose:	Observation Well
L.S. Elevation (ft):	N/A	Well Type:	1.25in. - PVC
Depth Drilled (ft):	180	Aquifer:	Undefined
Screen Int. (ft.):	153-160		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Silty, sandy, grayish-black
1-14	CLAY	Silty and sandy, moderate yellowish-brown, moderately cohesive, plastic, calcareous, oxidized
14-18	GRAVEL	Clayey, fine to medium, poorly sorted, angular to sub-rounded, estimate 45-55% shale; (grayish-black) and limestone dolostone and light colored granitics remainder
18-42	CLAY AND SILT	Sandy, olive-gray, cohesive, non-plastic, numerous limestone and shale grains and granules and
42-144	CLAY	Silty, gravelly, olive-gray to medium dark gray, cohesive, non-plastic, calcareous, gravel layers from 44 feet to 56 feet, poor samples, limestone (very pale orange), boulders and light colored granitic boulders are numerous, very rough drilling
144-162	GRAVEL	Fine to medium, small amount of very coarse, sub-rounded sand present, moderately well sorted, sub-angular to rounded, composition estimate 45-55% limestone and dolostone (pale yellowish orange well oxidized), 25-35% shale (grayish-black to grayish red), remainder being reddish, greenish, blackish, specular granitics, very small amount of lignite (black slightly indurated)
162-173	CLAY	Silty and sandy, olive gray to dark greenish gray, cohesive, non-plastic, calcareous, numerous limestone and shale grains, granules and pebbles imbedded in clay matrix, (till)
173-180	SHALE	Grayish brown to dusky brown, indurated, drills steady and hard, calcareous, marine cretaceous undifferentiated

156-056-09DDD
NDSWC 14780

Date Completed:	10/01/2001	Purpose:	Observation Well
L.S. Elevation (ft):	1176.06	Well Type:	2in. - PVC
Depth Drilled (ft):	60	Aquifer:	Fordville
Screen Int. (ft.):	30-35	Data Source:	J. Patch

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Black
1-7	GRAVEL	Sand, silt clay, oxidized, yellow-brown

7-21	SAND	Very fine to course, mainly medium, predominately silica and igneous rock fragments with 30% shale and carbonates; sub rounded to angular mainly sub-angular
21-38	GRAVEL AND SAND	Medium sand to 25mm + gravel, angular to rounded predominately sub-rounded, shale seems to increase with depth, up to 60% shale, other major fractions are igneous rock fragments, silica sand and carbonates
38-60	CLAY	Silty, sandy, pebbly, inclusions, medium gray to dark gray, high shale content of all sizes including the inclusions, (till)

156-056-11CCC
NDSWC 5375

Date Completed:	08/07/1969	Purpose:	Observation Well
L.S. Elevation (ft):	1260	Well Type:	1.25in. - PVC
Depth Drilled (ft):	300	Aquifer:	Undefined
Screen Int. (ft.):	117-120		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Silty, clayey, pebbly, brownish-black
1-52	CLAY	Silty, slightly sandy, pebbly, occasional cobbles, moderate yellowish-brown, cohesive, slightly to moderately plastic, oxidized (till)
52-91	CLAY	Silty, slightly sandy, pebbly, a few cobbles, olive gray, cohesive, slightly plastic, calcareous (till)
91-104	GRAVEL	Slightly sandy, fine to coarse, angular to sub-rounded, approximately 25-35% shale, 30-40% carbonates(limestone and dolostone), remainder granitics, not taking much water, not caving
104-106	CLAY	Very silty, sandy, medium dark gray, laminated, very calcareous, (fluvial sediment)
106-134	GRAVEL	Slightly sandy, fine to coarse, angular to sub-rounded, moderately well sorted, approximately 30-50% carbonates (limestone and dolostone), remainder shale and granitics, taking small amount of water not caving in, (some clay in lower 10-15 feet of section)
134-230	CLAY	Silty, slightly sandy, pebbly, occasional cobbles and boulders, cohesive, moderately to slightly plastic, calcareous (till)
230-274	CLAY	Silty, slightly sandy, occasional thin sandy gravel lenses, olive gray, cohesive, slightly plastic, calcareous (till)
274-287	COBBLES AND BOULDERS	Granite, limestone and dolostone, clay through-out (till), rough drilling
287-300	SHALE	Moderately clayey, brownish-black, calcareous, numerous white specks, bedded (Niobrara Formation)

156-056-13CCC
NDSWC 5034

Date Completed:	07/12/1968	Purpose:	Test Hole
L.S. Elevation (ft):	N/A		
Depth Drilled (ft):	360		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Sandy, pebbly, brownish-black
1-51	CLAY	Sandy, silty, pebbly, a few gravel layers, moderate yellow-brown to dusky yellow, slightly to moderately cohesive, slightly plastic, oxidized (till)
51-57	CLAY	Very silty, sandy, moderate yellowish-brown, slightly to moderately cohesive, slightly plastic, very calcareous, (fluvial sediment)
57-100	CLAY	Very silty, interbedded with very fine to fine grained predominantly quartz and limestone sand, olive gray slightly to moderately cohesive, plastic, calcareous, (fluvial sediment)
100-106	CLAY	Sandy, silty, slightly, pebbly, olive gray, moderately cohesive, slightly plastic, calcareous, limestone, dolostone and shale fragments in clay matrix (till)
106-123	SILT	Very clayey, olive gray with an occasional light olive gray lamination, slightly to moderately cohesive, plastic, very calcareous, (fluvial sediment)
123-200	CLAY	Silty, slightly sandy, pebbly, occasional cobbles, olive gray to medium dark gray, moderately cohesive, slightly plastic, limestone, dolostone and shale fragments in clay matrix, (till)
200-337	CLAY	Silty, sandy, pebbly, olive gray, slightly to moderately cohesive, moderately plastic, calcareous, a few gravel in layers lower portion of section, limestone, dolostone and shale fragments in clay matrix (till)
337-360	SHALE	Fossiliferous, grayish-brown to brownish-gray, with occasional light-brownish-gray laminae, slightly calcareous to non-calcareous, indurated, a few white specks, (Niobrara Formation)

156-056-14CDD
NDSWC 14785

Date Completed:	00/00/00	Purpose:	Test Hole
L.S. Elevation (ft):	N/A		
Depth Drilled (ft):	169		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Black

1-40	CLAY	Silty sandy pebbly inclusions, yellow-brown, oxidized, weathered, slightly cohesive to moderately cohesive, sand and gravel inclusions in silty clay matrix (till)
40-169	CLAY	(till) as above, un-oxidized, medium gray, moderately firm; sand and gravel (intertill) from 71-76 feet poorly sorted mostly shale and carbonates; sand and gravel from 80-83 feet; sand and gravel from 109-112 feet; very silty section from 141-147 feet

156-056-15DCC
NDSWC 2950

Date Completed:	5/1968	Purpose:	Observation Well
L.S. Elevation (ft):	1165	Well Type:	1.25in. - PVC
Depth Drilled (ft):	220	Aquifer:	Undefined
Screen Int. (ft.):	19.5-22.5		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Sandy, silty, brownish-black
1-7	CLAY	very silty, sandy, moderate yellowish-brown, moderately cohesive, slightly plastic, oxidized; laminated (lake sediment)
7-24	GRAVEL	Sandy, slightly silty, (approximately 25-35% medium to very coarse, angular to sub-rounded sand), fine to coarse, angular to rounded, moderately well sorted, mostly limestone and dolostone, shale, mudstone with some granite rocks, oxidized, taking water and caving, mixed 2 bags of mud, some cobble size material present
24-38	CLAY	Very silty, sandy, medium gray to olive gray, very slightly cohesive, slightly plastic to moderately plastic, very calcareous, laminated, (lake sediment)
38-50	CLAY	Sandy, silty, pebbly, olive-gray, cohesive, slightly plastic, calcareous, numerous shale and limestone fragments in clay matrix, a few cobbles present (till)
50-53	SANDY	Silty, clayey, fine to coarse grained, angular to sub-rounded, poorly sorted, mostly shale and mudstone some quartz and limestone; poor sample return
53-108	CLAY	Sandy, silty, pebbly, olive-gray, cohesive, moderately plastic, calcareous, numerous shale and limestone fragments in clay matrix, a few cobbles present (till)
108-180	CLAY	Sandy, silty, pebbly, olive-gray, cohesive, semi-plastic, calcareous, limestone and shale fragments, occasional cobbles (till)
180-185	GRAVEL	Sandy, clayey, silty, fine to coarse, angular to sub-rounded, poorly sorted, cobble size material present, mostly limestone and dolostone, very little shale, a few granite fragments, poor sample return
185-191	CLAY	Sandy, silty, pebbly, olive-gray, cohesive, slightly plastic, calcareous (till)
191-220	SHALE	Sandy, medium dark gray, a few dark greenish-gray grains, indurated, non-calcareous, (glauconitic)

156-056-15DDD
NDSWC 14784

Date Completed:	10/01/2001	Purpose:	Observation Well
L.S. Elevation (ft):	1170.59	Well Type:	2in. - PVC
Depth Drilled (ft):	60	Aquifer:	Fordville
Screen Int. (ft.):	45-50	Data Source:	J. Patch

Lithologic Log

Depth (ft)	Unit	Description
0-2	TOPSOIL	Black
2-19	CLAY AND SILT	Gravel inclusions, some cuttings show laminations, oxidized, weathered, gritty; very gravelly from 2 to 8 feet; sticky clay matrix from 8 to 18 feet, less silt less than above from 12 to 18 feet; rock at 19 feet
19-27	SAND AND GRAVEL	Medium sand to very course gravel, some shale tablets up to 25+mm, predominately coarse gravel,
27-54	SAND AND GRAVEL	As above, un-oxidized, predominately coarse sand to fine gravel
54-60	CLAY	Silty, sandy, pebbly, medium gray, moderately firm, sand and gravel inclusions in clay siltmatrix

156-056-16BAA
NDSWC 14781

Date Completed:	10/01/2001	Purpose:	Observation Well
L.S. Elevation (ft):	1172.8	Well Type:	2in. - ABS
Depth Drilled (ft):	40	Aquifer:	Fordville
Screen Int. (ft.):	24-29	Data Source:	J. Patch

Lithologic Log

Depth (ft)	Unit	Description
0-2	TOPSOIL	Black
2-23	SILT AND CLAY	Yellow-brown, some inclusions of sand and gravel, highly weathered and oxidized (alluvium)
23-27	SAND	Very fine to very coarse, predominately medium, mostly sub-rounded, grayish color, un-oxidized, 40% shale, 30 to 40% silica, remainder igneous rock fragments and carbonate rock fragments
27-31	SAND AND GRAVEL	Medium sand to coarse gravel up to 10mm in size, dark color due to about 60% shale content,sub-rounded to sub-angular
31-40	CLAY	Silty, sand, pebbly medium gray, moderately firm, inclusions, (till)

156-056-16BBB
NDSWC 14782

Date Completed:	10/02/2001	Purpose:	Test Hole
L.S. Elevation (ft):	N/A		
Depth Drilled (ft):	30		

Lithologic Log

Depth (ft)	Unit	Description
0-2	TOPSOIL	Black
2-6	CLAY AND SILT	Oxidized, yellow-brown, sticky slightly laminated, possibly alluvium lake sediment, some oxidized weathered inclusion
6-12	GRAVEL	Coarse, angular and sub-angular, up to 20mm in size, highly oxidized weathered shale; up to 50-60%, carbonate rock fragment and quartz rock fragments also present
12-13	CLAY	Silty, sand, pebbly, oxidized, (till)
13-18	SAND AND GRAVEL	As above, oxidized

156-056-16CCB
NDSWC 2783

Date Completed:	8/1967	Purpose:	Observation Well
L.S. Elevation (ft):	1172.35	Well Type:	1.25in. - PVC
Depth Drilled (ft):	40	Aquifer:	Fordville
Screen Int. (ft.):	28-32		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Silty and sandy, grayish-black
1-8	CLAY	Silty, sandy, dark yellowish-brown, cohesive and plastic, oxidized
8-29	GRAVEL	Sandy approximately 5-10% very coarse sand, sub-angular to rounded, gravel portion is fine to coarse, sub-angular to rounded, fair sorting, estimate 30-40% shale (grayish-black), limestone (very pale orange) and dolostone (moderate orange to pink) 25-35%, remainder being light-colored granitics, taking water used 3 bags of mud
29-40	CLAY	Silty and sandy, olive-gray, cohesive and slightly plastic, numerous limestone and shale grains and granules imbedded in clay matrix, (till)

156-056-16DDC
NDSWC 2951

Date Completed:	5/1968	Purpose:	Observation Well
L.S. Elevation (ft):	1163.61	Well Type:	1.25in. - ABS
Depth Drilled (ft):	40	Aquifer:	Fordville
Screen Int. (ft.):	17-20		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Sandy, silty, brownish-black
1-7	CLAY	Silty, slightly sandy, moderately yellowish-brown with a few light gray streaks, moderately cohesive, moderately plastic to plastic, laminated oxidized (lake sediment)
7-25	GRAVEL	Sandy (approximately 20-30% medium to coarse grained, angular to sub-rounded, moderately well-sorted, rapidly taking water and caving, predominantly limestone, dolostone and shale, with some granite rocks, some mudstone and quartzite, mixed 6 bags drilling mud
25-28	CLAY	Very silty, sandy, medium gray to olive-gray, slightly cohesive, plastic, very calcareous, laminated, (lake sediment)
28-40	CLAY	Sandy, silty, pebbly, a few cobbles, olive-gray, cohesive, semi-plastic, calcareous, numerous limestone and shale fragments in clay matrix (till)

156-056-17DCC
NDSWC 14783

Date Completed:	10/02/2001	Purpose:	Test Hole
L.S. Elevation (ft):	N/A		
Depth Drilled (ft):	40		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Black
1-4	CLAY	Oxidized, yellow-brown, sticky
4-5	ROCK	Granite, small ledge of sand and gravel and large rock; cobble and boulder
5-12	CLAY	Silty, sandy, pebbly, oxidized inclusions in oxidized clay matrix (till)
12-40	CLAY	Silty , sandy, pebbly, inclusions, medium gray, moderately firm, (till); rock at 29 feet

156-056-18AAA
NDSWC 5374

Date Completed:	08/07/1969	Purpose:	Test Hole
L.S. Elevation (ft):	N/A		
Depth Drilled (ft):	180		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Sandy, silty, clayey, brownish-black
1-8	CLAY	Silty, slightly to moderately sandy, pebbly, occasional cobbles and boulders, moderate yellowish-brown, cohesive, slightly plastic, oxidized (till)
8-64	CLAY	Silty, slightly sandy, pebbly occasional cobbles and boulders, cohesive, slightly to moderately
64-85	BLOCK	Shale, siliceous, moderately clayey, grayish-black, brittle, non-calcareous, fractured, bentonitic; (Pierre Formation); (moved in by ice)
85-85.5	BOULDER	Granite, black and white specular, hard
85.5-91	BLOCK	Sandstone, moderately clayey, very fine to fine grained, numerous limunitic concretions, greenish-gray to grayish-olive, sub-angular, micaceous, weathered; (Fox Hills Formation); (moved in by ice)
91-112	BLOCK	Shale, siliceous, moderately clayey, slightly fractured, non-calcareous, bedded, bentonitic; (Pierre Formation); (moved in by ice)
112-148	CLAY	Silty, slightly sandy, pebbly, occasional cobbles and boulders, olive-gray, cohesive, moderately plastic, calcareous (till)
148-180	SHALE	Moderately clayey, brownish-black, numerous white specks, very calcareous, bedded, horizontal parting (Niobrara Formation)

156-056-18CCC
NDSWC 5373

Date Completed:	08/07/1969	Purpose:	Test Hole
L.S. Elevation (ft):	N/A		
Depth Drilled (ft):	120		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Silty, sandy, clayey, occasional boulders, brownish-black
1-10	CLAY	Very silty, sandy, pebbly, occasional boulders, pale yellowish-brown, cohesive, slightlyplastic, oxidized (till)
10-16	SAND	Silty very fine to medium grained, angular to sub-rounded, fair sorting, mostly quartz and shale, some carbonates, slightly oxidized

16-25	CLAY	Very silty, sandy, pebbly, olive gray, cohesive, slightly plastic, calcareous (till)
25-31	SAND	Slightly gravelly, very fine to coarse grained, angular to sub-rounded, moderately well sorted, mostly quartz and shale, some carbonates and granitics
31-76	CLAY	Very silty, sandy, pebbly, occasional cobbles and boulders-boulders at 75 to 76 feet, granite, olive gray, cohesive, slightly plastic, calcareous (till)
76-84	BLOCK	Shale, clayey, siliceous, grayish-black to black, brittle, non-calcareous, (Pierre Formation); ice moved block
84-88	SAND	Very fine grained to medium grained, angular to sub-rounded, moderately well sorted, mostly quartz, some shale
88-95	CLAY	Very silty, olive-gray, with a few light olive gray laminations, slightly cohesive, plastic, very calcareous, (lacustrine sediment or fluvial sediment)
95-120	SHALE	Clayey, brownish-gray, occasional white specks, very calcareous, moderately indurated, (Niobrara Formation)

156-056-20DDD
NDSWC 14791

Date Completed:	10/03/2001	Purpose:	Test Hole
L.S. Elevation (ft):	N/A		
Depth Drilled (ft):	40		

Lithologic Log

Depth (ft)	Unit	Description
0-3	TOPSOIL	Black
3-7	SILT	Clayey slightly sandy, yellow-brown, some mottled with blackish streaks, appears to be laminated slightly, oxidized
7-23	ClAY	Silty, sandy, pebbly, yellow-brown, oxidized appears to be weathered till, moderately soft, easy drilling except for limestone rock at 21-22 feet
23-40	CLAY	Silty, sandy, pebbly, inclusions of sand and gravel in clay matrix medium gray to dark gray, moderately firm, (till); rocks and gravel from 28-30 feet

156-056-22CCC
NDSWC 14790

Date Completed:	10/03/2001	Purpose:	Observation Well
L.S. Elevation (ft):	1157.46	Well Type:	2in. - PVC
Depth Drilled (ft):	80	Aquifer:	Fordville
Screen Int. (ft.):	12-17	Data Source:	Calheim & Leuwter

Lithologic Log

Depth (ft)	Unit	Description
0-2	TOPSOIL	black
2-12	SILT	Clayey, brown to yellow in color, slightly sandy, laminated, smooth drilling, oxidized
12-17	SAND AND GRAVEL	Medium sand to very course gravel, poorly to moderately sorted, predominately very coarse sand, unoxidized, 35% shale, 30% granitic rock fragments, 20% carbonates, 15% quartz sand
17-80	CLAY	Silty sandy, pebbly inclusions, medium grain, firm to moderately firm, slightly cohesive, clay-silt matrix with sand and gravel inclusions (till); rocks (boulders and cobbles) at 51-52 feet; large rock (2 to 3 feet thick) 58-60 feet

156-056-22CCD
NDSWC 2931

Date Completed:	05/21/1968	Purpose:	Test Hole
L.S. Elevation (ft):	N/A		
Depth Drilled (ft):	165		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Sandy, gravelly, silty, brownish-black
1-25	GRAVEL	Sandy, (approximately 25-35% fine to very coarse, sub-angular to sub-rounded sand), fine to coarse, angular to rounded, moderately well sorted, mostly limestone and dolostone with someshale, granite, agate and chalcedony, rapidly taking water, mixed 2 bags of bentonite, oxidized to approximately 20-22 feet below land surface
25-27	COBBLES AND BOULDERS	Limestone, shale, granite, rough drilling
27-58	CLAY	Sandy with a few cobbles, silty, gravelly, olive-gray, moderately cohesive, moderately plastic, calcareous, numerous limestone and shale fragments in matrix of clay, (till)
58-72	CLAY	Very silty, sandy, pebbly, olive-gray, moderately cohesive, moderately plastic, calcareous, (till), cobbles
72-79	CLAY	Same as above only with numerous cobbles and boulders, (till)
79-82	COBBLES AND BOULDERS	Greenish and pinkish granite, hard, rough drilling

82-150	CLAY	Sandy, silty, pebbly, olive-gray, moderately cohesive to cohesive, moderately plastic, calcareous, numerous limestone and shale fragments (till), a few cobbles
150-164	CLAY	Sandy, silty, pebbly, olive-gray, numerous limestone and granite cobbles and boulders, very rough drilling
164-165	BOULDER	Granite, black-white specular very hard, abandoned at 165 feet

156-056-22DCC
NDSWC 14789

Date Completed:	10/03/2001	Purpose:	Observation Well
L.S. Elevation (ft):	1165.37	Well Type:	2in. - PVC
Depth Drilled (ft):	60	Aquifer:	Fordville
Screen Int. (ft.):	32-37	Data Source:	J. Patch

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Black
1-32	SAND AND GRAVEL	Medium sand to very coarse gravel, poorly sorted, predominately fine gravel, oxidized, yellow-rusty brown in color, rough drilling, used several bags of mud
32-35	SAND AND GRAVEL	As above, slightly finer grained, predominately shale 40 to 50%, granitic rock fragments 30%, carbonates and quartz sand, un-oxidized, dark colored due to shale content
35-60	CLAY	Silty, sandy, pebbly, inclusions of sand and gravel in clay matrix, medium gray, moderately firm, slightly cohesive, (till)

156-056-22DDD
NDSWC 2930

Date Completed:	5/1968	Purpose:	Observation Well - Recorder
L.S. Elevation (ft):	1165.58	Well Type:	4in. - PVC
Depth Drilled (ft):	280	Aquifer:	Fordville
Screen Int. (ft.):	52-57		

Completion Info: THERE ARE TWO LOGS FOR THIS LOCATION 2930 IS A TEST HOLE AND 2930A IS THE WELL. DIDN'T CHANGE ANY THING BECOUSE 22DDD IS ALREADY PUBLISHED.

Remarks: RECORDER

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Sandy, gravelly, silty, brownish-black
1-7	CLAY	Silty, sandy, pebbly, moderate yellowish-brown, slightly cohesive, slightly plastic, oxidized, numerous limestone and shale fragments (till)

7-20	GRAVEL	Sandy (approximately 20-30% sub-angular to sub-rounded, medium to very coarse-grained sand), fine to coarse, sub-angular to rounded, moderately well sorted, mostly limestone and dolostone, with a moderate amount of granite and shale, rapidly taking water mixed 2 bags of mud, a fewolive-gray to moderate yellowish-brown clay layers lower 10 feet, limestone and dolostone oxidized to light brown color
20-57	SAND	Medium to very coarse, sub-angular to rounded, moderately well-sorted mostly limestone, dolostone and shale with a few granitic fragments, taking some drilling water; shale portion increasing toward bottom of section
57-60	CLAY	Sandy, silty, gravelly, olive-gray, very cohesive, very slightly plastic, calcareous, numerous limestone and shale fragments (till)
60-168	CLAY	Sandy, silty, gravelly, olive-gray, very cohesive, very slightly plastic, calcareous, numerous limestone and shale fragments (till)
168-186	CLAY	Sandy, silty, pebbly, olive-gray to greenish black, very cohesive, very plastic, calcareous (till)
186-194	CLAY	Silty sandy pebbly, olive-gray, cohesive, moderately plastic, calcareous, a few cobbles, (till)
194-197	BOULDER	Sandstone, dark greenish-gray, cemented, calcareous, indurated
197-248	CLAY	Sandy, silty, pebbly, olive-gray to greenish-gray, cohesive, very plastic to moderately plastic, numerous limestone and shale grains and granules in clay matrix, (till)
248-280	SHALE	Interbedded with light gray limestone, brownish black, fossiliferous, parts along horizontal cleavage plains, very calcareous, Niobrara Formation

156-056-23BCC
NDSWC 14788

Date Completed:	10/03/2001	Purpose:	Observation Well
L.S. Elevation (ft):	1164.83	Well Type:	2in. - PVC
Depth Drilled (ft):	60	Aquifer:	Fordville
Screen Int. (ft.):	38-43	Data Source:	J. Patch

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Black
1-16	SAND AND GRAVEL	Coarse sand to very course gravel, poorly sorted, predominately course gravel, oxidized, rusty color, tough drilling, used much mud
16-25	SILTY	Sandy, slightly clayey, oxidized, drilled smooth, poor sample recovery
25-32	SAND	Fine to very course, moderately sorting, predominately course sand, high shale content up to 60%, sub-angular to round, predominately rounded tablets, possibly partially oxidized

32-46	SAND AND GRAVEL	Medium sand to 6mm gravel, predominately coarse sand to fine gravel, poorly sorted, un-oxidized, 40% shale, 30% granitic rock fragments
46-60	CLAY	Silty sandy, pebbly, inclusions of sand and gravel in clay matrix, medium gray, moderately firm, slightly to moderately cohesive, (till)

156-056-23CDD

NDSWC 14787

Date Completed:	10/02/2001	Purpose:	Observation Well
L.S. Elevation (ft):	1167.53	Well Type:	2in. - PVC
Depth Drilled (ft):	60	Aquifer:	Fordville
Screen Int. (ft.):	28-33	Data Source:	J. Patch

Lithologic Log

Depth (ft)	Unit	Description
0-2	TOPSOIL	15605623CDD
2-28	SAND AND GRAVEL	Medium sand to very coarse gravel, predominately coarse sand to coarse gravel, poorly sorted, coarser near the surface becoming finer with depth, to predominately coarse sand up to 25mm gravels, predominately shale up to 60% rounded tablets to angular fragments, 30% igneous-granitic rock fragments, also quartz sand and carbonates, oxidized rusty in color becoming darker colored with depth
28-32	SAND AND GRAVEL	As above, un-oxidized
32-47	SILT	Smooth drilling, poor sample recovery
47-60	CLAY	Silty, sandy, pebbly, inclusions, medium gray, moderately firm, clay matrix with sand and gravel inclusions, (till)

156-056-24BCC

NDSWC 14786

Date Completed:	10/02/2001	Purpose:	Observation Well
L.S. Elevation (ft):	1225.34	Well Type:	2in. - PVC
Depth Drilled (ft):	140	Aquifer:	Fordville
Screen Int. (ft.):	101-106	Data Source:	J. Patch

Lithologic Log

Depth (ft)	Unit	Description
0-2	TOPSOIL	Black
2-43	CLAY	Silty sandy, pebbly, inclusions, yellow-brown, oxidized, weathered, (till)
43-101	CLAY	(till), as above, un-oxidized, medium gray, moderately firm, cohesive, matrix with sand and gravel inclusions

101-109	SAND AND GRAVEL	Medium sand to very coarse gravel, poorly sorted, predominately fine gravel, 30% shale, angular to sub angular, 30% granitic rock fragments, 30% carbonates, 10% sand size quartz
109-140	CLAY	(till) As above; very silty; smooth drilling 121 to 131 feet, may be inter-bedded lacustrine, poor sample recovery

156-056-24CCC
NDSWC 2933

Date Completed:	5/1968	Purpose:	Observation Well
L.S. Elevation (ft):	1162	Well Type:	1.25in. - PVC
Depth Drilled (ft):	300	Aquifer:	Fordville
Screen Int. (ft.):	32-35		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Sandy, silty, brownish-black
1-10	SAND	Clayey, fine to medium grained, poorly sorted, sub-angular to sub-rounded, mostly quartz with some limestone
10-20	CLAY	Very sandy, silty, pebbly, moderate yellowish-brown except for lower 5-6 feet which is olive-gray, moderately cohesive, plastic, oxidized, numerous limestone, dolostone and shale fragments, (till)
20-40	GRAVEL	Sandy (approximately 25-35% fine to very coarse, sub-angular to sub-rounded sand), fine to coarse, angular to rounded, moderately well sorted, mostly limestone and dolostone and some shale, granite and mudstone, taking drilling water; 2 bags of drilling mud; lower 6 feet of section is predominately medium to very coarse grained sand
40-54	CLAY	Sand, silty, olive-gray to medium dark gray, very cohesive, plastic, calcareous, resembles lake sediment
54-76	CLAY	Sandy, pebbly with a few cobbles, olive-gray, moderately cohesive, moderately plastic, calcareous, numerous limestone, shale and a few lignite fragments (till)
76-82	GRAVEL	Sandy, fine to coarse, poorly sorted, angular to sub-rounded, mostly oxidized limestone and dolostone with some granitics; very clayey, interbedded
82-200	CLAY	Sandy, silty, pebbly, olive-gray to medium dark gray, cohesive, moderately plastic, calcareous, numerous limestone, dolostone, shale fragments, numerous cobbles, (till)
200-264	CLAY	Sandy, silty, pebbly, olive-gray, moderately cohesive, moderately plastic, calcareous, numerous limestone, dolostone, sale grains and granules in clay matrix with a few cobbles and boulders, (till)
264-300	SHALE	Interbedded with light gray limestone, brownish black, fossiliferous, indurated, parting noticeable along horizontal cleavage plains, very calcareous to slightly calcareous, Niobrara Formation

156-056-24CCC2
NDSWC 14807

Date Completed:	10/10/2001	Purpose:	Observation Well
L.S. Elevation (ft):	1164.96	Well Type:	2in. - PVC
Depth Drilled (ft):	40	Aquifer:	Fordville
Screen Int. (ft.):	30-35	Data Source:	J. Patch

Remarks: Replacment well 10' north of old well

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Black
1-9	CLAY	Oxidized, Yellowish
9-10	GRAVEL	Oxidized
10-17	CLAY	Oxidized, yellowish
17-21	CLAY	Silty, gray
21-36	SAND AND GRAVEL	Coarse sand and gravel
36-40	CLAY	Silty, gray

156-056-25CDD
NDSWC 14793

Date Completed:	10/03/2001	Purpose:	Observation Well
L.S. Elevation (ft):	1198.21	Well Type:	2in. - PVC
Depth Drilled (ft):	160	Aquifer:	Fordville
Screen Int. (ft.):	75-80	Data Source:	J. Patch

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Black
1-37	CLAY	Silty sandy pebbly, oxidized sand and gravel inclusions in and oxidized silty clay matrix, yellow-brown (till)
37-82	SAND	Very fine to very coarse, moderate sorting, predominately coarse sand to medium sand, 40-50% quartz sand, 20% shale, 20% carbonates,20% granitic rock fragments, oxidized to about 58 feet, shale content appears to increase with depth
82-111	SILT	Clayey, slightly sandy, medium gray, slightly firm, slightly cohesive, smooth easy drilling no chatter
111-160	CLAY	Silty, sandy, pebbly, sand and gravel inclusions in clay silt matrix, medium gray, moderately firm (till); sand and gravel (intertill) 126-127 feet; rocks at 131-132 feet; till much tougher drilling below 132, cuttings much firmer ; more consolidated

156-056-26BAB1
NDSWC 2949

Date Completed:	5/1968	Purpose:	Observation Well
L.S. Elevation (ft):	1180	Well Type:	1.25in. - PVC
Depth Drilled (ft):	74	Aquifer:	Undefined
Screen Int. (ft.):	47-50		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Sandy, gravel, brownish-black
1-19	GRAVEL	Sandy, slightly clayey and silty (approximately 20-30% medium to very coarse grained, angular to sub-rounded sand) fine to coarse, angular to rounded, moderately well sorted, mostly limestone, dolostone and shale with some granite rock, taking water mixed 1 bag of mud, oxidized
19-57	SAND	Gravely (approximately 10-20% fine to medium, angular to rounded gravel), fine to very coarse grained (predominantly medium to coarse grained) angular to rounded, moderately well sorted, taking water, caving slightly, mostly limestone, dolostone, quartz, shale with some granitic grains
57-65	CLAY	very silty, sandy, medium gray to olive-gray, slightly cohesive, moderately plastic, laminated, (lake sediment)
65-74	CLAY	Sandy, silty, pebbly, olive-gray, numerous cobbles and a few boulders, cohesive, semi-plastic,calcareous (till)

156-056-26BCC1
NDSWC 2943

Date Completed:	05/26/1968	Purpose:	Observation Well
L.S. Elevation (ft):	N/A	Well Type:	1.25in. - PVC
Depth Drilled (ft):	80	Aquifer:	Undefined
Screen Int. (ft.):	37-40		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Sandy, gravelly, silty, brownish-black
1-22	GRAVEL	Sandy (approximately 20-30% medium to very coarse angular to sub-rounded sand) fine to coarse, angular to rounded, moderately well sorted, oxidized, mostly limestone, shale, mudstone, with some granite rocks, taking water mixed 1 bag of mud
22-45	SAND	Gravelly (approximately 15-25% fine to medium, angular to rounded gravel), fine to very coarse grained, angular to rounded, mostly limestone, dolostone, and quartz with some shale, taking some water
45-50	CLAY	very silty, sandy, medium gray, slightly cohesive, moderately plastic (lake sediment)
50-80	CLAY	Sandy, silty, gravelly, olive gray, moderately cohesive, moderately plastic, calcareous, numerous cobbles (till)

156-056-26CBB
NDSWC 2945

Date Completed:	5/1968	Purpose:	Observation Well
L.S. Elevation (ft):	1170	Well Type:	1.25in. - PVC
Depth Drilled (ft):	70	Aquifer:	Undefined
Screen Int. (ft.):	37.5-41.5		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Sandy, gravelly, silty, brownish-black
1-17	GRAVEL	Silty, clayey, sandy (approximately 20-30% medium to very coarse, angular to sub-rounded sand), fine to coarse, angular to sub-rounded, oxidized, mostly limestone, dolostone, shale with some granite rocks, taking water mixed 1 bag of mud
17-45	SAND	Gravely, slightly silty, fine to very coarse, angular to rounded, moderately well sorted, mostly limestone, dolostone, quartz and shale, with shale content increasing lower 1-10 feet of section, taking some water, not caving core from 20-21 feet revealed a small amount of silt present, slightly oxidized sand
45-50	CLAY	Very sandy, silty, medium gray to olive-gray, slightly cohesive, plastic, (lake sediment), poor sample return; washing out
50-70	CLAY	Sandy, silty, gravelly, olive-gray, cohesive, moderately plastic, calcareous, numerous cobbles and boulders lower 2-4 feet of section, (till)

156-056-26DAA
NDSWC 10-3-2001

Date Completed:	10/03/2001	Purpose:	Observation Well
L.S. Elevation (ft):	1163.07	Well Type:	2in. - PVC
Depth Drilled (ft):	80	Aquifer:	Fordville
Screen Int. (ft.):	38-43	Data Source:	J. Patch

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Black
1-44	SAND AND GRAVEL	Fine sand to very coarse gravel, poorly sorted, mainly coarse sand to fine gravel, oxidixed to about 29 feet, increase shale content with depth, grains are sub-angular to round, predominately sub-round, Formation above water table took lots of water, used 4 bags of drilling mud
44-70	SILT	Clay, very slightly sandy, smooth drilling poor sample recovery
70-80	CLAY	Silty, sandy, pebbly, medium gray moderately firm, sand and gravel inclusions in clay matrix (till)

156-056-26DCC
NDSWC 12742

Date Completed:	1991	Purpose:	Observation Well
L.S. Elevation (ft):	1152.86	Well Type:	2in. - PVC
Depth Drilled (ft):	40	Aquifer:	Fordville
Screen Int. (ft.):	25-30	Data Source:	SWC

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	
1-7	CLAY	silty, oxidized, yellow
7-20	SAND & GRAVEL	very coarse sand to 30mm gravel,very coarse, oxidized
20-30	SAND & GRAVEL	very coarse sand to 30mm gravel, poorly sorted, 5mm median size, clean coarse section, angular to round, 30% shale, 30% carbonates, 30-40% other rock fragments
30-40	CLAY AND SILT	moderately soft, smooth, slightly cohesive, medium gray

156-056-27ADC
NDSWC 2947

Date Completed:	5/1968	Purpose:	Observation Well
L.S. Elevation (ft):	1170	Well Type:	1.25in. - PVC
Depth Drilled (ft):	60	Aquifer:	Undefined
Screen Int. (ft.):	27-30		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Sandy, gravelly, silty, brownish-black
1-16	GRAVEL	Silty, clayey, sandy (approximately 25-35% medium to very coarse grained angular to sub-rounded sand), fine to coarse, angular to sub-rounded, mostly limestone, dolostone, shale, mudstone, with some granite rocks, taking water, mixed 1 bag of mud; oxidized throughout
16-34	SAND	Gravel (approximately 15-25% fine to medium, angular to sub-rounded gravel), fine to very coarse, sub-angular to rounded, moderately well sorted, mostly quartz, limestone, dolostone, shale, with some granitic fragments, taking some water, not caving
34-48	CLAY	Very silty, sandy, medium gray to olive-gray, slightly cohesive, moderately plastic, calcareous, (lake sediment)
48-60	CLAY	Sandy, silty, gravelly, olive-gray, cohesive, moderately plastic, calcareous, numerous cobbles and a few boulders present lower 5-10 feet of section (till)

156-056-27ADD1
NDSWC 2942

Date Completed:	5/1968	Purpose:	Observation Well
L.S. Elevation (ft):	1170	Well Type:	1.25in. - PVC
Depth Drilled (ft):	100	Aquifer:	Undefined
Screen Int. (ft.):	42.5-45.5		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPPSOIL	Gravelly, sandy, silty, brownish-black
1-20	GRAVEL	Sandy (approximately 25-35% medium to very coarse grained, angular to sub-rounded sand), fine to coarse, angular to rounded, moderately well sorted, oxidized, mostly limestone, shale, mudstone with a few granitic rocks, taking water mixed 1 bag of mud
20-40	SAND	Gravelly (approximately 20-30% fine to medium, angular to sub-rounded gravel), very fine to very coarse, moderately well sorted, angular to rounded, mostly limestone, dolostone, quartz, taking some water, not caving
40-50	SAND	Slightly silty, very fine to coarse, sub-angular to rounded, well sorted predominately shale with some quartz and limestone; not taking water or caving
50-65	CLAY	Very silty, very sandy, medium gray to olive-gray, slightly cohesive, moderately plastic, calcareous, (lake sediment)
65-69	GRAVEL	Sandy (approximately 20-30% medium to coarse grained, angular to sub-rounded sand), fine to coarse, angular to rounded, mostly mudstone and shale with some granite rocks
69-100	CLAY	Sandy, silty, pebbly, olive gray, cohesive, slightly plastic, calcareous, numerous cobbles, (till)

156-056-27CCC
NDSWC 14792

Date Completed:	10/03/2001	Purpose:	Observation Well
L.S. Elevation (ft):	1167.77	Well Type:	2in. - PVC
Depth Drilled (ft):	40	Aquifer:	Fordville
Screen Int. (ft.):	22-27	Data Source:	J. Patch

Remarks: (LAND SURFACE) 6ft NORTH OF YELLOW TOPED STEEL POST IN FENCE LINE

Lithologic Log

Depth (ft)	Unit	Description
0-2	TOPSOIL	Black
2-27	SAND AND GRAVEL	Medium sand to very coarse gravel, poorly sorted, medium size is approximately fine gravel, oxidized, rusty in color, 30% shale, 40% igneous-granitic rock fragments, 30% other

27-40	CLAY	Silty, sandy, pebbly, inclusions of pebbles and sand grains is silty, very sandy clay matrix, medium gray, moderately firm, (till)

156-056-27DAD
NDSWC 2948

Date Completed:	5/1968	Purpose:	Observation Well
L.S. Elevation (ft):	1153	Well Type:	1.25in. - PVC
Depth Drilled (ft):	85	Aquifer:	Undefined
Screen Int. (ft.):	18.5-21.5		

Lithologic Log

Depth (ft)	Unit	Description
0-2	TOPSOIL	Sandy, silty, brownish-black
2-8	CLAY	Very silty, sandy, laminated, moderate yellowish-brown, slightly cohesive, semi-plastic, oxidized (lake sediment)
8-19	GRAVEL	Silty, clayey, sandy (approximately 20-30% medium to very coarse, angular to sub-rounded sand), fine to coarse, fair sorting, angular to sub-rounded, oxidized, taking water, mixed 1 bag of mud
19-22	SAND	Gravelly (approximately 15-30% fine to medium, angular to rounded gravel), fine to very coarse, sub-angular to rounded, moderately well sorted, slightly oxidized, limestone, dolostone,quartz, taking some water
22-35	CLAY	Very silty, sandy, medium gray to olive-gray, slightly cohesive, plastic, calcareous, slightly laminated (lake sediment)
35-41	CLAY	Sandy, pebbly, silty, olive-gray, cohesive, moderately plastic, calcareous, numerous limestone and shale fragments, (till)
41-46	SAND	Fine to coarse grained, angular to rounded, well sorted, mostly limestone and shale with some granitic grains and quartz, very clean looking
46-85	CLAY	Sandy, silty, pebbly, olive-gray, cohesive, slightly plastic, calcareous, numerous limestone and shale fragments imbedded in clay matrix (till)

156-056-28ABA
NDSWC 2932

Date Completed:	05/21/1968	Purpose:	Test Hole
L.S. Elevation (ft):	N/A		
Depth Drilled (ft):	260		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Sandy, gravelly, a few boulders, black
1-10	CLAY	Silty, sandy, pebbly, brownish-black, slightly cohesive, plastic

10-13	GRAVEL	Sandy (approximately 20-30% fine to very coarse grained sand), fine to coarse, angular to sub-rounded, poorly sorted, mostly limestone, dolostone, shale with some granite, mudstone and sandstone
13-38	CLAY	Very sandy with cobbles and boulders, olive-gray, moderately cohesive to cohesive, moderately plastic, calcareous, numerous limestone and shale fragments (till)
38-56	CLAY	Silty, sandy, pebbly, numerous cobbles and boulders, cohesive to moderately cohesive, plastic to slightly plastic, (till)
56-97	CLAY	Sandy, silty, pebbly, with numerous cobbles and boulders, olive-gray, cohesive, moderately plastic, (till)
97-100	GRAVEL	Sandy, fine to coarse, poorly sorted, angular to sub-rounded very poor sample
100-154	CLAY	Sandy, silty, pebbly, numerous boulders and cobbles, olive-gray, cohesive, moderately plastic, calcareous, (till)
154-158	GRAVEL	Fine to coarse, sub-angular to sub-rounded, moderately well sorted, mostly limestone and shale, poor samples, taking small amount of water
158-188	CLAY	Silty, sandy, gravelly, moderate yellowish-brown, moderately cohesive, slightly to moderately plastic, calcareous, numerous limestone and shale fragments in clay matrix, oxidized (till)
188-191	GRAVEL	Fine to coarse (predominantly medium), angular to sub-rounded, moderately well sorted, predominantly oxidized limestone and dolostone, with some shale and granite and lignite
191-220	CLAY	Sandy, silty, gravelly, olive-gray, numerous cobbles and boulders, moderately cohesive, moderately plastic, calcareous (till); numerous cobbles last 10 feet of section
220-260	SHALE	Interbedded with light gray limestone, brownish black, indurated, very fossiliferous, very calcareous to slightly calcareous; horizontal cleavage, visible

156-056-28CCC
NDSWC 12743

Date Completed:	06/11/1991	Purpose:	Test Hole
L.S. Elevation (ft):	N/A		
Depth Drilled (ft):	40		
		Data Source:	SWC

Lithologic Log

Depth (ft)	Unit	Description
0-4	TOPSOIL	
4-16	CLAY	silty, yellow, oxidized, soft, smooth
16-18	CLAY	as above, gray, unoxidized
18-40	TILL	silty, sandy, pebbly, inclusions, medium gray, moderately firm

156-056-34CCC
NDSWC 14799

Date Completed:	10/08/2001	Purpose:	Test Hole
L.S. Elevation (ft):	N/A		
Depth Drilled (ft):	40		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Black
1-22	SAND AND GRAVEL	Fine sand to coarse gravel, poorly sorted, predominately fine gravel, oxidized, angular to sub-round, predominately, sub-angular to sub-round, mainly granitic type rock fragments, with significant, shale and limestone fractions
22-40	CLAY	Silty, sandy, pebbly, inclusions, of sand and gravel in clay and silt matrix, medium dark gray to moderately firm, (till); oxidized to 26 feet; rock at 33-34 feet

156-056-34DCC
NDSWC 2939

Date Completed:	1968	Purpose:	Observation Well
L.S. Elevation (ft):	1168.89	Well Type:	1.25in. - ABS
Depth Drilled (ft):	65	Aquifer:	Fordville
Screen Int. (ft.):	37-40		

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Sandy, silty, gravelly, brownish-black
1-11	GRAVEL	Sandy, silty, fine to coarse, a few cobbles, sub-angular to sub-rounded to rounded, fair sorting, taking water mixed 2 bags of drilling mud, mostly limestone, dolostone, mudstone and shale, with some granite rock
11-29	SAND	Gravely (approximately 25-35% fine to medium, angular to rounded gravel, fine to very coarse grained, angular to rounded, moderately well sorted, taking some drilling water mostly limestone, shale, quartz, with some granitics
29-35	CLAY	Sandy, very silty, olive-gray, cohesive, very plastic, (lake sediment)
35-45	SANDY	With layered gravel, fine to very coarse grained, angular to rounded, moderately well sorted, mostly limestone, dolostone, mudstone and shale, with some quartz and granitics, taking some water
45-65	CLAY	Sandy, silty, pebbly, olive-gray, moderately cohesive to cohesive, moderately plastic, calcareous (till)
65-65.5	BOULDER	Granite, (abandoned hole)

156-056-34DDD

NDSWC 14798

Date Completed:	10/08/2001	Purpose:	Observation Well
L.S. Elevation (ft):	1163.56	Well Type:	2in. - PVC
Depth Drilled (ft):	60	Aquifer:	Fordville
Screen Int. (ft.):	27-32	Data Source:	J. Patch

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Black
1-32	SAND AND GRAVEL	Fine sand to coarse gravel, poorly sorted, predominately very coarse sand to fine gravel, oxidized, becomes higher shale content and rounded tablet grains with depth 22 feet and below, difficult to determine oxidized / un-oxidized boundary but in the range of 23-26 feet
32-43	SILT	Slightly clayey, sandy, drills fast and easy, medium to light gray, poor sample recovery, glacio-lacustrine
43-60	CLAY	Silty, sandy, pebbly, inclusions, medium gray, medium firm, (till)

156-056-35AAA

NDSWC 14794

Date Completed:	10/04/2001	Purpose:	Observation Well
L.S. Elevation (ft):	1159.28	Well Type:	2in. - PVC
Depth Drilled (ft):	80	Aquifer:	Fordville
Screen Int. (ft.):	47-52	Data Source:	J. Patch

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Black
1-56	SAND AND GRAVEL	Fine sand to coarse gravel, poorly sorted, mainly coarse to very coarse sand, oxidized, rusty stained grains, increasing shale content with depth, up to 50% shale, round to sub-angular, predominately sub rounded, becomes un-oxidized at about 31 feet, shale grains more rounded and larger content below about 31 feet
56-80	SILT	Clayey, smooth, gray, very slightly cohesive, easy fast drilling, no chatter

156-056-36CCC1
NDSWC 2934

Date Completed:	5/1968	Purpose:	Observation Well
L.S. Elevation (ft):	1145.23	Well Type:	1.25in. - ABS
Depth Drilled (ft):	280	Aquifer:	Fordville
Screen Int. (ft.):	27-30		

Remarks: WELL ON WEST SIDE OF ROAD NORTH OF PRODUCTION WELL

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	Sandy, silty, gravelly, brownish-black
1-7	CLAY	Sandy, silty, pebbly, moderate yellowish-brown, slightly to moderately cohesive, plastic, oxidized (till)
7-31	SAND	Gravelly (approximately 20-30% fine to medium, angular to rounded gravel), fine to very coarse grained, moderately well sorted, angular to rounded, mostly limestone shale and mudstone, taking water, mixed to bags of drilling mud
31-95	CLAY	Very silty, sandy, olive-gray, very cohesive and plastic (lake sediment)
95-97	BOULDER	granite
97-168	CLAY	Sandy, silty, gravelly, olive-gray, moderately to very cohesive, slightly plastic to plastic, numerous cobbles and boulders (till)
168-240	CLAY	Sandy, silty, gravelly, olive-gray, cohesive, plastic to slightly plastic, calcareous, numerous limestone and shale fragments, cobbles throughout section (till)
240-280	SHALE	Interbedded with limestone, indurated, brownish-black with numerous white specks(non-calcareous), paris along horizontal cleavage, calcareous, Niobrara Formation

156-056-36CDD
NDSWC 14796

Date Completed:	10/03/2001	Purpose:	Observation Well
L.S. Elevation (ft):	1180.45	Well Type:	2in. - PVC
Depth Drilled (ft):	120	Aquifer:	Fordville
Screen Int. (ft.):	53-58	Data Source:	J. Patch

Lithologic Log

Depth (ft)	Unit	Description
0-1	TOPSOIL	black,
1-35	CLAY	Silty, sandy, pebbly, oxidized sand and gravel inclusions in a clay silt matrix, yellow brown color, moderately firm (till)
35-37	CLAY	(till) as above gray, unoxidized

37-62	SAND AND GRAVEL	Fine sand to 2 mm gravel, predominantly very coarse sand, poorly to moderately sorted, 40-50% shale, granitic rock fragments 30% carbonates; 10 to 20% sub angular, predominantly sub-rounded
62-68	CLAY	(till) as above
68-70	CLAY	Silty, slightly sandy, smooth drilling, cuttings are soft, easy drilling, (lake sediment)
70-120	CLAY	As above (till); sand and gravel lens 70 to 71 feet; gravel lens from 92 to 93 feet; gravel lens from 101 to 103 feet

156-056-36DDD
NDSWC 5377

Date Completed:	08/11/1969	Purpose:	Test Hole
L.S. Elevation (ft):	1207		
Depth Drilled (ft):	380		

Lithologic Log

Depth (ft)	Unit	Description
0-0.5	TOPSOIL	Sandy, pebbly, clayey, brownish-black
0.5-40	CLAY	Very sandy to slightly sandy, pebbly, silty, occasional cobbles, dusky yellow to moderate yellowish-brown, slightly to moderately cohesive, slightly plastic, oxidized (till)
40-60	CLAY	Silty, slightly sandy, pebbly, a few cobbles, olive-gray, moderately cohesive, moderately plastic, calcareous (till)
60-100	CLAY	Very silty, sandy, a few pebbles occasionally gravelly lenses, olive-gray, moderately cohesive,
100-119	SAND	Interbedded with very silty, sandy clay, very fine to coarse grained (mostly medium grained), angular to sub-angular, moderately well sorted, mostly quartz and shale, some carbonates and granitics, not taking much water, not caving in
119-200	CLAY	Silty with a few cobbles and boulders, slightly to moderately sandy, pebbly, occasional thin gravelly lenses, olive-gray, moderately cohesive, slightly to moderately plastic, calcareous (till)
200-365	CLAY	Silty, slightly sandy, occasional thin gravel lenses, numerous cobbles and boulders, pebbly, olive-gray to medium dark gray, cohesive, slightly plastic to plastic, calcareous (till)
365-380	SHALE	Moderately clayey, brownish-gray to brownish-black, moderately indurated, numerous small white specks, very calcareous, bedded, horizontal parting in samples (Niobrara Formation)

Water-Level Measurements

155-055-30BBB
Fordville Aquifer

MP Elev (msl,ft)=1,147.15
SI (ft.)=29-34

Date	Depth to Water (ft)	WL Elev (msl, ft)
07/11/91	29.99	1117.16
07/16/91	30.01	1117.14
08/20/91	30.04	1117.11
09/25/91	30.06	1117.09
10/23/91	30.05	1117.10
11/26/91	30.04	1117.11
12/17/91	30.02	1117.13
04/18/92	29.67	1117.48
05/22/92	29.70	1117.45
06/16/92	29.95	1117.20
07/22/92	29.80	1117.35
08/26/92	29.93	1117.22
09/22/92	29.90	1117.25
10/21/92	29.92	1117.23
11/24/92	29.96	1117.19
01/26/93	30.01	1117.14
04/27/93	29.92	1117.23
05/25/93	29.95	1117.20
06/23/93	30.00	1117.15
07/21/93	30.07	1117.08
08/25/93	29.73	1117.42
09/22/93	29.58	1117.57
10/20/93	29.47	1117.68
10/27/93	29.48	1117.67
11/24/93	29.49	1117.66
04/05/94	29.42	1117.73
05/11/94	29.40	1117.75
06/08/94	29.47	1117.68
07/07/94	29.39	1117.76
08/17/94	29.42	1117.73
09/14/94	29.41	1117.74
10/12/94	29.43	1117.72
11/09/94	29.48	1117.67
12/07/94	29.51	1117.64
05/03/95	28.86	1118.29
06/09/95	28.90	1118.25
07/19/95	28.75	1118.40
10/12/95	28.59	1118.56
11/15/95	28.62	1118.53
05/15/96	28.05	1119.10
06/19/96	28.13	1119.02
07/24/96	28.25	1118.90

Date	Depth to Water (ft)	WL Elev (msl, ft)
09/11/96	28.35	1118.80
10/23/96	28.46	1118.69
12/10/96	28.52	1118.63
06/04/97	27.33	1119.82
07/16/97	27.41	1119.74
08/19/97	27.30	1119.85
09/24/97	27.28	1119.87
10/22/97	27.29	1119.86
11/18/97	27.38	1119.77
12/16/97	27.46	1119.69
05/27/98	27.37	1119.78
07/22/98	27.49	1119.66
08/19/98	27.53	1119.62
09/23/98	27.56	1119.59
12/01/98	27.64	1119.51
05/26/99	26.98	1120.17
06/23/99	26.60	1120.55
07/21/99	26.53	1120.62
08/25/99	26.54	1120.61
09/30/99	26.58	1120.57
10/28/99	26.71	1120.44
12/01/99	26.72	1120.43
05/17/00	27.30	1119.85
06/28/00	27.43	1119.72
08/22/00	27.59	1119.56
11/30/00	27.82	1119.33
05/02/01	27.66	1119.49
06/06/01	27.76	1119.39
07/11/01	27.84	1119.31
08/08/01	27.85	1119.30
09/05/01	27.89	1119.26
10/10/01	27.88	1119.27
10/23/01	27.95	1119.20
11/14/01	27.98	1119.17
12/05/01	27.98	1119.17
05/01/02	28.27	1118.88
06/19/02	28.33	1118.82
07/31/02	27.80	1119.35
09/11/02	27.64	1119.51
10/30/02	27.62	1119.53
12/05/02	27.65	1119.50

155-056-11ABB
Fordville Aquifer

MP Elev (msl,ft)=1,140.13
SI (ft.)=23-28

Date	Depth to Water (ft)	WL Elev (msl, ft)
06/19/91	3.85	1136.28
07/16/91	4.61	1135.52
08/20/91	4.65	1135.48
09/26/91	4.53	1135.60
10/23/91	4.47	1135.66
11/26/91	4.34	1135.79
12/17/91	4.36	1135.77
05/22/92	4.27	1135.86
06/16/92	4.44	1135.69
07/22/92	4.40	1135.73
08/26/92	4.47	1135.66
09/22/92	4.46	1135.67
10/21/92	4.46	1135.67
11/24/92	4.46	1135.67
04/27/93	4.35	1135.78
05/25/93	4.46	1135.67
06/23/93	4.33	1135.80
07/21/93	4.03	1136.10
08/25/93	3.73	1136.40
09/22/93	4.45	1135.68
10/27/93	4.74	1135.39
11/24/93	4.77	1135.36
04/05/94	4.04	1136.09
05/11/94	4.59	1135.54
06/08/94	4.60	1135.53
07/07/94	4.63	1135.50
08/17/94	5.00	1135.13
09/14/94	4.95	1135.18
10/12/94	4.96	1135.17
11/09/94	4.93	1135.20
05/03/95	4.99	1135.14
06/09/95	4.76	1135.37
07/19/95	4.25	1135.88
08/01/95	4.97	1135.16
10/12/95	5.18	1134.95
05/15/96	4.77	1135.36
06/19/96	4.87	1135.26
07/24/96	4.98	1135.15
09/11/96	5.50	1134.63
10/23/96	5.40	1134.73

Date	Depth to Water (ft)	WL Elev (msl, ft)
06/04/97	5.08	1135.05
07/16/97	4.98	1135.15
08/19/97	5.48	1134.65
09/24/97	5.49	1134.64
10/22/97	5.42	1134.71
11/18/97	5.60	1134.53
12/16/97	5.57	1134.56
05/27/98	5.58	1134.55
07/22/98	5.88	1134.25
08/19/98	5.93	1134.20
09/23/98	5.98	1134.15
12/01/98	5.97	1134.16
05/26/99	5.26	1134.87
06/23/99	5.49	1134.64
07/21/99	5.45	1134.68
08/25/99	5.58	1134.55
09/30/99	5.47	1134.66
10/28/99	5.49	1134.64
12/01/99	5.51	1134.62
05/17/00	5.81	1134.32
06/28/00	5.72	1134.41
08/22/00	5.66	1134.47
05/02/01	5.64	1134.49
06/06/01	5.83	1134.30
07/11/01	5.73	1134.40
08/08/01	5.63	1134.50
09/05/01	5.77	1134.36
10/10/01	5.80	1134.33
10/11/01	5.85	1134.28
10/23/01	5.75	1134.38
11/14/01	5.72	1134.41
12/05/01	5.65	1134.48
05/01/02	6.07	1134.06
06/19/02	5.82	1134.31
07/31/02	5.80	1134.33
09/11/02	5.45	1134.68
10/30/02	5.81	1134.32
12/05/02	5.76	1134.37

155-056-11DDD **MP Elev (msl,ft)=1,134.70**
Fordville Aquifer **SI (ft.)=11-16**

Date	Depth to Water (ft)	WL Elev (msl, ft)
06/19/91	8.21	1126.49
07/11/91	7.68	1127.02
07/16/91	7.84	1126.86
08/20/91	6.88	1127.82
09/25/91	7.47	1127.23
10/23/91	8.10	1126.60
11/26/91	7.58	1127.12
12/17/91	8.10	1126.60
04/18/92	7.33	1127.37
05/22/92	7.35	1127.35
06/16/92	7.35	1127.35
07/22/92	7.95	1126.75
08/26/92	8.64	1126.06
09/22/92	8.80	1125.90
10/21/92	8.87	1125.83
11/24/92	8.90	1125.80
01/26/93	8.95	1125.75
04/27/93	7.52	1127.18
05/25/93	7.98	1126.72
06/23/93	7.76	1126.94
07/21/93	7.99	1126.71
08/25/93	7.36	1127.34
09/22/93	7.73	1126.97
10/27/93	8.17	1126.53
11/24/93	8.29	1126.41
04/05/94	6.32	1128.38
05/11/94	7.47	1127.23
06/08/94	7.42	1127.28
07/07/94	6.49	1128.21
08/17/94	8.16	1126.54
09/14/94	8.46	1126.24
10/12/94	8.25	1126.45
11/09/94	7.98	1126.72
12/07/94	8.02	1126.68
05/03/95	6.56	1128.14
06/09/95	3.38	1131.32
07/19/95	7.06	1127.64
08/01/95	7.65	1127.05
10/12/95	8.01	1126.69
11/15/95	7.92	1126.78
06/19/96	6.36	1128.34
07/24/96	7.59	1127.11
09/11/96	8.18	1126.52

Date	Depth to Water (ft)	WL Elev (msl, ft)
10/23/96	7.82	1126.88
12/10/96	7.84	1126.86
06/04/97	6.29	1128.41
07/16/97	3.28	1131.42
08/19/97	6.98	1127.72
09/24/97	7.40	1127.30
10/22/97	7.12	1127.58
11/18/97	7.00	1127.70
12/16/97	7.06	1127.64
05/27/98	6.17	1128.53
07/22/98	7.16	1127.54
08/19/98	7.50	1127.20
09/23/98	7.67	1127.03
12/01/98	6.67	1128.03
05/26/99	4.97	1129.73
06/23/99	5.78	1128.92
07/21/99	6.14	1128.56
08/25/99	6.27	1128.43
09/30/99	6.54	1128.16
10/28/99	6.38	1128.32
12/01/99	6.36	1128.34
05/17/00	5.88	1128.82
06/28/00	6.08	1128.62
08/22/00	7.33	1127.37
11/30/00	6.33	1128.37
05/02/01	5.65	1129.05
06/06/01	5.84	1128.86
07/11/01	6.73	1127.97
08/08/01	6.68	1128.02
09/05/01	7.54	1127.16
10/10/01	7.42	1127.28
10/11/01	7.40	1127.30
10/23/01	7.30	1127.40
11/14/01	6.66	1128.04
12/05/01	6.87	1127.83
05/01/02	6.90	1127.80
06/19/02	6.12	1128.58
07/31/02	7.11	1127.59
09/11/02	5.55	1129.15
10/30/02	6.55	1128.15
12/05/02	6.79	1127.91

155-056-12CCD **MP Elev (msl,ft)=1,144.31**
Fordville Aquifer **SI (ft.)=32-35**

Date	Depth to Water (ft)	WL Elev (msl, ft)
06/19/91	18.75	1127.12
07/16/91	19.74	1126.13
08/20/91	19.68	1126.19
09/25/91	19.68	1126.19
10/23/91	19.64	1126.23
11/26/91	19.56	1126.31
12/17/91	19.56	1126.31
04/18/92	19.48	1126.39
05/22/92	19.47	1126.40
06/16/92	19.53	1126.34
07/22/92	19.60	1126.27
08/26/92	19.75	1126.12
09/22/92	19.87	1126.00
10/21/92	19.93	1125.94
11/24/92	19.97	1125.90
01/26/93	20.04	1125.83
04/27/93	19.95	1125.92
05/25/93	19.98	1125.89
06/23/93	20.03	1125.84
07/21/93	19.99	1125.88
08/25/93	19.54	1126.33
09/22/93	19.48	1126.39
10/27/93	19.45	1126.42
11/24/93	19.45	1126.42
04/05/94	19.37	1126.50
05/11/94	19.42	1126.45
06/08/94	19.44	1126.43
07/07/94	19.21	1126.66
08/17/94	19.29	1126.58
09/14/94	19.36	1126.51
10/12/94	19.40	1126.47
11/09/94	19.39	1126.48
12/07/94	19.36	1126.51
05/03/95	18.97	1126.90
06/09/95	18.85	1127.02
07/19/95	18.61	1127.26
08/01/95	18.63	1127.24
10/12/95	18.60	1127.27
05/15/96	18.38	1127.49
06/19/96	18.19	1127.68
07/24/96	18.35	1127.52
09/11/96	18.45	1127.42
10/23/96	18.46	1127.41
12/10/96	18.53	1127.34
06/04/97	17.77	1128.10
07/16/97	17.40	1128.47
08/19/97	17.35	1128.52
09/24/97	17.38	1128.49
10/22/97	17.38	1128.49
11/18/97	17.45	1128.42
12/16/97	17.47	1128.40
05/27/98	17.20	1128.67
07/22/98	17.18	1128.69
08/19/98	17.31	1128.56
09/23/98	17.47	1128.40
12/01/98	17.55	1128.32
05/26/99	16.69	1129.18
06/23/99	16.40	1129.47
07/21/99	16.26	1129.61
08/25/99	16.23	1129.64
09/30/99	16.26	1129.61
10/28/99	16.30	1129.57
12/01/99	16.34	1129.53
05/17/00	16.82	1129.05
06/28/00	16.93	1128.94
08/22/00	17.24	1128.63
11/30/00	17.39	1128.48
05/02/01	17.25	1128.62
06/06/01	17.25	1128.62
07/11/01	17.34	1128.53
08/08/01	17.32	1128.55
09/05/01	17.41	1128.46
10/10/01	17.46	1128.41
10/11/01	17.48	1128.39
10/23/01	15.93	1128.38
11/14/01	15.89	1128.42
12/05/01	15.93	1128.38
05/01/02	16.28	1128.03
06/19/02	16.24	1128.07
07/31/02	15.80	1128.51
09/11/02	15.56	1128.75
10/30/02	15.48	1128.83
12/05/02	15.50	1128.81

155-056-23AAA2 **MP Elev (msl,ft)=1,156.76**
Fordville Aquifer **SI (ft.)=37-40**

Date	Depth to Water (ft)	WL Elev (msl, ft)
03/05/71	31.58	1125.18
06/16/71	31.42	1125.34
09/13/71	31.50	1125.26
11/29/71	31.70	1125.06
03/25/72	31.77	1124.99
06/15/72	31.61	1125.15
09/07/72	31.78	1124.98
09/17/72	30.89	1125.87
12/05/72	31.65	1125.11
02/26/73	32.06	1124.70
06/13/73	32.24	1124.52
08/21/73	32.30	1124.46
03/12/74	32.43	1124.33
06/21/74	31.23	1125.53
09/17/74	30.99	1125.77
12/03/74	30.83	1125.93
03/13/75	31.10	1125.66
06/02/75	30.87	1125.89
09/04/75	30.95	1125.81
12/04/75	30.55	1126.21
03/03/76	31.20	1125.56
06/01/76	30.89	1125.87
09/07/76	31.15	1125.61
12/02/76	31.34	1125.42
03/14/77	31.65	1125.11
06/01/77	31.84	1124.92
12/01/77	32.22	1124.54
03/13/78	32.42	1124.34
06/09/78	31.74	1125.02
09/06/78	31.85	1124.91
11/20/78	31.88	1124.88
03/05/79	32.06	1124.70
06/15/79	31.15	1125.61
08/01/79	31.03	1125.73
09/13/79	31.02	1125.74
11/29/79	31.08	1125.68
03/07/80	31.23	1125.53
06/03/80	31.43	1125.33
09/08/80	31.29	1125.47
11/17/80	31.70	1125.06
03/12/81	32.10	1124.66
06/29/81	32.27	1124.49
09/30/81	32.40	1124.36
12/03/81	32.39	1124.37
03/09/82	32.36	1124.40
06/11/82	32.20	1124.56
11/30/82	30.76	1126.00
03/28/83	30.67	1126.09

Date	Depth to Water (ft)	WL Elev (msl, ft)
07/01/83	30.55	1126.21
10/03/83	30.82	1125.94
12/01/83	30.93	1125.83
04/18/84	31.17	1125.59
06/01/84	31.24	1125.52
10/02/84	31.45	1125.31
11/29/84	31.56	1125.20
03/11/85	31.69	1125.07
06/17/85	31.68	1125.08
09/12/85	31.72	1125.04
12/13/85	31.62	1125.14
03/11/86	31.62	1125.14
06/05/86	31.41	1125.35
10/02/86	31.34	1125.42
11/14/86	31.33	1125.43
03/24/87	31.14	1125.62
06/03/87	30.56	1126.20
08/07/87	30.65	1126.11
09/01/87	30.72	1126.04
12/08/87	30.87	1125.89
03/21/88	31.17	1125.59
06/22/88	31.31	1125.45
09/09/88	31.47	1125.29
10/27/88	31.59	1125.17
12/06/88	31.67	1125.09
01/25/89	31.76	1125.00
05/09/89	31.88	1124.88
09/07/89	32.18	1124.58
11/21/89	32.64	1124.12
03/14/90	32.50	1124.26
05/11/90	32.48	1124.28
06/18/90	32.74	1124.02
08/22/90	32.85	1123.91
09/07/90	32.93	1123.83
10/17/90	32.95	1123.81
11/15/90	33.00	1123.76
12/05/90	33.04	1123.72
03/27/91	33.29	1123.47
03/28/91	33.26	1123.50
04/25/91	33.35	1123.41
05/21/91	33.36	1123.40
06/06/91	33.41	1123.35
06/19/91	33.40	1123.36
07/16/91	33.43	1123.33
08/20/91	33.45	1123.31
09/17/91	33.51	1123.25
09/25/91	33.48	1123.28
10/23/91	33.46	1123.30
11/14/91	33.48	1123.28
11/26/91	33.42	1123.34
12/17/91	33.41	1123.35

155-056-23AAA2
Fordville Aquifer

MP Elev (msl,ft)=1,156.76
SI (ft.)=37-40

Date	Depth to Water (ft)	WL Elev (msl, ft)
04/18/92	33.13	1123.63
04/27/92	33.19	1123.57
05/22/92	33.15	1123.61
06/02/92	33.15	1123.61
06/16/92	33.15	1123.61
07/07/92	33.24	1123.52
07/22/92	33.21	1123.55
08/26/92	33.29	1123.47
09/22/92	33.33	1123.43
10/06/92	33.37	1123.39
10/21/92	33.33	1123.43
11/11/92	32.73	1124.03
11/24/92	33.39	1123.37
01/26/93	33.43	1123.33
04/27/93	33.39	1123.37
05/25/93	33.42	1123.34
06/09/93	34.45	1122.31
06/23/93	33.48	1123.28
07/21/93	33.50	1123.26
08/25/93	32.82	1123.94
09/22/93	32.90	1123.86
10/19/93	32.83	1123.93
10/20/93	32.82	1123.94
10/27/93	32.80	1123.96
11/19/93	32.79	1123.97
11/24/93	32.78	1123.98
04/05/94	32.72	1124.04
05/02/94	32.74	1124.02
05/11/94	32.73	1124.03
06/08/94	32.78	1123.98
06/23/94	32.79	1123.97
07/07/94	32.70	1124.06
08/17/94	32.62	1124.14
09/14/94	32.58	1124.18
09/26/94	32.61	1124.15
10/12/94	32.63	1124.13
11/09/94	32.60	1124.16
11/25/94	32.73	1124.03
12/07/94	32.65	1124.11
05/03/95	32.16	1124.60
06/09/95	32.09	1124.67
07/19/95	31.89	1124.87
08/01/95	31.84	1124.92
10/12/95	31.63	1125.13
11/15/95	31.65	1125.11
05/15/96	31.39	1125.37

Date	Depth to Water (ft)	WL Elev (msl, ft)
06/19/96	31.28	1125.48
07/24/96	31.34	1125.42
09/11/96	31.46	1125.30
10/23/96	31.52	1125.24
12/10/96	31.61	1125.15
06/04/97	30.66	1126.10
07/16/97	30.64	1126.12
08/19/97	30.46	1126.30
09/24/97	30.35	1126.41
10/22/97	30.35	1126.41
11/18/97	30.40	1126.36
12/16/97	30.43	1126.33
05/27/98	30.20	1126.56
07/22/98	30.34	1126.42
08/19/98	30.37	1126.39
09/23/98	30.42	1126.34
12/01/98	30.54	1126.22
05/26/99	29.97	1126.79
06/23/99	29.60	1127.16
07/21/99	29.40	1127.36
08/25/99	29.30	1127.46
09/30/99	29.28	1127.48
10/28/99	29.35	1127.41
12/01/99	29.39	1127.37
05/17/00	29.97	1126.79
06/28/00	30.13	1126.63
08/22/00	30.30	1126.46
11/30/00	30.60	1126.16
05/02/01	30.59	1126.17
06/06/01	30.60	1126.16
07/11/01	30.64	1126.12
08/08/01	30.64	1126.12
09/05/01	30.65	1126.11
10/10/01	30.70	1126.06
10/11/01	30.71	1126.05
10/23/01	30.75	1126.01
11/14/01	30.74	1126.02
12/05/01	30.73	1126.03
05/01/02	31.10	1125.66
06/19/02	31.18	1125.58
07/31/02	30.79	1125.97
09/11/02	30.60	1126.16
10/30/02	30.53	1126.23
12/05/02	30.51	1126.25

155-056-24AAA
Fordville Aquifer

MP Elev (msl,ft)=1,152.84
SI (ft.)=45-50

Date	Depth to Water (ft)	WL Elev (msl, ft)
10/10/01	27.50	1125.34
10/23/01	27.50	1125.34
11/14/01	27.53	1125.31
12/05/01	27.52	1125.32
05/01/02	27.92	1124.92
06/19/02	28.00	1124.84
07/31/02	27.43	1125.41
09/11/02	27.35	1125.49
10/30/02	27.24	1125.60
12/05/02	27.20	1125.64

155-056-24ABB
Fordville Aquifer

MP Elev (msl,ft)=1,145.38
SI (ft.)=42-47

Date	Depth to Water (ft)	WL Elev (msl, ft)
10/10/01	19.95	1125.43
10/23/01	19.98	1125.40
11/14/01	20.00	1125.38
12/05/01	20.01	1125.37
05/01/02	20.34	1125.04
06/19/02	20.45	1124.93
07/31/02	19.84	1125.54
09/11/02	19.80	1125.58
10/30/02	19.70	1125.68
12/05/02	19.71	1125.67

155-056-25ADD **MP Elev (msl,ft)=1,139.07**
Fordville Aquifer **SI (ft.)=30-33**

Date	Depth to Water (ft)	WL Elev (msl, ft)
08/26/67	24.97	1114.10
09/25/69	25.39	1113.68
11/17/69	25.70	1113.37
12/13/69	25.90	1113.17
01/17/70	25.97	1113.10
02/14/70	25.89	1113.18
04/07/70	25.87	1113.20
05/06/70	25.30	1113.77
06/09/70	25.35	1113.72
06/12/70	25.34	1113.73
07/22/70	25.09	1113.98
08/26/70	25.13	1113.94
10/23/70	25.19	1113.88
12/01/70	25.25	1113.82
03/05/71	25.98	1113.09
06/16/71	25.23	1113.84
09/13/71	25.33	1113.74
11/29/71	25.50	1113.57
04/25/72	25.66	1113.41
06/15/72	25.40	1113.67
09/07/72	25.51	1113.56
12/05/72	25.69	1113.38
02/26/73	25.83	1113.24
06/13/73	25.94	1113.13
08/21/73	26.05	1113.02
03/12/74	25.77	1113.30
06/21/74	24.89	1114.18
09/17/74	25.06	1114.01
12/03/74	25.17	1113.90
03/13/75	25.37	1113.70
06/02/75	25.15	1113.92
09/04/75	25.37	1113.70
12/04/75	25.05	1114.02
06/01/76	25.19	1113.88
09/07/76	25.37	1113.70
12/10/76	25.13	1113.94
03/07/77	25.73	1113.34
06/01/77	25.84	1113.23
08/31/77	25.90	1113.17
12/01/77	26.07	1113.00
03/07/78	24.95	1114.12
06/09/78	25.48	1113.59
09/06/78	25.64	1113.43
11/20/78	25.67	1113.40
06/15/79	24.80	1114.27
08/01/79	24.83	1114.24
09/13/79	24.95	1114.12
11/29/79	25.53	1113.54

Date	Depth to Water (ft)	WL Elev (msl, ft)
03/07/80	25.25	1113.82
06/03/80	25.30	1113.77
09/08/80	26.58	1112.49
11/17/80	25.44	1113.63
03/12/81	26.51	1112.56
06/29/81	26.07	1113.00
09/30/81	26.19	1112.88
12/03/81	26.17	1112.90
03/09/82	26.12	1112.95
06/11/82	25.81	1113.26
10/04/82	25.40	1113.67
11/30/82	25.31	1113.76
03/28/83	25.11	1113.96
07/01/83	24.82	1114.25
08/01/83	25.11	1113.96
10/03/83	25.17	1113.90
12/01/83	25.26	1113.81
04/18/84	25.36	1113.71
06/14/84	25.45	1113.62
10/02/84	25.61	1113.46
11/29/84	25.59	1113.48
03/11/85	25.68	1113.39
06/17/85	26.47	1112.60
09/18/85	25.77	1113.30
12/13/85	25.75	1113.32
03/11/86	26.82	1112.25
06/05/86	26.19	1112.88
10/03/86	26.75	1112.32
11/21/86	25.52	1113.55
03/31/87	25.04	1114.03
06/03/87	24.45	1114.62
09/01/87	24.78	1114.29
12/08/87	25.59	1113.48
03/21/88	25.29	1113.78
06/22/88	25.39	1113.68
09/09/88	25.58	1113.49
10/27/88	25.64	1113.43
12/06/88	25.75	1113.32
01/25/89	25.86	1113.21
05/09/89	26.89	1112.18
09/07/89	26.74	1112.33
11/21/89	26.93	1112.14
03/14/90	26.31	1112.76
05/11/90	26.42	1112.65
06/18/90	26.45	1112.62
08/22/90	26.54	1112.53
09/07/90	26.58	1112.49
10/17/90	26.64	1112.43
11/15/90	26.70	1112.37
12/05/90	26.66	1112.41

155-056-25ADD
Fordville Aquifer

MP Elev (msl,ft)=1,139.07
SI (ft.)=30-33

Date	Depth to Water (ft)	WL Elev (msl, ft)
03/27/91	26.78	1112.29
03/28/91	26.78	1112.29
04/25/91	26.84	1112.23
05/21/91	26.83	1112.24
06/06/91	26.82	1112.25
06/19/91	26.82	1112.25
07/16/91	26.89	1112.18
08/20/91	26.82	1112.25
09/17/91	26.79	1112.28
09/25/91	26.83	1112.24
10/23/91	26.80	1112.27
11/14/91	26.80	1112.27
11/26/91	26.80	1112.27
12/17/91	26.78	1112.29
04/18/92	26.55	1112.52
04/27/92	26.54	1112.53
05/22/92	26.47	1112.60
06/16/92	26.52	1112.55
07/07/92	26.56	1112.51
07/22/92	26.60	1112.47
08/26/92	26.68	1112.39
09/22/92	26.75	1112.32
10/06/92	26.71	1112.36
10/21/92	26.74	1112.33
11/11/92	26.74	1112.33
11/24/92	26.77	1112.30
01/26/93	26.82	1112.25
04/27/93	26.70	1112.37
05/25/93	26.73	1112.34
06/09/93	26.70	1112.37
06/23/93	26.77	1112.30
07/21/93	26.80	1112.27
08/25/93	26.63	1112.44
09/22/93	26.56	1112.51
10/19/93	26.44	1112.63
10/27/93	26.47	1112.60
11/19/93	26.40	1112.67
11/24/93	26.40	1112.67
04/05/94	26.20	1112.87
05/02/94	26.18	1112.89
05/11/94	26.23	1112.84
06/08/94	26.33	1112.74
06/23/94	26.25	1112.82
07/07/94	26.20	1112.87
08/17/94	26.24	1112.83
09/14/94	26.29	1112.78
09/26/94	26.30	1112.77
10/12/94	26.38	1112.69
11/09/94	26.35	1112.72
11/25/94	26.37	1112.70
12/07/94	26.38	1112.69

Date	Depth to Water (ft)	WL Elev (msl, ft)
05/03/95	25.82	1113.25
06/09/95	25.84	1113.23
07/19/95	25.79	1113.28
10/12/95	25.72	1113.35
11/15/95	25.77	1113.30
05/15/96	25.19	1113.88
06/19/96	25.24	1113.83
07/24/96	25.29	1113.78
09/11/96	25.39	1113.68
10/23/96	25.50	1113.57
12/10/96	25.61	1113.46
06/04/97	24.42	1114.65
07/16/97	24.46	1114.61
08/19/97	24.42	1114.65
09/24/97	24.45	1114.62
10/22/97	24.51	1114.56
11/18/97	24.56	1114.51
12/16/97	24.63	1114.44
05/27/98	24.51	1114.56
07/22/98	24.58	1114.49
08/19/98	24.63	1114.44
09/23/98	24.72	1114.35
12/01/98	24.84	1114.23
05/26/99	24.15	1114.92
06/23/99	23.99	1115.08
07/21/99	23.84	1115.23
08/25/99	23.75	1115.32
09/30/99	23.79	1115.28
10/28/99	23.83	1115.24
12/01/99	23.94	1115.13
05/17/00	24.44	1114.63
06/28/00	24.56	1114.51
08/22/00	24.70	1114.37
11/30/00	24.96	1114.11
05/02/01	24.84	1114.23
06/06/01	24.88	1114.19
07/11/01	24.97	1114.10
08/08/01	24.98	1114.09
09/05/01	25.01	1114.06
10/10/01	25.09	1113.98
10/23/01	25.13	1113.94
11/14/01	25.10	1113.97
12/05/01	25.12	1113.95
05/01/02	25.35	1113.72
06/19/02	25.35	1113.72
07/31/02	24.86	1114.21
09/11/02	24.78	1114.29
10/30/02	24.71	1114.36
12/05/02	24.72	1114.35

155-056-25BAA
Fordville Aquifer

MP Elev (msl,ft)=1,144.35
SI (ft.)=30-35

Date	Depth to Water (ft)	WL Elev (msl, ft)
06/19/91	28.00	1116.95
06/27/91	27.22	1117.73
07/10/91	26.53	1117.82
07/16/91	26.51	1117.84
08/20/91	26.56	1117.79
09/25/91	26.62	1117.73
10/23/91	26.62	1117.73
11/26/91	26.60	1117.75
12/17/91	26.58	1117.77
04/18/92	26.26	1118.09
05/22/92	26.29	1118.06
06/16/92	26.57	1117.78
07/22/92	26.40	1117.95
08/26/92	26.35	1118.00
09/22/92	26.45	1117.90
10/21/92	26.51	1117.84
11/24/92	26.54	1117.81
04/27/93	26.52	1117.83
05/25/93	26.56	1117.79
06/23/93	26.61	1117.74
07/21/93	26.65	1117.70
08/25/93	26.29	1118.06
09/22/93	26.19	1118.16
10/27/93	26.10	1118.25
11/24/93	26.09	1118.26
04/05/94	25.92	1118.43
05/11/94	26.03	1118.32
06/08/94	26.03	1118.32
07/07/94	25.91	1118.44
08/17/94	25.85	1118.50
09/14/94	25.91	1118.44
10/12/94	25.98	1118.37
11/09/94	25.96	1118.39
05/03/95	25.41	1118.94
06/09/95	25.40	1118.95
07/19/95	25.30	1119.05
08/01/95	25.26	1119.09
10/12/95	25.09	1119.26
11/15/95	25.18	1119.17
05/15/96	24.78	1119.57
06/19/96	24.72	1119.63

Date	Depth to Water (ft)	WL Elev (msl, ft)
07/24/96	24.82	1119.53
09/11/96	24.92	1119.43
10/23/96	25.00	1119.35
06/04/97	23.99	1120.36
07/16/97	23.92	1120.43
08/19/97	23.79	1120.56
09/24/97	23.78	1120.57
10/22/97	23.86	1120.49
11/18/97	23.91	1120.44
12/16/97	24.01	1120.34
05/27/98	23.88	1120.47
07/22/98	24.05	1120.30
08/19/98	24.08	1120.27
09/23/98	24.13	1120.22
12/01/98	24.25	1120.10
05/26/99	23.60	1120.75
06/23/99	23.34	1121.01
07/21/99	23.14	1121.21
08/25/99	23.05	1121.30
09/30/99	23.13	1121.22
10/28/99	23.21	1121.14
12/01/99	23.28	1121.07
05/17/00	23.85	1120.50
06/28/00	23.98	1120.37
08/22/00	24.13	1120.22
05/02/01	24.26	1120.09
06/06/01	24.36	1119.99
07/11/01	24.40	1119.95
08/08/01	24.43	1119.92
09/05/01	24.45	1119.90
10/10/01	24.50	1119.85
10/23/01	24.55	1119.80
11/14/01	24.57	1119.78
12/05/01	24.56	1119.79
05/01/02	24.79	1119.56
06/19/02	24.87	1119.48
07/31/02	24.35	1120.00
09/11/02	24.27	1120.08
10/30/02	24.22	1120.13
12/05/02	24.22	1120.13

155-056-25BBB **MP Elev (msl,ft)=1,141.88**
Fordville Aquifer **SI (ft.)=25-30**

Date	Depth to Water (ft)	WL Elev (msl, ft)
06/19/91	25.34	1116.54
07/10/91	25.33	1116.55
07/16/91	25.29	1116.59
08/20/91	25.33	1116.55
09/25/91	25.34	1116.54
10/23/91	25.36	1116.52
11/26/91	25.38	1116.50
12/17/91	25.38	1116.50
04/18/92	25.22	1116.66
05/22/92	25.24	1116.64
06/16/92	25.50	1116.38
07/22/92	25.31	1116.57
08/26/92	25.40	1116.48
09/22/92	25.43	1116.45
10/21/92	25.39	1116.49
11/24/92	25.41	1116.47
01/26/93	25.46	1116.42
04/27/93	25.40	1116.48
05/25/93	25.43	1116.45
06/23/93	25.44	1116.44
07/21/93	25.48	1116.40
08/25/93	25.01	1116.87
09/22/93	24.98	1116.90
10/27/93	24.94	1116.94
11/24/93	24.98	1116.90
04/05/94	24.89	1116.99
05/11/94	24.86	1117.02
06/08/94	24.95	1116.93
07/07/94	24.76	1117.12
08/17/94	24.76	1117.12
09/14/94	24.80	1117.08
10/12/94	24.77	1117.11
11/09/94	24.80	1117.08
12/07/94	24.82	1117.06
05/03/95	24.46	1117.42
06/09/95	24.38	1117.50
07/19/95	24.24	1117.64
08/01/95	24.19	1117.69
10/12/95	24.10	1117.78
11/15/95	24.15	1117.73
05/15/96	23.98	1117.90
06/19/96	23.93	1117.95
07/24/96	23.95	1117.93
09/11/96	24.05	1117.83
10/23/96	24.08	1117.80
12/10/96	24.13	1117.75
06/04/97	23.33	1118.55
07/16/97	23.19	1118.69
08/19/97	23.15	1118.73
09/24/97	23.15	1118.73
10/22/97	23.23	1118.65
11/18/97	23.27	1118.61
12/16/97	23.29	1118.59
05/27/98	23.30	1118.58
07/22/98	23.38	1118.50
08/19/98	23.41	1118.47
09/23/98	23.47	1118.41
12/01/98	23.53	1118.35
05/26/99	23.06	1118.82
06/23/99	22.85	1119.03
07/21/99	22.72	1119.16
08/25/99	22.67	1119.21
09/30/99	22.63	1119.25
10/28/99	22.72	1119.16
12/01/99	22.79	1119.09
05/17/00	23.25	1118.63
06/28/00	23.33	1118.55
08/22/00	23.42	1118.46
11/30/00	23.63	1118.25
05/02/01	23.59	1118.29
06/06/01	23.65	1118.23
07/11/01	23.68	1118.20
08/08/01	23.70	1118.18
09/05/01	23.73	1118.15
10/10/01	23.76	1118.12
10/23/01	23.80	1118.08
11/14/01	23.77	1118.11
12/05/01	23.77	1118.11
05/01/02	24.00	1117.88
06/19/02	24.02	1117.86
07/31/02	23.66	1118.22
09/11/02	23.57	1118.31
10/30/02	23.55	1118.33
12/05/02	23.56	1118.32

155-056-25BCD **MP Elev (msl,ft)=1,141.54**
Fordville Aquifer **SI (ft.)=33.5-35**

Date	Depth to Water (ft)	WL Elev (msl, ft)
01/04/71	26.17	1115.37
02/01/71	26.21	1115.33
03/05/71	26.28	1115.26
03/30/71	26.23	1115.31
05/13/71	25.77	1115.77
06/16/71	25.94	1115.60
07/13/71	25.95	1115.59
08/16/71	25.86	1115.68
09/13/71	25.99	1115.55
10/19/71	26.11	1115.43
11/23/71	26.15	1115.39
11/29/71	26.15	1115.39
12/23/71	26.22	1115.32
01/27/72	26.32	1115.22
02/28/72	26.38	1115.16
03/25/72	26.15	1115.39
04/25/72	25.96	1115.58
05/17/72	26.04	1115.50
06/15/72	26.15	1115.39
07/12/72	26.20	1115.34
08/15/72	26.41	1115.13
09/07/72	26.48	1115.06
10/10/72	26.47	1115.07
11/09/72	26.50	1115.04
12/05/72	26.53	1115.01
02/26/73	26.62	1114.92
04/02/73	26.44	1115.10
05/07/73	26.54	1115.00
06/13/73	26.63	1114.91
07/12/73	26.73	1114.81
08/14/73	26.80	1114.74
08/21/73	26.49	1115.05
10/09/73	26.71	1114.83
11/14/73	26.68	1114.86
02/07/74	26.85	1114.69
03/12/74	26.85	1114.69
04/02/74	26.89	1114.65
05/07/74	25.98	1115.56
06/13/74	25.27	1116.27
07/08/74	25.41	1116.13
09/03/74	25.63	1115.91
09/17/74	25.71	1115.83
10/10/74	25.67	1115.87
11/21/74	25.77	1115.77
02/10/75	25.91	1115.63
03/13/75	26.03	1115.51
05/16/75	25.66	1115.88
06/02/75	25.68	1115.86
07/09/75	25.62	1115.92
08/18/75	25.97	1115.57
09/04/75	26.03	1115.51
10/07/75	26.09	1115.45
11/05/75	26.10	1115.44
12/04/75	26.00	1115.54
02/05/76	26.25	1115.29
03/03/76	26.18	1115.36
04/13/76	25.77	1115.77
05/11/76	25.69	1115.85
06/01/76	25.91	1115.63
07/06/76	26.02	1115.52
08/03/76	26.20	1115.34
09/07/76	26.25	1115.29
10/07/76	26.34	1115.20
11/09/76	26.40	1115.14
12/02/76	26.40	1115.14
01/12/77	26.49	1115.05
02/02/77	26.47	1115.07
03/07/77	26.57	1114.97
04/04/77	26.38	1115.16
05/02/77	26.36	1115.18
06/01/77	26.51	1115.03
07/11/77	26.62	1114.92
08/02/77	26.53	1115.01
08/31/77	26.60	1114.94
10/17/77	26.45	1115.09
11/01/77	26.47	1115.07
12/01/77	26.57	1114.97
01/04/78	26.58	1114.96
02/07/78	26.73	1114.81
05/02/78	26.03	1115.51
06/09/78	26.06	1115.48
07/10/78	26.13	1115.41
08/08/78	26.24	1115.30
09/06/78	26.31	1115.23
09/19/78	26.29	1115.25
10/03/78	26.32	1115.22
10/31/78	26.31	1115.23
11/20/78	26.39	1115.15
01/18/79	26.51	1115.03
02/05/79	26.59	1114.95
03/05/79	26.60	1114.94
04/03/79	26.75	1114.79
05/11/79	25.60	1115.94
06/15/79	25.54	1116.00
07/12/79	25.41	1116.13
08/14/79	25.60	1115.94
09/13/79	25.74	1115.80
10/04/79	25.77	1115.77
11/29/79	25.94	1115.60
03/07/80	26.07	1115.47
04/11/80	26.00	1115.54
05/06/80	26.07	1115.47
06/03/80	26.25	1115.29
07/09/80	26.38	1115.16
08/07/80	26.48	1115.06
09/08/80	26.32	1115.22
10/07/80	26.35	1115.19
11/03/80	26.33	1115.21
11/17/80	26.33	1115.21
12/17/80	26.46	1115.08

155-056-25BCD **MP Elev (msl,ft)=1,141.54**
Fordville Aquifer **SI (ft.)=33.5-35**

Date	Depth to Water (ft)	WL Elev (msl, ft)
01/27/81	26.57	1114.97
03/12/81	26.63	1114.91
04/07/81	26.57	1114.97
05/21/81	26.68	1114.86
06/29/81	26.56	1114.98
07/29/81	26.72	1114.82
09/30/81	26.54	1115.00
12/03/81	26.55	1114.99
03/09/82	26.72	1114.82
06/11/82	26.32	1115.22
08/25/82	25.80	1115.74
10/04/82	25.84	1115.70
12/02/82	26.76	1114.78
03/28/83	25.83	1115.71
07/01/83	25.79	1115.75
08/01/83	26.10	1115.44
10/03/83	25.90	1115.64
12/01/83	25.99	1115.55
04/18/84	25.98	1115.56
06/14/84	25.99	1115.55
10/02/84	26.50	1115.04
11/29/84	26.33	1115.21
03/11/85	26.48	1115.06
06/17/85	26.22	1115.32
09/18/85	26.29	1115.25
12/13/85	26.21	1115.33
03/11/86	26.36	1115.18
06/05/86	25.99	1115.55
10/03/86	26.06	1115.48
11/21/86	25.97	1115.57
03/24/87	26.09	1115.45
06/03/87	25.35	1116.19
09/01/87	25.57	1115.97
12/08/87	25.92	1115.62
03/21/88	26.09	1115.45
06/22/88	26.23	1115.31
09/09/88	26.58	1114.96
10/27/88	26.66	1114.88
12/06/88	26.67	1114.87
01/25/89	26.67	1114.87
05/09/89	26.41	1115.13
09/07/89	26.85	1114.69
11/21/89	27.02	1114.52
03/14/90	26.94	1114.60
05/11/90	27.38	1114.16
06/18/90	26.91	1114.63
08/22/90	27.17	1114.37
09/07/90	27.14	1114.40
10/17/90	27.23	1114.31
11/15/90	27.25	1114.29
12/05/90	27.30	1114.24
03/27/91	27.27	1114.27
03/28/91	27.32	1114.22
04/25/91	27.36	1114.18
05/21/91	27.14	1114.40
06/10/91	27.12	1114.42
06/19/91	27.18	1114.36
07/16/91	26.86	1114.68
08/20/91	26.94	1114.60
09/17/91	26.89	1114.65
09/25/91	26.90	1114.64
10/23/91	26.99	1114.55
11/14/91	26.86	1114.68
11/26/91	26.91	1114.63
12/17/91	26.99	1114.55
04/18/92	26.97	1114.57
04/27/92	26.95	1114.59
05/22/92	27.04	1114.50
06/02/92	27.15	1114.39
06/16/92	27.07	1114.47
07/07/92	27.05	1114.49
07/22/92	27.10	1114.44
08/26/92	27.27	1114.27
09/22/92	27.27	1114.27
10/06/92	27.26	1114.28
10/21/92	27.30	1114.24
11/11/92	25.87	1115.67
11/24/92	27.34	1114.20
01/26/93	27.36	1114.18
04/27/93	27.20	1114.34
05/25/93	27.25	1114.29
06/09/93	27.14	1114.40
06/23/93	27.17	1114.37
07/21/93	26.90	1114.64
08/25/93	26.68	1114.86
09/22/93	26.68	1114.86
10/19/93	26.69	1114.85
10/20/93	26.75	1114.79
10/27/93	26.74	1114.80
11/19/93	26.75	1114.79
11/24/93	26.80	1114.74
04/05/94	26.75	1114.79
05/02/94	26.68	1114.86
05/11/94	26.76	1114.78
06/08/94	26.80	1114.74
06/23/94	26.53	1115.01
07/07/94	26.49	1115.05
08/17/94	26.62	1114.92
09/14/94	26.72	1114.82
09/26/94	26.70	1114.84
10/12/94	26.70	1114.84
11/09/94	26.65	1114.89
11/25/94	26.67	1114.87
12/07/94	26.70	1114.84
05/03/95	26.22	1115.32
06/09/95	26.13	1115.41

155-056-25BCD
Fordville Aquifer

MP Elev (msl,ft)=1,141.54
SI (ft.)=33.5-35

Date	Depth to Water (ft)	WL Elev (msl, ft)
07/19/95	26.13	1115.41
10/12/95	26.29	1115.25
11/15/95	26.46	1115.08
05/15/96	25.79	1115.75
06/19/96	25.80	1115.74
07/24/96	25.92	1115.62
09/11/96	26.12	1115.42
10/23/96	25.75	1115.79
12/10/96	26.19	1115.35
06/04/97	25.08	1116.46
07/16/97	24.75	1116.79
08/19/97	25.06	1116.48
09/24/97	25.25	1116.29
10/22/97	25.31	1116.23
11/18/97	25.37	1116.17
12/16/97	25.43	1116.11
05/27/98	25.40	1116.14
07/21/98	25.35	1116.19
08/19/98	25.58	1115.96
09/23/98	25.79	1115.75
12/01/98	25.67	1115.87
05/26/99	24.83	1116.71
06/23/99	24.83	1116.71
07/21/99	24.78	1116.76

Date	Depth to Water (ft)	WL Elev (msl, ft)
08/25/99	24.77	1116.77
09/30/99	24.84	1116.70
10/28/99	24.95	1116.59
12/01/99	25.02	1116.52
05/17/00	25.51	1116.03
06/28/00	25.55	1115.99
08/22/00	25.79	1115.75
11/30/00	25.72	1115.82
05/02/01	25.63	1115.91
06/06/01	25.67	1115.87
07/11/01	25.82	1115.72
08/08/01	25.83	1115.71
09/05/01	25.91	1115.63
10/10/01	25.99	1115.55
10/11/01	26.00	1115.54
10/23/01	26.05	1115.49
11/14/01	25.97	1115.57
12/05/01	25.98	1115.56
05/01/02	26.14	1115.40
06/19/02	26.04	1115.50
07/31/02	25.60	1115.94
09/11/02	25.47	1116.07
10/30/02	25.56	1115.98
12/05/02	25.61	1115.93

156-056-09DDD
Fordville Aquifer

MP Elev (msl,ft)=1,177.93
SI (ft.)=30-35

Date	Depth to Water (ft)	WL Elev (msl, ft)
10/16/01	24.95	1152.98
10/30/01	24.91	1153.02
11/14/01	24.88	1153.05
12/05/01	24.84	1153.09
05/01/02	25.07	1152.86

Date	Depth to Water (ft)	WL Elev (msl, ft)
06/19/02	25.12	1152.81
07/31/02	25.09	1152.84
09/11/02	24.36	1153.57
10/30/02	24.30	1153.63
12/05/02	24.21	1153.72

156-056-15DDD
Fordville Aquifer

MP Elev (msl,ft)=1,173.05
SI (ft.)=45-50

Date	Depth to Water (ft)	WL Elev (msl, ft)
10/16/01	24.07	1148.98
10/30/01	24.00	1149.05
11/14/01	24.02	1149.03
12/05/01	23.99	1149.06
05/01/02	24.29	1148.76

Date	Depth to Water (ft)	WL Elev (msl, ft)
06/19/02	24.35	1148.70
07/31/02	24.10	1148.95
09/11/02	23.67	1149.38
10/30/02	23.51	1149.54
12/05/02	23.53	1149.52

156-056-16BAA
Fordville Aquifer

MP Elev (msl,ft)=1,174.16
SI (ft.)=24-29

Date	Depth to Water (ft)	WL Elev (msl, ft)
10/16/01	9.40	1164.76
10/30/01	9.41	1164.75
11/14/01	9.20	1164.96
12/05/01	9.40	1164.76
05/01/02	10.11	1164.05

Date	Depth to Water (ft)	WL Elev (msl, ft)
06/19/02	8.83	1165.33
07/31/02	8.72	1165.44
09/11/02	7.20	1166.96
10/30/02	7.80	1166.36
12/05/02	7.83	1166.33

156-056-16CCB
Fordville Aquifer

MP Elev (msl,ft)=1,174.33
SI (ft.)=28-32

Date	Depth to Water (ft)	WL Elev (msl, ft)
08/25/67	10.36	1163.82
09/05/67	11.08	1163.10
09/13/67	11.24	1162.94
10/05/67	11.45	1162.73
10/23/67	12.02	1162.16
11/14/67	11.68	1162.50
12/13/67	11.98	1162.20
01/16/68	11.98	1162.20
02/08/68	12.10	1162.08
03/20/68	9.66	1164.52
04/11/68	9.78	1164.40
04/30/68	9.76	1164.42
05/21/68	8.73	1165.45
05/27/68	9.93	1164.25
06/03/68	10.08	1164.10
06/10/68	9.63	1164.55
07/02/68	10.40	1163.78
07/17/68	10.75	1163.43
08/14/68	11.32	1162.86
09/11/68	11.57	1162.61
11/06/68	12.02	1162.16
02/13/69	12.44	1161.74
04/22/69	8.80	1165.38
07/07/69	9.57	1164.61
08/12/69	12.91	1161.27
09/27/69	11.70	1162.48
11/15/69	12.21	1161.97
12/13/69	12.35	1161.83
01/17/70	12.53	1161.65
02/14/70	12.57	1161.61
03/18/70	12.70	1161.48
05/09/70	9.31	1164.87
05/30/70	9.07	1165.11
07/30/70	9.37	1164.81
08/25/70	10.70	1163.48
10/24/70	11.52	1162.66
12/01/70	10.75	1163.43
03/05/71	12.24	1161.94
05/16/71	8.85	1165.33
09/13/71	10.07	1164.11
11/29/71	10.95	1163.23
03/25/72	9.73	1164.45
06/15/72	9.45	1164.73
09/07/72	10.66	1163.52
12/05/72	12.11	1162.07
02/26/73	12.38	1161.80
06/13/73	11.55	1162.63
08/20/73	11.68	1162.50
12/02/73	11.28	1162.90
03/12/74	12.02	1162.16
06/21/74	8.50	1165.68
09/17/74	10.15	1164.03
12/03/74	10.97	1163.21

Date	Depth to Water (ft)	WL Elev (msl, ft)
03/13/75	11.65	1162.53
06/02/75	8.85	1165.33
09/03/75	9.99	1164.19
12/04/75	10.95	1163.23
03/03/76	10.55	1163.63
06/01/76	9.05	1165.13
09/07/76	11.35	1162.83
12/02/76	12.01	1162.17
03/14/77	12.21	1161.97
06/01/77	12.24	1161.94
08/31/77	12.44	1161.74
12/01/77	12.72	1161.46
03/13/78	12.98	1161.20
06/09/78	8.67	1165.51
09/06/78	10.95	1163.23
11/20/78	11.53	1162.65
03/05/79	12.22	1161.96
06/15/79	8.32	1165.86
09/18/79	10.55	1163.63
11/29/79	11.39	1162.79
03/07/80	11.97	1162.21
06/03/80	11.31	1162.87
09/08/80	12.21	1161.97
11/17/80	12.39	1161.79
03/12/81	10.69	1163.49
06/29/81	8.83	1165.35
09/30/81	10.27	1163.91
12/03/81	9.29	1164.89
03/09/82	11.19	1162.99
06/11/82	7.96	1166.22
10/04/82	9.33	1164.85
11/30/82	9.74	1164.44
03/28/83	8.52	1165.66
07/01/83	8.50	1165.68
10/03/83	10.00	1164.18
12/01/83	10.49	1163.69
04/18/84	8.89	1165.29
06/01/84	9.14	1165.04
10/02/84	11.26	1162.92
11/29/84	11.24	1162.94
03/11/85	10.43	1163.75
06/17/85	9.49	1164.69
09/12/85	11.18	1163.00
12/13/85	11.33	1162.85
03/11/86	11.86	1162.32
06/05/86	8.82	1165.36
10/03/86	10.09	1164.09
11/14/86	10.26	1163.92

156-056-16CCB **MP Elev (msl,ft)=1,174.33**
Fordville Aquifer **SI (ft.)=28-32**

Date	Depth to Water (ft)	WL Elev (msl, ft)
03/24/87	5.87	1168.31
06/03/87	8.19	1165.99
08/06/87	9.21	1164.97
09/01/87	10.02	1164.16
12/08/87	11.15	1163.03
03/21/88	11.07	1163.11
06/22/88	10.09	1164.09
09/09/88	11.84	1162.34
10/27/88	12.18	1162.00
12/06/88	12.35	1161.83
01/25/89	12.52	1161.66
05/09/89	9.28	1164.90
08/23/89	11.95	1162.23
11/21/89	12.71	1161.47
03/14/90	13.04	1161.14
05/10/90	13.63	1160.55
06/18/90	13.06	1161.12
08/22/90	13.57	1160.61
09/07/90	13.49	1160.69
10/17/90	13.75	1160.43
11/15/90	13.80	1160.38
11/16/90	13.66	1160.52
12/05/90	13.85	1160.33
03/27/91	13.67	1160.51
03/28/91	13.85	1160.33
04/25/91	13.99	1160.19
05/21/91	13.73	1160.45
06/06/91	12.36	1161.82
06/19/91	11.57	1162.61
07/16/91	10.54	1163.64
08/20/91	12.14	1162.04
09/17/91	10.64	1163.54
09/25/91	10.04	1164.14
10/23/91	11.22	1162.96
11/14/91	9.57	1164.61
11/26/91	9.42	1164.76
12/17/91	9.63	1164.55
04/18/92	8.73	1165.45
04/27/92	8.61	1165.57
05/22/92	9.08	1165.10
06/02/92	9.14	1165.04
06/16/92	9.02	1165.16
07/07/92	9.44	1164.74
07/22/92	10.33	1163.85
08/26/92	11.36	1162.82
09/22/92	11.88	1162.30
10/06/92	11.85	1162.33
10/21/92	12.15	1162.03
11/11/92	12.18	1162.00
11/24/92	12.45	1161.73
01/26/93	12.84	1161.34
04/27/93	9.40	1164.78
05/25/93	9.34	1164.84

Date	Depth to Water (ft)	WL Elev (msl, ft)
06/09/93	8.18	1166.00
06/23/93	8.62	1165.56
07/21/93	8.09	1166.09
08/25/93	7.14	1167.04
09/22/93	8.08	1166.10
10/19/93	8.39	1165.79
10/27/93	8.58	1165.60
11/19/93	8.77	1165.41
11/24/93	8.99	1165.19
04/05/94	7.84	1166.34
05/02/94	8.39	1165.79
05/11/94	8.74	1165.44
06/08/94	8.38	1165.80
06/23/94	7.59	1166.59
07/07/94	8.59	1165.59
08/17/94	10.10	1164.08
09/14/94	10.71	1163.47
09/26/94	10.56	1163.62
10/12/94	10.85	1163.33
11/09/94	10.88	1163.30
11/25/94	10.90	1163.28
12/07/94	10.30	1163.88
05/03/95	7.82	1166.36
06/09/95	7.60	1166.58
07/19/95	6.66	1167.52
08/09/95	8.69	1165.49
10/12/95	10.03	1164.15
11/15/95	9.77	1164.41
05/15/96	7.21	1166.97
06/19/96	7.29	1166.89
07/24/96	7.80	1166.38
09/11/96	9.90	1164.28
10/23/96	11.00	1163.18
12/10/96	10.93	1163.25
06/04/97	7.36	1166.82
07/16/97	7.69	1166.49
08/19/97	8.85	1165.33
09/24/97	10.08	1164.10
10/22/97	10.47	1163.71
11/18/97	10.68	1163.50
12/16/97	10.86	1163.32
05/27/98	8.49	1165.69
07/22/98	8.66	1165.52
08/19/98	9.85	1164.33
09/23/98	10.75	1163.43
12/01/98	10.76	1163.42
05/26/99	7.11	1167.07
06/23/99	7.97	1166.21
07/21/99	8.54	1165.64
08/25/99	9.15	1165.03
09/30/99	10.03	1164.15
10/28/99	10.36	1163.82
12/01/99	10.68	1163.50

156-056-16CCB **MP Elev (msl,ft)=1,174.33**
Fordville Aquifer **SI (ft.)=28-32**

Date	Depth to Water (ft)	WL Elev (msl, ft)
05/17/00	10.17	1164.01
06/28/00	9.36	1164.82
08/22/00	10.61	1163.57
11/30/00	10.62	1163.56
05/02/01	7.86	1166.32
06/06/01	8.13	1166.05
07/11/01	8.40	1165.78
08/08/01	8.15	1166.03
09/05/01	9.84	1164.34
10/10/01	10.59	1163.59

Date	Depth to Water (ft)	WL Elev (msl, ft)
10/12/01	10.65	1163.53
10/30/01	10.90	1163.43
11/14/01	10.79	1163.54
12/05/01	10.95	1163.38
05/01/02	9.42	1164.91
06/19/02	8.54	1165.79
07/31/02	9.25	1165.08
09/11/02	7.35	1166.98
10/30/02	8.10	1166.23
12/05/02	8.64	1165.69

156-056-16DDC
Fordville Aquifer

MP Elev (msl,ft)=1,165.25
SI (ft.)=17-20

Date	Depth to Water (ft)	WL Elev (msl, ft)
03/28/91	9.72	1155.38
04/25/91	9.80	1155.30
05/21/91	9.70	1155.40
06/19/91	9.57	1155.53
07/16/91	9.20	1155.90
08/20/91	8.58	1156.52
09/25/91	8.06	1157.04
10/23/91	7.97	1157.13
11/26/91	7.41	1157.69
12/17/91	7.68	1157.42
04/18/92	6.69	1158.41
05/22/92	6.20	1158.90
06/02/92	6.31	1158.79
06/16/92	6.29	1158.81
07/22/92	7.24	1157.86
08/26/92	7.95	1157.15
09/22/92	8.20	1156.90
10/21/92	8.29	1156.81
11/24/92	8.44	1156.66
01/26/93	8.73	1156.37
04/27/93	7.40	1157.70
05/25/93	6.98	1158.12
06/23/93	5.98	1159.12
07/21/93	5.96	1159.14
08/25/93	4.93	1160.17
09/22/93	5.36	1159.74
10/27/93	5.90	1159.20
11/24/93	6.26	1158.84
04/05/94	6.24	1158.86
05/11/94	5.91	1159.19
06/08/94	5.22	1159.88
07/07/94	5.94	1159.16
08/17/94	7.25	1157.85
09/14/94	7.21	1157.89
10/12/94	6.92	1158.18
11/09/94	6.88	1158.22
12/07/94	7.03	1158.07
05/03/95	5.05	1160.05
06/09/95	4.68	1160.42
07/19/95	5.34	1159.76
08/09/95	6.54	1158.56
10/12/95	6.40	1158.70
11/15/95	6.65	1158.45
05/15/96	4.62	1160.48
06/19/96	3.90	1161.20
07/24/96	5.15	1159.95
09/11/96	7.14	1157.96
10/23/96	6.76	1158.34
12/10/96	7.03	1158.07
06/04/97	4.58	1160.52
07/16/97	4.86	1160.24
08/19/97	6.54	1158.56
09/24/97	6.60	1158.50
10/22/97	6.52	1158.58
11/18/97	6.62	1158.48
12/16/97	6.78	1158.32
05/27/98	4.89	1160.21
07/22/98	5.56	1159.54
08/19/98	6.69	1158.41
09/23/98	7.14	1157.96
12/01/98	6.80	1158.30
05/26/99	3.42	1161.68
06/23/99	4.84	1160.26
07/21/99	6.13	1158.97
08/25/99	6.38	1158.72
09/30/99	6.51	1158.59
10/28/99	6.70	1158.40
12/01/99	6.90	1158.20
05/17/00	6.85	1158.25
06/28/00	5.90	1159.20
08/22/00	7.47	1157.63
11/30/00	6.99	1158.11
05/02/01	5.59	1159.51
06/06/01	5.35	1159.75
07/11/01	6.33	1158.77
08/08/01	6.40	1158.70
09/05/01	6.99	1158.11
10/10/01	7.09	1158.01
10/16/01	7.10	1158.00
10/30/01	7.20	1158.05
11/14/01	6.93	1158.32
12/05/01	7.03	1158.22
05/01/02	7.20	1158.05
06/19/02	5.88	1159.37
07/31/02	6.60	1158.65
09/11/02	3.82	1161.43
10/30/02	5.80	1159.45
12/05/02	6.25	1159.00

156-056-22CCC
Fordville Aquifer

MP Elev (msl,ft)=1,159.14
SI (ft.)=12-17

Date	Depth to Water (ft)	WL Elev (msl, ft)
10/16/01	11.40	1147.74
10/30/01	11.40	1147.74
11/14/01	11.28	1147.86
12/05/01	11.49	1147.65
05/01/02	11.89	1147.25
06/19/02	11.98	1147.16
07/31/02	11.71	1147.43
09/11/02	10.88	1148.26
10/30/02	10.82	1148.32
12/05/02	10.92	1148.22

156-056-22DCC
Fordville Aquifer

MP Elev (msl,ft)=1,167.51
SI (ft.)=32-37

Date	Depth to Water (ft)	WL Elev (msl, ft)
10/16/01	20.68	1146.83
10/30/01	20.65	1146.86
11/14/01	20.67	1146.84
12/05/01	20.73	1146.78
05/01/02	21.10	1146.41
06/19/02	21.08	1146.43
07/31/02	20.89	1146.62
09/11/02	20.06	1147.45
10/30/02	20.24	1147.27
12/05/02	20.35	1147.16

156-056-22DDD **MP Elev (msl,ft)=1,167.18**
Fordville Aquifer **SI (ft.)=52-57**

Date	Depth to Water (ft)	WL Elev (msl, ft)
10/23/70	20.42	1146.76
11/02/70	20.42	1146.76
12/01/70	20.40	1146.78
01/04/71	20.52	1146.66
02/01/71	20.61	1146.57
03/05/71	20.70	1146.48
03/30/71	20.70	1146.48
05/13/71	20.02	1147.16
06/16/71	20.10	1147.08
07/13/71	20.14	1147.04
08/16/71	20.06	1147.12
09/13/71	20.11	1147.07
10/19/71	20.23	1146.95
11/23/71	20.29	1146.89
11/29/71	20.32	1146.86
12/23/71	20.34	1146.84
01/27/72	20.44	1146.74
02/28/72	20.58	1146.60
03/25/72	20.30	1146.88
04/25/72	20.11	1147.07
05/17/72	20.11	1147.07
06/15/72	20.20	1146.98
07/12/72	20.25	1146.93
08/15/72	20.35	1146.83
09/07/72	20.39	1146.79
10/10/72	20.53	1146.65
11/09/72	20.52	1146.66
12/05/72	20.58	1146.60
02/26/73	20.82	1146.36
04/02/73	20.74	1146.44
05/07/73	20.88	1146.30
06/13/73	20.94	1146.24
07/12/73	20.94	1146.24
08/14/73	21.01	1146.17
08/20/73	21.00	1146.18
10/09/73	21.41	1145.77
11/14/73	21.02	1146.16
02/07/74	21.23	1145.95
03/12/74	21.28	1145.90
04/02/74	21.31	1145.87
05/07/74	20.50	1146.68
07/17/74	19.38	1147.80
08/06/74	19.49	1147.69
09/17/74	19.93	1147.25
11/21/74	20.05	1147.13
02/10/75	20.38	1146.80
03/13/75	20.60	1146.58
05/16/75	20.20	1146.98
06/02/75	20.41	1146.77
07/09/75	20.16	1147.02
08/18/75	20.34	1146.84
09/04/75	19.92	1147.26
10/07/75	20.05	1147.13
11/05/75	20.26	1146.92
01/09/76	20.22	1146.96
02/05/76	20.34	1146.84
03/03/76	20.33	1146.85
04/13/76	19.88	1147.30
05/12/76	20.12	1147.06
06/01/76	20.50	1146.68
07/06/76	20.66	1146.52
08/03/76	20.88	1146.30
09/07/76	20.87	1146.31
10/07/76	20.95	1146.23
11/09/76	21.07	1146.11
12/02/76	20.98	1146.20
01/12/77	21.22	1145.96
02/02/77	21.33	1145.85
03/14/77	21.40	1145.78
04/06/77	21.39	1145.79
05/02/77	21.76	1145.42
06/01/77	21.65	1145.53
07/11/77	21.50	1145.68
08/02/77	21.89	1145.29
08/31/77	21.89	1145.29
10/17/77	22.05	1145.13
11/01/77	21.74	1145.44
12/01/77	21.72	1145.46
01/11/78	22.20	1144.98
02/07/78	22.00	1145.18
03/13/78	22.29	1144.89
04/05/78	21.79	1145.39
05/02/78	21.62	1145.56
06/09/78	21.73	1145.45
07/10/78	21.83	1145.35
08/08/78	21.89	1145.29
09/06/78	22.02	1145.16
09/19/78	21.85	1145.33
10/03/78	21.77	1145.41
10/31/78	21.81	1145.37
11/20/78	21.78	1145.40
01/18/79	22.05	1145.13
02/05/79	21.99	1145.19
03/05/79	22.11	1145.07
04/03/79	22.28	1144.90
05/11/79	21.14	1146.04
06/15/79	21.40	1145.78
07/12/79	21.28	1145.90
08/14/79	21.38	1145.80
09/13/79	21.46	1145.72
10/03/79	21.51	1145.67
11/29/79	21.64	1145.54
03/07/80	21.88	1145.30
04/11/80	21.98	1145.20
05/06/80	22.28	1144.90
06/03/80	22.46	1144.72
07/09/80	22.55	1144.63
08/07/80	22.77	1144.41
09/08/80	22.82	1144.36
10/07/80	22.76	1144.42

156-056-22DDD
Fordville Aquifer

MP Elev (msl,ft)=1,167.18
SI (ft.)=52-57

Date	Depth to Water (ft)	WL Elev (msl, ft)
11/03/80	22.73	1144.45
11/17/80	22.64	1144.54
12/17/80	22.66	1144.52
01/28/81	22.67	1144.51
03/12/81	22.95	1144.23
04/07/81	22.84	1144.34
05/21/81	23.23	1143.95
06/29/81	23.03	1144.15
07/29/81	23.28	1143.90
09/30/81	23.13	1144.05
12/03/81	22.88	1144.30
03/09/82	23.22	1143.96
06/11/82	23.04	1144.14
08/25/82	22.38	1144.80
10/04/82	22.41	1144.77
11/30/82	21.94	1145.24
01/07/83	21.87	1145.31
03/28/83	21.73	1145.45
07/01/83	22.32	1144.86
08/01/83	22.55	1144.63
08/19/83	22.73	1144.45
10/03/83	22.59	1144.59
12/01/83	22.49	1144.69
12/20/83	22.65	1144.53
01/09/84	22.81	1144.37
02/17/84	22.99	1144.19
04/18/84	23.29	1143.89
06/14/84	23.18	1144.00
08/06/84	23.38	1143.80
10/02/84	23.68	1143.50
11/29/84	23.47	1143.71
03/11/85	23.83	1143.35
05/01/85	23.57	1143.61
06/17/85	23.65	1143.53
07/25/85	23.92	1143.26
09/12/85	23.93	1143.25
10/16/85	23.82	1143.36
12/13/85	23.65	1143.53
03/11/86	23.92	1143.26
04/23/86	23.62	1143.56
06/05/86	23.72	1143.46
07/17/86	23.80	1143.38
08/22/86	23.62	1143.56
10/03/86	23.53	1143.65
11/14/86	23.56	1143.62
06/03/87	22.88	1144.30
07/24/87	22.91	1144.27
09/01/87	23.08	1144.10
10/19/87	23.05	1144.13
12/08/87	23.03	1144.15
03/21/88	23.40	1143.78
05/12/88	23.46	1143.72

Date	Depth to Water (ft)	WL Elev (msl, ft)
06/22/88	23.89	1143.29
08/05/88	24.27	1142.91
09/09/88	24.31	1142.87
10/27/88	24.29	1142.89
12/06/88	24.13	1143.05
01/25/89	24.32	1142.86
03/01/89	24.32	1142.86
05/09/89	24.17	1143.01
06/23/89	24.40	1142.78
08/23/89	24.91	1142.27
10/03/89	24.89	1142.29
11/21/89	24.58	1142.60
01/08/90	24.57	1142.61
03/14/90	24.83	1142.35
05/11/90	25.07	1142.11
06/18/90	25.02	1142.16
08/22/90	25.57	1141.61
09/07/90	25.87	1141.31
10/17/90	25.55	1141.63
11/15/90	25.46	1141.72
12/05/90	25.46	1141.72
01/15/91	25.60	1141.58
03/27/91	25.44	1141.74
03/28/91	25.47	1141.71
04/25/91	25.70	1141.48
05/21/91	25.75	1141.43
06/10/91	25.75	1141.43
06/19/91	25.90	1141.28
07/16/91	25.68	1141.50
08/20/91	25.81	1141.37
09/17/91	25.67	1141.51
09/25/91	25.82	1141.36
10/23/91	25.30	1141.88
11/14/91	25.16	1142.02
11/26/91	25.43	1141.75
12/17/91	25.19	1141.99
04/18/92	25.00	1142.18
04/27/92	24.90	1142.28
05/22/92	25.22	1141.96
06/02/92	25.41	1141.77
06/16/92	25.43	1141.75
07/07/92	26.36	1140.82
07/22/92	25.55	1141.63
08/26/92	25.90	1141.28
09/22/92	25.67	1141.51
10/06/92	25.64	1141.54
10/21/92	25.63	1141.55
11/20/92	25.58	1141.60
11/24/92	25.50	1141.68
01/26/93	25.55	1141.63
04/27/93	25.63	1141.55
05/25/93	25.94	1141.24
06/09/93	25.72	1141.46
06/23/93	25.80	1141.38
07/21/93	25.93	1141.25

156-056-22DDD
Fordville Aquifer

MP Elev (msl,ft)=1,167.18
SI (ft.)=52-57

Date	Depth to Water (ft)	WL Elev (msl, ft)
08/25/93	25.16	1142.02
09/22/93	24.88	1142.30
10/19/93	24.71	1142.47
10/20/93	24.89	1142.29
10/27/93	24.89	1142.29
11/19/93	24.54	1142.64
11/24/93	24.50	1142.68
04/05/94	24.90	1142.28
05/02/94	24.73	1142.45
05/11/94	24.80	1142.38
06/08/94	24.98	1142.20
06/23/94	24.81	1142.37
07/07/94	24.70	1142.48
08/17/94	24.96	1142.22
09/14/94	24.88	1142.30
09/26/94	24.81	1142.37
10/12/94	24.75	1142.43
11/09/94	24.68	1142.50
11/25/94	24.79	1142.39
12/07/94	24.65	1142.53
05/03/95	24.25	1142.93
06/09/95	24.40	1142.78
07/19/95	24.40	1142.78
09/20/95	24.49	1142.69
10/12/95	24.40	1142.78
11/15/95	24.27	1142.91
01/09/96	24.60	1142.58
05/15/96	23.95	1143.23
06/19/96	23.85	1143.33
06/25/96	23.66	1143.52
07/24/96	23.71	1143.47
08/05/96	23.53	1143.65
09/11/96	23.44	1143.74
09/19/96	23.47	1143.71
10/23/96	23.67	1143.51
11/19/96	23.64	1143.54
12/10/96	23.74	1143.44
05/02/97	22.75	1144.43
06/04/97	22.78	1144.40
06/18/97	22.89	1144.29
07/16/97	22.61	1144.57
08/06/97	22.59	1144.59
08/19/97	22.52	1144.66
09/24/97	22.71	1144.47
10/16/97	22.62	1144.56
10/22/97	22.60	1144.58
11/18/97	22.62	1144.56
12/16/97	22.68	1144.50
12/18/97	22.66	1144.52
02/10/98	22.73	1144.45
04/07/98	22.51	1144.67

Date	Depth to Water (ft)	WL Elev (msl, ft)
05/27/98	23.10	1144.08
06/16/98	22.93	1144.25
07/21/98	22.95	1144.23
07/28/98	23.16	1144.02
08/19/98	23.33	1143.85
09/15/98	23.39	1143.79
09/23/98	23.18	1144.00
11/04/98	23.08	1144.10
12/01/98	23.29	1143.89
02/03/99	23.10	1144.08
03/11/99	23.32	1143.86
05/19/99	21.94	1145.24
05/26/99	22.00	1145.18
06/23/99	21.90	1145.28
06/24/99	21.86	1145.32
07/21/99	22.00	1145.18
08/25/99	22.07	1145.11
09/30/99	22.06	1145.12
10/05/99	22.00	1145.18
10/28/99	22.02	1145.16
12/01/99	22.02	1145.16
01/24/00	22.58	1144.60
03/15/00	22.75	1144.43
05/17/00	23.10	1144.08
06/28/00	22.84	1144.34
07/14/00	22.98	1144.20
08/22/00	22.93	1144.25
08/31/00	23.05	1144.13
10/16/00	23.36	1143.82
11/30/00	22.94	1144.24
12/04/00	22.97	1144.21
01/26/01	23.15	1144.03
03/15/01	23.32	1143.86
04/30/01	23.17	1144.01
05/02/01	23.19	1143.99
06/06/01	23.00	1144.18
06/22/01	22.59	1144.59
07/11/01	23.00	1144.18
08/03/01	23.02	1144.16
08/08/01	22.98	1144.20
09/05/01	22.58	1144.60
10/01/01	22.92	1144.26
10/04/01	22.58	1144.60
10/10/01	22.87	1144.31
11/14/01	22.65	1144.53
12/05/01	22.50	1144.68
05/01/02	23.10	1144.08
06/19/02	23.30	1143.88
07/31/02	23.08	1144.10
09/11/02	22.72	1144.46
10/30/02	22.33	1144.85
12/05/02	22.52	1144.66

156-056-23BCC
Fordville Aquifer

MP Elev (msl,ft)=1,166.42
SI (ft.)=38-43

Date	Depth to Water (ft)	WL Elev (msl, ft)
10/16/01	18.85	1147.57
10/30/01	18.82	1147.60
11/14/01	18.83	1147.59
12/05/01	18.86	1147.56
05/01/02	19.22	1147.20
06/19/02	19.18	1147.24
07/31/02	18.90	1147.52
09/11/02	18.21	1148.21
10/30/02	18.29	1148.13
12/05/02	18.34	1148.08

156-056-23CDD
Fordville Aquifer

MP Elev (msl,ft)=1,169.25
SI (ft.)=28-33

Date	Depth to Water (ft)	WL Elev (msl, ft)
10/16/01	24.62	1144.63
10/30/01	24.60	1144.65
11/14/01	24.54	1144.71
12/05/01	24.53	1144.72
05/01/02	24.86	1144.39
06/19/02	24.95	1144.30
07/31/02	24.88	1144.37
09/11/02	24.57	1144.68
10/30/02	24.24	1145.01
12/05/02	24.19	1145.06

156-056-24BCC
Fordville Aquifer

MP Elev (msl,ft)=1,227.08
SI (ft.)=101-106

Date	Depth to Water (ft)	WL Elev (msl, ft)
10/16/01	83.83	1143.25
10/23/01	83.70	1143.38
11/14/01	83.70	1143.38
12/05/01	83.48	1143.60
05/01/02	83.88	1143.20
06/19/02	83.95	1143.13
07/31/02	83.91	1143.17
09/11/02	83.76	1143.32
10/30/02	83.64	1143.44
12/05/02	83.54	1143.54

156-056-24CCC2
Fordville Aquifer

MP Elev (msl,ft)=1,166.68
SI (ft.)=30-35

Date	Depth to Water (ft)	WL Elev (msl, ft)
10/16/01	23.70	1142.98
11/14/01	23.63	1143.05
12/05/01	23.61	1143.07
05/01/02	23.88	1142.80
06/19/02	23.95	1142.73
07/31/02	23.85	1142.83
09/11/02	23.49	1143.19
10/30/02	23.44	1143.24
12/05/02	23.43	1143.25

156-056-25CDD
Fordville Aquifer

MP Elev (msl,ft)=1,199.89
SI (ft.)=75-80

Date	Depth to Water (ft)	WL Elev (msl, ft)
10/11/01	64.35	1135.54
10/23/01	64.35	1135.54
11/14/01	64.35	1135.54
12/05/01	64.20	1135.69
05/01/02	64.53	1135.36
06/19/02	64.62	1135.27
07/31/02	64.49	1135.40
09/11/02	64.51	1135.38
10/30/02	64.45	1135.44
12/05/02	64.41	1135.48

156-056-26DAA
Fordville Aquifer

MP Elev (msl,ft)=1,164.47
SI (ft.)=38-43

Date	Depth to Water (ft)	WL Elev (msl, ft)
10/16/01	22.42	1142.05
10/30/01	22.42	1142.05
11/14/01	22.41	1142.06
12/05/01	22.42	1142.05
05/01/02	22.66	1141.81
06/19/02	22.74	1141.73
07/31/02	22.56	1141.91
09/11/02	22.15	1142.32
10/30/02	22.05	1142.42
12/05/02	22.09	1142.38

156-056-26DCC
Fordville Aquifer

MP Elev (msl,ft)=1,154.56
SI (ft.)=25-30

Date	Depth to Water (ft)	WL Elev (msl, ft)
06/19/91	11.80	1142.76
07/16/91	14.80	1139.76
08/20/91	14.78	1139.78
09/25/91	14.74	1139.82
10/23/91	14.56	1140.00
11/26/91	14.43	1140.13
12/17/91	14.42	1140.14
04/18/92	13.98	1140.58
05/22/92	14.01	1140.55
06/16/92	14.30	1140.26
07/22/92	14.18	1140.38
08/26/92	14.41	1140.15
09/22/92	14.45	1140.11
10/21/92	14.51	1140.05
11/24/92	14.55	1140.01
01/26/93	14.65	1139.91
04/27/93	14.34	1140.22
05/25/93	14.30	1140.26
06/23/93	14.28	1140.28
07/21/93	14.21	1140.35
08/25/93	13.51	1141.05
09/22/93	13.55	1141.01
10/27/93	13.64	1140.92
11/24/93	13.67	1140.89
04/05/94	13.38	1141.18
05/11/94	13.45	1141.11
06/08/94	13.49	1141.07
07/07/94	13.49	1141.07
08/17/94	13.72	1140.84
09/14/94	13.85	1140.71
10/12/94	13.87	1140.69
11/09/94	13.88	1140.68
12/07/94	13.81	1140.75
05/03/95	13.08	1141.48
06/09/95	13.16	1141.40
07/19/95	13.39	1141.17
08/09/95	13.50	1141.06
10/12/95	13.65	1140.91
11/15/95	13.69	1140.87
05/15/96	12.98	1141.58
06/19/96	12.38	1142.18
07/24/96	12.76	1141.80

Date	Depth to Water (ft)	WL Elev (msl, ft)
09/11/96	13.06	1141.50
10/23/96	13.17	1141.39
12/10/96	13.28	1141.28
06/04/97	12.18	1142.38
07/16/97	12.28	1142.28
08/19/97	12.40	1142.16
09/24/97	12.48	1142.08
10/22/97	12.53	1142.03
11/18/97	12.61	1141.95
12/16/97	12.67	1141.89
05/27/98	12.43	1142.13
07/22/98	12.63	1141.93
08/19/98	12.75	1141.81
09/23/98	12.89	1141.67
12/01/98	12.94	1141.62
05/26/99	11.80	1142.76
06/23/99	11.73	1142.83
07/21/99	11.87	1142.69
08/25/99	12.07	1142.49
09/30/99	12.11	1142.45
10/28/99	12.17	1142.39
12/01/99	12.23	1142.33
05/17/00	12.69	1141.87
06/28/00	12.78	1141.78
08/22/00	12.98	1141.58
11/30/00	12.96	1141.60
05/02/01	12.50	1142.06
06/06/01	12.46	1142.10
07/11/01	12.64	1141.92
08/08/01	12.78	1141.78
09/05/01	12.83	1141.73
10/10/01	12.85	1141.71
10/30/01	12.90	1141.66
11/14/01	12.87	1141.69
12/05/01	12.86	1141.70
05/01/02	13.08	1141.48
06/19/02	13.12	1141.44
07/31/02	12.95	1141.61
09/11/02	12.47	1142.09
10/30/02	12.49	1142.07
12/05/02	12.54	1142.02

156-056-27CCC
Fordville Aquifer

MP Elev (msl,ft)=1,167.59
SI (ft.)=22-27

Date	Depth to Water (ft)	WL Elev (msl, ft)
10/12/01	20.60	1149.27
10/30/01	18.32	1149.27
11/14/01	18.29	1149.30
12/05/01	18.36	1149.23
05/01/02	18.70	1148.89

Date	Depth to Water (ft)	WL Elev (msl, ft)
06/19/02	18.60	1148.99
07/31/02	18.20	1149.39
09/11/02	17.49	1150.10
10/30/02	18.03	1149.56
12/05/02	18.26	1149.33

156-056-34DCC **MP Elev (msl,ft)=1,171.27**
Fordville Aquifer **SI (ft.)=37-40**

Date	Depth to Water (ft)	WL Elev (msl, ft)
03/28/91	28.32	1142.09
04/25/91	28.37	1142.04
05/21/91	28.36	1142.05
06/19/91	28.45	1141.96
07/16/91	28.46	1141.95
08/20/91	28.49	1141.92
09/25/91	28.48	1141.93
10/23/91	28.36	1142.05
11/26/91	28.22	1142.19
12/17/91	28.21	1142.20
04/18/92	27.59	1142.82
05/22/92	27.63	1142.78
06/02/92	27.65	1142.76
06/16/92	27.59	1142.82
07/22/92	27.64	1142.77
08/26/92	27.66	1142.75
09/22/92	27.74	1142.67
10/21/92	27.70	1142.71
11/24/92	27.72	1142.69
01/26/93	27.81	1142.60
04/27/93	27.82	1142.59
05/25/93	27.88	1142.53
06/23/93	27.85	1142.56
07/21/93	27.90	1142.51
08/25/93	27.72	1142.69
09/22/93	27.55	1142.86
10/27/93	27.30	1143.11
11/24/93	27.21	1143.20
04/05/94	26.79	1143.62
05/11/94	26.72	1143.69
06/08/94	26.72	1143.69
07/07/94	26.68	1143.73
08/17/94	26.63	1143.78
09/14/94	26.57	1143.84
10/12/94	26.60	1143.81
11/09/94	26.60	1143.81
12/07/94	26.55	1143.86
05/03/95	25.84	1144.57
06/09/95	25.84	1144.57
07/19/95	25.70	1144.71
08/09/95	25.67	1144.74
10/12/95	25.52	1144.89
11/15/95	25.63	1144.78
05/15/96	25.32	1145.09

Date	Depth to Water (ft)	WL Elev (msl, ft)
06/19/96	25.08	1145.33
07/24/96	24.85	1145.56
09/11/96	24.87	1145.54
10/23/96	24.89	1145.52
12/10/96	24.99	1145.42
06/04/97	24.14	1146.27
07/16/97	24.22	1146.19
08/19/97	24.11	1146.30
09/24/97	24.14	1146.27
10/22/97	24.19	1146.22
11/18/97	24.28	1146.13
12/16/97	24.39	1146.02
05/27/98	24.65	1145.76
07/22/98	24.84	1145.57
08/19/98	24.81	1145.60
09/23/98	24.89	1145.52
12/01/98	25.10	1145.31
05/26/99	24.52	1145.89
06/23/99	24.12	1146.29
07/21/99	23.97	1146.44
08/25/99	23.91	1146.50
09/30/99	23.96	1146.45
10/28/99	24.06	1146.35
12/01/99	24.15	1146.26
05/17/00	25.10	1145.31
06/28/00	25.30	1145.11
08/22/00	25.49	1144.92
11/30/00	25.80	1144.61
05/02/01	25.56	1144.85
06/06/01	25.57	1144.84
07/11/01	25.58	1144.83
08/08/01	25.55	1144.86
09/05/01	25.53	1144.88
10/10/01	25.51	1144.90
10/23/01	26.42	1144.85
11/14/01	26.45	1144.82
12/05/01	26.44	1144.83
05/01/02	26.93	1144.34
06/19/02	27.04	1144.23
07/31/02	27.04	1144.23
09/11/02	26.92	1144.35
10/30/02	26.72	1144.55
12/05/02	26.63	1144.64

156-056-34DDD
Fordville Aquifer

MP Elev (msl,ft)=1,165.29
SI (ft.)=27-32

Date	Depth to Water (ft)	WL Elev (msl, ft)
10/23/01	23.37	1141.92
11/14/01	23.38	1141.91
12/05/01	23.38	1141.91
05/01/02	23.77	1141.52
06/19/02	23.86	1141.43
07/31/02	23.76	1141.53
09/11/02	23.64	1141.65
10/30/02	23.45	1141.84
12/05/02	23.42	1141.87

156-056-35AAA
Fordville Aquifer

MP Elev (msl,ft)=1,160.92
SI (ft.)=47-52

Date	Depth to Water (ft)	WL Elev (msl, ft)
10/16/01	20.08	1140.84
10/23/01	20.08	1140.84
11/14/01	20.10	1140.82
12/05/01	20.06	1140.86
05/01/02	20.33	1140.59
06/19/02	20.33	1140.59
07/31/02	20.13	1140.79
09/11/02	19.67	1141.25
10/30/02	19.72	1141.20
12/05/02	19.80	1141.12

156-056-36CCC1
Fordville Aquifer

MP Elev (msl,ft)=1,148.05
SI (ft.)=27-30

Date	Depth to Water (ft)	WL Elev (msl, ft)
05/27/68	8.74	1136.76
06/10/68	8.68	1136.82
07/02/68	8.70	1136.80
07/19/68	8.46	1137.04
08/14/68	8.57	1136.93
09/11/68	8.29	1137.21
10/07/68	8.44	1137.06
10/30/68	8.60	1136.90
01/10/69	8.16	1137.34
05/09/69	7.93	1137.57
07/07/69	8.38	1137.12
09/25/69	8.50	1137.00
10/20/69	8.48	1137.02
11/15/69	8.59	1136.91
12/13/69	8.59	1136.91
01/17/70	8.28	1137.22
02/14/70	8.53	1136.97
03/18/70	8.19	1137.31
05/06/70	7.58	1137.92
07/20/70	8.07	1137.43
08/25/70	8.23	1137.27
10/24/70	8.41	1137.09
12/01/70	8.40	1137.10
03/05/71	7.00	1138.50
06/16/71	7.45	1138.05
09/13/71	8.44	1137.06
04/25/72	7.68	1137.82
06/15/72	8.26	1137.24
09/07/72	7.80	1137.70
12/05/72	8.72	1136.78
02/26/73	8.37	1137.13
06/13/73	8.80	1136.70
08/21/73	8.35	1137.15
12/02/73	8.35	1137.15
12/03/74	7.99	1137.51
03/14/77	8.59	1136.91
06/01/77	8.15	1137.35
08/31/77	8.13	1137.37
12/01/77	7.86	1137.64
03/13/78	7.17	1138.33
06/09/78	7.13	1138.37
09/06/78	7.84	1137.66
11/20/78	7.85	1137.65
03/05/79	7.08	1138.42
06/15/79	7.08	1138.42
09/13/79	7.32	1138.18
11/29/79	7.35	1138.15
09/08/80	7.85	1137.65
11/17/80	7.98	1137.52

Date	Depth to Water (ft)	WL Elev (msl, ft)
06/29/81	6.88	1138.62
07/08/81	7.84	1137.66
09/30/81	10.33	1137.72
12/03/81	10.52	1137.53
03/09/82	10.03	1138.02
06/11/82	10.01	1138.04
10/04/82	9.96	1138.09
11/30/82	10.20	1137.85
03/28/83	9.64	1138.41
07/01/83	10.21	1137.84
10/03/83	10.54	1137.51
12/01/83	10.55	1137.50
04/18/84	10.30	1137.75
06/01/84	10.62	1137.43
10/02/84	10.72	1137.33
11/29/84	10.80	1137.25
03/11/85	11.38	1136.67
06/17/85	11.04	1137.01
09/12/85	10.77	1137.28
12/13/85	10.64	1137.41
03/11/86	10.82	1137.23
06/05/86	10.48	1137.57
10/03/86	10.44	1137.61
11/14/86	10.41	1137.64
06/03/87	9.38	1138.67
08/06/87	10.11	1137.94
09/01/87	10.00	1138.05
12/08/87	10.28	1137.77
03/21/88	10.12	1137.93
06/22/88	10.40	1137.65
09/09/88	10.55	1137.50
10/27/88	10.46	1137.59
12/06/88	10.47	1137.58
01/25/89	10.34	1137.71
05/09/89	10.36	1137.69
09/07/89	10.78	1137.27
11/21/89	10.72	1137.33
03/14/90	10.31	1137.74
05/11/90	10.07	1137.98
06/18/90	10.94	1137.11
08/22/90	11.02	1137.03
09/07/90	10.98	1137.07
10/17/90	10.97	1137.08
11/15/90	10.97	1137.08
12/05/90	11.04	1137.01
03/27/91	10.64	1137.41
03/28/91	10.68	1137.37
04/25/91	10.95	1137.10
05/21/91	10.93	1137.12
06/06/91	10.95	1137.10

156-056-36CCC1
Fordville Aquifer

MP Elev (msl,ft)=1,148.05
SI (ft.)=27-30

Date	Depth to Water (ft)	WL Elev (msl, ft)
06/19/91	11.00	1137.05
07/16/91	10.76	1137.29
08/20/91	11.09	1136.96
09/17/91	11.05	1137.00
09/25/91	10.93	1137.12
10/23/91	10.96	1137.09
11/14/91	10.83	1137.22
11/26/91	10.82	1137.23
12/17/91	10.77	1137.28
04/18/92	10.02	1138.03
04/27/92	10.05	1138.00
05/22/92	10.19	1137.86
06/02/92	10.32	1137.73
06/16/92	10.42	1137.63
07/07/92	10.43	1137.62
07/22/92	10.51	1137.54
08/26/92	10.65	1137.40
09/22/92	10.70	1137.35
10/06/92	10.74	1137.31
10/21/92	10.88	1137.17
11/11/92	10.75	1137.30
11/24/92	10.84	1137.21
01/26/93	10.78	1137.27
04/27/93	10.23	1137.82
05/25/93	10.50	1137.55
06/09/93	10.46	1137.59
06/23/93	10.46	1137.59
07/21/93	10.32	1137.73
08/25/93	9.27	1138.78
09/22/93	9.88	1138.17
10/19/93	10.10	1137.95
10/27/93	10.30	1137.75
11/19/93	10.29	1137.76
11/24/93	10.32	1137.73
04/05/94	9.57	1138.48
05/02/94	10.04	1138.01
05/11/94	10.38	1137.67
06/08/94	10.37	1137.68
06/23/94	10.11	1137.94
07/07/94	10.12	1137.93
08/17/94	10.20	1137.85
09/14/94	10.13	1137.92
09/26/94	10.04	1138.01
10/12/94	10.30	1137.75
11/09/94	10.12	1137.93
11/25/94	10.11	1137.94
12/07/94	10.18	1137.87
05/03/95	9.52	1138.53
06/09/95	9.85	1138.20
07/19/95	9.74	1138.31
08/09/95	10.08	1137.97

Date	Depth to Water (ft)	WL Elev (msl, ft)
10/12/95	10.35	1137.70
11/15/95	10.40	1137.65
05/15/96	9.50	1138.55
06/19/96	9.27	1138.78
07/24/96	9.78	1138.27
09/11/96	10.04	1138.01
10/23/96	10.08	1137.97
12/10/96	9.91	1138.14
06/04/97	9.07	1138.98
07/16/97	9.22	1138.83
08/19/97	9.54	1138.51
09/24/97	9.76	1138.29
10/22/97	9.83	1138.22
11/18/97	9.86	1138.19
12/16/97	9.93	1138.12
05/27/98	9.70	1138.35
07/22/98	9.94	1138.11
08/19/98	9.94	1138.11
09/23/98	10.07	1137.98
12/01/98	10.14	1137.91
05/26/99	8.85	1139.20
06/23/99	9.18	1138.87
07/21/99	9.36	1138.69
08/25/99	9.56	1138.49
09/30/99	9.65	1138.40
10/28/99	9.75	1138.30
12/01/99	9.80	1138.25
05/17/00	10.10	1137.95
06/28/00	10.05	1138.00
08/22/00	10.11	1137.94
11/30/00	10.14	1137.91
05/02/01	9.41	1138.64
06/06/01	9.75	1138.30
07/11/01	9.80	1138.25
08/08/01	9.78	1138.27
09/05/01	9.99	1138.06
10/10/01	10.25	1137.80
10/16/01	10.26	1137.79
10/23/01	10.30	1137.75
11/14/01	10.28	1137.77
12/05/01	10.29	1137.76
05/01/02	10.44	1137.61
06/19/02	10.36	1137.69
07/31/02	10.11	1137.94
09/11/02	9.63	1138.42
10/30/02	9.94	1138.11
12/05/02	10.07	1137.98

156-056-36CDD
Fordville Aquifer

MP Elev (msl,ft)=1,181.91
SI (ft.)=53-58

Date	Depth to Water (ft)	WL Elev (msl, ft)
10/11/01	44.25	1137.66
10/23/01	44.25	1137.66
11/14/01	44.22	1137.69
12/05/01	44.26	1137.65
05/01/02	44.45	1137.46

Date	Depth to Water (ft)	WL Elev (msl, ft)
06/19/02	44.49	1137.42
07/31/02	44.15	1137.76
09/11/02	43.91	1138.00
10/30/02	43.93	1137.98
12/05/02	44.05	1137.86

Table 7. General Chemical Analyses for Water Samples Collected in the Study Area .

Location	Screened Interval (ft)	Date	SiO2	Fe	Mn	Ca	Mg	Na	K	HCO3	CO3	SO4	Cl	F	NO3	B	TDS	CaCO3	NCH	% Na	SAR	Cond µmohs	Temp °C	Field pH
			mg/l																					
155-055-30BBB	29-34	10/10/01		0.1	0.2	77	28	13	2.6	270	0	110	4.7	0.2	6.6		375	310	86	8	0.3	583		
155-055-30BBB	29-34	10/23/01																				583		
155-056-11ABB	23-28	6/27/91	26	0	0.4	71	24	17	2.3	271	0	88	3.1	0.2	0.2	0.1	365	280	54	12	0.4	622	9	
155-056-11ABB	23-28	8/1/95		0.1	0.4	67	20	31	3.7	271	0	97	6.4	0.2	1		360	250	28	21	0.9	533	7.3	
155-056-11ABB	23-28	10/11/01		0.1	0.4	73	21	28	3.8	288	0	100	4.5	0.2	0.1		373	270	33	18	0.7	578		
155-056-11ABB	23-28	10/23/01																				622		
155-056-11DDD	11-16	6/27/91	24	1.5	1	67	26	27	2.7	363	0	42	4	0.3	0.7	0.1	375	270	0	17	0.7	627	10	
155-056-11DDD	11-16	8/1/95		3.3	1.1	64	26	16	2.3	359	0	20	3.8	0.3	1		315	270	0	11	0.4	494	6.7	
155-056-11DDD	11-16	10/11/01		3.1	1.2	72	27	14	2.1	385	0	21	0	0.3	0.1		331	290	0	9	0.4	558		
155-056-11DDD	11-16	10/23/01																				567		
155-056-12CCD	32-35	5/24/68	24	1.8	0.6	78	21	19	3.8	297	0	83	6.4	0.2	0	0.4	384	283	39	13	0.5		6.1	
155-056-12CCD	32-35	7/10/69	24	6.6	0.7	75	24	17	3.8	302	0	70	3.7	0.1	1	0.1	374	287	39	11	0.4		6.1	
155-056-12CCD	32-35	7/9/91	23	1.1	0.7	78	29	17	2.2	301	0	110	9.3	0.2	1	0	419	310	68	10	0.4	661	9	
155-056-12CCD	32-35	8/1/95		0.7	0.7	75	28	18	3.4	298	0	97	8.3	0.2	1		379	300	58	11	0.5	544	9.4	
155-056-12CCD	32-35	10/11/01		0.2	0.7	82	29	18	3.1	311	0	120	5.8	0.2	0.1		412	320	69	11	0.4	630		
155-056-12CCD	32-35	10/23/01																				632		
155-056-23AAA2	37-40	6/16/70	25	0.7	0	68	22	60	5.7	242	0	179	6.1	0.4	1	0	487	260	61	33	1.6		9	
155-056-23AAA2	37-40	8/1/79	25	0	0.6	75	35	17	3.3	247	0	160	4.8	0.2	1	0.1	444	330	130	10	0.4	680	12	8.6
155-056-23AAA2	37-40	10/20/93	20	5	4.4	88	32	27	2.9	219	0	170	18	0.3	0	0.1	476	350	170	14	0.6	724	8	
155-056-23AAA2	37-40	8/1/95		0.9	1.3	77	35	16	2.8	258	0	160	5.8	0.2	1		427	340	120	9	0.4	606	11	
155-056-23AAA2	37-40	10/11/01		0.1	1.2	76	34	18	3	272	0	140	8.8	0.3	7.9		423	330	110	10	0.4	641		
155-056-23AAA2	37-40	10/23/01																				539		
155-056-23DCD	0-0	7/14/67	26	3		73	21	6.1	3	231	0	63	3.1	0.2	24	0.1	336	268	79	5	0.2		9.4	
155-056-23DCD	0-0	3/22/68	28	0.6	0	68	20	3.2	2.7	217	0	47	2.1	0.1	36	0	315	250	72	3	0.1		3	
155-056-23DCD	0-0	5/9/69	27	0	0	72	20	4.4	2.8	227	0	39	0	0.1	45	0.1	322	261	75	3	0.1			
155-056-24AAA	45-50	10/10/01		0.1	0.4	72	24	10	2.2	262	0	92	0	0.2	0.3		330	280	64	7	0.3	524		
155-056-24AAA	45-50	10/23/01																				525		
155-056-24ABB	42-47	10/10/01		0.1	0.4	69	24	16	2.8	267	0	82	2.3	0.2	0.2		329	270	52	11	0.4	533		

Table 7. General Chemical Analyses for Water Samples Collected in the Study Area .

Location	Screened Interval (ft)	Date	SiO2	Fe	Mn	Ca	Mg	Na	K	HCO3	CO3	SO4	Cl	F	NO3	B	TDS	CaCO3	NCH	% Na	SAR	Cond µmohs	Temp °C	Field pH
			mg/l																					
155-056-24ABB	42-47	10/23/01																				546		
155-056-25ADD	30-33	8/3/88	21	0	0.1	72	27	8	3.1	274	0	67	6.7	0.2	38	0	378	290	66	6	0.2	683	10	
155-056-25ADD	30-33	6/12/96		0	0	85	32	9.5	3.5	274	0	98	5.6	0.1	74		443	340	120	6	0.2	606	13	
155-056-25ADD	30-33	10/10/01		0	0.1	95	33	14	3.5	300	0	130	7.7	0.2	11		442	370	130	7	0.3	673		
155-056-25ADD	30-33	10/23/01																				636		
155-056-25BAA	30-35	6/27/91	24	0	0.2	80	30	27	4	343	0	100	4.9	0.3	2.5	0.1	442	320	42	15	0.7	707	12	
155-056-25BAA	30-35	8/1/95		0.9	0.6	80	30	22	3.9	321	0	98	6.7	0.2	1		401	320	60	13	0.5	555	7.8	
155-056-25BAA	30-35	10/10/01		0.1	0.3	74	27	18	3.3	324	0	72	3.8	0.3	0.1		359	300	30	12	0.5	564		
155-056-25BAA	30-35	10/23/01																				570		
155-056-25BBB	25-30	6/27/91	25	0	0.4	86	28	12	2.7	246	0	150	5	0.2	2.2	0	433	330	130	7	0.3	669	12	
155-056-25BBB	25-30	8/1/95		0.6	0.6	85	28	8.5	2.5	245	0	140	10	0.1	1		397	330	130	5	0.2	578	7.9	
155-056-25BBB	25-30	10/10/01		0.1	0.5	93	31	7.5	2.6	264	0	140	9.3	0.1	0.5		415	360	140	4	0.2	633		
155-056-25BBB	25-30	10/23/01																				634		
155-056-25BCC	0-300	7/14/67	30	24		78	30	14	5.4	277	0	70	16	0.1	33	0.1	437	318	91	9	0.3			
155-056-25BCC	0-300	5/29/68	29	0	0	95	16	10	4.1	257	0	77	8	0.2	34	0.1	400	302	91	7	0.3			
155-056-25BCC	0-300	5/29/68		0.4																				
155-056-25BCD	33.5-35	7/29/81	25	0	0.5	79	27	11	3.7	254	0	130	4.6	0.2	1	0.5	410	310	100	7	0.3	575	18	
155-056-25BCD	33.5-35	10/20/93	24	0.3	0.5	81	29	10	2.8	244	0	150	4.9	0.2	0	0.1	423	320	120	6	0.2	632	9	
155-056-25BCD	33.5-35	7/21/98		0.3	0.5	90	28	10	2.2	251	0	150	3	0.2	0.1		408	340	130	6	0.2	605		
155-056-25BCD	33.5-35	10/11/01		0.2	0.4	87	29	11	2.9	282	0	130	2.1	0.3	0.1		402	340	110	7	0.3	604		
155-056-25BCD	33.5-35	10/23/01																				608		
156-055-21BBA	0-21	5/24/69	25	7.2	0	78	41	22	15	340	0	130	4.6	0.1	8.6	0.3	499	363	84	11	0.5			
156-055-28AAB	0-0	8/11/70	27	0.4	0	220	101	56	27	322	0	766	27	0.3	55	0.4	1440	967	703	11	0.8		9	
156-056-04CCC	153-160	8/24/67	24	0		146	55	318	12	273	0	387	481	0.6	0	1.4	1560	591	357	53	5.7		6.7	
156-056-04CCC	153-160	7/10/69	24	2.6	0.9	150	50	313	11	298	0	380	469	0.4	0	0.4	1550	580	336	53	5.7		6.7	
156-056-08DAD	654-672	7/27/67	6.5	0.6		22	6.1	1410	10	766	0	1320	845	3.7	5.4	3.2	4010	80	0	97	69			

Table 7. General Chemical Analyses for Water Samples Collected in the Study Area .

Location	Screened Interval (ft)	Date	SiO2	Fe	Mn	Ca	Mg	Na	K	HCO3	CO3	SO4	Cl	F	NO3	B	TDS	CaCO3	NCH	% Na	SAR	Cond µmohs	Temp °C	Field pH
			mg/l																					
156-056-09DDD	30-35	10/16/01		0	0.1	110	32	50	3.3	331	0	210	11	0.3	0.1		580	410	130	21	1.1	840		
156-056-09DDD	30-35	10/30/01																				925		
156-056-15DCC	19.5-22.5	6/5/68	24	0.7	0.4	83	25	42	3.5	293	0	147	12	1.5	0	0.2	483	310	70	23	1		7.8	
156-056-15DDD	45-50	10/16/01		0.1	1.1	160	47	23	3.4	453	0	250	8.7	0.2	0.1		717	590	220	8	0.4	992		
156-056-15DDD	45-50	10/30/01																				1028		
156-056-16BAA	24-29	10/16/01		0.1	0.2	80	29	48	3.5	349	0	120	22	0.5	2		477	320	33	24	1.2	739		
156-056-16BAA	24-29	10/30/01																				980		
156-056-16CCB	28-32	8/24/67	24	0.7		101	28	49	4.8	276	0	240	11	0.1	0	1.2	596	369	143	22	1.1		7.2	
156-056-16CCB	28-32	7/10/69	24	3.1	0.4	109	28	40	4.2	272	0	241	9.5	0.1	1	0	594	389	166	18	0.9		7.2	
156-056-16CCB	28-32	8/8/73	22	0.7	0.6	91	35	41	6.1	291	0	190	14	0.2	1	0.1	545	370	130	19	0.9		8	
156-056-16CCB	28-32	8/1/79	24	0.8	0.5	120	41	46	5.2	275	0	330	11	0.2	1	0.6	715	470	240	17	0.9	1090	7.5	8.2
156-056-16CCB	28-32	6/1/84	25	0.2	0.6	120	38	45	5	253	0	280	12	0.2	1	0.1	652	460	250	17	0.9	1060	7.5	7.9
156-056-16CCB	28-32	6/2/92	22	0.5	0.6	130	43	47	4.6	324	0	330	22	0.3	0	0.1	760	500	240	17	0.9	1685	8	
156-056-16CCB	28-32	8/9/95		0.5	0.5	99	33	56	4.8	320	0	250	14	0.3	1		617	380	120	24	1.2	843	7.3	
156-056-16CCB	28-32	10/12/01		0.4	0.5	98	32	37	3.8	322	0	190	14	0.3	0.1		535	380	110	17	0.8	763		
156-056-16CCB	28-32	10/30/01																				866		
156-056-16DDC	17-20	6/6/68	24	0.8	0	70	22	22	2.3	282	0	67	8.1	0.5	1.2	0	357	265	34	15	0.6			
156-056-16DDC	17-20	6/2/92	20	0	2.5	54	19	8.5	11	249	0	44	8.3	0.2	2	0	293	210	9	8	0.3	735	7	
156-056-16DDC	17-20	8/9/95		1	3.9	54	20	11	19	270	0	15	13	0.2			280	220	0	9	0.3	486	7.6	
156-056-16DDC	17-20	10/16/01		0.4	4.2	57	19	8	21	248	0	56	9.1	0.2	1.4		298	220	17	7	0.2	513		
156-056-16DDC	17-20	10/30/01																				1198		
156-056-22CCC	12-17	10/16/01		0	0.9	81	32	30	2.8	401	0	82	4.6	0.3	0.1		432	330	5	16	0.7	661		
156-056-22CCC	12-17	10/30/01																				663		
156-056-22DCC	32-37	10/16/01		0	0.4	81	24	31	4.8	313	0	100	8.7	0.2	0.2		404	300	44	18	0.8	636		
156-056-22DCC	32-37	10/30/01																				648		
156-056-22DDD	52-57	5/22/68	27	0.1	0.4	81	22	33	3.5	284	0	117	12	0.2	0	0.3	436	293	60	20	0.9		6.1	

Table 7. General Chemical Analyses for Water Samples Collected in the Study Area .

Location	Screened Interval (ft)	Date	SiO2 (mg/l)	Fe (mg/l)	Mn (mg/l)	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K (mg/l)	HCO3 (mg/l)	CO3 (mg/l)	SO4 (mg/l)	Cl (mg/l)	F (mg/l)	NO3 (mg/l)	B (mg/l)	TDS (mg/l)	CaCO3 (mg/l)	NCH (mg/l)	% Na	SAR	Cond µmohs	Temp °C	Field pH
156-056-22DDD	52-57	5/29/68		0.7																				
156-056-22DDD	52-57	7/29/81	25	0.4	0.6	73	26	33	4.3	305	0	110	8.5	0.2	1	0.5	432	290	40	20	0.8	630	8.5	
156-056-22DDD	52-57	8/1/83	27	0.5	0.6	79	26	31	4.1	281	0	97	36	0.2	1	0.1	440	300	74	18	0.8	690	12	7.6
156-056-22DDD	52-57	10/22/86	25	0.3	0.5	72	24	32	4	279		92	15	0.2	1	0.1	403	280	50	20	0.8	660	7.5	7.5
156-056-22DDD	52-57	7/21/98		0.4	0.4	70	23	30	2.6	300	0	81	4.8	0.2	0.1		360	270	23	19	0.8	569		
156-056-23BCC	38-43	10/16/01		0.1	0.5	110	33	35	3.9	379	0	140	22	0.3	0.1		531	410	100	15	0.8	804		
156-056-23BCC	38-43	10/30/01																				824		
156-056-23CDD	28-33	10/16/01		0.2	0.5	120	39	24	3.6	367	0	220	8.3	0.2	0.5		597	460	160	10	0.5	850		
156-056-23CDD	28-33	10/30/01																				872		
156-056-24BCC	101-106	10/16/01		0.1	0.8	160	48	17	5.2	454	0	300	4.3	0.2	0.5		760	600	220	6	0.3	959		
156-056-24BCC	101-106	10/23/02																				1030		
156-056-24CCC	32-35	5/24/68	25	2.7	0.4	82	19	17	4.1	283	0	89	6.9	0.2	0	0.2	385	285	53	11	0.4		6.1	
156-056-24CCC2	30-35	10/16/01		0.1	0.4	110	36	38	5.3	381	0	200	7.7	0.2	3.4		589	420	110	16	0.8	841		
156-056-24CCC2	30-35	10/23/01																				892		
156-056-25CDD	75-80	10/11/01		0	0.3	100	36	32	4.8	332	0	210	5.8	0.3	2.8		556	400	130	15	0.7	763		
156-056-25CDD	75-80	10/23/01																				764		
156-056-25DAD	100-105	3/28/68	23	2.9	0	87	22	11	3	290	0	93	4.6	0.2	0	0.3	390	306	68	7	0.3		7	
156-056-26BAB1	47-50	5/31/68																					6.7	
156-056-26BAB2	50-52	8/17/67	27	0.3		84	16	21	3.1	264	0	93	8.8	0.2	3	0.2	387	276	59	14	0.6			
156-056-26BCC1	37-40	5/27/68	26	0.6	0.3	86	22	20	4.1	284	0	119	6.2	0.2	0	0.3	429	306	73	12	0.5		6.7	
156-056-26BCC3	38-48	5/26/68	26	0.6	0.4	90	21	21	4.7	292	0	113	5.1	0.2	1	0.2	427	311	71	13	0.5		6.1	
156-056-26BCC3	38-48	6/4/68	27	0.1	0.3	79	24	21	4.3	280	0	96	6.8	0.4	13	0.1	410	298	68	13	0.5			
156-056-26BCC3	38-48	6/5/68																						
156-056-26BCC3	38-48	6/13/68	27		0	0.2	86	20	20	5.1	273	0	90	6.2	0.2	22	0	411	296	72	13	0.5		

Table 7. General Chemical Analyses for Water Samples Collected in the Study Area .

Location	Screened Interval (ft)	Date	mg/l																	% Na	SAR	Cond µmohs	Temp °C	Field pH
			SiO2	Fe	Mn	Ca	Mg	Na	K	HCO3	CO3	SO4	Cl	F	NO3	B	TDS	CaCO3	NCH					
156-056-26BCC3	38-48	6/14/68																					6.7	
156-056-26BCC3	38-48	6/15/68																					6.7	
156-056-26BCC3	38-48	6/16/68	27		0.2	84	18	20	10	271	0	86	5.9	0.2	24	0.1	408	286	64	13	0.5		6.7	
156-056-26CBB	37.5-41.5	5/8/68	26	0.3	0.2	83	22	23	4	287	0	106	6.9	0.2	4.1	0.4	417	299	64	14	0.6		6.7	
156-056-26DAA	38-43	10/16/01		0.2	0.4	73	22	27	3.3	279	0	91	7.8	0.3	0.1		362	270	44	17	0.7	568		
156-056-26DAA	38-43	10/30/01																				589		
156-056-26DCC	25-30	7/10/91	25	0.1	0.3	82	29	32	2.9	296	0	150	9.3	0.2	1	0.1	478	320	82	18	0.8	752	12	
156-056-26DCC	25-30	8/9/95		0.1	0.7	92	32	26	3.9	305	0	160	14	0.2	1		480	360	110	13	0.6	721	7	
156-056-26DCC	25-30	10/16/01		0	0.5	98	44	28	4.1	314	0	170	16	0.2	0.1		516	430	170	12	0.6	755		
156-056-26DCC	25-30	10/30/01																				767		
156-056-27ADC	27-30	5/30/68																						
156-056-27ADD1	42.5-45.5	5/27/68	27	0	0.4	86	17	21	3.9	279	0	99	6.8	0.2	0	0.2	398	285	56	14	0.6		6.7	
156-056-27ADD2	37.5-40.5	5/28/68	26	0.4	0.3	88	20	19	4.2	281	0	108	6.9	0.2	0	0.2	411	301	70	12	0.5		6.7	
156-056-27ADD3	37-40	5/28/68	28	0.2	0.2	94	13	23	4.7	298	0	112	5.2	0.2	0	0.2	427	288	44	15	0.6		6.7	
156-056-27CCC	22-27	10/12/01		0	0.2	90	33	31	3.7	285	0	150	7.5	0.2	63		519	360	130	16	0.7	750		
156-056-27CCC	22-27	10/30/01																				794		
156-056-27DAD	18.5-21.5	5/29/68																				490	6.1	
156-056-27DAD	18.5-21.5	5/31/68	25	0.9	0.3	77	28	36	3.9	306	0	126	11	0.8	0	0.2	460	308	57	20	0.9		5	
156-056-27DAD1	41.5-44.5	5/30/68	27	0.7	0.4	66	20	105	8.6	346	0	167	15	0.8	0	0.6	581	245	0	47	2.9			
156-056-34DCC	37-40	5/27/68	27	1	0.1	70	14	69	5.4	309	0	132	8.4	0.2	0	0.7	480	234	0	38	2			
156-056-34DCC	37-40	6/2/92	26	0.1	0.4	60	18	59	5.2	301	0	110	7.4	0.2	2.1	0.2	437	220	0	36	1.7	1055	8	
156-056-34DCC	37-40	8/9/95		0.1	0.3	64	19	59	5	304	0	120	9.6	0.2	1		428	240	0	34	1.7	661	7.5	
156-056-34DCC	37-40	10/11/01		0.1	0.3	66	15	60	5.3	313	0	120	7.5	0.2	0.1		429	230	0	36	1.7	655		
156-056-34DCC	37-40	10/23/01																				660		

Table 7. General Chemical Analyses for Water Samples Collected in the Study Area .

Location	Screened Interval (ft)	Date	SiO2	Fe	Mn	Ca	Mg	Na	K	HCO3	CO3	SO4	Cl	F	NO3	B	TDS	CaCO3	NCH	% Na	SAR	Cond µmohs	Temp °C	Field pH
			mg/l																					
156-056-34DDD	27-32	10/11/01		0	0	73	28	16	2.4	259	0	80	2.9	0.2	43		374	300	85	10	0.4	578		
156-056-34DDD	27-32	10/23/01																				581		
156-056-35AAA	47-52	10/16/01		0	0.3	68	21	60	5.6	329	0	120	9.1	0.3	3.4		450	260	0	33	1.6	682		
156-056-35AAA	47-52	10/23/01																				691		
156-056-36CCC1	27-30	5/23/68	26	3.3	0.6	74	23	23	3.3	271	0	107	7.7	0.2	0	0.4	402	281	59	15	0.6		5.6	
156-056-36CCC1	27-30	8/8/73	21	0.5	1.2	83	23	14	7.9	273	0	100	8.1	0.2	2.5	0.5	396	300	76	9	0.4		6.5	
156-056-36CCC1	27-30	7/8/81	22	0	1.1	77	19	18	15	287	0	90	4.6	0.1	1	0	389	270	35	12	0.5	612	8	7.7
156-056-36CCC1	27-30	6/2/92	24	0.1	0.7	83	25	22	9	291	0	110	11	0.2	4.2	0.1	432	310	72	13	0.5	1025	9	
156-056-36CCC1	27-30	8/9/95		0.4	0.7	83	27	22	7	307	0	110	13	0.2	1		415	320	67	13	0.5	644	8.6	
156-056-36CCC1	27-30	10/16/01		1.5	0.9	90	28	18	7.7	301	0	140	8.4	0.2	0.1		443	340	93	10	0.4	676		
156-056-36CCC1	27-30	10/23/01																				670		
156-056-36CDD	53-58	10/11/01		0	0.2	81	29	33	3.7	276	0	160	5.5	0.3	1		450	320	96	18	0.8	662		
156-056-36CDD	53-58	10/23/01																				900		

Table 8. Trace Element Analyses for Water Samples Collected in the Study Area (units are in micrograms per liter).

Location	Date Sampled	Selenium	Lead	Arsenic	Lithium	Molybdenum	Strontium
15505530BBB	10/23/01	0	0	4	20	1	220
15505611ABB	10/23/01	0	0	22	50	8	400
15505611DDD	10/23/01	1	0	1	20	1	260
15505612CCD	10/23/01	1	0	0	20	1	260
15505623AAA2	10/23/01	0	0	1	30	6	220
15505624AAA	10/23/01	0	0	6	20	2	200
15505624ABB	10/23/01	0	0	7	20	1	240
15505625ADD	10/23/01	0	0	1	20	1	220
15505625BAA	10/23/01	0	0	1	30	1	230
15505625BBB	10/23/01	0	0	5	20	1	250
15505625BCD	10/23/01	0	0	1	20	2	240
15605609DDD	10/30/01	0	0	1	50	1	360
15605615DDD	10/30/01	0	0	4	60	0	410
15605616BAA	10/30/01	0	8	6	60	0	410
15605616CCB	6/1/84	0	0	1	50	0	450
15605616CCB	10/30/01	0	0	1	40	1	360
15605616DDC	10/30/01	1	0	1	40	2	240
15605622CCC	10/30/01	4	0	2	50	2	280
15605622DCC	10/30/01	0	0	5	30	2	220
15605622DDD	8/1/83	0	3	5	40	1	250
15605622DDD	10/22/86		1	6	35	2	280
15605623BCC	10/30/01	0	0	2	40	1	330
15605623CDD	10/30/01	0	0	4	20	0	350
15605624BCC	10/23/02	0	0	8	40	3	590
15605624CCC2	10/23/01	0	0	2	40	2	350
15605625CDD	10/23/01	0	0	2	30	5	350
15605626DAA	10/30/01	0	0	5	40	1	260
15605626DCC	10/30/01	0	0	4	30	0	260
15605627CCC	10/30/01	4	0	0	40	2	290
15605634DCC	10/23/01	0	0	21	50	9	360
15605634DDD	10/23/01	3	0	2	20	1	210
15605635AAA	10/23/01	0	0	11	40	7	310
15605636CCC1	10/23/01	0	0	5	20	1	260
15605636CDD	10/23/01	4	0	4	30	9	290