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Hydrogeology of the Hamilton north and Corvallis quadrangles Bitterroot Valley southwestern Montana

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HYDROGEOLOGY OF THE HAMILTON NORTH AND CORVALLIS QUADRANGLES, BITTERROOT VALLEY, SOUTHWESTERN MONTANA

By

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ABSTRACT

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The development of the Bitterroot Valley has placed increased demands on available water resources. The objectives of this investigation were to develop a hydrogeologic data base and interpret the hydrogeologic setting of the selected quadrangles for future ground water resource management. Methods included a description and interpretation of the surficial geology from field mapping, an inventory of over 500 well log reports to document occurrence and distribution of ground water, measurements of static water levels to determine direction and rate of ground water movement, estimation of aquifer hydraulic properties from specific capacity data, and documentation of ground water quality from selective sampling and laboratory chemical analyses.

Geologic units include Quaternary glacial deposits west of the Bitterroot River and fluvial deposits along the valley floor. Tertiary lacustrine and fluvial deposits are widespread along the eastside of the valley. Fine- and coarse-grained Tertiary deposits show similarities with the Renova and Sixmile Creek Formations of nearby intermontane valleys.

All geologic units are water-bearing to various degrees. Measured static water levels indicated ground water flow direction toward discharge areas in the lower valley from recharge areas on the high-terraces. The ground water fluctuations averaged about 10 ft on the high-terraces and 5 ft on the valley floor. Water levels were lowest during late winter through spring and highest during the summer. Tributary streams draining the Bitterroot Mountains recharge the westside wells. Irrigation canal seepage partially contributes to recharge of eastside wells. Aquifer hydraulic properties of the Bitterroot floodplain are high; transmissivity and storativity are $\geq$ 100,000 gpd/ft and $\geq$0.25, respectively. Aquifer transmissivity and storativity of the nearby terraces are generally $\leq$15,000 gpd/ft and $\leq$0.15, respectively. A water budget was not determined due to insufficient data. Ground water quality was very good, although water east of the Bitterroot River was more mineralized. Total dissolved solids ranged from 33 to 396 mg/l. There is greater potential for further ground water development on the floodplain than on the nearby terraces.

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I express my appreciation to my family who offered support and patiently endured through the completion of the project. I thank Bill Woessner, project chairman, who suggested the study and provided guidance. I thank John Donahue and David Alt who served on the committee. Finally, I thank those Bitterroot Valley residents, who permitted access to their wells, for their cooperation and patience throughout this project.

TABLE OF CONTENTS

LIST OF TABLES

TABLE

LIST OF FIGURES

CHAPTER I

INTRODUCTION

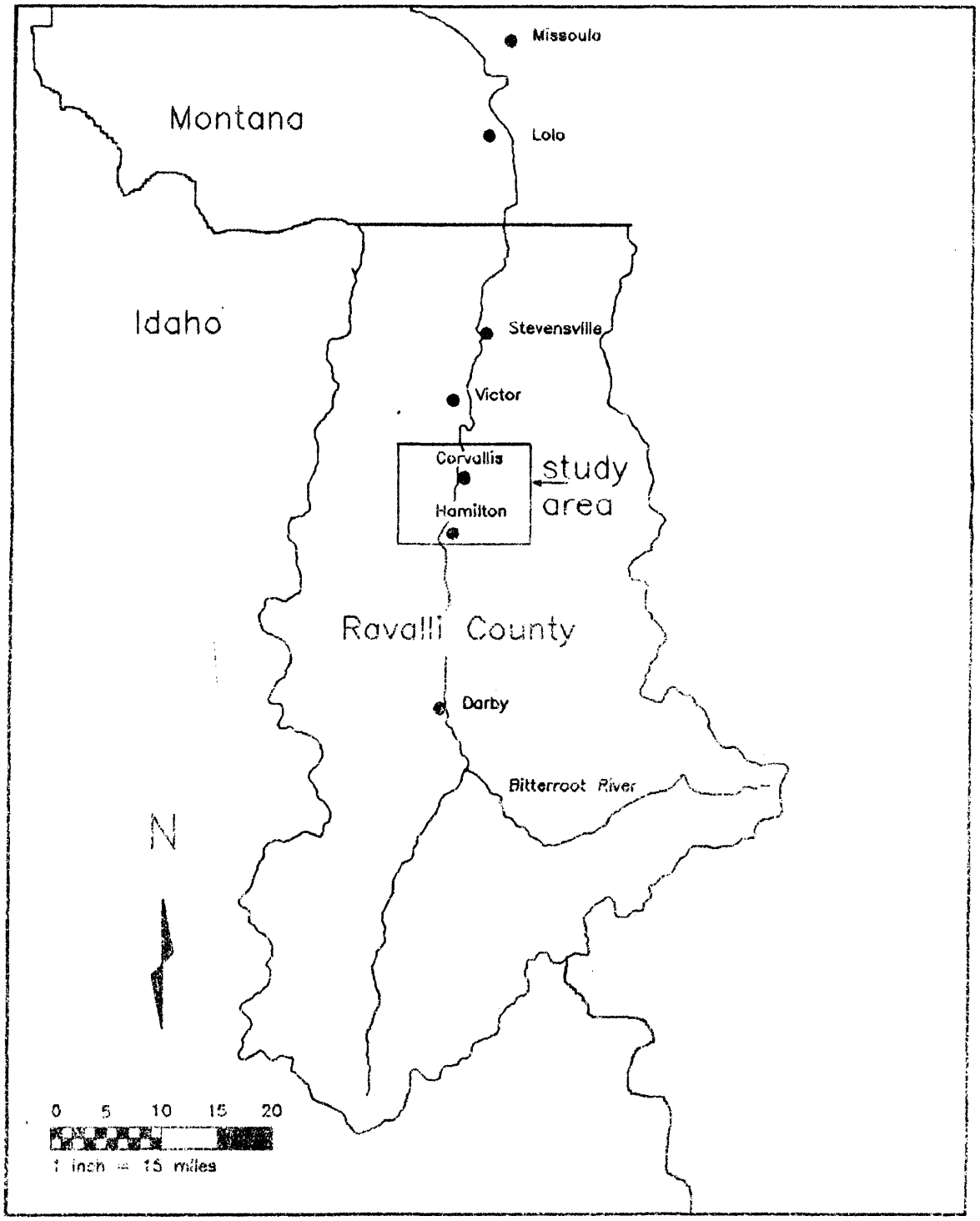
Statement of Problem

The Bitterroot Valley of Ravalli County offers a scenic quality which has attracted a great influx of new residents. As a result, a greater demand has been placed on the available water resources of the area. The Bitterroot Valley ground water supply is only partly developed and presently appears adequate. However, continuing rapid development may cause acute water shortages unless regulatory and legislature groups develop additional management policies aimed at maintaining water consumption at levels which the local aquifers can accomodate.

Long-term water management of the geologically-complex Bitterroot Valley requires more detailed, site-specific, hydrogeological studies than those conducted in the past (McMurtrey et al., 1972). The problem addressed in this investigation is ground water availability within a portion of the Bitterroot Valley represented on the Hamilton North and Corvallis U.S. Geological Survey 7½ minute quadrangle maps (Figure 1.1). Specific objectives of this investigation include development of a hydrologic data base and interpretation of the hydrogeologic setting. Procedures used to achieve these objectives include:

1) description and interpretation of the surficial geology;
2) definition of the sedimentology, stratigraphy, and spatial extent of the various aquifer systems;

Figure 1.1: Location of Study Area in Ravalli County



3) determination of the distribution of hydraulic head, direction and rate of ground water movement, and locations of aquifer recharge and discharge areas;
4) documentation and interpretation of seasonal ground water level fluctuations;
5) estimation of the aquifer hydraulic properties; and
6) documentation of ground water quality.

Previous Investigations

The Bitterroot Valley has served as the subject of many diverse geological investigations. The earliest reports include Lindgren's (1904) reconnaissance across the Bitterroot Mountains and Douglass' (1901, 1903) description of new fossil vertebrates.

Structural and petrologic investigations include those of Langton (1935), Ross (1950), Pardee (1950), Groff (1954), Chase (1961), Wehrenberg (1972), Hyndman (1980) and Barkman (1984). The only major geophysical study of the Bitterroot Valley is Langston's (1975) gravity survey and seismic reflection profiles of subsurface geology.

Cenozoic stratigraphic and surficial geology investigations are few. Fields (1981) analyzed Tertiary stratigraphic and lithologic data collected from several deep exploratory wells (2,450-2,700 ft in depth). Hutchison (1959) described volcanic ash deposits in the northern part of the Bitterroot Valley. McMurtrey et al. (1972) interpreted the surficial geology of the valley. Konizeski (1958) published on Tertiary vertebrate paleontology and its stratigraphic significance. Alden (1953) addressed Quaternary glacial stratigraphy

and landform development west of the Bitterroot River. Weber (1972) correlated glacial deposits with fluctuations of Glacial Lake Missoula in four tributary valleys of the Bitterroot Range. The U.S.D.A. Soil Conservation Service (1959) conducted a soil classification survey of the Bitterroot Valley.

The Bitterroot Valley has also served as the focus of several hydrologic studies. Senger (1975) compiled an overview of surface hydrology. Nolan (1973) mapped 50-year and 100-year flood hazard zones for the Bitterroot floodplain. Hoffman (1980) evaluated subsurface rock weathering and hydrogeologic conditions responsible for hillside slumping near Darby. Cartier (1984) correlated channel braiding and migration of the Bitterroot River to Recent tectonic movement of large crustal blocks. McMurtrey et al. (1972) compiled the only general overview of the entire Bitterroot Valley hydrogeology. McHugh (1982) and Finstick (1986) completed site-specific ground water studies within the valley near the Florence and Victor-Stevensville areas, respectively.

Physical Setting

Physiography

The Bitterroot Valley is an elongate north-south trending intermountain valley in southwestern Montana. It extends south from Lolo along the Bitterroot River to the confluence of the South and North Forks at Conner. The main valley is approximately 70 miles long and up to 10 miles wide.

The crests of the Bitterroot and Sapphire Mountains define the Bitterroot River watershed of 2,800 square miles. The Bitterroot Range forms the western boundary of the valley. Elevations of Bitterroot peaks are generally higher than those of the Sapphires and increase toward the south from 9,100 ft at Lolo Peak to 10,131 ft at Trapper Peak near Darby. The Sapphire Mountains form the eastern boundary of the valley. They are less imposing and more irregular than the Bitterroot Range. Most peaks of the Sapphires are less than 8,000 ft.

The central Bitterroot Valley includes a broad zone of floodplain alluvium. Elevations of the valley bottom range from 3,200 ft at Lolo to 4,000 ft near Conner. The Bitterroot River flows along an average gradient of 12 feet per mile.

The Bitterroot River and more than four dozen tributaries supply irrigation water to supplement late-season agricultural demands. Storage reservoirs and a network of irrigation canals provide a continuous source of water. Painted Rocks reservoir, on the West Fork of the Bitterroot, has a storage capacity of 31,700 acre-feet and Lake Como, on Rock Creek, has a storage capacity of 37,000 acre-feet.

Climate

Moist Pacific maritime systems dominate the climate of the Bitterroot Valley to create mild winters and cool summers. Precipitation shows seasonal variation; the average maxima occur in May and June. The inner valley precipitation averages 12 to 16 inches annually (Water Resources Survey, 1958).

Bedrock and Structural Geology

The oldest exposed rocks of the Bitterroot area consist of Precambrian Belt Series metasedimentary rocks of Newland Limestone and the Ravalli Group of the Sapphire Mountains. The Willow Creek stock near the Sapphire Mountains and the imposing Bitterroot Mountains consist of late Cretaceous quartz monzonite and granodiorite.

The most obvious structural feature of the Bitterroot Valley is the linear, uniformly-dipping, metamorphosed "border-zone" gneiss along the eastern flank of the Bitterroot Mountains (Langton, 1935). Lindgren (1904) first recognized the frontal zone gneiss as a major geological structure. He inferrred a major normal fault along the eastern Bitterroot flanks with a double motion dislocation involving downward motion of the hanging wall and an uplift of the footwall. Hyndman (1980) interpreted the structure as a glide plane along which the Sapphire tectonic block moved eastward following its detachment from the roof of the Idaho Batholith. A slow isostatic rise of the Bitterroot Mountains, occurring in response to the unloading of the Sapphire block, tilted the mylonite zone 25° to the east. The present interpretation is that the glide plane represents a large, normal, listric fault plane which flattens at depth and has accomodated extensional movement throughout the Cenozoic Era. Minor rotational faulting has remained active along the main Bitterroot fault as seen by a fault scarp reported near the Curlew mine in 1898 (Lindgren, 1904).

Lindgren (1904) believed that the origin of the Bitterroot Valley was structurally associated with the development of the Bitterroot Mountains and later Cenozoic tectonic adjustments. Barkmann (1984), who mapped structurally-related regional photo linears and lineaments, concurred with Lindgren and inferred that the linear trends represent a regional fracture system controlling erosional patterns. Cartier (1984) hypothesized the existence of two regionally-active NE trending lineaments transecting the Bitterroot region to explain the unusual hydraulic nature of a section of the Bitterroot River. A downdropped crustal block between the Tin Cup Lineament near Hamilton and the Stevensville Lineament has locally increased the gradient of the Bitterroot River. This has created braided channel patterns and high rates of bedload deposition between the two parallel faults. Fracture control appears evident along the eastside of the valley where tributary streams have incised obliquely rather than parallel to the west dip of the Tertiary strata. Langton (1935) mapped numerous series of concentric thrust faults believed to be related to late Laramide tectonic uplift of the Idaho Batholith and eastward thrusting of the Sapphire tectonic block.

Bouguer gravity anomaly mapping (Langston, 1975) has determined the distribution of subsurface bedrock topography and has produced bedrock cross-section profiles of the Bitterroot Valley. Gravity maps and profiles indicate a N-S trending trough which widens and deepens in the vicinity of Corvallis. Seismic reflection data indicate lower seismic velocities within the uppermost 2,000 ft which suggests

unconsolidated basin-fill alluvium. Higher seismic velocities at depths of 2,000 to 3,300 ft may indicate the plane of the detachment zone of the Sapphire block.

Deep exploratory wells drilled in the Tertiary section to assess uranium availability encountered frontal zone gneiss at 1,650 ft below land surface near Bass Creek and at 2,500 ft further east in the valley (Fields, 1981).

The Bitterroot Valley appears to be aseismic since earthquake fault plane solutions and tension axes are unknown. The valley does not lie within the active Intermountain Seismic Belt and, since there are no discernible Recent faults, major faulting probably has not occurred since late Pleistocene. Recent minor faulting, however, is active and is believed to be east-west extensional along normal listric faults (Barkman, 1984).

Surficial Geology

The Bitterroot Valley shares Cenozoic stratigraphic similarities with other intermontane valleys of southwestern Montana. Workers now recognize this region as basin-and-range type geology. They consider southwestern Montana to be a northward extension of this physiographic province and include southwestern Montana in interpretations of its geologic origins (Pardee, 1950; Reynolds, 1979).

Intermontane valleys in southwestern Montana have accumulated thousands of feet of Cenozoic continental sediments distinguished by four principal, regionally-similar, stratigraphic subdivisions (Thompson et al., 1981, 1982). These include: early Eocene

conglomerates, the mid-Tertiary Renova Formation, the late-Tertiary Sixmile Creek Formation, and Quaternary lake silts, glacial drift, and thick floodplain gravels.

The Renova Formation accumulated during the mid-Tertiary Period in rapidly subsiding, closed, drainage basins as low-energy lacustrine, fluvial, and coal swamp depositional environments. The Renova is characterized by thick sequences of silts and clays, small-pebble conglomerates (Robinson, 1960), paludal deposits and coal seams (Fields et al., 1985), and abundant, externally-derived, volcanic ash (Thompson et al., 1982). The top of the Renova is marked by a regional erosional unconformity.

The Sixmile Creek Formation, which unconformably overlies Renova strata, accumulated during late-Tertiary times in response to emerging fault-block uplifts and climatic reversals to arid conditions (Kuenzi et al., 1971). The distinguishing lithologic feature is the coarseness of the sediment. Stratigraphic sequences include alluvial fans, channel fills, mudflows, and debris flows. Sixmile Creek sedimentation ended in early Pliocene as newly-established streams evacuated hundreds of feet of basin sediments (Fields et al., 1985).

The rejuvenation of streams in early Pleistocene re-established through-flowing, major tributaries. Sedimentation occurred on remnant Tertiary strata as alpine glaciation developed throughout the mountainous regions of southwestern Montana. Alluvial fans, glaciofluvial outwash, and morainal tills constitute the principal,

coarse, Quaternary sediments. Glacial lake silts accumulated in some western Montana valleys. Pleistocene deposits are not regionally correlated and are not referred to by formal stratigraphic names.

The Bitterroot Valley is a montage of semi-consolidated to unconsolidated deposits. Fine- and coarse-grained Tertiary sediments outcrop as terraces east of the Bitterroot River (McMurtrey et al., 1972). Although these deposits are undifferentiated into formations, they are similar to the Renova and Sixmile Creek Formations described in nearby intermontane valleys. There are few fossil vertebrates from the Bitterroot region to accurately date the Tertiary sediments (Fields et al., 1985). The Tertiary section exists as multi-level terraces, indicating incomplete erosion during the Quaternary Period.

Alden (1953) described the glacial geology of the Bitterroot Valley as extensive and well-preserved terraces resulting from three major glaciations. Terrace development was evidently followed by long erosion during which canyons were deepened. Glacial moraines formed near the tributary canyon mouths and great bouldery fans accumulated beyond the deepened tributaries from either glaciofluvial or interglacial stream origins. Weber (1972) conducted detailed mapping of the glacial geology of four tributaries in the Bitterroot Range and also recognized three major Pleistocene glaciations in the area. He applied relative age-dating criteria, such as relative topographic position, degree of dissection, and relative degree of soil development, to suggest probable ages of the terrace deposits as pre-, early-, and late-Wisconsin.

CHAPTER II

METHODS OF INVESTIGATION

I delineated Cenozoic surficial geology from topographic examination of the terrain and field investigation of gravel pits, road cuts, and stream banks. I mapped the observed geology on U.S. Geological Survey 7½ minute quadrangles and refined the mapping by using U.S.D.A. Forest Service color stereo aerial photo pairs and Montana DNRC Missoula Water Rights Field Office large-scale black and white aerial photos. The mapping and description emphasized the recognition of lithofacies types, their areal distribution, probable depositional environment, and resultant geomorphic expression. I collected several lithologic samples from which thin-sections were prepared for optical microscope examination.

I initiated the hydrogeological investigation by collecting and categorizing 526 well log reports obtained from the DNRC Water Rights Bureau. I grouped these well logs relative to major geologic units and sequentially arranged them according to descriptive identification numbers based on their geographic positions within a township north of the Montana Base Line, a range west of the Montana Principal Meridian, and a section within the township and range. I verified for correct field location approximately one-third or 175 of the inventoried well log reports. I listed pertinent hydrogeological information from the well log reports in the well log inventory; this included well construction features, aquifer characteristics and estimated hydraulic parameters.

I delineated the aquifers by similarities in their origin and relative stratigraphic positions. I interpreted the well log reports to provide credible estimates of depths to and thicknesses of principal water-bearing intervals and of stratigraphic relationships for at least the uppermost and most often-used water-bearing zones.

I selected sixty-one wells for static water level monitoring and water quality analyses. All major geologic units are represented by at least two monitored wells. I located the positions of the monitored wells on U.S. Geological Survey 7½ minute orthophoto quadrangle maps to an accuracy of one-quarter acre. I transferred their coordinates to contoured topographic quadrangles where elevations were interpolated to the nearest foot. These interpolated elevations are accurate to ±5 feet of their true values. I measured static water levels in these wells approximately twice per month for a sixteen-month period from July, 1983 through October, 1984. I collected measurements with a graduated steel tape in triplicate to verify accuracy and did not record data if recovery following pumping was occurring. I did not attempt measurements if the well pump was operating. I plotted all measured hydraulic heads and constructed a composite potentiometric surface map for the selected measurement period of September 6 to 8, 1983 which represented the period when the ground water rose to its highest level.

I recorded measured static water level and water chemistry data in computer-based data files. I accessed these data by a computer software BASIC program, WELLS.BAS, which I developed. This program

transformed static water level measurements to available drawdowns and hydraulic heads, outputted this information into a formatted display, summarized water quality parameters, output interpretations on the water quality values, constructed hydrographs of water level fluctuations, and formatted command and data files for presentation-quality hydrographs for both the mainframe-based SPSSX graphics and PC-based Golden Graphics GRAPHER plotting software. I prepared the hydrographs and tables of water level fluctuations of the monitored wells using SPSSX graphics software and WELLS.BAS, respectively. I presented a listing of the water level changes, a hydrograph of these data, and a record of observed water quality parameters to each well owner participating in this investigation.

I did not conduct constant-discharge aquifer testing as part of this investigation. The complicating factor to the use of domestic wells for the purpose of aquifer parameter determination was either the absence of nearby abandoned wells for drawdown observation or unavailability of nearby observation wells. Well owners chose not to discontinue use for any substantial length of time so that drawdown measurements could be gathered. The quantity of water in aquifer storage and that moving through the system remain undetermined; insufficient hydrologic information precluded a water budget determination.

I evaluated transmissivity for each well log report as the product of specific capacity obtained from reported, short-term, pump test data and a well coefficient term, using a modification of the Jacob

method (Cooper et al., 1946) for nonequilibrium radial flow of water to a discharging well. The average value of 1,500 min/day was selected for this coefficient based on conservative estimates of aquifer properties (Driscoll, 1986). Calculated transmissivity values are often lower than actual transmissivity values because equations do not account for partial penetration and well loss effects.

I measured water quality field parameters for fifty-nine of the monitored wells. I pumped each well for 15-20 minutes to evacuate the well bore storage and obtain water samples from the aquifer. I measured and interpolated water temperature to the nearest 0.1° C. I measured pH to the nearest 0.01 unit following a field calibration of the Orion pH instruemnt at each well. I measured field specific conductance to the nearest 0.01 unit on the YSI Model 33 specific conductance meter and adjusted/reported the value at 25° C.

I selected twenty-one of the monitored wells for a complete water chemistry analysis for major, minor, and trace dissolved ionic constituents. I selected one or more wells from each of the aquifer units and collected one sample of surface water from the Big Ditch irrigation canal. I collected three samples from each well; these included an unfiltered and unpreserved sample, a filtered and unpreserved sample, and a filtered sample preserved in 3 ml of nitric acid. I transported collected water samples to the analytical chemistry lab of the Hydrology Division, Montana Bureau of Mines and Geology in Butte for analysis. Following the receipt of the analysis reports, I formulated predictive regression equations for specific

conductance, total dissolved solids, and hardness. I used these regression equations and specific field conductances measured in the remaining, monitored wells to estimate total dissolved solids and hardness for these wells. I presented the analyses of major ionic constituents as Stiff diagrams and compared the measured and estimated water quality parameters of the study area to EPA National Interim Primary Drinking Water Standards.

The following chapters present and interpret the data and results of this hydrogeological investigation. Chapter 3 describes the surficial geology in terms of stratigraphy, geomorphology, and valley evolution. Chapter 4 presents the hydrogeological data base and setting. Chapter 5 summarizes the results of this investigation and briefly suggests recommendations for future hydrological studies. Appendix 1 describes the well log inventory. Appendix 2 presents the water level data and hydrographs of the sixty-one monitored wells. Appendix 3 presents the water chemistry analyses conducted by the Montana Bureau and Mines and Geology.

CHAPTER III

SURFICIAL GEOLOGY OF THE CENTRAL BITTERROOT VALLEY

INTRODUCTION

This geological investigation addresses the Cenozoic alluvial basin fill. The surficial geology east and west of the river differs in both origin and age. No complete sequences of Tertiary and Quaternary strata exist either as a single outcrop or a series. Poor exposures, a lack of identifiable fossil vertebrates, and rapid lateral and vertical facies changes (Picard et al., 1972) preclude complete stratigraphic description and correlation. However, available evidence suggests Cenozoic stratigraphic development similar to that in nearby intermontane basins (Fields, 1981; Fields et al., 1985).

To maintain consistency in stratigraphic nomenclature, mapped rock units are grouped within the Cenozoic stratigraphic framework. The Cenozoic stratigraphy of other intermontane basins is divided into a four-fold classification also recognized in the Bitterroot Valley. The classes include: a pre-basin fill Eocene conglomerate (Robinson, 1963; Fields, 1981), the Tertiary Bozeman Group which includes the Renova Formation (Kuenzi et al., 1971) and the Sixmile Creek Formation (Robinson, 1967), and the Quaternary deposits, which lack formal stratigraphic nomenclature and are mapped and described by dominant rock types.

EOCENE BASAL CONGLOMERATE

The earliest known Cenozoic sediments of the Bitterroot Valley (Fields et al., 1981) are coarse Eocene clastics whose equivalents are recognized in several other Tertiary basins (Robinson, 1963). Deep exploratory drilling by the Bendix Field Engineering Corporation encountered this unit at a depth of 780-960 ft southeast of Corvallis. Fields (1981) described well-rounded to subangular cobbles up to 50 cm in diameter supported in a matrix of fine gravel and sand and tightly cemented with calcite. He interpreted the unit as repetitive debris flow and fanglomerate deposits transported from the highlands to the east. This discovery marks the only observation of an early Eocene conglomerate in the Bitterroot and the Missoula basins. These coarse Eocene clastics overlie Cretaceous granite, substantiating other observations that Eocene conglomerates rest unconformably upon pre-Tertiary rocks.

TERTIARY BOZEMAN GROUP

Background

Peale (1893) designated the continental sediments of the Three Forks basin as the Bozeman lake beds. Robinson (1963) defined the Bozeman Group as fluvial, eolian, and lacustrine siltstones, sandstones, limestones, clays, marls, and conglomerates, which accumulated in the basins of western Montana after the Laramide orogeny. Fields et al. (1985) inferred an age range of 50 to 7 million years. Many workers (Robinson, 1960, 1963, 1967; Kuenzi et al., 1971;

Thompson et al., 1981, 1982; Fields et al., 1985) have recognized that, throughout southwestern Montana, the Bozeman Group consists of two formations, the Renova and Sixmile Creek.

Kuenzi et al. (1971) first defined the Renova Formation in the Jefferson Basin by unifying all variations in the lower part of the section to include fine-grained sediments deposited in lakes, marshes, and on floodplains. The age of the Renova Formation ranges from middle Eocene to early Miocene (50-20 mybp) (Fields et al., 1985).

The Renova and Sixmile Creek Formations are separated by a regional erosional unconformity first mapped in southwestern Montana (Robinson, 1960) and extended to other Tertiary basins (Rasmussen, 1973). The duration of the unconformity is variable but always includes most of the Barstovian Land Mammal Age of the early Miocene (Fields et al., 1985). Sedimentation resumed concurrently throughout southwestern Montana during the middle Miocene.

Robinson (1967) first defined coarse Tertiary sediments lying unconformably on the lower Renova Formation in the Toston Basin as the Sixmile Creek Formation. It is characterized by both matrix-and clast-supported gravels. Kuenzi et al. (1971) define the Sixmile Creek Formation as post mid-Tertiary unconformity. The Sixmile Creek Formation ranges from middle to late Miocene (17-7 mybp) based on contained fossil vertebrates (Fields et al., 1985). These deposits were derived from developing fault block mountains and were incorporated into alluvial fans, debris flows, mudflows, and channel fills.

Description

Tertiary Bozeman Group sediments are abundant along the eastside of the Bitterroot Valley (McMurtrey et al., 1972). Tertiary deposits have not been positively identified west of the Bitterroot River because they have either been removed by erosion or deeply buried. Several hundred feet of Tertiary materials may have been evacuated from the valley (Weber, 1972). Remnant Tertiary materials have been subsequently covered by Quaternary deposits.

Fine-grained Tertiary Unit

Massive, fine-grained strata outcrop mostly at localities along the high, eastside terraces as cutbanks or ledges along ephemeral drainages.

a) Coyote and Holloron Gulches

Fine-grained exposures outcrop along Coyote Gulch (SWNE Sec 14 T7N R20W), Holloron Gulch (SWSE Sec 22 T7N R20W), and in roadcuts in Secs 14, 15, 22 and 23 T6N R20W. Field descriptions are virtually identical from all localities. The sediments are light-brown, fine-grained, massive, poorly indurated, micaceous siltstones. Thin-section lithologic examination of collected samples indicated an abundance of sickle-shaped, cusp-like, volcanic shards in a matrix of quartz, feldspar, and clay.

The exposure at Holloron Gulch contains a lenticular, ledge-forming material. The outcrop is fine-grained, compact, massive, and medium gray. Thin-section lithologic examination showed a predominance ($\geq$90%) of acicular volcanic glass shards.

b) Soft Rock Creek

An exposure of fine-grained strata occurs on the north side of Soft Rock Creek in SW Sec 25 T7N R20W where it extends for 600 ft along the Big Ditch irrigation canal. This exposure is characterized by two, distinctly different rock units. A coarse, upper, matrix-supported unit overlies a lower, fine-grained unit, separated by a distinct contact. The lower fine-grained unit is a light-to-medium brown, structureless silt and micrite-cemented sand enclosing infrequent, small-pebble lenses. The fine-grained matrix is poorly lithified and includes occasional limey concretions. The fine-grained strata is traced eastward along upper Soft Rock Creek to the 4,300 foot contour (NE Sec 31 T7N R19W) where it ultimately disappears under coarse Tertiary (?) deposits.

c) Blodgett and Churn Creeks

Fine-grained, buff-and-tan colored, massive sediments, resembling those from the eastside Bitterroot terraces, are exposed along the deeply-incised Blodgett Creek canyon in NE Sec 15 T6N R21W west of the river.

d) blue clays

Blue clays are described in well drillers' lithologic logs for the westside of the Bitterroot Valley. The only known exposure of blue clay occurs in a deep ravine on the Dutch Hill terrace northwest of Woodside in Sec 35.

Coarse-grained Tertiary Unit

Coarse sediments overlie the fine-grained strata on the eastside of the valley. The thickness of the coarse clastics ranges from a veneer near the floodplain to an estimated maximum thickness of 1,000 ft under the high terraces along the Sapphire Range.

a) Eastside high-terrace gravel unit

Coarse, angular gravels and sands comprise the high terraces above the 3,900 ft contour in the Chaffin Butte area (Secs 14 and 25 T7N R20W) and the 4,200 ft contour in the Willow Creek Stock area and south (T6N R19W). The terrace sediments are coarse, angular to semi-rounded, dark brown, carbonate-coated pebbles and boulders. Several huge boulders, ranging in size from 4-10 ft at maximum diameter, are scattered over the surface of the high terrace. Granite, basalt, and quartzite constitute their major lithologies.

The only high-terrace deposit outcrops at Soft Rock Creek. Its upper unit is a moderately-lithified, poorly-sorted, matrix-supported, pebble-cobble conglomerate. The matrix includes light-medium brown silts and sand which support randomly-oriented, angular gravels. The clasts constitute 50% of the unit. Crude low angle and trough cross-strata are present in the outcrop. The surfaces in Secs 25 and 36 slope eastward into the Soft Rock Creek drainage. The terrace deposits represent a remnant alluvial fan system which formed along Soft Rock Creek in the late Tertiary. These fans are now dissected and the surfaces beveled.

b) Eastside mid-terrace gravel unit

The eastside mid-terrace gravel unit includes most of the gently undulating topography of the eastside high terraces. The characteristic features of the alluvium are clast-supported, dark brown, moderate- to well-rounded cobbles whose weathered surfaces are pitted and fractured.

Exposures of eastside mid-terrace gravels occur in two gravel pits (NWNE Sec 33 T7N R20W and SWSE Sec 16 T6N R20W) and at roadcuts along the eastside terraces. Sedimentary structures include low angle horizontal and channel-fill trough strata which intercalate with sand and silt lenses.

Interpretation

Fine-grained Tertiary Unit

The fine-grained sediments are judged to be Renova Formation equivalents because their characteristics are similar to those described by Kuenzi et al. (1971). Massive clay or silt and silty sands suggest standing water or low-energy depositional environments such as lakes, deltas, marshes, and meandering floodplains. The presence of volcanic glass shards throughout the clayey matrix suggests that airfall ash was reworked and transported to deposition sites. The grey lenticular body of volcanic ash at Holloron Gulch represents a topographic depression, probably a pond, in which ash was concentrated by either fluvial or eolian processes.

The Soft Rock Creek exposures suggest an origin by overbank sedimentation and stream surges which occasionally transported larger particles. Organic-rich blue clays represent partly-decomposed vegetation in anerobic swamp and/or marsh depositional environments.

The Soft Rock Creek outcrop may represent the mid-Tertiary unconformity and its westernmost extension into southwestern Montana. The lower, fine-grained unit closely matches the lithologic features described by Kuenzi et al. (1971). Konizeski (1958) dated the upper conglomeratic unit as Clarendonian-Hemphillian in age, based on local Tertiary vertebrate faunas. According to a recent revision of the North American Land Mammal ages (Fields et al., 1985), these biostratigraphic subdivisions post-date the mid-Tertiary unconformity and are late Miocene in age. In consequence, the upper deposits are classified as Sixmile Creek Formation equivalents.

The Renova strata dip slightly to the west under younger Tertiary gravels (Figure 3.1). The Tertiary sediments are discontinuous near the floodplain. The ancestral Bitterroot River eroded these strata to an unknown but significant depth and deposited younger alluvium upon any remnants (Figure 3.2). Renova blue clays lie beneath the unconsolidated gravels west of the Bitterroot River (Figure 3.3).

Coarse-grained Tertiary Unit

The coarse clastics along the eastside high and mid-level terraces may be interpreted as Sixmile Creek Formation equivalents. This formation is characterized by both matrix- and clast-supported gravels deposited as piedmont alluvial fans in response to tectonic uplift and

Figure 3.1: Block Diagram of Eastside Terrace

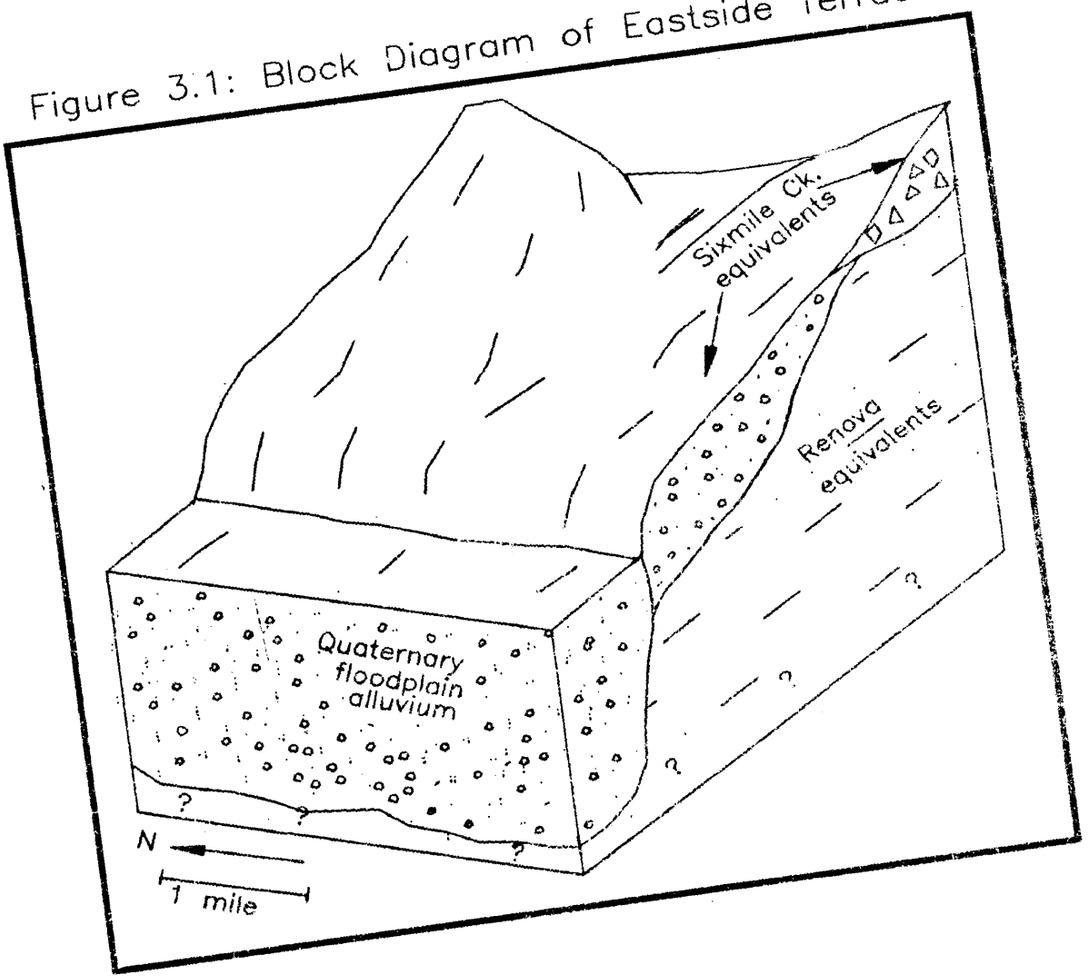


Figure 3.2: Block Diagram of Bitterroot Floodplain

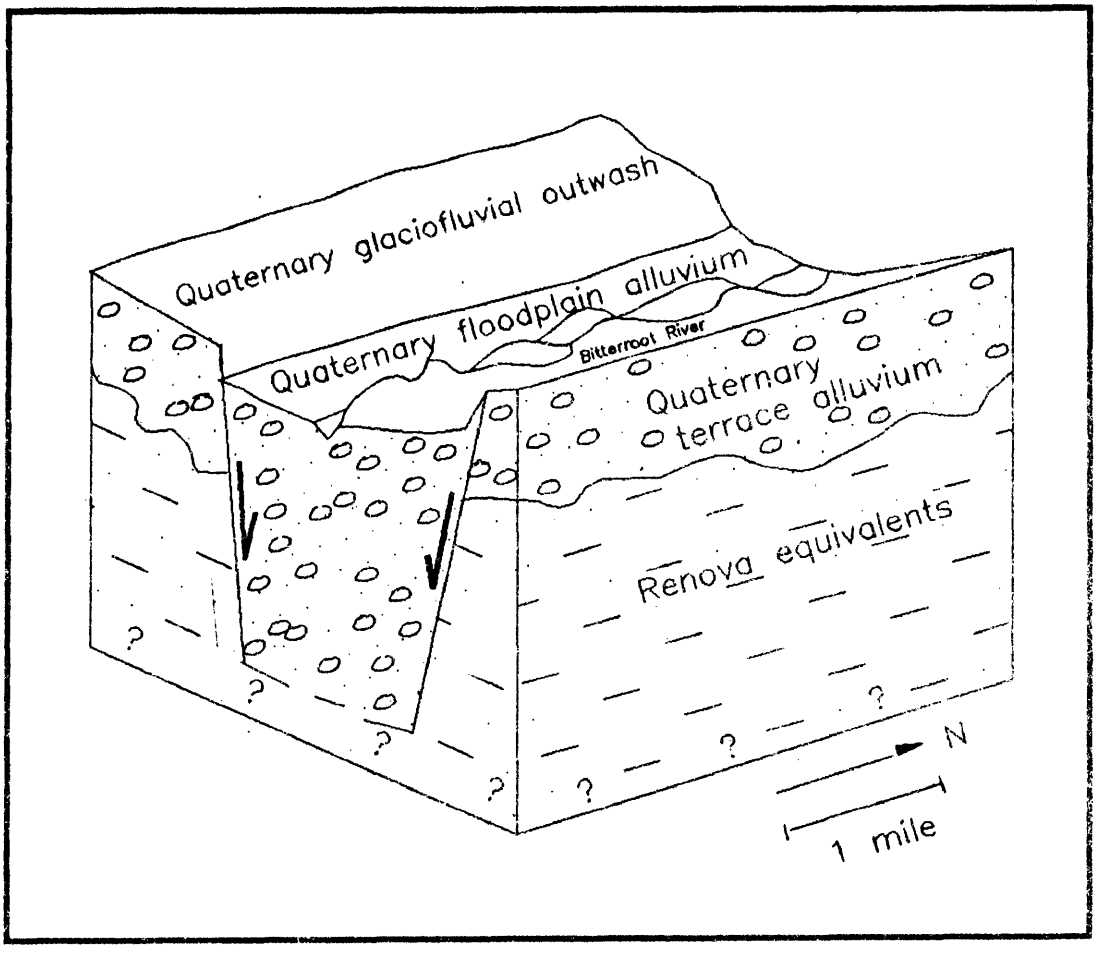
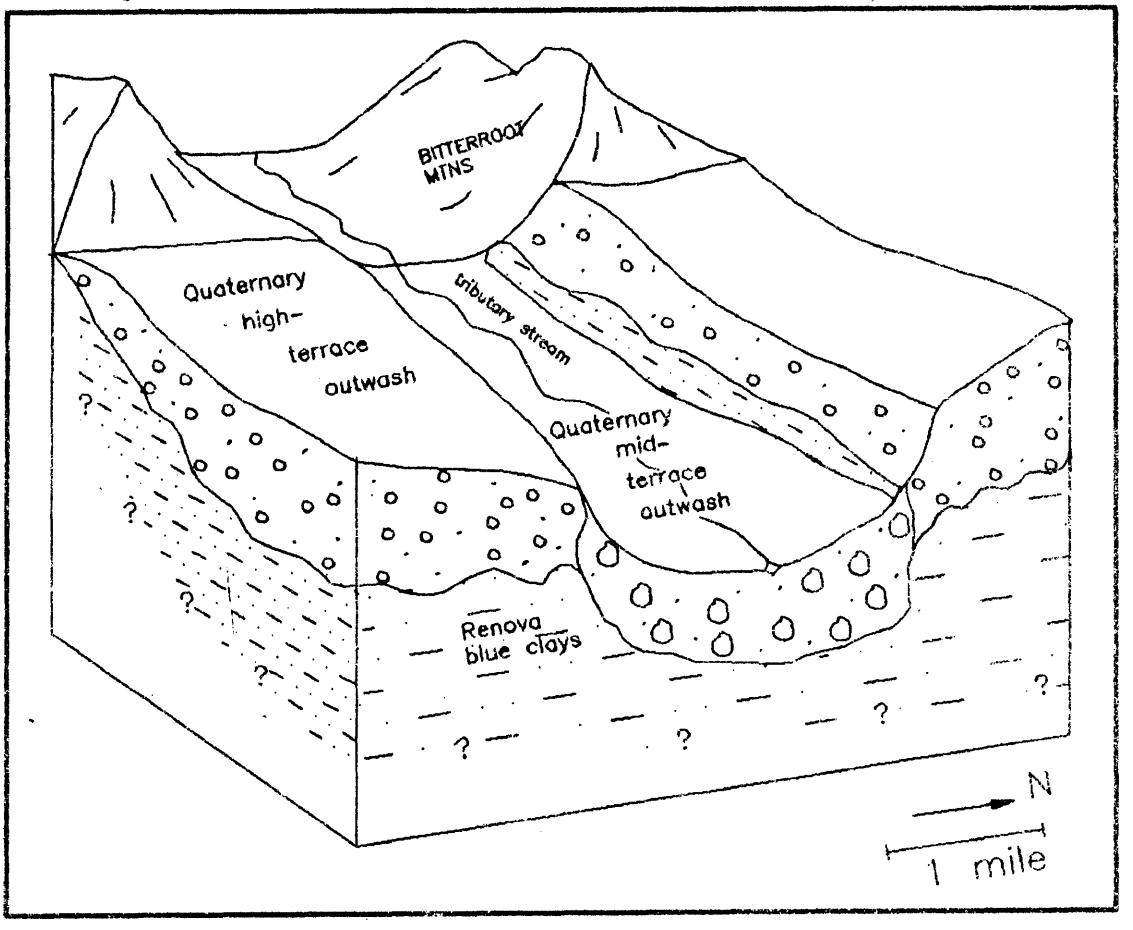


Figure 3.3: Block Diagram of Westside Terraces



semi-arid conditions. Fan deposits reflect geometries diagnostic of their mode of deposition. Each stratum represents a single depositional event characterized by a particular set of hydraulic conditions, source and amount of sediment load, and mode of transport. Modes of transport include: sheetfloods, streamfloods, and gravity-flows (Blissenbach, 1954; Bull,1972).

Matrix-supported sediments characterize the high, eastside terraces (Figure 3.1) and indicate a predominance of debris flow and mudflow sedimentation. The sediments near Chaffin Butte consists of colluvial and gravity-flow deposits derived from local steep sources near the proximal ends of alluvial fans. Gravity-flow sedimentation is promoted by the presence of sufficient clay to make unconsolidated material slippery when wet, slopes incompletely covered with vegetation, and of episodic, heavy precipitation (Bull, 1972). Lensoidal trough crossbedding within the matrix-supported material indicates reworking of the upper surface by streams. Debris flows are characteristically poorly-sorted, contain large fragments embedded in a fine-grained matrix, and may be internally structureless (Fisher, 1971).

Clast-supported gravels, which characterize the mid-terraces (Figure 3.1), are interpreted as alluvial fan streamflood deposits. Cross-strata are well-developed on alluvial fans (Blissenbach, 1954). Lensoidal trough crossbeds represent coarse gravels and sands backfilled in entrenched, braided, distributary channels. Low-angle cross-strata in ephemeral, braided channels indicate channel bar

deposition. Sandy, horizontal laminations represent sheetflood deposition as sediment-laden water surged over stream banks and spread out in sheets to cover parts of the fan.

QUATERNARY DEPOSITS

Background

The Tertiary Period ended with prolonged regional erosion that removed significant amounts of the Bozeman Group sediments. Recurrent tectonic uplift of mountain ranges and slow climatic deterioration through the Pliocene and early Pleistocene rejuvenated streams and re-established through-flowing rivers and major tributaries. Sloping pediment surfaces, which lap on to the adjacent mountain ranges, formed as erosional agents beveled the Tertiary strata. Concurrent gravel deposition upon these pediments ensued as a glacial climate became dominant. By middle Pleistocene, alluvial fan and glaciofluvial outwash gravels had covered the pediments and had partially backfilled incised tributaries. Floodplain alluvium had aggraded in major river valleys despite the re-establishment of the through-flowing rivers (Alden, 1953; Thompson et al., 1981, 1982).

Alpine glaciation was widespread throughout the Rocky Mountains during the Pleistocene Epoch. Several alpine glaciations, separated by interglacial periods, are now recognized and correlated with advances of the large continental ice sheets. Studies of glacial depositon throughout the Rocky Mountains have not resulted in definitive regional correlation and formal stratigraphic units. Although

correlation of valley glacial deposits is tenuous, there is significant evidence from widespread areas to suggest an informal stratigraphic classification for alpine glaciation.

Blackwelder (1915) and Richmond (1965) have formulated a classification scheme for valley glacial deposits from several Rocky Mountain sites. The classification is based on relative stratigraphic position, the degree of stream entrenchment of moraines, the degree of weathering of glacial deposits, and the stage of soil development. The scheme recognizes Pre-Bull Lake, Bull Lake, and Pinedale Rocky Mountain glacial stages that correlate with pre-Wisconsin, early Wisconsin, and late Wisconsin continental glacial episodes, respectively.

Richmond (1972) has divided the Bull Lake glaciation into two events; early Bull Lake times span 120,000 to 110,000 years B.P. and late Bull Lake spans 105,000 to 70,000 years B.P. The Pinedale glaciation ranges from 30,000 to 6,500 years B.P.

Description

Alpine glacial deposits occur along the valley west of the river from Victor south to the confluence of the East and West Forks of the Bitterroot River. Included are two major gravel units: high-terrace glacial outwash and moraines, and mid-terrace outwash cobbles (Figure 3.3). Glacial meltwater stream also contributed tremendous sediment loads which eventually were deposited as floodplains.

1) Westside high-terrace moraine and outwash gravels

High-terrace alluvium forms bluffs west of the river. Tributary streams have deeply incised this once-continuous alluvium into four distinct segments. Each high terrace contains unique, distinctive depositional features.

a) Fred Burr Creek terrace

The Fred Burr Creek terrace in T7N R21W north of Sheafman Creek and south of Fred Burr Creek is multi-level. The eastern portion of the terrace is profusely mantled with light-colored granite cobbles. In NW Sec 25 a gravel pit exposes rust-brown, interbedded, sandy gravels. The clasts are noticeably weathered, and many show pitting and/or fracturing.

A higher outwash, 100 ft above the eastern portion of the Fred Burr Creek terrace, extends to the slopes of the Bitterroot Mountains. The dominant sediment comprising this outwash are thick, coarse, arkosic sands and pea gravels. Granite cobbles and boulders, exposed in a roadcut in SW Sec 21, are so intensely weathered and disintegrated that only their indistinct forms are recognizable.

An arcuate ridge of large, angular boulders is found in NW Sec 21 near the Fred Burr Creek canyon. Bouldery till slopes into the steep-sided canyon in SE Sec 16 where deposits have been obliterated almost beyond recognition by more recent stream erosion.

b) Dutch Hill terrace

The Dutch Hill terrace rises steeply as bluffs directly west of Woodside. It is comprised of well-rounded cobbles and coarse weathered arkosic debris. A gravel pit exposing 50 ft of unconsolidated, stratified alluvium existed in NWNW Sec 1 T6N R21W until 1985 when the Mill Creek road was re-routed through the pit. This gravel pit was the best exposed vertical sequence of alluvium within the study area. Layers of different textures and sorting were intercalated in 1-3 foot thick layers dipping approximately 15° to the east.

A prominent till extends beyond the Mill Creek canyon. It curves across Mill Creek in a wide arcuate pattern and grades onto the terrace surface to the north.

c) Blodgett Creek terrace

The Blodgett Creek terrace occupies the high tracts located between Tag Alder and Blodgett Creeks in Secs 9, 10, 14 and 15. The terrace is cut into two portions by the main branch of Blodgett Creek. The northern section of the terrace contains few glaciofluvial outwash gravels above the 3,950 ft contour; however, the lower surface contains abundant coarse gravels. Angular boulders and alluvium on the higher slopes have resulted from landslides and debris flows originating in the steep, upper canyons of the Bitterroot front.

The southern part of the terrace has undergone intense erosion and is deeply covered with coarse, well-rounded, granite cobbles. The southern half of the terrace extends nearly to the Bitterroot River.

The Blodgett Creek moraine forms a prominent ridge across the south fork of Blodgett Creek in Sec 15 and has overlapped the southern part of the Blodgett Creek terrace. Large boulders along the south side of Blodgett Creek form a steep-sided high lateral moraine in Sec 21.

d) Canyon Creek terrace

The Canyon Creek terrace appears as a prominent ridgeline west of Hamilton in Secs 22 and 23. Two gravel units comprise this terrace. Coarse cobble outwash lies between a morainal till in Secs 21, 22 and 23. The cobble outwash extends as a lobate interfluve terrace to within 1,500 ft of the Bitterroot River. In SE Sec 22 a roadcut exposes bright, rust-colored, interstratified gravels, sands and gravels and sandy silt or clay strata.

Large moraines extend from the Canyon Creek drainage. Scattered, extremely large boulders are found in N½ Sec 27. Numerous glacial advances have modified the morainal topography into a "stair-step" pattern.

2) Westside mid-terrace outwash gravels

Three inset, apron-like terraces of cobble-rich alluvium form nearly-continuous surfaces below the truncated bluffs of the higher terraces on Blodgett Creek Flats west of Hamilton, Mill Creek Flats southwest of Woodside, and Poverty Flats southwest of Victor. These deposits consist of large, well-rounded, granite cobbles in a matrix of fine earths and small, weathered granitic pebbles. The cobble outwash forms thick, areally extensive deposits which head at the

outer flanks of the glacial moraines and extend toward the Bitterroot River where they are truncated as low, continuous bluffs formed by river erosion. On Poverty Flats west of Tucker Crossing in N½ Sec 13 and S½ Sec 12 T7N R21W there are lobate remnants of an older, higher-level, cobble outwash surface. The gravel pit exposes coarse, poorly-sorted granitic cobbles and boulders in a silty sand and pebble matrix which often exhibits crude horizontal stratification.

3) Valley-center river terrace and floodplain gravels

Two alluvial river terraces lie parallel to the northerly-flowing Bitterroot River. These river terraces are separated from the eastside Tertiary pediment terraces by a 25 ft bluff extending from Hamilton to a point south of Corvallis where the surfaces merge and lose their identities. These river terraces are easily distinguishable on the westside of the valley by low bluffs which delineate the cobble outwash terraces. The westside river terrace remnants correlative with terraces east of the river extend from Woodside northward for approximately 2½ miles. The upper terrace averages one mile in width and lies 25 ft above the floodplain.

The lower river terrace remnants lie 15 ft above the floodplain and directly adjacent to the active channel of the Bitterroot River. Although difficult to recognize from field examination, river channel meander scars exist on the lower river terraces. Patterns of vegetation, discontinuous scarplets representing remnant cutbanks, abandoned channels, sloughs, swales, and old channel bars identify these channel scars. These scars are fresher toward the Bitterroot

River and do not occur on the higher-level, older river terrace. The lower terraces are traceable a short distance up the tributary valleys.

No natural outcrops expose the internal sedimentary structures of the river terraces and floodplain. Fresh, well-rounded cobbles are scattered abundantly over the surfaces of the lower river terrace and the floodplain. A gravel pit on the lower river terrace near Corvallis exposes large, rounded, unweathered, granite cobbles.

Interpretation

The Quaternary deposits west of the river are of glacial and glaciofluvial origins. The topographically-highest glacial deposits are tills preserved only where later glaciers have not reworked and obliterated these deposits. These tills, which occur on the high south slopes near Fred Burr and Blodgett Creeks, are judged to be early Bull Lake in age on the basis of their topographic position and the degree of weathering. Prominent morainal tills, which lie along the canyons of Fred Burr, Mill, Blodgett and Canyon Creeks, may be late Bull Lake. Late Bull Lake ice advances overrode and obliterated most pre-Bull Lake and early Bull Lake deposits before depositing their own terminal moraines. Hummocky inter-morainal deposits represent tills of successively younger glacial advances.

Large gravels and weathered granitic sands of the high westside terraces are glaciofluvial outwash sediments transported from meltwater streams that drained from the canyon glaciers. This alluvium

may be late Bull Lake in age but may also include reworked early and pre-Bull Lake deposits. Pinedale glaciers contributed negligible quantities of outwash gravels and sands because they were confined within the canyons and behind older lateral moraines; Glacial Lake Missoula waters also reduced glaciofluvial Pinedale outwash deposition (Weber, 1972).

Interstratified, rust-colored gravels exposed in westside roadcuts are probably late Bull Lake outwash oxidized to reddish hues during warm interglacial times. The interstratified gravels west of Woodside were deposited on the Mill Creek terrace by meltwaters of the Mill Creek glacier. The highly weathered glaciofluvial sediments in roadcuts along the Cherry Hill Loop and near Bourne Lane northwest of Woodeside are probably pre- and early Bull Lake based on their degree of weathering and low stratigraphic position. The higher bench on the Fred Burr Creek terrace is probably early Bull Lake outwash. These outwash gravels have undergone a long period of weathering, as evidenced by the decomposed cobbles and coarse arkosic sands.

Late Bull Lake glaciations contributed voluminously to the areally-extensive lower outwash fans at Blodgett Creek Flats, Mill Creek Flats, and Poverty Flats. These glaciofluvial outwash fans, which may be late Bull Lake, aggraded upon older dissected outwash fan remnants. The deposits represent multi-channeled, braided, coarse alluvium deposited as a series of rapidly-shifting channel scour-and-fill and mid-channel longitudinal bars. Braiding is developed as a stream leaves behind those sizes of load which it

cannot handle. Re-deposition initiates longitudinal bar formation (Miall, 1977; McDonald et al., 1971). Braided streams migrate laterally and deposit sheetlike deposits of channel and bar complexes.

Higher-level outwash gravel once extended over the westside of the valley. One isolated remnant is the ovoid ridge in N½ Sec 13 T7N R21W on Poverty Flats. This ridge sits approximately 50 feet above the lower outwash plain. It represents a residual remaining after long erosional removal ot the pre-existing higher glacial outwash plain.

The west slopes of the Sapphire Mountains along the eastern margins of the valley were not glaciated. Erosion has been the dominant geomorphic process acting since cessation of Sixmile Creek sedimentation. The eastside Tertiary piedmont alluvial fan deposits are preserved as multi-level interfluve pediment surfaces resulting from incomplete erosional cycles. They are incised by Soft Rock, Willow, Cow and Gird Creeks. The pediment is a geomorphic expression resulting from rare but intense thunderstorm runoff which is manifested as sheetflood (Rahn, 1967; Hogg, 1982) rather than channelized flow. Short flow distance and brief duration are fundamental features of sheetfloods. Since sheetflood flow is considered turbulent, it is capable of erosion in which the surfaces are swept of debris. The gentle topography of the mid-level terraces represent remnants of a late-Tertiary alluvial fan system across which early- and mid-Quaternary tributary streams reworked, transported, and removed gravels. Deep, narrow drainages incised into these terraces represent late Quaternary stream erosion into the underlying Renova silts.

The multi-level Bitterroot River terraces are climatically-controlled geomorphic features attributed to fluctuating colder glacial intervals and warmer interglacial periods. Huge sediment loads transported by glacial meltwaters resulted in aggradation and widening of the floodplain. Conversely, during interglacials, sediment loads decreased, causing channel incision and river terrace formation (Schumm, 1965).

During a glacial interval the river aggraded to build a floodplain whose terraced remnants lie below the Dutch Hill and Fred Burr Creek terraces west and northwest of Woodside. Weber (1972) believes that more than 200 ft of erosion has occurred following the truncation of the Dutch Hill surface and prior to aggradation of the older river terrace. The relative age of this terrace is based on its topographic position. Late Bull Lake (?) glaciofluvial outwash deposits overlie the river terrace deposits along its western margins (Figure 3.2). After late Bull Lake glaciation, the Bitterroot River probably incised the floodplain. River terrace bluffs, representing this entrenchment, are evident near the floodplain.

After Pinedale glaciation, another river entrenchment occurred but did not deeply incise due to periodic valley flooding by Glacial Lake Missoula. Subtle river terrace scarplets are traceable over short distances near Corvallis. The terrace lies only a few feet above the modern floodplain. Since Pinedale glacial times the river has migrated to the west.

CHAPTER IV

HYDROGEOLOGY OF THE CENTRAL BITTERROOT VALLEY

OCCURRENCE OF GROUND WATER

Well Log Inventory

A well log inventory (Appendices 1.1 - 1.13) was compiled from 526 well log reports to assess the site-specific hydrogeology. It is estimated that these logs represent only 10-15% of the existing wells. Although only a small number of the total existing wells are accompanied by filed, readily accessible well log reports, it is believed that this small number is sufficient to adequately describe the distribution and gross characteristics of the aquifers. Although well drillers' reports are most often imprecise and lacking in detail, an examination of a large number of well log reports is helpful in gaining an overview of the ground water environment of the area.

Aquifer Distribution and Description

The aquifer descriptions are based on well log lithologic descriptions of the water-bearing intervals and on surficial geologic mapping. The aquifers are grouped into four broad categories which are: 1) the westside Quaternary high-level terraces, 2) the westside mid-level cobble outwash terraces, 3) the extensive Bitterroot River fluvial terraces with lateral tributary extensions into Sheafman and Willow Creeks and 4) the eastside Tertiary high-terraces. The distribution of these aquifers generally coincides with the recognized geologic units and is presented in Figure 4.1.

Figure 4.1: Distribution of Study Area Aquifers.

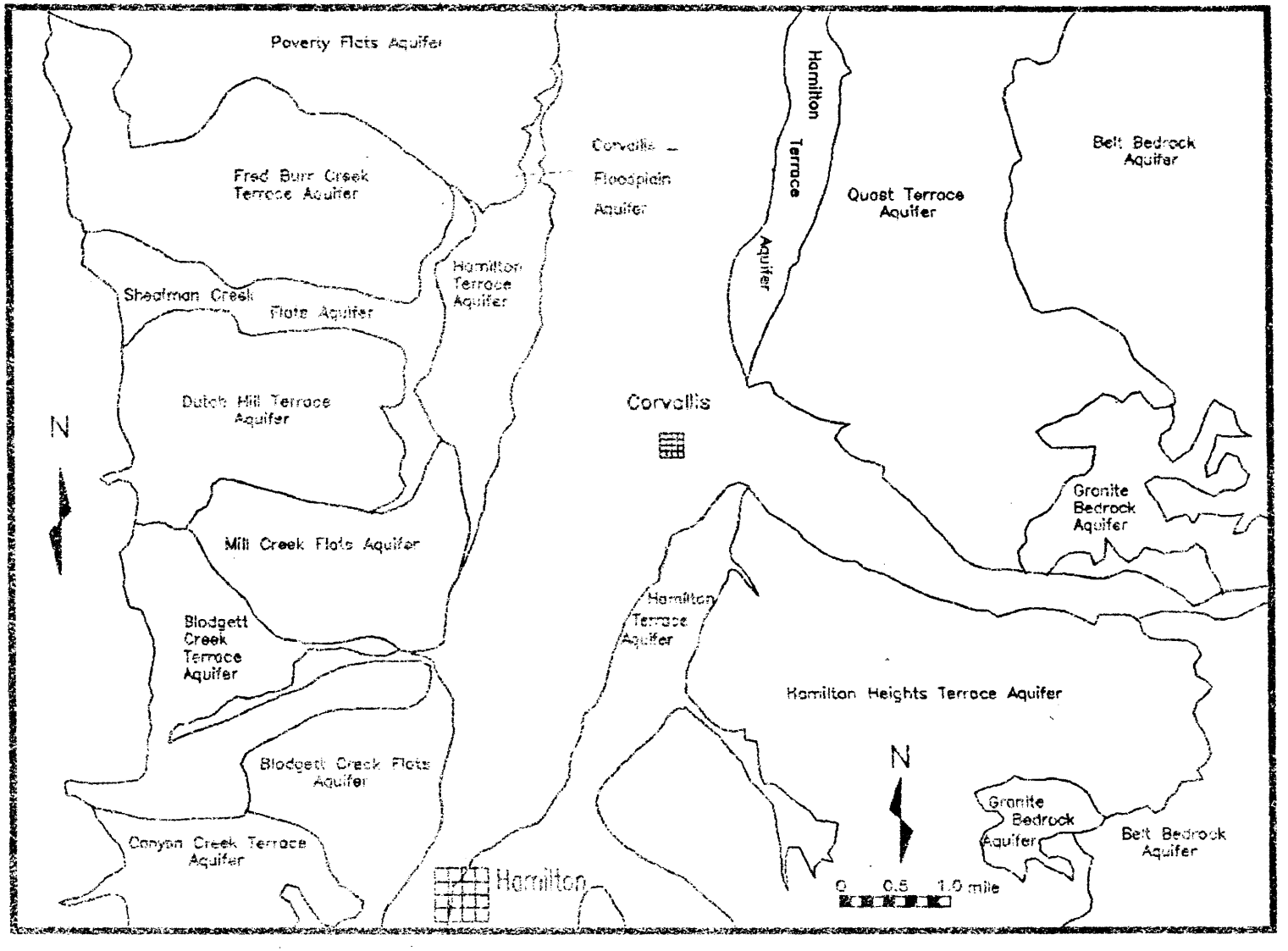


Table 4.1 summarizes for each aquifer the number, depths, and water levels of wells recorded in the well log inventory. The data include means, standard deviations, minimums, and maximums where appropriate.

TABLE 4.1: SUMMARY OF WELL DEPTHS AND STATIC WATER LEVELS FROM EXAMINATION OF WELL LOG REPORTS

AQUIFER	WELL LOGS	WELL DEPTH (ft)				STATIC LEVEL (ft)			
		MEAN	ST.DV	MIN	MAX	MEAN	ST.DV	MIN	MAX
WESTSIDE QUATERNARY HIGH-TERRACE AQUIFERS									
Fred Burr Ck	48	144.2	84.8	33	520	78.6	50.2	4	200
Dutch Hill	32	168.5	68.6	42	309	102.6	49.5	10	174
Blodgett Ck	30	144.8	87.9	40	412	60.1	26.6	10	95
Canyon Ck	30	125.0	62.3	56	300	64.0	28.0	16	112
Sheafman Ck	17	62.3	31.1	28	136	16.8	9.0	5	82
WESTSIDE QUATERNARY OUTWASH TERRACE AQUIFERS									
Poverty Flts	24	84.5	69.3	27	280	29.7	29.0	5	114
Mill Ck Flts	28	74.7	71.3	29	400	21.0	15.3	2	80
Bldg Ck Flts	35	64.0	43.2	20	205	21.8	17.4	3	76
QUATERNARY RIVER TERRACE AQUIFERS									
Hamilton	65	51.9	28.4	31	198	11.0	16.7	0	85
Corv-Flodpln	69	43.3	13.4	26	105	11.4	10.1	1	60
EASTSIDE TERTIARY HIGH-TERRACE AQUIFERS									
Quast	59	112.2	60.7	34	410	52.3	40.7	5	220
Hamilton Hgts	74	107.9	41.7	46	240	54.9	29.8	5	149
Frac Bedrock	15	320.0	161.6	120	600	70.0	46.8	7	180

1) Westside Quaternary High-Terrace aquifers

The topographically-highest westside aquifers exist as four spatially-discontinuous, discrete units whose physical characteristics are very similar because they share a common geomorphic origin. These units are the Fred Burr Creek, Dutch Hill, Blodgett Creek, and Canyon Creek Terrace aquifers. From their contact with the Bitterroot Mountain front, they thin eastward and are truncated by bluffs along the river. The aquifers are bounded laterally by bluffs and are distally truncated by the Bitterroot River. These aquifers are described from 140 well log reports summarized in Appendices 1.1- 1.4.

The stratigraphy of these four aquifers is poorly defined. The geologic materials on each terrace consists of coarse Quaternary alluvium and, at depth, possibly some late-Tertiary gravels. The water-bearing alluvium is texturally variable, heterogeneous, and consistent with intermittent streamflood, channelfill, and glaciofluvial outwash sedimentation. The aquifers show no spatial trends or patterns in materials or in continuity of water-bearing strata. The unconsolidated deposits are well-rounded gravels, sandy-clayey gravels, angular grus, sandy or gravelly clays, and clays. Each aquifer is considered to be generally unconfined and hydraulically interconnected although there are local, minor water-bearing intervals that may initially respond to pumping in a semi-confined manner. Unsuccessful wells are documented for the westside high-terraces.

a) Fred Burr Creek Terrace aquifer

The Fred Burr Creek Terrace aquifer, covering 4.8 square miles, is the northernmost high-terrace aquifer. The mean minimum depth to the shallowest water-bearing zone is 103 ft. Water-bearing units average 18.4 ft in thickness. The total thickness of the aquifer is not clearly defined from well log reports. The actual aquifer thickness may be variable because many deep wells (>175 ft) are finished in coarse alluvium, whereas shallower wells are completed in thick sequences of grey-blue clay or black shale at depths ranging from 42 to 220 ft from the surface.

b) Dutch Hill Terrace aquifer

The Dutch Hill Terrace aquifer, covering 4.3 square miles, is located west of Woodside. The mean minimum depth to the shallowest water-bearing zone is 105 ft. Water-bearing strata average 26.5 ft in thickness. The total thickness of this aquifer is unknown but may be greater than 280 ft, the maximum depth of the deepest water-bearing zone. The well log reports indicate that all but three wells are completed in sandy or coarser alluvium.

The log for well 7-21-33acd, located high on the terrace near the bedrock contact, lists decomposed granite from 385 to 560 ft. This well penetrates the alluvium and is completed in the underlying batholith rocks. The logs for wells 7-21-34b and 7-21-26dd list a gravelly blue clay from 160-170 ft and blue clay mixes from 157-193 ft, respectively. A possible interpretation is that the blue clay represents an irregular, erosional surface of substantial topographic relief. Most wells in this aquifer do not penetrate blue clays.

c) Blodgett Creek Terrace aquifer

The Blodgett Creek Terrace aquifer, covering 3.6 square miles, is located immediately south of the Dutch Hill Terrace aquifer. The mean minimum depth to the shallowest water-bearing zone is 82.1 ft. Water-bearing strata average 23.9 ft in thickness. The geometry of this aquifer is readily interpretable from an examination of lithologic decriptions. The aquifer consists of a relatively constant thickness of 100-125 ft of unconsolidated alluvium overlying blue-grey clay or blue shale of undetermined thickness. Several wells completely penetrate the blue clays in Sec 9 T6N R21W at approximately 200 ft in depth and are finished in granite. The blue clays are 75-100 ft in thickness at this location, indicating shallow bedrock of the Bitterroot Front. Eastward and downslope several wells are finished at 240-300 ft depths within the blue clay. Logs also indicate thin strips to thick lenses of gravel within the blue clay. These gravels may have originated from episodic streamfloods. Furthermore, there are many wells that penetrate deeper than the level at which the blue clays are expected. These are completed in channel-fill alluvium. The blue clays seem more abundant under the Blodgett Creek Terrace because it was not so thickly covered by Quaternary glacial outwash sediments as the terraces to the north. Thus, the aquifer is thinner and the underlying blue clays are more often encountered by water wells.

d) Canyon Creek Terrace aquifer

The Canyon Creek Terrace aquifer, covering 2.1 square miles, is the southernmost high-terrace aquifer. The mean minimum depth to the shallowest water-bearing zone is 71.8 ft. Water-bearing intervals

average 18.0 ft in thickness. The total thickness is not interpretable from well log reports; however, the total is greater than 250 ft because several wells withdraw water from coarse, saturated alluvium at this depth. Three well log reports describe blue clays and shale at approximately the same subsurface elevation. One well, 6-21-23bc, penetrates this shale and is completed in the underlying decomposed granite cobbles. It is difficult to define the thickness and base of the aquifer based on the occurrence of blue clay on the three well logs. Considering that deeper, nearby wells do not penetrate the blue clays, the aquifer base is interpreted as the bounding, irregular, erosional surface of this blue clay sequence. This buried topography was most likely deeply eroded and subsequently filled during deposition of the coarse aquifer alluvium.

2) Westside Quaternary Mid-Terrace aquifers

The three westside mid-level aquifers are separate, spatially-discontinuous units. These aquifers are the Poverty Flats, Mill Creek Flats, and Blodgett Creek Flats aquifers. They extend westward up the tributary valleys and abut against the terminal moraines. The aquifers are laterally constrained by the adjacent high-terrace scarps and are distally truncated by the Bitterroot River. The aquifers are described from 87 well log reports summarized in Appendices 1.5 - 1.7.

The stratigraphy of these aquifers is unconsolidated, spatially-discontinuous, irregular sheets, wedges, and lenses of well-rounded boulders and cobbles and gravelly to clayey sands interspersed with thin clay and "shale" intervals. The aquifers

consist entirely of Pleistocene glaciofluvial deposits overlying a deeply dissected, Tertiary blue clay horizon. The uppermost 50 ft of the aquifers include a very high proportion of boulders. There are no correlative water-bearing intervals. Each is unconfined with its water-bearing units maintaining some degree of hydraulic interconnection.

a) Poverty Flats aquifer

The Poverty Flats aquifer is located directly west of Tucker Crossing and Highway 93 in Township 7 North, Range 21 West. It covers 4.8 square miles. The mean minimum depth to the shallowest water-bearing zone is 36.9 ft. Water-bearing intervals average 23.9 ft in thickness. The total thickness of the aquifer is 200 or more ft since at least two wells penetrate water-bearing zones near that depth. There is a higher frequency of large, rounded granite boulders and cobbles in the uppermost 50 ft of the aquifer and also a conspicuous decrease in the frequency of claybound strata.

Sequences of blue clays occur in wells in Section 15 at depths of 50 to 60 ft; however, there is no indication of such occurrences in Sections 13 and 14. This lack is attributed to this stratigraphic horizon having been deeply dissected by erosion and lying below the depths at which most wells are completed.

b) Mill Creek Flats aquifer

The Mill Creek Flats aquifer, covering 3.1 square miles, is located southwest of Woodside. The mean minimum depth to the shallowest water-bearing zone is 34.8 ft. Water-bearing zones average 16.8 ft in thickness. The total thickness of this aquifer in its

proximal and mid-sections ranges from 75 ft to 270 ft. Boulders and gravels in a sandy matrix predominate in this aquifer. The base of this outwash gravel is delimited by the Tertiary blue clay paludal deposits with intermittent sand/gravel stringers. These clays lie approximately 75 ft beneath the surface along the center axis of the aquifer but are shallower along the margins of the adjacent terraces (28 ft in well 6-21-11). The aquifer rapidly thickens distally. Well 6-21-12bd, for example, penetrates through 270 ft of stream gravels and sands overlying the blue clays.

c) Blodgett Creek Flats aquifer

The Blodgett Creek Flats aquifer, which covers 3.0 square miles, is located northwest of Hamilton. The mean minimum depth to the shallowest water-bearing zone is 25.0 ft. Water-bearing units average 16.7 ft in thickness. The total thickness of the outwash gravels is not readily interpretable from well log reports; however, its thickness most likely ranges from 50 to 180 or more ft. The aquifer materials are described as boulder to cobble-sized gravels in a sandy matrix. However, more clay intervals and claybound sands and gravels are described for this aquifer than the previous two outwash aquifers. Thin "shale" intervals are also noted on several logs. The aquifer base is delineated by a dissected erosional surface associated with Tertiary paludal blue clay deposits. These clays are described on well logs located in Sections 13 and 23. The depths to these horizons, however, is rather variable which suggests an irregular subsurface geometry.

3) Quaternary River Terrace aquifers

The river terrace aquifers east and west of the river are the Hamilton and Corvallis-Floodplain aquifers. They are hydraulically-interconnected and, because they share a common origin, their physical characteristics are very similar. The aquifers probably interfinger and show such imperceptible changes that subsurface delineation is not only pointless but would be futile based on an analysis of 151 available well log reports. The stratigraphy is described as discontinuous layers of mixed, well-rounded gravels and coarse sands.

The aquifers are unconfined and bounded by high bluffs along their margins. The upper aquifer is delimited by inner terrace bluffs below which is located the more recently formed Corvallis-Floodplain aquifer. These aquifers are described from 151 well log reports summarized in Appendices 1.8 - 1.10.

a) Hamilton river terrace aquifer

The Hamilton aquifer, covering 8.4 square miles, lies above the younger Corvallis-Floodplain river terrace aquifer. The mean minimum depth to the shallowest water-bearing zone is 19.9 ft. Water-bearing strata average 20.4 ft in thickness. The total thickness of the aquifer is unobtainable from the well log reports. An examination of all lithologic intervals on the well log reports indicates that interstratified sands, sands and gravels, gravels and boulders constitute the bulk of the aquifer materials. The blue clay horizon appears on three well logs, which are located at an approximate depth

of 60-70 ft on the aquifer segment west of the Bitterroot River. These occurrences of blue clay represent portions of the dissected Tertiary blue clays which underlie much of the westside terraces.

b) Corvallis-Floodplain aquifer

The Corvallis-Floodplain aquifer, encompassing 18.1 square miles, lies below the Hamilton river terrace aquifer along the central axis of the valley. The mean minimum depth to the shallowest water-bearing zone is 15.1 ft. Water-bearing units average 18.4 ft in thickness. The total thickness of the aquifer is unobtainable from well log reports due to completion of wells in shallow water-bearing zones after penetrating only the uppermost intervals of the aquifer. The lithologic description from well 6-20-11ab located upon the Willow Creek extension two miles east of the principal Corvallis-Floodplain aquifer indicates that intermittent layers of clay, sand, and pea gravels overlie light-brown clay and sedimentary rock at 290 ft in depth. The lower materials are believed to represent Tertiary deposits which comprise the base of the Quaternary Corvallis-Floodplain aquifer in the upper reaches of Willow Creek. Fields (1981) noted that stratigraphic boundaries between Quaternary and late-Tertiary materials and mid-Tertiary deposits were not discernible during deep drilling near the Bitterroot River. It is suggested that, near the river, the entire thickness involves continuous river channel and point-bar deposits and that, either the Tertiary is indistinguishable from the Quaternary, or the river alluvium is so thick that little, if any, of the Tertiary deposits remain along the valley axis. The cumulative footage of lithologic well log intervals for the

Corvallis-Floodplain aquifer indicates a high predominance of intermixed sands and gravels and homogeneous gravel layers. Fields (1981) also indicated that gravel and sands comprise 70-100% of samples to the 2,416 ft depth of the Bendix well drilled near the Bitterroot River.

c) Sheafman Creek extension of the Corvallis-Floodplain aquifer

The Sheafman Creek aquifer, covering 2.1 square miles, lies in the drainage between the Fred Burr Creek Terrace and Dutch Hill Terrace aquifers. The mean minimum depth to the shallowest water-bearing zone is 28.0 ft. Water-bearing units average 16.7 ft in thickness. The stratigraphy is comprised of discontinuous bodies of sands and gravels with a higher proportion of clays than that of the glacial outwash aquifers. The total depth of the aquifer is inferred to be approximately 70 ft. However, the blue clay horizon appears on the lithologic descriptions of several well logs at approximately 35 ft below surface.

4) Eastside high-terrace aquifers

The eastside high-terrace aquifers are the remnants of former Tertiary basin-fill lying above and east of the bluffs delimiting the Quaternary river terrace aquifers and sloping up to the bedrock flanks of the Sapphire Mountains. These aquifers are the Quast and Hamilton Heights Terrace aquifers and the high-level fractured bedrock aquifer. These aquifers are described from 148 well log reports summarized in Appendices 1.11 - 1.13. Dry wells are not uncommon in these terraces.

a) Quast/Hamilton Heights Terrace aquifer

The Quast and Hamilton Heights aquifers were once a continuous, hydraulically interconnected aquifer system. The continuity of the system is now disrupted by the transverse dissection of Willow Creek. These aquifers are described as two distinct units for the convenience of data presentation.

The Quast/Hamilton Heights aquifer includes two distinct lithologic sequences. The aquifer is comprised of: 1) the upper, stratigraphically-thin Sixmile Creek Formation equivalents and 2) the lower, thicker Renova Formation equivalents. The Sixmile Creek equivalents are described as fills of discontinuous bodies of "dirty" sands, sands and gravels, and clayey gravels deposited by intermittent streams. The lithology of the lower Renova strata is described from the well log reports as consisting of brown sandstones and thick sequences of massive, light-tan clays with intermittent, thin "strips" or "stringers" of sands and/or gravels or thicker, more homogeneous intervals of channel-fill sands or gravels. Aquifer intervals are generally not correlative between widely-separated wells. There are instances, however, when some degree of correlation of strata exists or may be inferred between closely-spaced wells. The aquifers range from unconfined to locally semi-confined depending on the geometry of the overlying clays and interconnection of the aquifer with nearby coarse deposits.

The Quast Terrace aquifer, encompassing 11.0 square miles, includes the northeastern section of the eastside Tertiary aquifer. The mean minimum depth to the shallowest water-bearing zone is 71.3

ft. Water-bearing strata average 16.5 ft in thickness. The thickness, where interpretable from well logs, generally increases westward towards the valley center from 10 to 35 ft. The upper interval thins upslope toward the east to a general thickness of 5 to 20 ft. The thickness of the lower sequence may range from several hundred to two thousand feet.

The Hamilton Heights Terrace aquifer, expressed over 13.8 square miles, includes the southeastern section of the eastside Tertiary aquifer. The mean minimum depth to the shallowest water-bearing zone 66.6 ft. Water-bearing units average 17.3 ft in thickness. The Sixmile Creek unit is generally thicker in the west where 30 to 40 ft intervals overlie thick sequences of Renova clays. However, upslope the general thickness of the upper unit is typically 5 to 15 ft overlying the Renova. The Renova is exposed at the surface in many places. The thickness of this unit is undefined and probably reaches up to 1,500 ft in depth.

Most wells have penetrated the Sixmile Creek equivalents and are finished in intercalated sands/gravels characterizing the upper sections of the Renova. Only a few shallow wells are finished solely in the inferred Sixmile Creek interval of the aquifer.

b) Bedrock aquifer

The Bedrock aquifer occurs on the high eastside terraces. It includes the granites of the Willow/Coalpit Creek stock, subsidiary granite bodies in Secs 23 and 24 T6N R20W, and shallow Precambrian Belt limestones and argillites northeast of Soft Rock Creek. These aquifers are either exposed at the surface or underlie shallow

colluvial, debris flow, and pediment sheetwash deposits. The mean minimum depth through the overburden to the intersection of water-bearing fractures is 105.1 ft. The water-bearing fracture zones average 214.9 ft in thickness. The well log reports do not list information regarding fracture locations, extent, frequency and orientation.

MOVEMENT OF GROUND WATER

Direction and Rate of Ground Water Flow

The elevation of the water table, an irregular surface derined by water levels in nonpumped wells, generally rises and falls with the topography of the area. The total hydraulic heads were measured in sixty-one wells from July 1, 1983 through October 31, 1984. These measurements were used to construct a composite water table potentiometric map for September 6-8, 1983 (Figure 4.2). These dates correspond to a period when the water table was generally at its highest in most wells.

The map indicates that ground water flows toward the valley center from the surrounding foothills. As indicated by flow line convergence, the valley floor serves as a discharge area. The surrounding foothills are the recharge areas; flow lines diverge at the topographic divides and follow the general hydraulic gradient toward the valley floor. The hydraulic gradient and direction of ground water flow vary spatially due to site-specific changes in topography and aquifer transmissivity. Equipotential lines are more closely spaced when either the topography is steeper or transmissivity decreases.

Figure 4.2: Composite Potentiometric Surface (ft above msl) for September, 1983

West of the Bitterroot River ground water generally moves directly eastward toward the river. The gradients were calculated between several known points of hydraulic head; the average gradient was 0.0364. East of the Bitterroot River the general ground water flow direction has a northwesterly component. The measured average gradient was 0.0309. The ground water gradient along the valley-center Corvallis-Floodplain and Hamilton aquifers is less pronounced because the transmissivity of the alluvium is high. Ground water flows north discharging to the Bitterroot River under a gradient of 0.00335.

General estimates of ground water velocity may be obtained by the substitution of conservative average values of hydraulic conductivity and porosity (Freeze and Cherry, 1979) into Darcy's Law. These variables and the resulting velocities are presented in Table 4.2.

TABLE 4.2: SUMMARY OF GROUND WATER VELOCITY ESTIMATIONS

AQUIFER REGION	HYDRL. COND (gpd/ft^2)	GRADIENT	POROSITY	VELOCITY (ft/year)
WEST	100	0.0363	0.20	885
VALLEY-CENTER	1,000	0.0034	0.25	650
EAST	32	0.0296	0.15	310

Ground water flow most likely consists of combinations of local and intermediate flow systems. The Bitterroot River receives ground water contributions from the adjacent topographic highs. Head potential should decrease with depth in recharge areas and increase with depth in discharge areas (Saines, 1981).

Ground Water Level Fluctuations

The quantity of water in aquifer storage responds to both recharge and discharge. Ground water levels rise when aquifer recharge exceeds discharge, thereby increasing storage. Conversely, the levels decline when discharge exceeds recharge.

Changes in ground water storage were documented by repeated water level measurements in sixty-one monitored wells at approximately two-week intervals. Ground water level fluctuations and hydrographs for the sixty-one monitored wells are presented in Appendices 2.1 - 2.61.

The observed water level fluctuations of the nineteen wells (Appendices 2.1 - 2.19) monitored on the westside high-terrace aquifers range from 33.69 to 1.10 ft. The average fluctuation is 9.81 ft with a 9.96 ft standard deviation. The lowest and highest water levels in these wells occurred in April-May and June-July, respectively, as exemplified by well 6-21-14bdb (Figure 4.3). The principal sources of recharge to these wells are the tributary streams draining the Bitterroot Mountains from the west. Hydrographs show inconsistent and variable responses to recharge due to heterogeneity of water-bearing zones, aquifer discontinuity, and variability in aquifer transmissivity. The variation in response to recharge is demonstrated in several wells and illustrated by well 6-21-21dda (Figure 4.4). This hydrograph indicates a prolonged lag time between the lowest and highest water levels occurring respectively in late June-July and December-January. Spatial variation in water level

Figure 4.3: Hydrograph of Well 6-21-14bdb

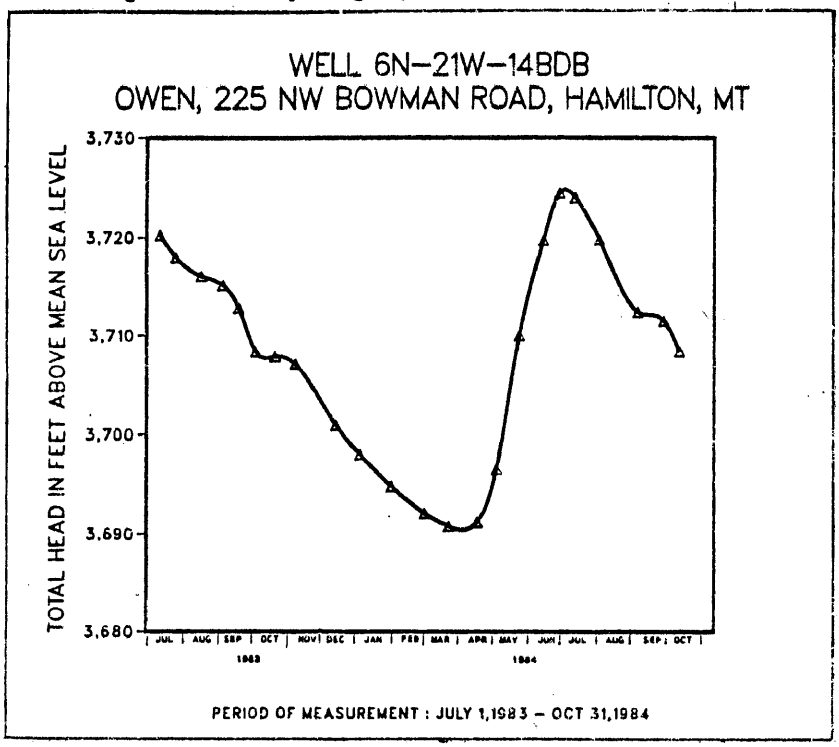
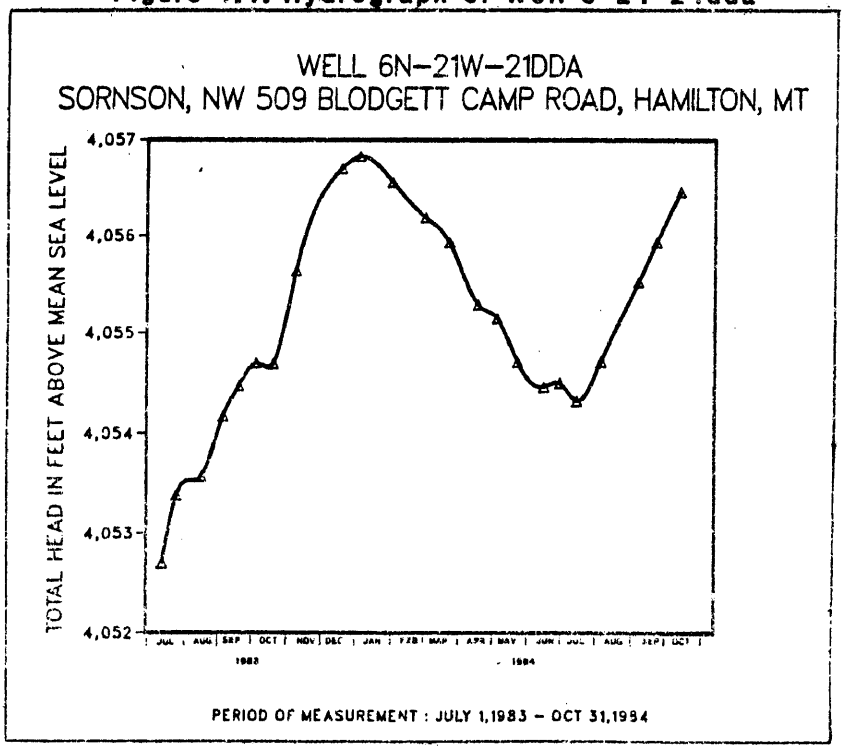


Figure 4.4: Hydrograph of Well 6-21-21dda



fluctuations is exemplified in wells 7-21-35dac and 7-21-25ccd with respective fluctuations of 12.31 and 1.10 ft. These wells, located on the Dutch Hill Terrace aquifers, are approximately a half mile apart.

The observed water level fluctuations of the fourteen wells (Appendices 2.20 - 2.33) located on the westside mid-terrace aquifers range from 16.76 to 0.34 ft. The average fluctuation is 5.42 ft with a 4.23 ft standard deviation. The lowest and highest water levels in these wells occurred in March-April and June-July, respectively, and are exemplified by well 7-20-18abb (Figure 4.5). The hydrographs of water level fluctuations show very similar responses to recharge, both in time and in magnitude. Correlation of the water levels with recharge indicates a great homogeneity of the aquifer materials. That these wells reach their highest levels at the same time as the high-terrace wells, which are closer to the source of recharge, results from a greater transmissivity of the mid-terrace materials.

The water level responses in the westside mid-terrace wells indicate a high degree of hydraulic interconnection with the tributary streams. An example of this ground water surface water interconnection is shown on the hydrograph of well 6-21-23baa (Figure 4.6) on the Blodgett Creek Flats aquifer. The hydrograph indicates a sudden and dramatic decline in the general upward water level trend between June 14 and September 28, 1984, the dropoff being most likely a response to an upgradient surface irrigation diversion.

The observed water level fluctuations of the nine wells (Appendices 2.34 - 2.42) monitored on the Corvallis-Floodplain and on the eastside Hamilton aquifers fall into two distinct categories. The

Figure 4.5: Hydrograph of Well 7--20-18abb

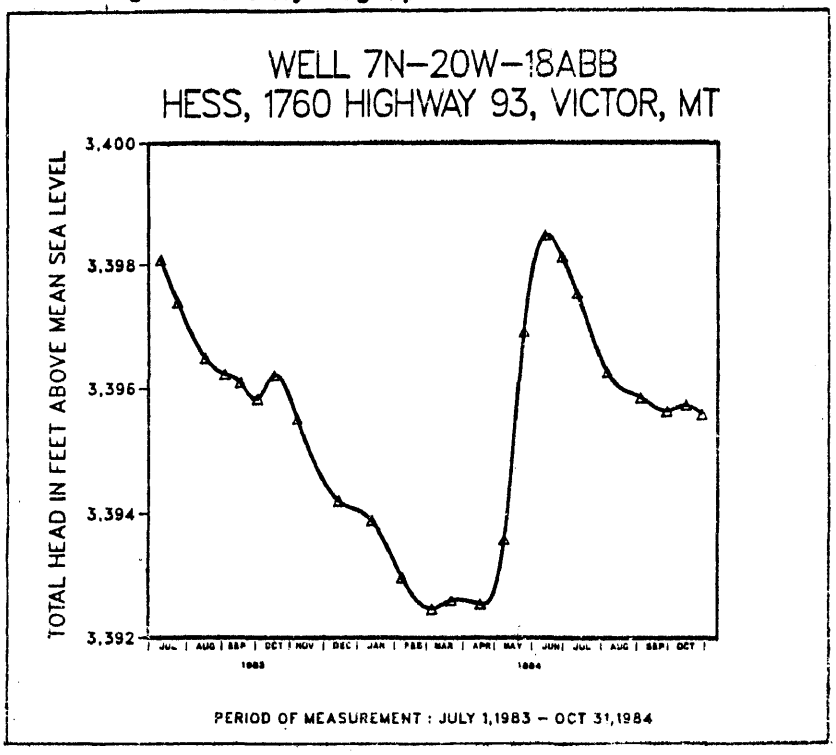
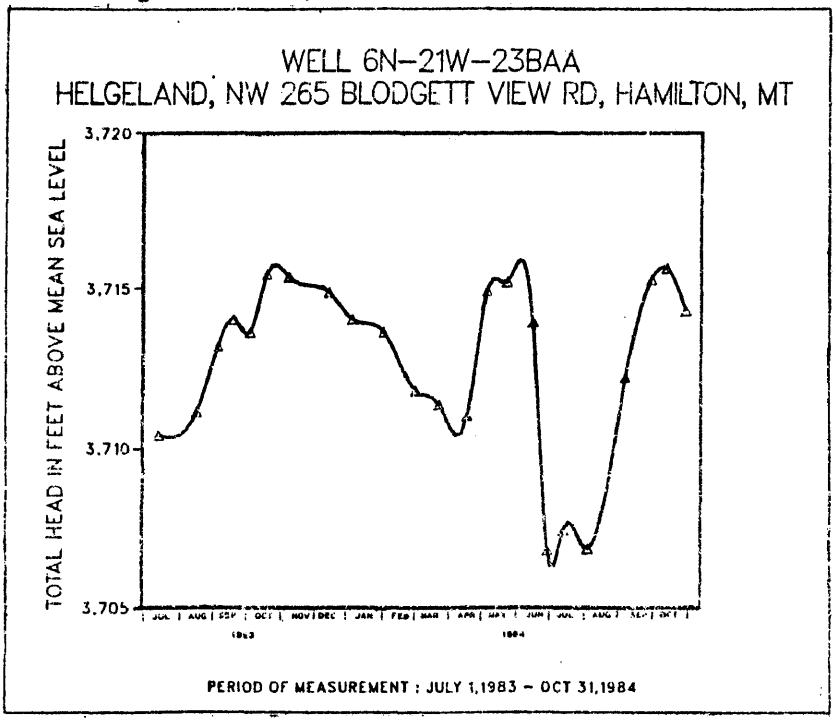


Figure 4.6: Hydrograph of Well 6-21-23baa



four monitored wells located on the Corvallis-Floodplain aquifer exhibit water level fluctuations ranging from 5.53 to 2.65 ft, with an average fluctuation of 3.83 ft and a standard deviation of 1.22 ft. These wells experienced their lowest and highest water levels, respectively, in late February-early April and June. Water level fluctuations are slight because the valley serves as a discharge area for a large watershed. Well 6-21-12dbd is located the closest to the river of all monitored wells. The hydrograph (Figure 4.7) shows recharge related directly to river stage between mid-May and mid-June, 1984.

The five wells located on the eastside Hamilton aquifer and the Willow Creek extension of the Corvallis-Floodplain aquifer are topographically higher and farther from the Bitterroot River. Thus, they are less influenced by river recharge. The range of water level fluctuations in these five wells varies from 13.71 to 7.61 ft, the average fluctuation is 10.58 ft and the standard deviation is 2.19 ft. These wells experience their lowest and highest water levels respectively in May and late summer-early autumn and are illustrated by well 6-20-4adc (Figure 4.8). The wells are partially dependent on baseflow recharge from the eastside, high-terrace, Tertiary aquifers and on recharge from nearby irrigation canal seepage.

The observed water level fluctuations in nineteen wells (Appendices 2.43 - 2.61) monitored on the eastside, high-terrace, Tertiary aquifers are very consistent in the timing of their rise and decline. Water level fluctuations range from 27.70 to 1.98 ft, the average fluctuation is 10.67 ft, and the standard deviation is 7.31

Figure 4.7: Hydrograph of Well 6-21-12dbd

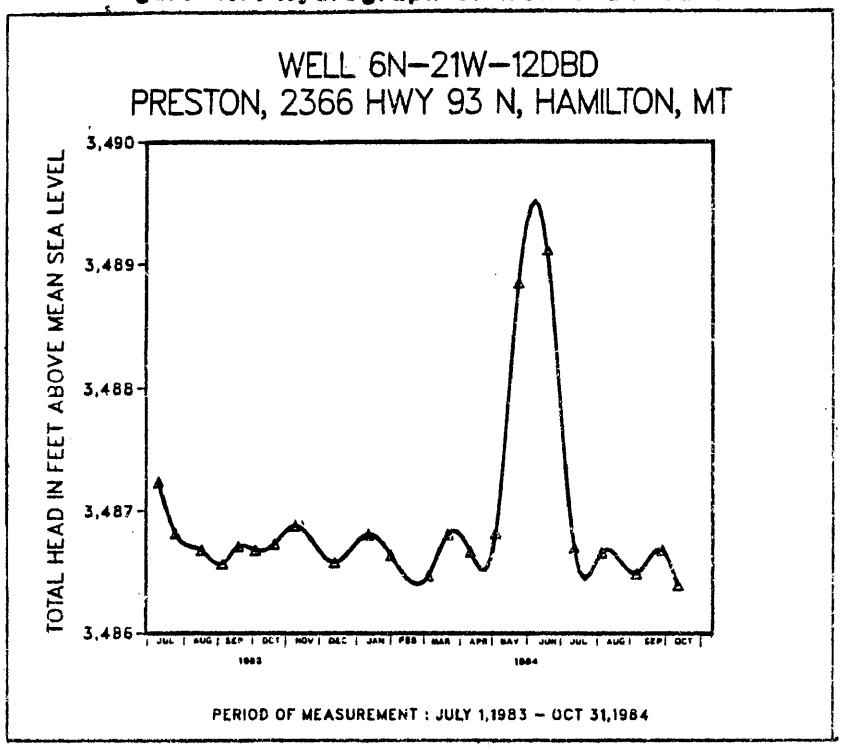
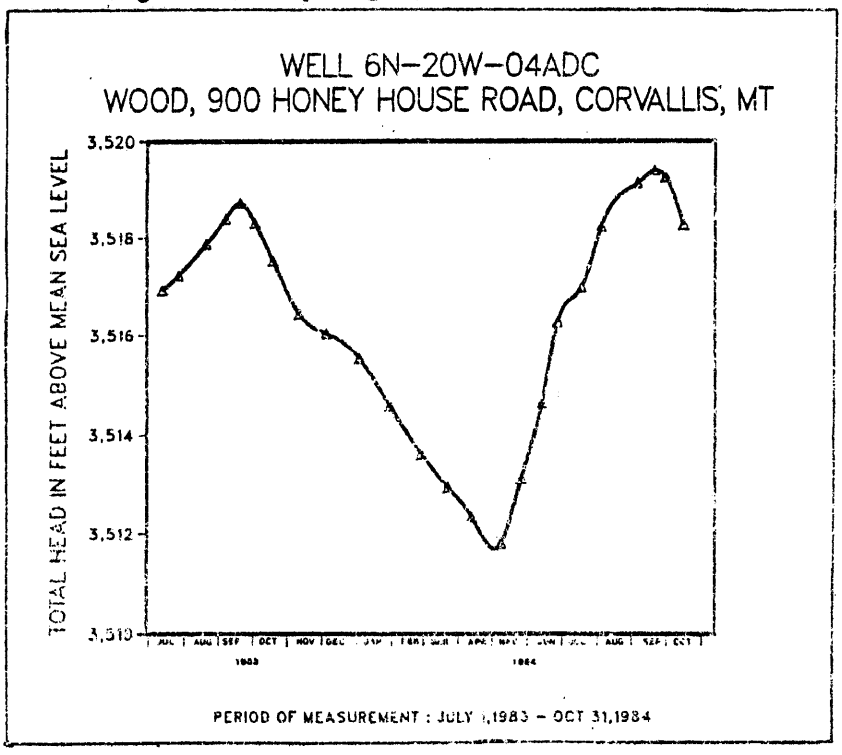
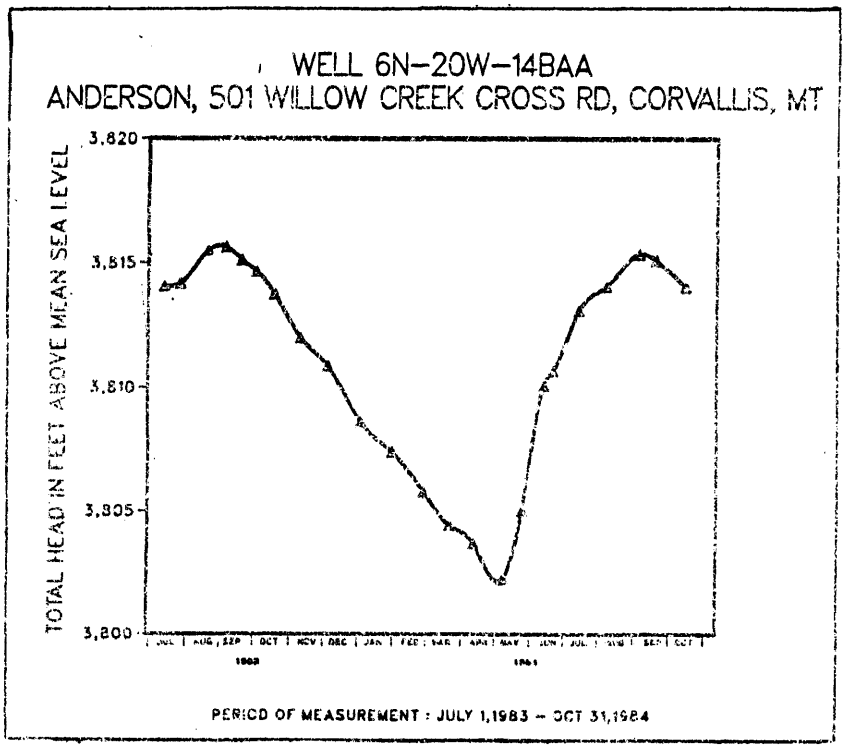


Figure 4.8: Hydrograph of Well 6-20-4adc



ft. Most wells experienced lowest levels in May and highest in late-September to early October, as illustrated by well 6-20-14baa (Figure 4.9). Most eastside, high-terrace wells receive recharge from irrigation canals, especially from the Big Ditch canal. Irrigation ditch flow generally begins by mid-May and ceases by late September. The wide variability in recharge response depends on distance of the well from the source of recharge and aquifer heterogeneity.

Figure 4.9: Hydrograph of Well 6-20-14baa



QUANTITY OF GROUND WATER

Transmissivities

Aquifer transmissivities were approximated by multiplying the specific capacity of each well on the well log inventory by an average specific capacity coefficient. Average transmissivity values for each aquifer were then determined. The results of this application are presented for each well in Appendices 1.1 - 1.13. The summary results, which include the means and standard deviations, are presented for each aquifer in Table 4.3.

TABLE 4.3: SUMMARY OF WELL AND AQUIFER PROPERTIES FROM EXAMINATION OF WELL LOG REPORTS

AQUIFER	YIELD (gpm)	SPECIFIC CAPACITY (gpm/ft)		TRANSMISSIVITY (gpd/ft)	
	MEAN	MEAN	ST.DV	MEAN	ST.DV
WESTSIDE QUATERNARY HIGH-TERRACE AQUIFERS					
Fred Burr Ck	14.0	0.49	0.44	750	650
Dutch Hill	11.4	0.79	1.17	1,200	1,750
Blodgett Ck	13.5	0.76	1.24	1,150	1,850
Canyon Ck	13.0	0.89	1.18	1,350	1,750
Sheafman Ck	12.7	0.56	0.40	800	600
WESTSIDE QUATERNARY MID-TERRACE AQUIFERS					
Poverty Flts	17.3	1.03	0.91	1,550	1,350
Mill Ck Flts	17.3	0.98	1.00	1,450	1,500
Bldg Ck Flts	21.7	1.91	2.99	1,850	1,750

QUATERNARY RIVER TERRACE AQUIFERS					
Hamilton	28.9	2.74	3.42	4,250	5,250
Corv-Flodpln	23.7	2.82	3.65	4,250	5,450
EASTSIDE TERTIARY HIGH-TERRACE AQUIFERS					
Quast	17.0	1.02	1.43	1,550	2,150
Hamilton Hgts	16.6	0.69	0.78	1,050	1,200
Frac Bedrock	7.5	0.08	0.13	150	200

The observed specific capacities and calculated transmissivities of the four recognized aquifer categories are compared with results reported by different investigators. Transmissivities calculated from several hundred well log reports were considerably lower than values obtained from aquifer tests. The calculated and measured values do not closely compare because those derived from the well log reports reflect partial penetration and well loss effects.

1) Westside Quaternary High-Terrace aquifers

The average specific capacities of the five westside, high-terrace aquifers range from 0.56 to 0.89 gpm/ft; calculated transmissivities range from 750 to 1,350 gpd/ft. Actual transmissivities may be higher but are probably less than 10,000 gpd/ft.

Hydrometrics (1987) conducted aquifer tests on the Sheafman Creek aquifer for the Town of Pinesdale on four new water supply wells which, along with two preexisting wells, are intended to provide the sole municipal water supply. The six wells, located in NWSW Section 25 T7N R21W, range in depth from 48 to 52 ft. The objectives of these

aquifer tests were to determine hydraulic properties and the feasibility of the well field providing a long-term, sustained yield of 140 gpm. Twenty-four hour aquifer tests, conducted on several wells, yielded constant-rate discharges ranging from 33 to 47 gpm. Resulting transmissivities ranged from 1,000 to 7,800 gpd/ft, with a mean value of 3,240 gpd/ft. Storage coefficients ranged from $2x10^{-3}$ to $3x10^{-5}$ which are lower than expected for an unconfined aquifer.

Calculations were made to determine the theoretical potential of the well field for maintaining a sustained yield of 140 gpm as the average daily municipal demand. Because the transmissivities were low and the well spacings were close, predicted, severe, well interference effects precluded pumping the well field at the anticipated rate. It was concluded that the Sheafman Creek well field had a potential for producing a sustained 75 gpm and that more distant wells were required to fully supply Pinesdale's water demands.

Two factors limit the transmissivity values. These are the abundance of clay throughout the water-bearing strata and the thin, discontinuous nature of these water-producing zones. The hydraulic properties of the westside, high-terrace aquifers are sufficient to supply low yield, rural domestic wells. The properties are poor for high-capacity municipal or irrigation wells.

2) Westside Quaternary Mid-Terrace aquifers

The average specific capacities of the three westside mid-terrace aquifers range from 0.98 to 1.91 gpm/ft. These values contrast with an average of 20 gpm/ft from several wells finished in the mid-terrace glacial outwash (McMurtrey et al., 1972). Calculated transmissivity

values range from 1,450 to 1,850 gpd/ft. A site-specific transmissivity value was determined by Newman (1986) who conducted aquifer testing for a subdivision well in SW Sec 14 T6N R21W on the Blodgett Creek Flats aquifer. He determined aquifer properties and projected drawdowns for various pumping rates. Resulting transmissivities ranged from 20,000 to 25,000 gpd/ft from various analytical methods; credible storage coefficients were not determined.

McMurtrey et al. (1972) conducted aquifer testing on the Mill Creek Flats aquifer and determined a transmissivity value of 25,000 gpd/ft. They also determined an average specific capacity value of 20 gpm/ft which, if multiplied by the average well coefficient term of 1,500 min/day, yields a transmissivity value of 30,000 gpd/ft. This compares favorably with measured transmissivity values.

The westside mid-terrace aquifers are characterized by higher transmissivities than the nearby high-terraces because they are comprised of thicker sequences of coarser, more permeable gravels and sands with lesser amounts of clay within the matrix. The reported values represent excellent potential for domestic water supply and may support limited municipal withdrawals.

3) Quaternary River Terrace aquifers

The average specific capacities of the two river terrace aquifers range from 2.74 to 2.82 gpm/ft. McMurtrey et al. (1972) list average specific capacities of wells on the Corvallis-Floodplain aquifer as 85 gpm/ft. When multiplied by the average coefficient of 1,500 min/day, the resulting transmissivity estimate is 128,000 gpd/ft.

Values of transmissivity calculated from well log reports average 4,250 gpd/ft for the two aquifers. This value contrasts with those of McMurtrey et al. (1972) who conducted aquifer testing as part of their water resources investigation of the Bitterroot Valley. Several tests were conducted on the Corvallis-Floodplain aquifer in Sec 6 T6N R20W and Secs 21, 28, and 32 T7N R20W. Resultant transmissivity values ranged from 130,000 to 280,000 gpd/ft.

These values are believed to be representative of the unconfined, Bitterroot Valley Quaternary river terrace aquifers because similar transmissivity values have been reported for the Beaverhead River alluvium (Botz, 1967) and for the Clark Fork River alluvium in the Missoula Valley (Clark, 1986).

Norbeck (1980) conducted aquifer tests on the Bitterroot floodplain aquifer as part of the Missoula-Bitterroot Valley deep-well uranium exploration project. The objectives of these aquifer tests were to determine the occurrence of deep-lying, high yield, water-bearing zones and the hydraulic properties of these zones. Hole MB-11 was drilled on the Corvallis-Floodplain aquifer in NWNW Sec 18 T6N R20W to a depth of 2,416 ft. Difficulties plauged the drilling operation and aquifer testing was not conducted at this site. However, flows ranging from 75 to 175 gpm from various deep-lying, coarse, arkosic strata were noted.

These reported transmissivities and discharges are favorable to development of irrigation or municipal supplies. High transmissivity values are due to thick sequences of coarse, permeable, saturated gravels and sands.

4) Eastside Tertiary High-Terrace aquifers

The average specific capacities of the two eastside high-terrace aquifers range from 0.69 to 1.02 gpm/ft; calculated transmissivities range from 1,050 to 1,550 gpd/ft. McMurtrey et al. (1972) found specific capacities of wells and transmissivities of the eastside Tertiary aquifers to average about 5 gpm/ft and 7,500 gpd/ft, respectively. This latter transmissivity is reasonable for clay-rich, water-bearing zones and is comparable with measured aquifer properties of Tertiary strata from both the Bitterroot Valley (Norbeck, 1980) and the Helena Valley (Uthman, 1988).

Norbeck (1980) also conducted aquifer testing on the eastside Tertiary terraces. Hole MB-12 was drilled into the Hamilton Heights aquifer in NWNW Sec 14 T6N R20W to a depth of 1,063 ft. For various reasons, three aquifer tests were conducted at this well. Time-drawdown measurements from a 72-hour test yielded transmissivity and storativity values of 1,670 gpd/ft and 4.8×10^{-5}, respectively, whereas recovery data resulted in a transmissivity value of 1,650 gpd/ft. Subsequent aquifer testing yielded transmissivity values ranging from 1,200 to 1,400 gpd/ft and storativity values between $2X10^{-3}$ and $3X10^{-4}$. Specific capacities were 0.8 to 0.9 gpm/ft. It may be concluded that, although deep water-bearing zones are present, the zones are intermittent and thin; their transmissivities and storativities are low, indicating at least semi-confined conditions; and wells finished in these zones would probably exhibit low specific capacities and limited productivities.

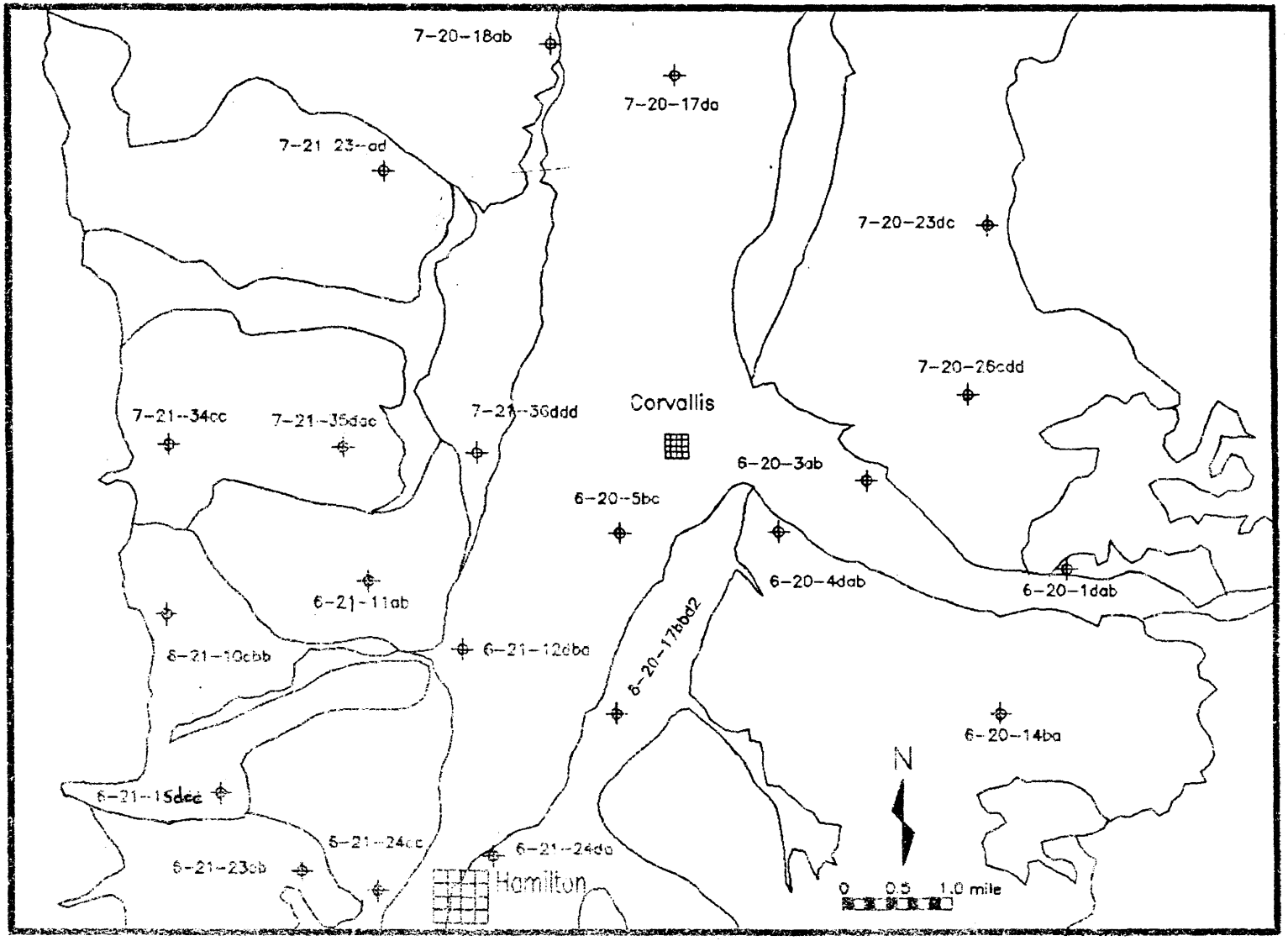
Storage Coefficients

Storage coefficients were estimated from the hydrogeological literature (eg. Johnson, 1967). The following specific yields are judged to be the most representative estimates for the four major unconfined aquifer categories. They include: 1) 0.25 to 0.35 for the valley-center, river terrace aquifers composed of coarse materials, 2) 0.15 to 0.20 for the westside, mid-terrace aquifers composed of intermixed large gravels, reworked grus, and glacial clays, 3) 0.05 to 0.12 for the westside, high-terrace aquifers composed of gravels, grus in various stages of decompositon, and clays derived from weathering, and 4) 0.03 to 0.10 for the eastside aquifers composed of clay-rich, coarse-grained strata intercalated with thick deposits of sandy silts and clays. Storage coefficient estimates of basin-fill alluvium are approximate because of numerous gradations among textures at individual wells and problems in extrapolating such values from well sites to an entire sedimentary basin. Because transmissivity exerts a greater influence on drawdown than the storage coefficient, large errors in specific yield result in small variations in drawdown projections.

QUALITY OF GROUND WATER

A complete water chemistry analysis was conducted by the Montana Bureau of Mines and Geology on filtered, preserved ground water samples from twenty-one selected wells representing all major aquifer units (Figure 4.10) and a surface water sample from the eastside Big Ditch irrigation canal. Results of the MBMG water chemistry analysis are presented in Appendix 3.

Figure 4.10: Distribution of Water Quality Samples



The analyses demonstrate certain trends in water quality distribution. The valley-margin, high-terrace aquifers have the highest specific conductances, total dissolved solids, and hardness values. However, the eastside values are several times greater than those from the west. The data indicate that these values, regardless of location, decrease toward the Bitterroot River. The lowest values, reflecting the best water quality, are associated with the westside outwash terrace aquifers and the westside segment of the Hamilton river terrace aquifer. Water quality parameters significantly increase to the east of the Bitterroot River on the Corvallis-Floodplain aquifer and on the eastside segment of the Hamilton river terrace aquifer. Such an increase indicates a significant contribution of ground water recharge from aquifers sloping from the Sapphire Mountains.

The ground water east of the Bitterroot River is distinctly more mineralized than that west of the river. These chemical distinctions reflect differences in geologic environments through which the ground water has flowed and residence times in the aquifers. Tertiary sediments and the Newland Limestone along the eastside of the valley contain higher proportions of highly-soluble calcium, magnesium, and carbonate. The Quaternary sediments, granites, and gneisses west of the Bitterroot River are more resistant to rapid solution and contain lower amounts of carbonates.

Because water chemistry on each side of the study area reflects distinctly different and unique geologic environments, water quality parameters for each environment were represented by separate, linear

regression equations. Regression equations were determined for TDS on field conductance and on hardness from values derived from all aquifer units on each side of the study area. These equations are presented in Table 4.4 and Figures 4.11 - 4.14.

TABLE 4.4: SUMMARY OF WATER QUALITY REGRESSION EQUATIONS FOR THE WEST AND EAST SIDES OF THE STUDY AREA

	WEST SIDE	EAST SIDE
TDS on FIELD CONDUCTANCE Correlation Coefficient	$Y = 0.655X + 24.245$ $r^2 = 0.927$	$Y = 0.621X + 10.455$ $r^2 = 0.991$
HARDNESS on TDS Correlation Coefficient	$Y = 0.555X - 11.917$ $r^2 = 0.765$	$Y = 0.608X + 28.913$ $r^2 = 0.993$

The value of these models lies in estimating water quality parameters from just the temperature and specific electrical conductance of a ground water sample. TDS and hardness were estimated for the remaining monitored wells from field chemistry data using these equations. These data are presented in Appendices 2.1 - 2.61.

The observed ranges of concentrations of dissolved ions are presented in Tables 4.5 and 4.6 along with the EPA National Interim Primary Drinking Water Standards for maximum contaminant levels. Concentrations in excess of these standards have varying effects on human health. The range of inorganic constituents is generally much lower than the listed EPA standards. There was one well, 6-21-11ab on the Mill Creek Flats aquifer, where iron and manganese exceeded EPA standards. The owner of this well ultimately had to install an expensive, sophisticated, water purification unit to remove not only these cations but also fine sands and sulfurous odors. All other wells

sampled during this investigation yielded chemical values below the maximum permissible concentrations. There is potential for septic tank contamination in high-density areas with coarse soils and high water tables. However, anomalously high values of nitrates, chlorides, and total dissolved solids were not detected in the water chemistry analyses.

TABLE 4.5: SUMMARY OF RANGES OF DISSOLVED IONIC CONSTITUENTS FROM SAMPLED STUDY AREA WELLS AND EPA STANDARDS

	Ca	Mg	Na	K	Fe	Mn	SiO_4	HCO_3	Cl	SO_4	NO_3	F
	(milligrams per liter)											
LOW	3.3	0.7	2.4	0.6	<0.002	<0.001	14.4	20	0.3	0.6	0.06	<0.1
HI	79.6	25.1	39.4	5.5	0.86	0.12	54.8	401	6.5	29.4	1.81	1.1
EPA STD	NO STD	NO STD	500	NO STD	0.03	0.05	NO STD	NO STD	250	250	10	2

TABLE 4.6: SUMMARY OF RANGES OF WATER QUALITY PARAMETERS FROM SAMPLED STUDY AREA WELLS AND EPA STANDARDS

	pH	SPEC COND (μmhos/cm)	TDS (mg/l)	HARDNESS (ppm)
LOW	5.48	34	33.19	11.12
HIGH	10.48	650	396.41	276.35
EPA STD	6-8.5	750	500	<300

Stiff diagrams (Hem, 1970) provide convenient comparisons of the water quality of the area (Figures 4.15 - 4.18). The diagrams characterize most water samples as a calcium bicarbonate water type. However, wells 6-21-23cb, 6-21-11ab, and 6-21- 24cc provide a mixed sodium-calcium bicarbonate water type.

FIGURE 4.11

FIELD CONDUCTANCE AND TDS – WESTSIDE AQUIFERS

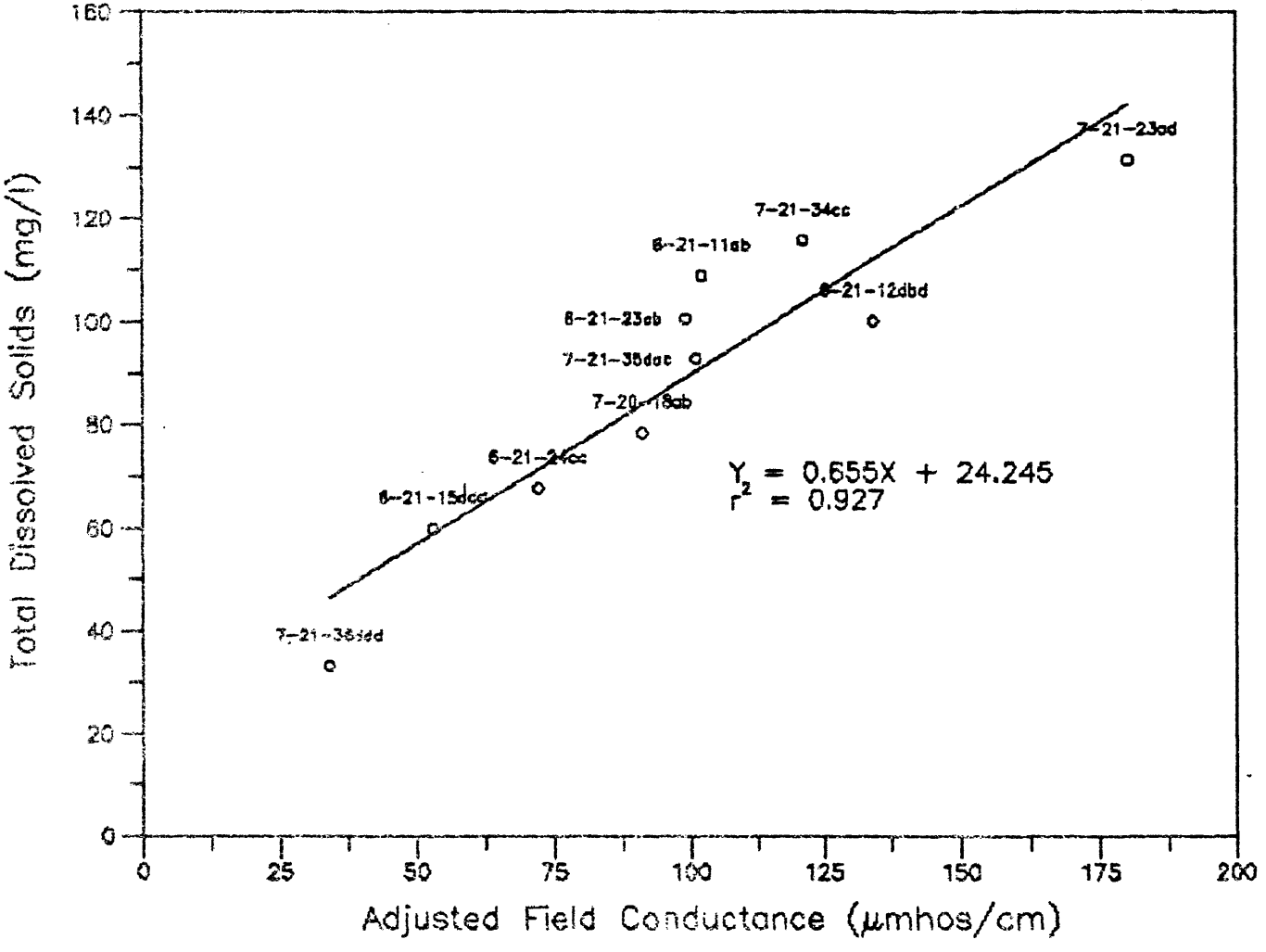


FIGURE 4.12

FIELD CONDUCTANCE AND TDS – EASTSIDE AQUIFERS

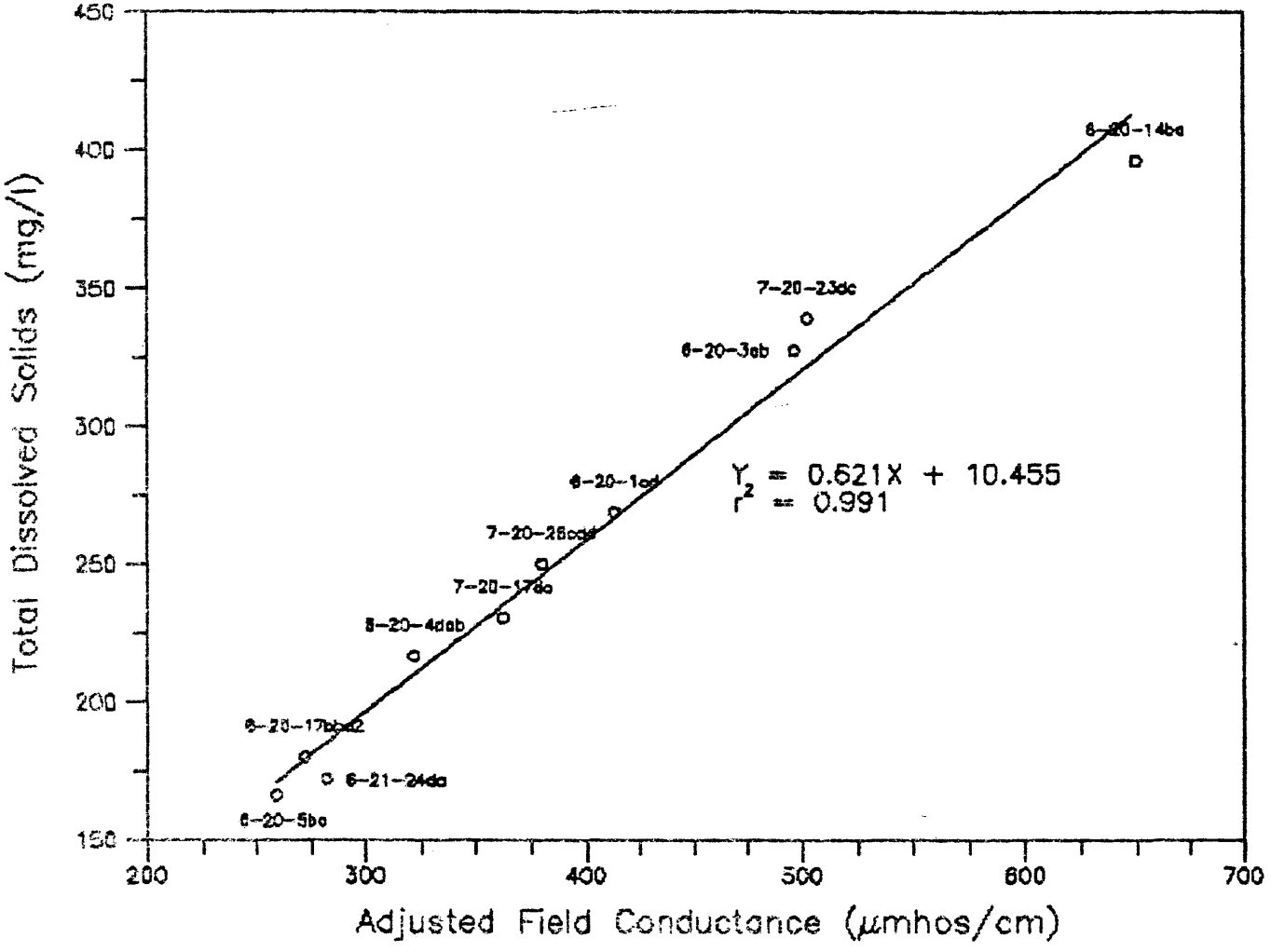


FIGURE 4.13

TDS AND HARDNESS – WESTSIDE AQUIFERS

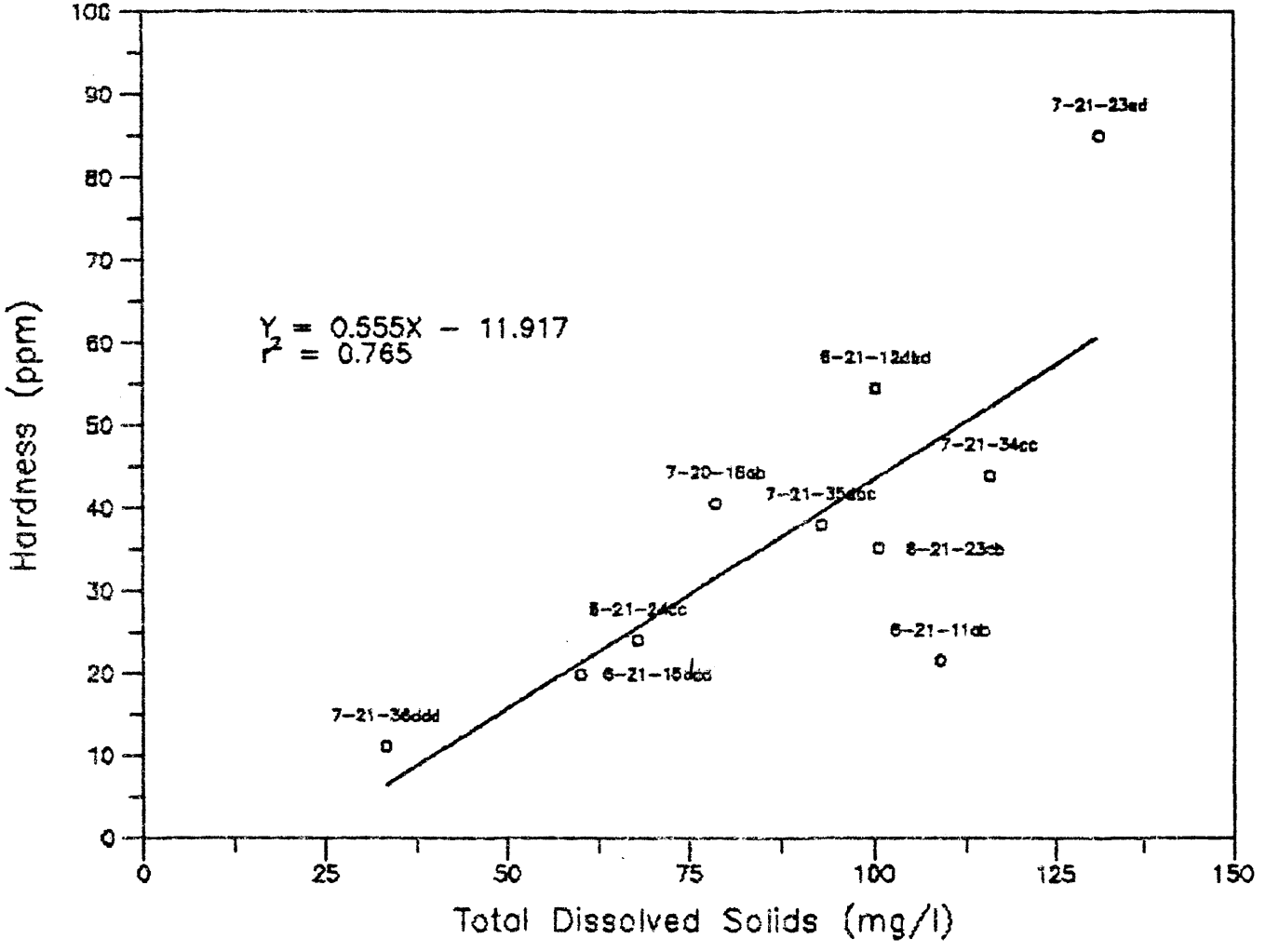


FIGURE 4.14

TDS AND HARDNESS – EASTSIDE AQUIFERS

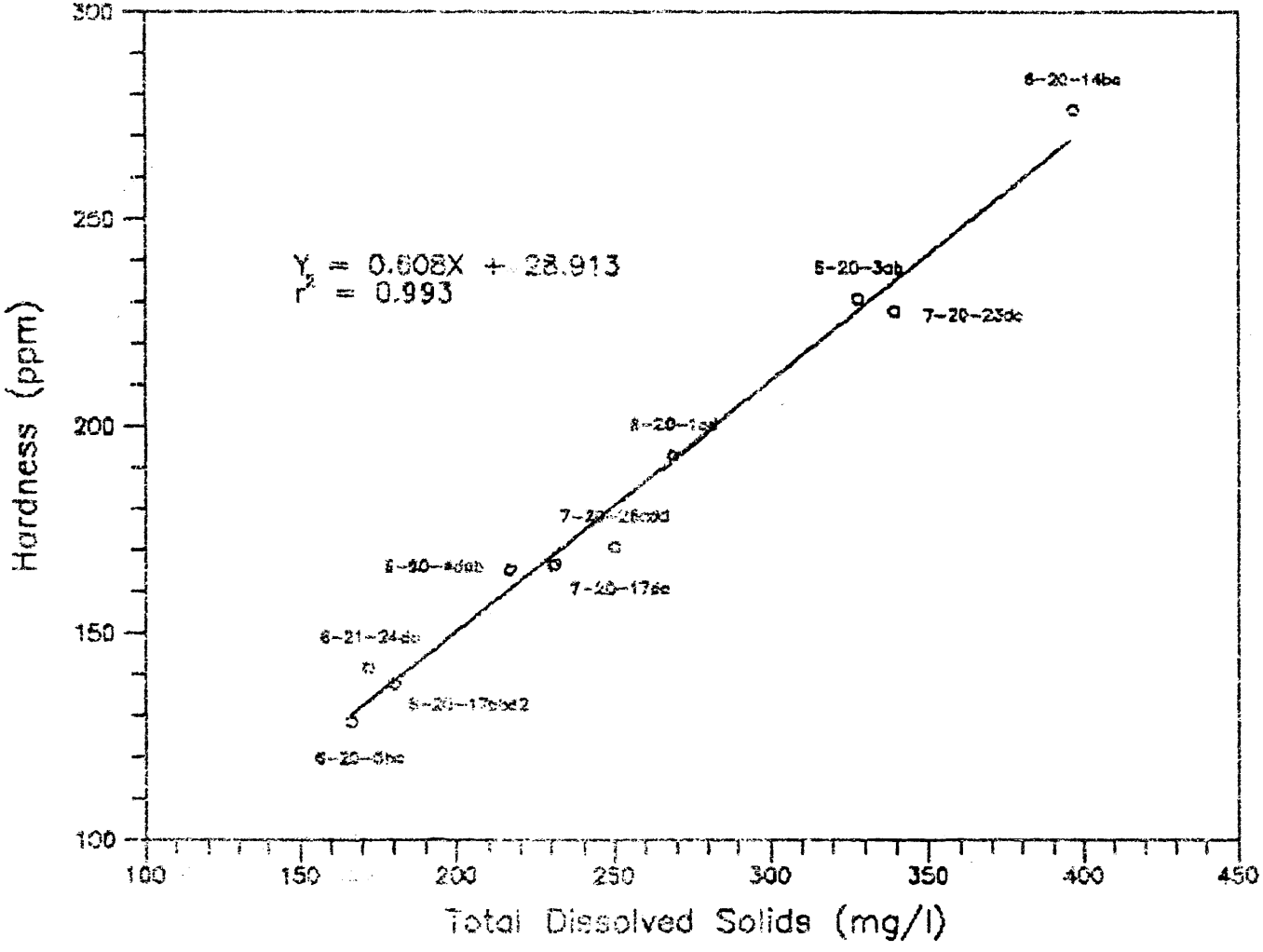


FIGURE 4.15

STIFF DIAGRAMS OF WATER QUALITY
WESTSIDE HIGH TERRACE AQUIFERS
(%meq/l)

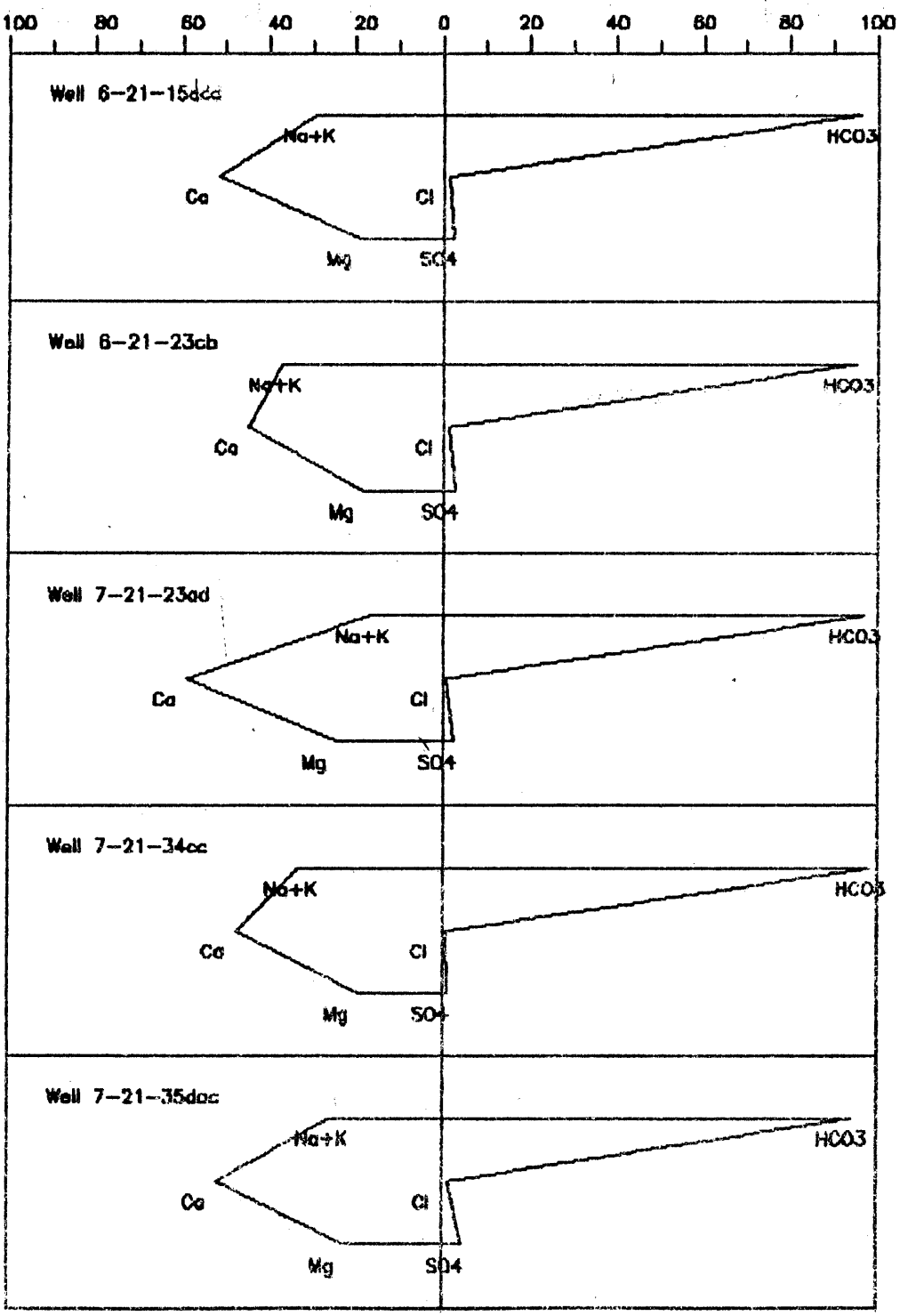


FIGURE 4.16

STIFF DIAGRAMS OF WATER QUALITY
WESTSIDE LOW TERRACE AQUIFERS
(%meq/l)

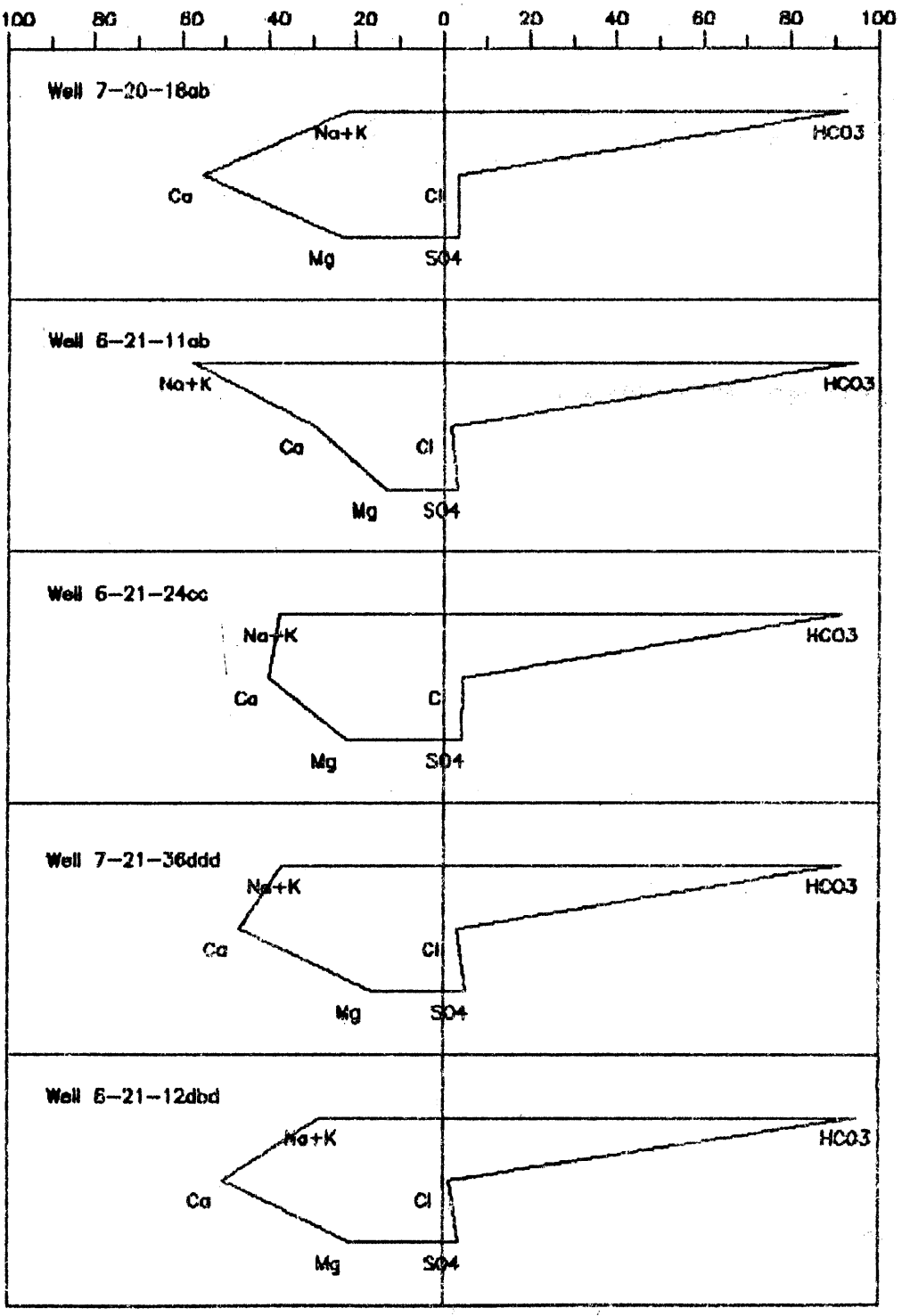


FIGURE 4.17

STIFF DIAGRAMS OF WATER QUALITY
EASTSIDE HIGH TERRACE AQUIFERS
(%meq/l)

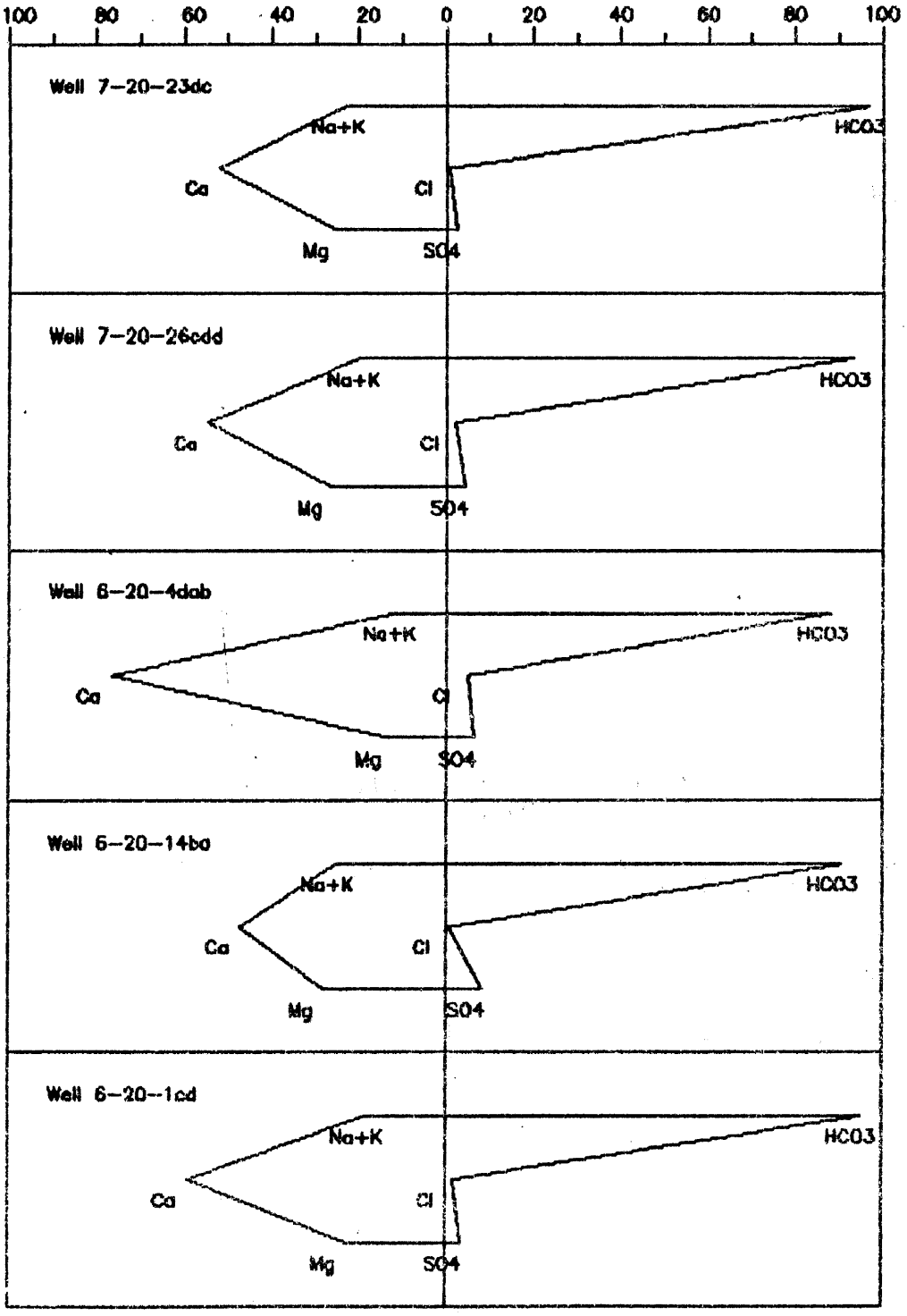
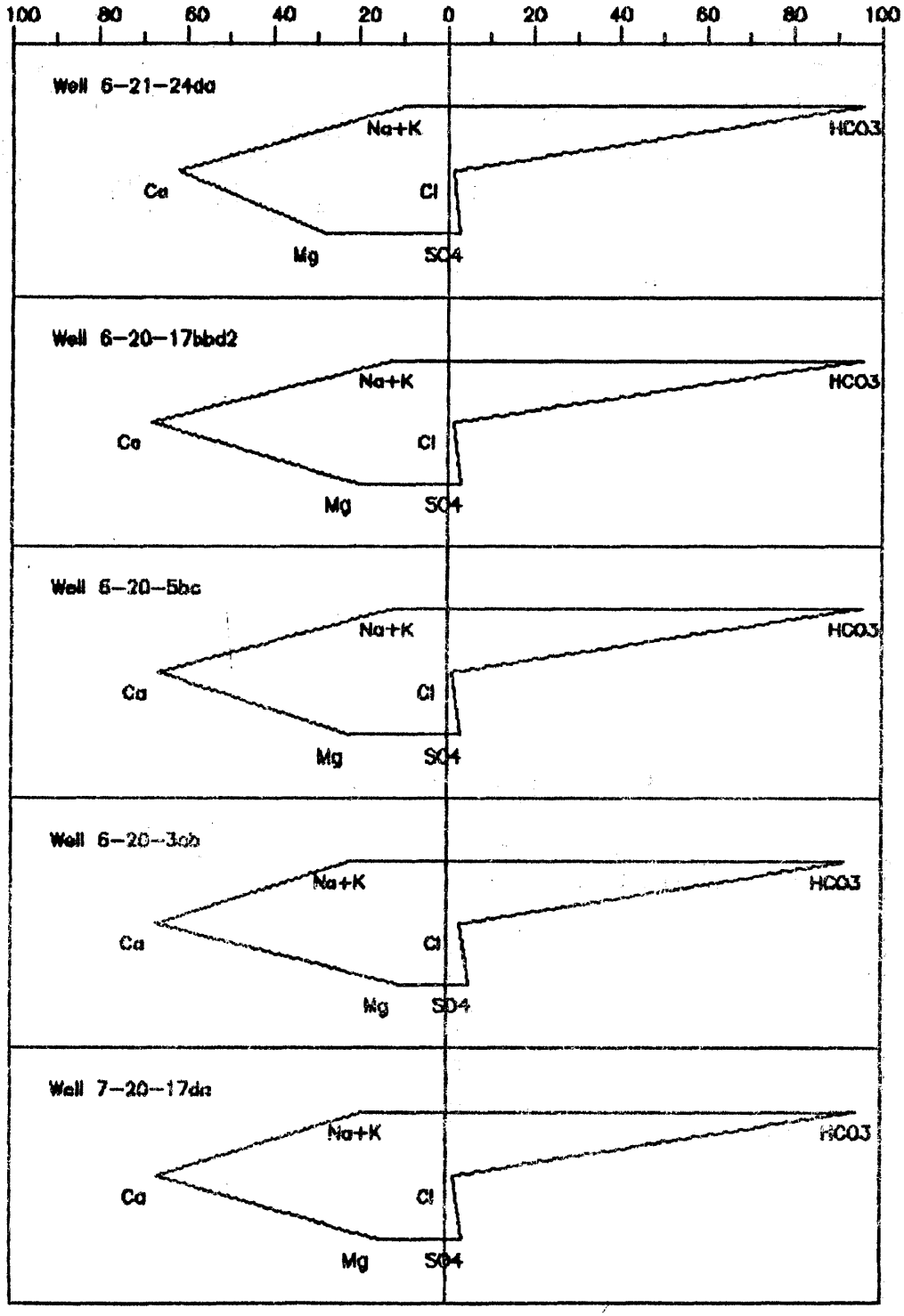


FIGURE 4.18

STIFF DIAGRAMS OF WATER QUALITY
EASTSIDE LOW TERRACE AQUIFERS
(%meq/l)



CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The surficial geology consists of a four-part Cenozoic stratigraphic sequence. The Eocene strata are not exposed. The mid-Tertiary, fine-grained Renova Formation equivalents intermittently outcrop on the eastside terraces and probably underlie the westside terraces as a "blue clay" facies. The late-Tertiary, coarse-grained, Sixmile Creek Formation equivalents overlie the Renova strata on the high eastside terraces. The Tertiary section may be completely removed along the valley floor. Quaternary alluvium predominates in the truncated terraces near the Bitterroot River and forms thick deposits along the valley axis. The westside terraces consist of unconsolidated glacial tills and glaciofluvial outwash.

Ground water is present in various quantities on the thirteen identified aquifers. The water levels average about 75 feet on both the east- and westside high-terraces. Ground water levels rise in lower parts of the valley that serve as discharge areas. The thicknesses of the various aquifer units are unknown; however, most wells penetrate water-bearing units 20 to 150 feet below land surface. The aquifer stratigraphy is basin-fill alluvium which is unconsolidated, generally unconfined, and hydraulically interconnected. There may be local occurrences of semi-confining clay lenses, but these units are discontinuous.

Ground water flows from the high-terrace recharge zones toward the valley center discharge zone where it turns north discharging to the

Bitterroot River. Potentiometric surface fluctuations are variable depending on the distance from the recharge source and hydraulic properties of the aquifer. Observed fluctuations ranged from the extremes of 33 to less than 1 ft over relatively short distances. The high water levels occur in June on the westside and in August for the eastside of the valley. The lowest ground water levels occur from February to May for the entire study area. The westside aquifers are dependent on the tributary streams draining the Bitterroot Range for their recharge, and the eastside aquifers appear to be partially dependent on losses from irrigation canals for their recharge. Discharge and recharge seem to remain in quasi-equilibrium.

Total quantity of available ground water is undetermined but does not appear to present major problems in the lower parts of the valley. Aquifer hydraulic properties are high ($T \geq 100{,}000$ gpd/ft, $S \geq 0.25$) for the valley floor aquifers, which imply a high potential for ground water development near the river. Aquifer hydraulic properties decrease on the mid-level terraces ($T = 20{,}000$ gpd/ft, $S = 0.20$), values that nonetheless imply some potential for high capacity ground water development in these areas. Regardless, water for domestic consumption appears abundant. Aquifer hydraulic properties become marginal on the east- and westside high-terraces ($T \leq 10{,}000$ gpd/ft, $S \leq 0.12$), a condition which implies that domestic availability may be a problem in some areas and that continuing rural development may encounter future problems. There are several documented cases of unsuccessful wells on these high terraces.

Neither the rates or timing of water use nor the present patterns of well density suggest that the consumption of ground water in most areas will create adverse effects from well interference or from overappropriation of water-bearing strata. The present discharge is generally sustainable; however, there have been instances when water drawn from shallow strata could no longer meet required demand, necessitating the replacement or deepening of wells to tap lower water-bearing zones.

There is little possibility that high capacity irrigation wells will be sited on high-terrace aquifers. There is cause for concern, however, if high density housing development should occur on the upper terraces, especially on the eastside above the Big Ditch irrigation canal. Water levels are deep, specific capacities are low, and sustainable water sources are unproven. In addition, there is potential for severe well interference and ground water depletion. Definitive answers to questions of ground water availability, long-term sustained yields, and significant incremental/cumulative impacts lie in a water budget analysis.

Water availability on mid-terraces varies with recharge from the tributary mountain streams. Water is generally available to the relatively isolated, rural domestic wells. High capacity irrigation wells are no threat because irrigable acreage is limited and is adequately watered by diversions from streams. Again, the development of high density, rural subdivisions may prove cause for concern. Although aquifer properties may permit development of a water system,

serious questions would be raised concerning overappropriation of water resources, water quality problems, and legal issues regarding water rights.

The Corvallis-Floodplain aquifer seemingly has such superior hydraulic properties that it may be rated as excellent potential for municipal and irrigation development. Transmissive and storage properties are high; thus, the potential for adverse impacts is low.

Water quality is generally good. Dissolved ionic concentrations fall below nationally recognized standards. Sporadically high concentrations of iron pose water quality problems to westside residents. High total dissolved solids and hardness may create potential problems for eastside residents. Higher transmissivity aquifers with shallow water tables have greater potential for ground water contamination from increased septic tank density, increased herbicide use, and fuel spills.

Hardness would have the most deleterious effect on eastside residents. Hard water has the potential to clog plumbing and water heaters through scale buildup; thus, water softeners are often installed to alleviate this problem. On the westside, high iron and manganese concentrations, derived from granites of the Bitterroot Range, are the most troublesome to water quality. Although the distribution is sporadic, high iron concentrations are common in the aquifers west of the river. Many ground water users resort to a filtering system to prevent the staining of appliances.

The most serious potential for man-caused contamination and deterioration of natural ground water quality would result from an

increased density of septic tanks tied to the development of additional rural homesites and subdivisions. Septic tank leachate is considered to be the most common cause of rural ground water contamination (Yates, 1985). The seepage of effluent from septic tanks represents a threat to potability of ground water and to human health because several waterborne diseases stem from septic effluent. Contamination obviously increases as the density of septic tanks increases so that high densities may ultimately overwhelm the soil's capacity to absorb the effluent.

Recommendations for further hydrogeological investigations in the Bitterroot Valley include a hydrological mass balance determination, quantification of ground water surface water interactions, and the effects of septic systems on various aquifers.

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APPENDIX 1

WELL LOG INVENTORY

The well log inventory is comprised of 526 well log reports. They are grouped relative to major geologic units and sequentially arranged according to descriptive identification numbers. The well identification numbers indicated by bold print mark the wells in which static water levels were monitored from July, 1983 through October, 1984. Each number is based on the geographic location of the well within a township north of the Montana Base Line, a range west of the Montana Principal Meridian, and a section within the township and range. Most well log locations were further subdivided into at least a quarter-section (160 acres). A smaller proportion of well log reports were more precisely located to quarter-quarter-section (40 acres). The fractional section location of the well identification number is designated by lower-case letters following the township, range, and section numbers. Thus, the letters "a", "b", "c", and "d" indicate the northeast, northwest, southwest, and southeast quarters, respectively. The assigned letter designations begin with the quarter-section and proceed to the smallest subdivision, the quarter-quarter-quarter-section (10 acres).

The well log inventory includes the interpreted depth to, thickness of, and lithologic descriptions of water-bearing intervals, range and distribution of well depths, static water levels, pump test levels, and pumping rates. Well log information provided estimates for the hydraulic characteristics of the water wells and aquifer zones stressed by the individual wells.

Well drillers' descriptions identified aquifer intervals as "water-bearing"; otherwise, the static water level, perforated casing intervals, and presence of sand and/or gravel intervals in the lithologic descriptions provided estimates of the water-bearing interval. Geologic material is the textural description of the aquifer materials. Bodies of "dirty" sands, gravels, and boulders comprise the bulk of the aquifer materials although fractured bedrock is water-bearing in a small portion of aquifer along the high terraces. The well log inventory indicates predominant aquifer materials by upper-case letter abbreviations with descriptive lower-case modifiers relating to color, degree of weathering, texture, and degree of homogeneity. The following table indexes aquifer materials to descriptive abbreviations.

INDEX OF GEOLOGIC MATERIALS
ON WELL LOG INVENTORY

S - sand	s - sandy
G - gravel	g - gravelly
B - boulders	c - clay-rich
C - clay	dec - decomposed
St- silt	fr - fractured
Sh- shale	m - mixed
Ss- sandstone	i - intermittent
Gr- granite	b - blue
bdrk- bedrock	br- brown
f - fine	r - red
cr- coarse	w - white
	y - yellow

A static water level measurement, reported to the nearest foot and measured from the top of the well casing, is listed on each well log report. These measurements were recorded during both different

seasonal and annual precipitation periods and at different topographic elevations; thus, they serve neither as an indication of areas of recharge, discharge, or lateral flow nor do they indicate the magnitude of seasonal water level fluctuations. The mean values for each of the aquifers serve as indications of the level at which ground water may be expected in any particular aquifer. The pump rate or yield is the discharge from the well as reported by the driller. Whether measured, estimated, or assumed its value is expressed in gallons per minute. The reported yields most commonly lie within a range of 10-30 gpm which is adequate for domestic consumption.

Well logs report short-duration aquifer tests. The lengths of the pumping are variable; the majority of tests lasted 1-2 hours with some lasting 3 or more hours in length. Specific capacity, which is the ratio of well yield to drawdown, is calculated for each well. The specific capacities of wells on any particular terrace may offer credible, representative estimates of the ability of the aquifer to yield water.

APPENDIX 1.1: WELL LOG INVENTORY FOR FRED BURR CREEK TERRACE AQUIFER

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Interval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
7-21-13cc	Hudson	3590	140	6	110-140	30	SG	105	135	30	30	1.0	3.5	1,500
7-21-14dc1	Pierce	3680	134	6	120-134	14	SG	86	130	44	30	0.68	3.5	1,020
7-21-14dc2	Stern	3685	154	6	110-154	44	SG	114	150	36	30	0.83	3.5	1,245
7-21-14dcd	Cremer	3670	33	6	18-33	15	SGB	18	31	13	20	1.54	2.0	2,210
7-21-14ddc	Roberts	3665	80	6	60-75 75-80	15 5	CG SG	50	70	20	15	0.75	1.0	1,125
7-21-14ddd	Gross	3640	104	6	90-104	14	SG	64	100	36	15	0.42	3.5	630
7-21-21da	Rudolph	4140	157	6	148-157	9	SG	45	130	55	6	0.11	3.0	165
7-21-22aab	Mariana	3920	57	6	45-57	12	SG	30	40	10	10	1.0	1.0	1,500
7-21-22aad	Trouter	3850	160	6	45-80	35	CG	35	100	65	8	0.12	24.0	180
7-21-22ad	Brumder	3875	258	6	120-130	10	SG	117	—	—	24	—	3.0	—
7-21-22bc1	Todd	4060	59	6	42-59	17	SG	21	54	33	12	0.36	4.5	540
7-21-22bc2	Schakis	4100	100	6	45-100	55	CS	27	90	63	—	—	24.0	—
7-21-22bdd	Evans	3990	82	6	35-42 75-82	7 7	SG SG	20	50	30	20	0.67	2.0	1,005

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capecity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
7-21-22c1	McCray	4000	256	6	206-256	50	G	156	251	95	1.5	0.02	1.5	30
7-21-22c2	Vandenberg	4010	129	6	47-51	4	SG	20	95	75	3	0.04	3.0	60
					85-95	10	sSh							
7-21-22c3	Vandenberg	4000	520	6	230-238	8	G	193	440	247	3	0.01	3.0	15
					475-480	5	G							
7-21-22ca	Schmiekle	3990	110	6	88-93	5	CG	77	107	30	10	0.33	2.0	495
7-21-22dbc	Bishop	3950	208	6	195-208	13	CS	145	204	59	5	0.08	2.0	120
7-21-23a1	Pederson	4020	96	6	80-96	16	SG	76	90	14	20	1.43	3.0	2,145
7-21-23a2	Gibson	3675	116	6	80-116	36	SG	72	114	42	15	0.36	2.0	540
7-21-23ac	Orndorff	3710	137	6	129-133	4	SG	83	117	34	10	0.29	3.0	435
7-21-23acc	Briske	3715	120	6	110-120	10	crS	100	119	19	10	0.53	1.0	795
7-21-23acd	Bede	3705	157	6	120-140	20	CG	95	140	45	15	0.33	2.0	495
					150-157	7	SG							
7-21-23ad	Olson	3680	159	6	120-159	39	iCSG	102	150	48	8	0.17	2.0	255
7-21-23bbc	Shirley	3810	215	6	208-215	7	SG	186	210	24	10	0.42	24.0	630
7-21-23bc	Foley	3755	160	6	115-160	45	CG	105	150	45	10	0.22	1.5	330

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
7-21-23bd	Samsel	3725	134	6	120-134	14	SG	113	130	17	10	0.59	24.0	885
7-21-23cea	Johnson	3700	140	6	50-80	30	B	40	120	80	10	0.13	1.5	195
					120-140	20	G							
7-21-23cc1	Schnee-berger	3690	61	6	35-61	26	SG	35	60	25	15	0.60	1.5	900
7-21-23cc2	Kippen-stein	3680	80	6	15-80	65	SG	15	60	45	30	0.67	2.0	1,005
7-21-24bbb	McCrimmon	3570	44	6	38-44	6	SG	4	42	38	30	0.79	1.0	1,185
7-21-24cd1	Cook	3510	69	6	59-69	10	CSG	48	67	19	10	0.53	3.0	795
7-21-24cd2	Deremiah	3570	122	6	48-50	2	SG	36	100	64	20	0.31	1.0	465
					110-120	10	SG							
7-21-24dc	Hern	3490	71	6	50-71	21	SG	50	60	10	15	1.50	1.0	2,250
7-21-25b	Jones	3490	55	6	40-55	15	SG	35	56	21	—	—	—	—
7-21-25bab	Tuttle	3530	85	6	80-85	5	G	60	75	15	12	0.80	1.5	1,200
7-21-25bbd	Locatelli	3560	120	6	115-120	5	S	65	105	40	8	0.20	1.5	300
7-21-25bda	Winters	3480	150	6	90-120	30	S	80	145	65	10	0.15	1.5	225
					140-150	10	S							

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
7-21-25bd	Chontos	3490	105	6	100-105	5	S	60	85	25	10	0.40	1.0	600
7-21-26a	Holt	3690	158	6	133-158	25	CSGB	133	219	86	30	0.35	4.0	525
7-21-26aa	Brandbo	3700	151	6	128-151	33	SG	128	140	12	20	1.67	0.5	2,505
7-21-26aac	Dodson	3680	275	6	160-220	60	S	200	255	55	8	0.15	2.0	225
					265-275	10	S							
7-21-26ab	Brandbo	3710	156	6	135-156	21	SG	128	151	23	20	0.87	12.0	1,305
7-21-26bad	Alarcon	3660	112	6	70-112	42	SGB	70	—	—	18	—	2.0	—
7-21-27aab	Quinn	3750	174	6	168-169	1	ibCG	44	170	126	8	0.06	2.0	90
7-21-27ab	Hendricks	3830	300	6	260-280	20	GB	158	240	82	7	0.09	2.0	135
7-21-27abb	O'Gier	3900	310	6	210-310	100	iCSGB	110	300	190	8	0.04	12.0	60
7-21-27bbb	Olson	3920	150	6	36-45	8	SG	20	145	125	5	0.04	1.0	60
					53-61	8	CS							
					64-65	1	SG							
					135-150	15	SG							

APPENDIX 1.2: WELL LOG INVENTORY FOR DUTCH HILL TERRACE AQUIFER

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Totel Depth (ft)	Well Dia. (in)	Aquifer Intrvel (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
7-21-25cc	Boothe	3600	78	6	60-78	18	StS	53	70	17	15	0.88	1.0	1,320
7-21-25ccd	Frank	3520	101	6	54-101	47	iCSG	54	96	42	15	0.36	2.0	540
7-21-26c	Minch	3730	120	6	80-120	40	iCSG	30	70	40	8	0.20	48.0	300
7-21-26dcc	Carrard	3705	126	6	105-120 120-125 125-126	15 5 1	gS S SG	100	125	25	12	0.48	1.5	720
7-21-26dd	Royle	3640	193	6	180-190	10	bC, iSG	165	170	5	3	0.60	0.5	900
7-21-27c	Lion Land Dev Co	3960	130	6	84-88	4	Ss	80	125	45	2	0.04	1.0	60
7-21-27cad	Goodrich	3860	42	6	32-42	10	StC	20	40	20	7	0.35	2.0	525
7-21-27d	Fink	3700	125	6	40-125	85	fG	15	125	110	12	0.11	1.0	165
7-21-27dd	Jones	3840	164	6	148-164	16	SG	148	156	8	20	2.50	2.0	3,750
7-21-33acd	Bechteld	4140	560	6	40-140	100	cG	4	540	536	1.5	0.003	2.0	5
7-21-34aa	Jones	3840	187	6	164-187	23	SG	167	184	17	8	0.47	3.5	705
7-21-34ab	Holt	3870	300	6	99-115	16	iCSG	95	110	15	4	0.27	2.0	405

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
7-21-34aba	Anderson	3850	309	6	129-170	41	SG	109	304	195	6	0.03	24.0	45
7-21-34ac	Schumaker	3930	220	6	95-180	85	SG	110	119	9	1	0.11	24.0	165
7-21-34acc	Robertson	3940	190	6	181-188	9	SG	174	185	11	15	1.36	4.0	2,040
7-21-34b	Marle	3900	170	6	43-112	69	Ss	10	170	160	4	0.03	5.0	45
7-21-34cc	Maher	4050	127	6	110-127	17	SGB	100	125	25	10	0.40	3.5	600
7-21-35acd	Thomas	3730	210	6	100-130	30	S	120	180	60	10	0.17	1.5	255
					175-190	15	S							
					204-210	6	SG							
7-21-35b	Hurless	3780	154	6	65-154	89	iCSG	133	150	17	20	1.18	2.0	1,770
7-21-35ba	Fischer	3770	137	6	117-137	20	SG	117	125	8	20	2.50	1.0	3,750
7-21-35bdd	Parker	3790	98	8	70-98	28	SG	32	70	38	200	5.26	2.0	7,890
7-21-35cba	Dearborn	3830	180	6	175-180	15	SG	165	175	10	7	0.70	2.0	1,050
7-21-35cbb	Fullerton	3860	171	6	160-171	11	SG	150	165	15	15	1.00	2.5	1,500
7-21-35cb	Myers	3850	170	6	140-170	30	SG	120	150	30	12	0.40	1.5	600
7-21-35dac	Wallece	3720	127	6	100-108	8	Ss	96	102	6	20	3.33	2.0	4,995
					126-127	1	cS							

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
7-21-35dbc1	Forbes	3760	280	6	140-160	20	B	150	240	90	30	0.33	1.5	495
					180-200	20	S							
					275-280	5	SG							
7-21-35dbc2	Hall	3770	280	6	160-180	20	CG	160	240	80	12	0.15	1.5	225
					215-220	5	SG							
					230-235	5	S							
					240-245	5	SG							
					260-270	10	S							
7-21-35dbc3	Hartel	3770	260	6	230-260	30	ClSG	170	220	50	15	0.30	1.5	450
7-21-35dc1	Maier	3725	250	6	70-80	10	G	85	225	140	8	0.06	1.0	90
					110-200	90	SG							
7-21-35dc2	Maier	3730	140	6	40-80	40	crSG	85	140	55	12	0.22	1.0	330
7-21-36bb	Garnett	3520	100	6	92-100	8	SG	86	—	—	10	—	1.0	—
6-21-2ba	Edens	3786	85	6	50-85	35	SG	81	—	—	20	—	2.0	—

APPENDIX 1.3: WELL LOG INVENTORY FOR BLODGETT CREEK TERRACE AQUIFER

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
6-21-4dd	Bowman	4190	145	6	80-145	65	SG	95	142	47	3	0.06	2.0	90
6-21-9da	Polichek	4100	412	6	380-412	32	frGr	FLOWS	408	—	8	—	2.0	—
6-21-9daa	Pokorny	4080	260	8	120-260	140	frGr	50	240	190	15	0.08	3.0	120
6-21-9dda1	Waln	4060	700	6	180-700	520	frGr	—	680	—	3	—	2.0	—
6-21-9dda2	McLaughln	4040	180	6	80-100	20	G	16	150	134	1	0.008	—	12
					160-180	20	G							
6-21-10ba	Cole	3880	123	7	105-123	18	SG	10	70	60	10	0.17	5.0	255
6-21-10ca	Dunbar	3860	40	6	38-40	2	SG	18	25	7	20	2.86	2.0	4,290
6-21-10cbb	Piatt	4030	600	6	330-440	110	G	215	570	355	10	0.03	2.0	45
					480-580	100	frGr							
6-21-10cdc	Benish	3920	140	6	45-47	2	SG	51	135	84	8	0.10	2.0	150
					130-140	10	SG							
6-21-10dd	Lilyquist	3790	40	6	40-60	20	B	40	70	30	8	0.27	2.0	405
					60-85	25	G							
6-21-10ddd	Pollard	3790	240	6	150-157	7	G	90	215	125	20	0.16	1.5	240
					212-240	28	G							

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
6-21-11cb	Williams	3707	42	6	30-40	10	SG	16	30	14	6	0.43	1.5	645
					40-42	2	G							
6-21-11dcd	Boulter	3710	95	6	80-85	5	S	67	84	17	12	0.71	1.5	1,065
					90-95	5	G							
6-21-14b1	Buell	3700	106	6	83-106	23	SGB	83	102	19	20	1.05	2.0	1,575
6-21-14b2	Buell	3740	108	6	90-105	15	SG	72	100	28	15	0.54	2.0	810
6-21-14ba	Smith	3690	240	6	62-69	7	G	80	120	40	20	0.50	2.0	750
					160-162	2	G							
6-21-14bab	Holzer	3750	85	6	36-85	49	SGB	36	80	44	50	1.14	2.0	1,710
6-21-14bb	Tallent	3810	100	6	60-80	20	SG	55	80	25	6	0.24	2.0	360
					84-95	11	G							
6-21-14bbb1	Pollard	3700	160	6	75-110	35	CG	56	150	94	2	0.02	1.5	30
6-21-14bbb2	Pollard	3680	280	6	200-240	40	G	70	265	195	6	0.03	2.0	45
6-21-14bc	Sample	3840	99	6	86-99	13	SG	76	96	20	15	0.75	2.5	1,125
6-21-14bd	Owen	3780	110	6	100-110	10	SGB	85	95	10	15	1.50	3.0	2,250
6-21-14bdb	Owen	3780	90	6	78-90	12	CG	65	75	10	10	1.00	2.0	1,500
6-21-15ada1	Pellant	3840	111	6	83-111	28	SGB	83	91	8	50	6.25	0.5	9,375

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
6-21-15ada2	Giles	3850	300	6	100-160	60	G	90	170	80	5	0.06	2.0	90
6-21-15adb	Danelz	3845	155	6	130-155	25	G	95	150	55	1	0.02	3.0	30
6-21-15cbd	Centers	4080	115	6	110-115	5	SGB	94	105	11	15	1.36	12.0	2,040
6-21-15dcc1	Greyson	3910	120	6	60-100	40	CG	55	75	20	10	0.50	1.5	750
6-21-15dcc2	Pickart	3900	77	6	60-77	17	SG	40	70	30	30	1.00	2.0	1,500
6-21-15dcc3	Huston	3900	80	6	35-80	45	GB	35	65	30	12	0.40	1.5	600

APPENDIX 1.4: WELL LOG INVENTORY FOR CANYON CREEK TERRACE AQUIFER

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
6-21-21a	Larsen	4400	200	6	98-100	2	SG				DRY			
					142-143	1	SG							
6-21-21add	Bergtson	4160	180	6	160-180	20	iGiC	97	165	68	6	0.09	2.0	135
6-21-21ccb	Rapp	4700	300	6	280-300	20	G	70	285	215	5	0.02	2.0	30
6-21-21d	West	4170	225	6	78-89	11	SG	85	—	—	—	—	—	—
					114-130	16	G							
					185-225	40	G							
6-21-21dad	Olson	4100	55	6	41-50	9	SG	20	52	32	12	0.38	2.0	570
6-21-21dcc	Hand	4130	81	6	50-81	31	SG	60	75	15	7	0.47	1.0	705
6-21-21dd	Sornson	4125	81	6	64-81	17	iSG	64	78	14	8	0.57	6.0	855
6-21-22ad	Smith	3930	57	6	31-37	6	G	31	50	29	7	0.24	4.0	360
					47-53	6	CSG							
6-21-22b1	Dudney	4070	119	6	15-119	104	GBiC	25	119	94	10	0.11	1.0	165
6-21-22b2	Dudney	4080	136	6	135-136	1	CG				DRY			
6-21-22bc	Pease	4100	110	6	18-21	3	St	89	104	15	8	0.53	1.0	795
					42-61	19	sC							
					106-110	4	SG							

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
6-21-22dcc	Erickson	3935	105	6	50-60	10	B	40	85	45	15	0.33	1.5	495
					100-105	5	SG							
6-21-23c1	Fagerstrom	3840	100	6	18-19	1	S	88	95	7	12	1.71	1.0	2,565
					98-100	2	SG							
6-21-23c2	Lein	3810	128	6	28-35	7	GB	90	108	18	18	1.00	1.0	1,500
					65-95	30	G							
					120-128	8	SG							
6-21-23c3	Morris	3810	145	6	135-145	10	G	90	130	40	12	0.30	1.5	450
6-21-23c4	Likey	3700	106	6	80-106	26	SG	86	98	12	20	1.67	0.5	2,505
6-21-23c5	Anacker	3810	133	6	110-129	19	SG	112	116	4	20	5.00	2.0	7,500
6-21-23cab	Hanna	3830	260	6	100-140	40	CG	85	180	95	20	0.21	1.5	315
					220-260	40	G							
6-21-23cb	Pease	3860	160	6	15-20	5	G	95	150	55	10	0.18	2.0	270
					140-160	20	CG							
6-21-23cc	Evans	3840	113	6	96-113	17	SG	78	98	20	30	1.50	5.0	2,250
6-21-23cd	Bennett	3740	100	6	60-65	5	S	65	75	10	12	1.20	2.0	1,800
					80-90	10	SG							

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
6-21-23d	Fagerstrom	3850	134	6	78-110	32	CG	83	100	17	12	0.71	3.0	1,065
					110-114	4	CG							
					114-131	17	SG							
					131-134	3	CG							
6-21-26ba1	Latta	3780	85	6	60-63	3	G	30	70	40	9	0.23	1.5	345
					80-82	2	S							
6-21-26ba2	Arechy	3760	80	6	50-80	30	G	60	70	10	10	1.00	2.0	1,500
6-21-26bac	Arechy	3760	200	6	55-200	145	G	55	180	125	8	0.06	2.0	90
6-21-26bbc1	Linardi	3750	60	6	40-57	17	SG	40	45	5	20	4.00	3.0	6,000
6-21-26bbc2	Ekin	3790	56	6	36-45	9	G	36	—	—	20	—	2.0	—
6-21-27a	Johnson	3830	59	6	35-46	11	SG	16	49	33	15	0.45	2.0	675
6-21-27ada	Mason	3790	56	6	20-40	20	CSG	20	51	31	15	0.48	12.0	720
					40-56	16	SG							
6-21-27bba	Wheeler	4030	126	6	119-122	3	SG	83	95	12	9	0.75	3.0	1,125
					122-126	4	G							

APPENDIX 1.5: WELL LOG INVENTORY FOR POVERTY FLATS AQUIFER

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
7-20-7dcc	Bernard	3420	59	6	45-59	14	SG	29	56	27	25	0.93	2.0	1,395
7-20-18ab	Hess	3421	44	6	22-44	22	SG	22	30	8	20	2.50	1.0	3,750
7-21-10b	Pollard	3880	190	8	105-107	2	SG	50	180	130	2	0.02	1.0	30
					130-146	16	G							
					181-190	10	sG							
7-21-10ccb	Griswold	3825	40	6	30-40	10	G	15	35	20	15	0.75	2.0	1,125
7-21-10cd1	Schueler	3810	50	6	40-50	10	CSG	26	37	11	10	0.91	1.0	1,365
7-21-10cd2	Schueler	3810	160	6	40-50	10	SG	40	70	30	10	0.33	2.0	495
					140-160	20	G							
7-21-10da	Rice	3700	145	6	25-30	5	SG	11	135	124	9	0.07	2.0	105
					60-145	85	bCG							
7-21-10dd	Lane	3790	180	6	120-130	10	G	70	170	100	10	0.10	1.0	150
7-21-11cda	Watz	3650	32	6	10-32	22	SGB	10	23	13	25	1.92	1.0	2,880
7-21-13bbs	Swanson	3610	100	6	55-100	45	SGB	55	90	45	15	0.33	1.5	495
7-21-13bc	Case	3560	29	6	6-29	23	SGB	6	25	19	20	1.05	2.0	1,575
7-21-13cc1	McCabe	3545	125	6	15-125	110	BG	15	125	110	20	0.18	1.0	270

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrvl (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
7-21-13cc2	Raithel	3560	31	6	11-31	20	SGB	11	29	18	50	2.78	1.0	4,170
7-21-13dde	Hochstettler	3475	27	6	13-29	16	SG	6	15	9	20	2.22	1.0	3,330
7-21-14bd	Permenter	3665	32	6	31-32	1	G	17	22	5	12	2.40	2.0	3,600
7-21-14ca	Reed	3665	27	6	7-27	20	SGB	7	21	14	20	1.43	2.0	2,145
7-21-14cab	Jacobson	3655	118	6	78-108 116-118	30 2	SC CSG	68	115	47	10	0.21	1.0	315
7-21-14cac	Carlson	3670	69	6	32-69	37	SG	32	66	34	5	0.15	2.0	225
7-21-15aa1	Simpson	3760	157	6	114-157	43	SG	114	152	38	10	0.26	2.0	390
7-21-15aa2	Martin	3770	32	6	29-32	3	SG	8	24	16	30	1.88	5.0	2,822
7-21-15sce	Laine	3775	29	6	9-29	20	SGB	9	27	18	15	0.83	1.0	1,245
7-21-15bcc	Kenney	3910	280	6	30-80 160-170	50 10	yCB G	80	179	99	1	0.01	2.0	15
7-21-24aa	Lippel	3475	31	6	14-31	17	SG	6	20	14	30	2.14	1.0	3,210
7-21-24ad	Hayes	3462	40	6	5-40	35	SG	5	30	25	30	1.20	1.0	1,800

APPENDIX 1.6: WELL LOG INVENTORY FOR MILL CREEK FLATS AQUIFER

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
6-21-1	Monk	3535	40	6	18-40	22	SGB	18	30	12	30	2.50	2.0	3,750
6-21-1ba	Fullerton	3525	45	6	35-45	10	SG	25	35	10	5	0.50	2.0	750
6-21-1baa	Fullerton	3520	32	6	20-32	12	SG	20	21	1	15	15.00	2.0	22,500
6-21-2bc	Fournier	3760	60	8	52-60	8	SG	23	45	22	22	1.00	1.0	1,500
6-21-2cb1	Trimber	3750	78	6	68-78	10	SG	40	75	35	20	0.57	2.0	855
6-21-2cb2	Champion	3750	53	6	25-53	28	SGB	25	50	25	30	1.20	2.0	1,800
6-21-2cda	Toole	3690	112	6	40-50 96-112	10 16	StSG SyCG	34	73	39	7	0.18	4.0	270
6-21-2cdb	Wicks	3710	40	6	12-40	28	GB	12	35	23	10	0.44	1.0	660
6-21-2dd	Hilton	3640	55	6	50-55	5	S	22	35	13	12	0.92	1.0	1,380
6-21-3[1]	Lockhart	3810	92	6	47-48 59-60 64-91	1 1 26	S S G	30	84	54	5	0.09	2.0	135
6-21-3[2]	Pearson	3880	84	6	7-24	17	SGB	7	40	33	20	0.61	4.0	915
6-21-3ab	Baker	3870	61	6	8-61	53	tCSG	7	25	18	10	0.56	0.5	840

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
6-21-3ac	Cargile	3860	51	6	12-51	39	SGB	12	45	33	12	0.36	1.5	540
6-21-3acb	Benson	3870	45	8	26-28	2	GB	20	35	15	25	1.67	1.0	2,505
6-21-3b	Oberloier	3930	66	6	52-58	6	SGB	38	63	25	25	1.00	24.0	1,500
6-21-3ba	Grover	3940	52	6	40-52	12	SB	27	48	21	12	0.57	2.5	855
6-21-3bd	Skelton	3880	106	6	100-104	4	SG	80	96	16	15	0.94	1.0	1,410
6-21-3ca	Weisbeck	3860	42	6	9-17	8	SG	9	15	6	30	5.00	0.25	7,500
					35-42	7	SG							
6-21-3cd	Stephani	3810	320	6			DRY							
6-21-3da1	Hale	3780	38	6	31-38	7	SG	9	35	26	30	1.15	2.0	1,725
6-21-3da2	Hale	3770	39	6	32-39	7	SG	15	35	20	20	1.00	2.5	1,500
6-21-3dbb	Wilson	3840	47	8	13-16	3	CB	13	28	15	12	0.80	2.0	1,200
					25-47	22	SB							
6-21-3dd1	Stein	3760	128	6	108-128	20	SSt	20	80	60	20	0.33	2.0	495
6-21-3dd2	Stein	3770	34	6	4-34	30	SGB	4	20	16	25	1.56	1.0	2,340
6-21-3ddd	Stein	3750	29	6	2-29	27	SGB	2	20	18	20	1.11	0.5	1,665
6-21-11	Peterson	3620	53	6	13-25	12	CB	13	50	37	4	0.11	2.0	165
					45-49	4	G							

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Drew Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
~~6-21-11ab~~	Felton	3630	136	6	75-136	66	bCSG	22	—	—	7	—	48.0	—
6-21-12bd	Trone	3545	400	6	40-70	30	G	20	100	80	25	0.31	2.0	465
					100-270	170	S							

APPENDIX 1.7: WELL LOG INVENTORY FOR BLODGETT CREEK FLATS AQUIFER

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
6-21-13	Landry	3550	68	6	46-68	22	SG	41	50	9	20	2.22	0.5	3,330
6-21-13acb	Pontet	3555	72	6	65-72	7	SG	40	67	27	15	0.56	4.0	840
6-21-13ac	Applebury	3555	64	6	45-64	19	SGB	45	60	15	20	1.33	1.0	1,995
6-21-13ba1	Shiloh School	3557	105	6	45-105	60	SG	45	80	35	40	1.14	2.0	1,710
6-21-13ba2	Hammer	3560	45	6	31-45	14	cSBG	31	40	9	25	2.78	2.0	4,170
6-21-13cc	Johnson	3640	152	6	86-110	24	SG	76	135	59	20	0.34	2.0	510
					140-152	12	S							
6-21-13dbc	Toews	3553	65	6	25-38	13	sC	14	60	46	10	0.22	1.0	330
					38-40	2	SG							
					40-65	25	bCiG							
6-21-23b	Fagerstrom	3775	46	6	8-10	2	SG	4	25	21	50	2.38	3.5	3,570
					17-46	29	SGB							
6-21-23ba1	Murphy	3750	80	6	16-30	14	GB	16	70	54	10	0.19	1.5	285
					55-58	3	G							
					75-80	5	G							

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
6-21-23ba2	Murphy	3730	85	6	16-24	8	SG	15	60	45	40	0.89	1.0	1,335
					32-40	8	SG							
					82-85	3	SG							
6-21-23ba3	Helgeland	3730	205	6	10-55	45	B	7	—	—	30	—	2.0	—
					200-205	5	SG							
6-21-23bd	Ottinger	3715	29	6	4-29	25	SGB	4	25	21	20	0.95	2.0	1,425
6-21-23bda	Irwin	3710	33	6	4-33	30	SGB	4	7	3	30	10.0	0.25	15,000
6-21-23d1	Singleton	3815	100	6	23-45	22	GB	9	30	21	10	0.48	1.0	720
					74-76	3	S							
6-21-23d2	Townsend	3590	40	6	22-40	18	GB	22	35	13	8	0.62	1.5	930
6-21-23da1	Wittrock	3640	29	6	5-29	24	SGB	5	24	19	50	2.63	2.0	3,945
6-21-23da2	Vincent	3620	200	6	20-80	60	GB	40	100	60	25	0.42	3.0	630
					100-102	2	G							
					190-200	10	SG							
6-21-23db1	McKinney	3660	42	6	4-42	38	SGB	4	20	16	25	1.56	2.0	2,340
6-21-23db2	McKinney	3660	32	6	3-32	29	SGB	3	15	12	25	2.08	2.0	3,120
6-21-23db3	Robins	3670	48	6	5-48	43	GB	5	20	15	45	3.00	1.0	4,500
6-21-23dc	Rose	3635	32	6	10-32	22	SGB	6	30	24	15	0.63	2.0	945

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
6-21-23dd	Tibbets	3605	20	6	15-20	5	SG	5	20	15	60	4.00	2.0	6,000
6-21-23dda	Farlin	3600	40	6	12-40	28	GB	12	35	23	8	0.35	1.5	525
6-21-23ddd	Maloney	3595	40	6	35-40	5	G	15	38	23	10	0.44	2.0	660
6-21-24ba1	Justus	3570	46	6	25-44	19	tC	21	44	23	12	0.52	1.0	780
					44-46	2	G							
6-21-24ba2	Curdy	3575	62	6	40-62	22	SG	40	55	15	18	1.20	2.0	1,800
6-21-24ba3	Curdy	3580	72	6	60-72	12	SG	47	65	18	18	1.00	2.0	1,500
6-21-24bdd	Ruark	3575	42	6	27-42	15	sCSGB	26	30	4	20	5.00	0.25	7,500
6-21-24c	Kirby	3595	50	6	14-50	36	SGB	14	45	31	10	0.32	1.0	480
6-21-24cb	Blodgett	3605	32	6	10-19	9	B	10	11	1	15	15.00	3.0	22,500
					19-25	6	SG							
6-21-24cc	Hebert	3595	43	6	25-43	18	SGB	25	50	25	15	0.60	1.0	900
6-21-26a1	Secrist	3580	52	6	30-35	5	GB	25	50	25	7	0.28	2.0	420
					50-52	2	G							
6-21-26a2	Cameron	3605	65	6	38-40	2	G	35	60	25	10	0.40	2.0	600
					60-65	5	G							
6-21-26aa1	Sandqust	3590	45	6	12-40	28	GB	12	36	24	15	0.63	1.0	945
					40-45	5	S							

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
6-21-26 aa a2	Saum	3590	58	6	40-50	10	S	40	55	15	10	0.67	2.0	1,005
					50-58	8	G							

APPENDIX 1.8: WELL LOG INVENTORY FOR HAMILTON AQUIFER

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
6-20-4cb	Moeller	3495	70	6	45-50	5	SG	37	63	26	30	1.15	1.0	1,725
					60-70	10	SG							
6-20-4ccb	Moeller	3495	40	6	25-40	15	SG	25	35	10	15	1.50	1.0	2,250
6-20-4ccc1	Gesvoda	3500	70	6	60-70	10	crG	23	30	7	20	2.86	4.0	4,290
6-20-4ccc2	Peterson	3495	50	6	22-50	28	SG	22	45	23	50	2.17	1.0	3,255
6-20-5d1	Marshall	3495	42	6	16-42	26	SG	16	20	4	30	1.50	0.5	2,250
6-20-5d2	Atkins	3495	41	6	15-41	26	SG	10	20	10	20	2.00	1.0	3,000
6-20-5da	Nimmick	3495	40	6	17-40	23	SG	17	—	—	40	—	2.0	—
6-20-5dda	Wernath	3495	40	6	20-40	20	SG	20	35	15	20	1.33	1.5	1,995
6-20-5ddb	McKinney	3495	45	6	8-45	37	SG	8	30	22	25	1.14	1.0	1,710
6-20-5ddd	Reeves	3495	40	6	7-40	33	SG	7	30	23	20	0.87	1.0	1,305
6-20-8[1]	Dye	3515	42	6	41-42	1	S	18	27	9	25	2.78	2.0	4,170
6-20-8[2]	Sheppard	3520	44	6	15-44	29	sG, G, sC, cS	15	18	3	12	4.00	24.0	6,000
6-20-8[3]	Carrol	3515	44	6	14-44	30	CSG	14	24	10	30	3.00	0.25	4,500

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
6-20-8(4)	Spence	3515	115	6	103-110	7	S	85	95	10	30	3.00	1.0	4,500
					110-115	5	S							
6-20-8aa	Dilger	3530	39	6	24-39	15	SG	22	—	—	12	—	24.0	—
6-20-8da	Turner	3515	50	6	27-50	23	CSG	27	45	18	15	0.83	1.0	1,245
6-20-8bb	Gasvoda	3485	140	10	16-140	124	GB	16	100	84	800?	9.52?	3.0	14,280?
6-20-8ca	Krueger	3515	41	7	35-41	6	SG	14	26	12	20	1.67	1.0	2,505
6-20-8d1	Martin	3515	44	6	20-44	24	CG	14	26	12	30	2.50	0.5	3,750
6-20-8d2	Crockett	3495	39	6	23-39	16	SG	23	28	5	35	7.00	2.5	10,500
6-20-8d3	Keyes	3530	39	6	12-39	27	SG	12	38	26	50	1.92	3.0	2,880
6-20-8da1	DeMott	3520	38	6	19-38	19	SGiC	19	30	11	15	1.36	0.5	2,040
6-20-8da2	Frohberg	3500	41	6	20-26	6	SGiC	20	22	2	12	6.00	24.0	9,000
					26-41	15	sG							
6-20-8dac	Hitchell	3530	40	6	10-40	30	SG	10	30	20	20	1.00	1.5	1,500
6-20-8dad	LaTour	3520	40	6	21-40	19	SG	21	37	16	10	0.63	1.0	945
6-20-8db1	Beard	3510	49	6	36-49	13	SG	27	45	18	50	2.78	1.0	4,170
6-20-8db2	Shannon	3515	45	8	40-45	5	SG	22	22	0	80	—	2.0	—

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
6-20-8dbe1	Martin	3515	39	8	25-39	14	cS,S,G	25	33	8	30	3.75	0.25	5,625
6-20-8dba2	Sprachlin	3510	45	6	20-42	22	SG	20	29	9	60	6.67	1.0	10,005
6-20-17abd1	Wanner	3530	105	10	20-80	60	SC	20	90	70	99	1.41	3.0	2,115
					80-105	25	SG							
6-20-17abd2	Wanner	3530	67	8	33-45	12	yS	33	46	13	50	3.85	2.0	5,775
					45-65	20	sC							
6-20-17bb	Ryan	3510	60	6	50-60	10	G	20	60	40	20	0.50	1.0	750
6-20-17bbd1	Ryan	3525	65	6	20-48	28	G	20	45	25	30	1.20	1.5	1,800
					52-65	13	SG							
6-20-17bbd2	Hopin-gardner	3515	60	6	17-40	23	G	17	50	33	20	0.61	1.5	915
					40-60	20	SG							
6-20-18bbc	Ward	3505	40	6	12-20	8	BG	12	30	18	20	1.11	1.0	1,665
					20-40	20	SG							
6-20-18dac	Richards	3525	39	6	12-22	10	sG	8	15	7	25	3.57	0.25	5,355
					22-25	3	cS							
					25-39	14	SGiC							
6-21-1aaa	Dunbar Mill	3490	36	6	18-36	19	SG	15	20	5	25	5.00	12.0	7,500
6-21-1ddb	Blahnik	3495	60	6	8-40	32	G	7	47	40	15	0.38	1.0	570
					40-57	17	SG							

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
6-21-24da	Molyneaux	3540	40	6	20-40	20	G	20	35	15	10	0.67	2.0	1,005
6-21-24daa	Osterbauer	3540	40	6	20-40	20	SG	10	30	20	15	0.75	1.5	1,125
6-21-24dac	Hieronymus	3545	39	6	23-25	4	S	6	39	33	75	2.27	1.5	3,405
					25-39	14	SG							
6-21-25aa	Buckholz	3565	40	6	12-40	28	SG	12	30	18	40	2.22	2.0	3,330
6-21-25aad	U.B.C.	3560	42	6	18-42	24	SG	18	35	17	12	0.71	1.5	1,065
6-21-25aba1	City of Hamilton	3555	45	6	15-35	20	SG	10	35	25	35	1.40	1.0	2,100
					37-45	7	GB							
6-21-25aba2	Carpenter	3560	39	6	10-23	13	SGB	10	15	5	30	6.00	0.25	9,000
					23-27	4	cS							
					27-32	5	S							
					32-39	7	SG							
6-21-25abc	Snell	3565	41	6	6-11	5	SG	6	8	2	50	25.00	0.25	37,500
					11-13	2	cS							
					13-21	8	SG							
					21-27	6	G							
					29-41	12	SG							
7-20-18aca	Unruh	3420	40	6	12-40	28	SG	12	30	18	15	0.83	1.5	1,245
7-20-18db	Unruh	3435	40	6	15-40	25	SG	15	22	7	30	4.29	2.0	6,435

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
7-20-19bd	Hendrickson	3440	81	6	10-69	59	SG	10	16	6	20	3.33	1.5	4,995
					79-81	3	G							
7-20-21dd	Erickson	3440	40	6	15-20	5	G	15	35	20	10	0.50	1.5	750
					20-35	15	S							
					35-40	5	G							
7-20-30cb	Wilson	3460	39	6	14-39	25	SGB	14	35	21	30	1.43	1.0	2,145
7-20-30cc	Oliver	3460	41	6	10-41	31	SG	10	15	5	25	5.00	12.0	7,500
7-20-31bbb	Lippert	3468	40	6	18-40	22	GB	18	30	12	20	1.67	1.0	2,505
7-20-31c1	Bryson	3485	40	6	13-40	27	SG	13	30	17	20	1.18	2.0	1,770
7-20-31c2	Jessop	3485	36	6	13-36	23	SG	13	30	17	50	2.94	0.5	4,410
7-20-31cd	Rowland	3485	25	6	5-25	20	SG	5	19	14	60	4.29	4.0	6,435
7-20-32d	Holmberg	3465	41	6	10-41	31	SG	10	12	2	15	7.50	24.0	11,250
7-20-33b	Johnson	3480	40	6	20-40	20	SG	20	35	15	15	1.00	1.0	1,500
7-21-24ddd	Kershner	3450	108	6	3-40	37	GB	0	40	40	30	0.75	2.0	1,125
					40-65	25	SG							
					65-80	15	bCG							
					103-108	5	G							
7-21-25aa	Peterson	3452	39	6	9-39	30	SG	9	37	28	20	0.71	2.0	1,065

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
7-21-25aaa	Hill	3454	105	6	7-65	58	G	7	15	8	35	4.38	2.0	6,570
					90-100	10	SG							
7-21-25dbd	Rousselow	3460	198	6	5-20	15	SG	—	—	—	20	—	0.5	—
					20-60	40	S							
					60-140	80	SGiC							
					156-170	14	fS							
7-21-36dd1	Bandett	3485	32	6	14-32	18	SG	14	29	15	20	1.33	1.0	1,995
7-21-36dd2	Sampson	3485	40	6	20-40	20	SG	20	30	10	15	1.50	1.0	2,250
7-21-36ddd	Dunbar	3487	31	6	12-31	19	SG	12	25	13	20	1.54	1.0	2,310

APPENDIX 1.9: WELL LOG INVENTORY FOR CORVALLIS-FLOODPLAIN AQUIFER

Well Location [Well Id #]	Well Owner	Apprx Elev. [ft]	Total Depth [ft]	Well Dia. [in]	Aquifer Interval [ft]	Aquifer Thickness [ft]	Geol Mat.	Static Level [ft]	Pump Test Water Level [ft]	Draw Down [ft]	Pump Rate [gpm]	Specific Capacity [gpm/ft]	Pump Test Duration [hrs]	Trans. [gpd/ft]
6-20-2	Brown	3685	77	6	24-77	53	brSs	1	45	44	30	0.68	2.0	1,020
6-20-3ab	Hull	3583	59	6	45-58	13	Ss	36	49	13	17	1.31	2.0	1,965
					58-59	1	SG							
6-20-4adc	Wood	3540	100	6	90-100	10	SG	50	80	30	10	0.33	1.0	495
6-20-4bb	Peterson	3475	26	6	8-26	18	SG	8	20	12	30	2.50	0.5	3,750
6-20-4bbb	Exgley	3475	40	6	16-40	24	SG	16	35	19	15	0.79	1.5	1,185
6-20-4bcc	Wagner	3490	50	6	14-45	31	SG	14	43	29	20	0.69	1.0	1,035
					45-50	5	G							
6-20-5aa1	Heaps	3475	40	6	10-28	18	sG	4	4	0	15	—	24.0	high
					28-30	2	S							
					30-34	4	SG							
					34-36	2	cS							
					36-40	4	SG							
6-20-5aa2	Heaps	3475	38	6	6-18	12	SG	5	7	2	20	10.0	0.25	15,000
					18-24	6	S							
					24-26	2	SG							
					26-28	2	S							
					28-38	10	SGiC							

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
6-20-5aac	Dehner	3475	31	6	5-31	26	G	5	5	0	15	—	2.0	high
6-20-5b	Barntish	3470	38	6	27-38	11	SG	5	20	15	30	2.0	0.5	3,000
6-20-5bc	DeWit	3475	45	6	6-35 35-41 41-45	29 6 4	GB sC G	6	30	24	25	1.04	1.0	1,560
6-20-6[1]	Sanderson	3485	40	6	8-36 36-40	28 4	fS crS	8	20	12	60	5.00	2.0	7,500
6-20-6[2]	Martin	3475	31	6	6-31	25	SG	6	12	6	40	6.67	2.0	10,005
6-20-6aa	Conklin	3470	29	6	8-29	21	G	8	25	17	20	1.18	1.0	1,770
6-20-6cc	Erbig	3478	39	6	5-39	34	SG	7	8	1	15	15.00	24.0	22,500
6-20-6dc	Kewish	3480	47	6	20-47	27	G	6	10	4	20	5.00	2.0	7,500
6-20-6dd1	Donaldson	3485	65	6	12-40 50-65	28 15	GB CG	8	25	17	25	1.47	2.0	2,205
6-20-6dd2	Hixon	3485	29	6	5-29	24	SG	5	15	10	20	2.00	24.0	3,000
6-20-6dd3	Gerrard	3475	40	6	4-40	36	SG	4	30	26	30	1.15	1.0	1,725
6-20-6ddd	Leech	3480	29	6	5-29	24	SG	5	25	20	30	1.50	2.0	2,250
6-20-7ac	Wiseman	3488	29	6	9-29	20	SG	9	15	6	30	5.00	12.0	7,500

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
6-20-7dc	Wetherald	3497	53	6	10-35	25	SG	10	43	33	15	0.45	2.0	675
					51-53	2	SG							
6-20-11ab	Brown	3725	299	6	28-156	?	CiSG	9	250	241	5	0.02	7.0	30
6-20-18cb	Bell	3525	40	6	10-40	30	SG	10	30	20	15	0.75	2.0	1,125
6-20-18ccb	Angel	3525	40	6	8-35	27	G	8	35	27	14	0.52	1.0	760
					35-37	2	CG							
					37-40	3	G							
6-21-1ddb	Blahnik	3485	40	6	5-40	35	G	5	30	25	12	0.48	1.0	720
6-21-1dd	Hetland	3483	40	6	8-40	32	GB	8	35	27	15	0.56	1.0	840
6-21-12aac	Weber	3490	50	6	12-30	18	CSG	8	37	29	25	0.86	1.5	1,290
					30-35	5	G							
					40-50	10	SG							
6-21-12db	McKillap	3492	42	6	7-30	23	GB	7	34	27	20	0.74	1.5	1,110
					38-42	4	SG							
6-21-12dbd	Preston	3493	50	6	20-40	20	G	20	45	25	10	0.40	1.0	600
					40-50	10	SG							
6-21-13dd	Granteer	3525	40	6	8-40	32	GiC	8	35	27	12	0.44	1.0	660
6-21-24a	Burgess	3520	39	6	9-39	30	SGiC	9	14	5	30	6.00	0.25	9,000

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
6-21-24aab	Enebo	3520	31	6	28-31	3	G	16	24	8	40	5.00	2.0	7,500
6-21-24aad	Stanford	3525	28	4	8-15	7	G	8	12	4	25	6.25	2.0	9,375
					15-26	11	S							
					26-28	2	SG							
6-21-24ad	Kratofil	3530	41	6	3-22	19	SG	3	20	17	25	1.47	0.5	2,205
					22-26	3	cS							
					26-35	9	G							
					35-38	3	S							
					38-41	3	crG							
6-21-24daa	Gardner	3535	36	6	17-19	2	G	17	20	3	40	13.3	2.0	19,950
					29-36	7	G							
6-21-24da	Phillips	3540	40	6	18-40	22	SG	18	26	8	60	7.5	2.0	11,250
6-21-25bda	Fullerton	3560	40	6	13-30	17	SG	13	16	3	20	6.67	0.25	10,005
					30-36	6	cS							
					36-40	4	SG							
7-20-17da	Hamilton	3415	69	6	33-39	6	cSG	4	63	59	60	1.02	4.0	1,530
					61-66	5	SG							
7-20-20aa	Vann	3420	42	6	5-42	37	SG	5	12	7	30	4.29	2.0	6,435
7-20-20acd	Lewis	3425	50	6	8-50	42	SG	8	40	32	20	0.63	1.5	945
7-20-21ccb	Tanner	3435	40	6	5-40	35	CSG	3	15	12	20	1.67	1.5	2,505

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
7-20-28ccc	Soft Rock Ranch	3465	40	6	6-40	32	SG	6	25	19	10	0.53	1.0	795
7-20-29aa	Gingerich	3440	41	6	4-41	37	SG	4	7	3	50	16.67	2.0	25,005
7-20-32	Yurian	3460	29	6	3-29	26	SG	3	15	12	20	1.67	2.0	2,505
7-20-32cca	Lazena	3465	37	6	11-37	26	SG	8	35	27	30	1.11	1.0	1,665
7-20-32d	Hall	3475	40	8	15-40	25	SG	7	30	23	30	1.30	1.0	1,950
7-20-32daa	Rav.Cty. Co-op	3475	50	6	10-40 40-45 45-50	30 5 5	G SG G	10	40	30	20	0.67	1.0	1,005
7-20-32dad	Corval. School	3475	40	8	10-40	30	SG	10	30	20	50	2.50	1.5	3,750
7-20-32db	Moderie	3470	45	6	10-45	35	SG	10	19	9	20	2.22	2.0	3,330
7-20-32dd1	Cherry	3475	40	6	15-40	25	SG	15	20	5	20	4.00	2.0	6,000
7-20-32dd2	Gibbons	3478	40	6	20-40	20	SG	20	30	10	10	1.00	2.0	1,500
7-20-32dd3	Holbrock	3475	30	6	6-30	24	SG	6	15	9	25	2.78	1.0	4,170
7-20-32dda	Martin	3475	40	6	8-40	32	SG	8	30	22	25	1.14	1.0	1,710
7-20-32ddb	Wilson	3475	40	6	10-40	30	SG	10	30	20	20	1.00	2.0	1,500

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
7-20-32ddd	Corval. Church	3475	42	6	19-42	23	SG	19	26	7	30	4.29	2.0	6,435
7-20-33(1)	Manager	3475	40	6	15-40	25	SG	15	18	3	40	13.30	2.0	19,950
7-20-33(2)	Harris	3475	42	6	20-42	22	SG	10	26	16	20	1.25	1.5	1,875
7-20-33(3)	Wilson	3515	36	6	32-36	4	SG	12	30	18	15	0.83	2.0	1,245
7-20-33ad	Holm	3515	61	6	15-40 55-61	25 6	SG SG	15	50	35	16	0.46	2.0	690
7-20-33bbb	Pile	3465	40	6	7-40	33	SG	7	30	23	20	0.87	1.0	1,305
7-20-33cc1	Birky	3475	40	6	12-40	28	SG	12	30	18	30	1.67	2.0	2,505
7-20-33cc2	Wright	3475	40	6	15-40	25	SG	17	30	13	30	2.31	2.0	3,465
7-20-33cc3	Doty	3480	40	6	6-15 25-40	9 15	SG SG	6	37	31	15	0.48	1.5	720
7-20-33ccb	Weber	3475	40	6	20-40	20	SG	16	35	19	12	0.63	1.0	945
7-20-33ccc	Nelson	3475	40	6	19-40	21	SG	19	26	7	15	2.14	2.0	3,210
7-20-33ccd	Saiage	3480	40	6	9-40	29	SG	9	35	26	12	0.46	1.0	690
7-20-34bcc	Applebury	3540	66	6	60-66	6	SG	38	60	22	15	0.68	2.0	1,020
7-20-34dcc	Flander	3575	85	6	70-85	15	SG	60	75	15	8	0.53	1.5	795

APPENDIX 1.10: WELL LOG INVENTORY FOR SHEARMAN CREEK AQUIFER

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
7-21-25bdd	O'Conner	3465	136	6	25-35	10	G	20	120	100	15	0.15	1.5	225
					130-136	6	SG							
7-21-25caa	Dittbrndr	3470	40	6	25-30	5	GB	20	35	15	10	0.66	1.0	990
					35-40	5	SG							
7-21-25cb	Williams	3510	80	6	15-40	25	GB	9	65	56	15	0.27	2.0	405
					40-60	20	S							
					75-80	5	S							
7-21-26ac1	Branza	3550	60	6	35-60	25	CSG	35	55	20	10	0.50	1.0	750
7-21-26ac2	Briscoe	3570	57	6	30-57	27	SGB	30	—	—	12	—	2.0	—
7-21-26bc	McDaniel	3630	60	6	20-40	20	sC	16	30	14	20	1.40	1.0	2,100
					40-60	20	SG							
7-21-26bd	Burlson	3570	130	6	20-30	10	G	5	105	100	8	0.08	2.0	120
					95-130	35	bCiG							
7-21-26c	Gordon	3570	64	6	60-64	4	G	10	65	55	4	0.07	2.0	105
7-21-26cbd	Sutton	3610	28	6	5-28	23	SG	5	25	20	15	0.75	1.5	1,125
7-21-27	Ryan	3670	37	6	17-37	20	SGB	17	34	17	15	0.88	1.5	1,320

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Tast Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capecity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
7-21-27ac1	Selby	3720	71	6	15-40	25	OG	11	65	54	30	0.56	2.0	840
					40-71	31	CSG							
7-21-27ac2	Taylor	3730	56	6	15-35	25	OG	10	50	40	12	0.30	2.0	450
					35-56	21	CSs							
7-21-27bc	Holman	3890	60	6	17-21	4	OG	15	30	15	15	1.00	1.0	1,500
					21-35	14	CSGB							
7-21-27bdc	Marle	3780	245	6	100+-245	?	bCiG	82	240	158	1	0.006	3.0	9
7-21-27c	Smith	3800	46	6	35-45	10	iCG	31	45	14	4	0.29	2.0	435
7-21-27caa	Day	3780	32	6	15-32	17	iCG	14	—	—	15	—	12.0	—
7-21-27da	Fink	3680	40	6	27-38	11	SG	21	37	16	15	0.94	3.0	1,410

APPENDIX 1.11: WELL LOG INVENTORY FOR QUAST TERRACE AQUIFER

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
6-19-8bb	Koch	4135	55	6	36-55	19	S	11	30	19	60	3.16	1.0	4,740
6-20-1dc	Hochstetler	3875	410	8	10-14 20-65 65-410	4 45 345	SG brSs decGriS	—	—	—	5	—	—	—
6-20-2aa	Leir	3755	120	6	65-70 112-116	5 4	S SG	22	110	88	4	0.05	2.0	75
6-20-2bb	Martin	3670	39	6	18-34 34-39	16 5	sG crGS	5	—	—	—	—	—	—
6-20-2bdc	Brown	3680	63	6	36-37 60-63	1 3	SG Ss	11	34	23	8	0.35	2.0	525
6-20-2ddc	Adams	3770	280	6	275-280	5	SG	220	275	55	10	0.18	2.0	270
7-20-11dc	Sorenson	3650	160	6	70-160	90	brSs	30	130	100	7	0.07	2.0	105
7-20-12dc	Sweenen	3780	120	6	40-120	80	GiC	5	80	75	10	0.13	1.5	195
7-20-14cd1	Swanson	3645	124	6	40-115	75	CtSG	33	120	87	6	0.07	30.0	105
7-20-14cd2	Swanson	3645	69	6	58-69	11	St	19	65	46	5	0.11	12.0	165
7-20-15ab	Huls	3517	140	6	133-140	7	SG	70	—	—	30	—	—	—

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
7-20-15bd	Huls	3465	100	8	58-62	4	mSG	60	80	20	30	1.50	2.0	2,250
					99-100	1	SG							
7-20-22a	Garlick	3625	44	6	31-38	7	SG	28	38	10	12	1.20	0.5	1,800
7-20-22aba	Smith	3540	149	6	130-149	19	SG	125	143	18	10	0.56	1.5	840
7-20-22ba	Ferrantino	3510	98	6	35-39	4	CSG	70	95	25	25	1.00	1.0	1,500
					51-53	2	CSG							
					63-67	4	SG							
					95-98	3	SG							
7-20-22cc1	Savage	3485	125	6	75-80	5	CtG	66	100	34	15	0.44	2.0	660
					100-109	9	S							
					115-120	5	S							
					120-125	5	SG							
7-20-22cc2	Koelling	3490	73	6	60-73	13	SG	40	65	25	10	0.40	8.0	600
7-20-22ccc	Marshall	3480	111	6	57-59	2	SfG	40	60	20	20	1.00	0.25	1,500
					109-111	2	SGiC							
7-20-22cd1	Goddard	3495	103	6	55-83	28	SGiC	53	63	10	20	2.00	0.50	3,000
					93-100	7	SiC							
					100-103	3	SG							
7-20-22cd2	Sellers	3525	130	6	100-127	27	SGiC	82	—	—	20	—	0.25	—
					127-130	3	crGiS							

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
7-20-22cdc	Probst	3495	94	6	70-94	24	G	70	90	20	20	1.00	2.0	1,500
7-20-22db	Taylor	3550	175	6	130-145	15	S	115	150	35	12	0.34	2.0	510
					145-155	10	sSt							
					170-175	5	SG							
7-20-23	Milner	3650	65	6	64-65	1	SG	42	58	16	12	0.75	2.0	1,125
7-20-23bba	Johnston	3590	38	6	25-34	9	SG	17	35	18	12	0.67	24.0	1,005
7-20-23dc	Caldwell	3720	78	6	48-49	1	CSG	20	70	50	12	0.24	1.0	360
					69-70	1	CSG							
7-20-24ccc	Sylvester	4020	34	6	32-34	2	SGiC	6	20	14	12	0.86	12.0	1,290
7-20-26	Hall	3705	40	6	7-40	33	SG	7	15	8	40	5.00	2.0	7,500
7-20-26ba	Hacker	3705	35	6	10-34	24	CS	10	30	20	10	0.50	2.0	750
					34-35	1	C							
7-20-26cd	Bowlend	3725	129	6	120-129	9	SG	52	120	68	30	0.44	3.0	660
7-20-26cdd	Courtney	3745	105	6	75-105	30	iCG	59	102	43	15	0.35	2.0	525
7-20-26db1	Garrard	3710	114	6	113-114	1	CiG	35	110	75	9	0.12	0.5	180
7-20-26db2	Nicholson	3735	60	6	59-60	1	SG	24	54	30	12	0.40	2.0	600
7-20-27ab	Martin	3610	148	6	105-110	5	S	105	125	20	15	0.75	4.0	1,125
					140-148	2	SG							

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Drew Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
7-20-27ac	Hall	3585	54	6	44-54	10	G	28	33	5	30	6.00	2.0	9,000
7-20-27acd	Lamar	3635	150	6	100-120 130-150	20 20	CiG G	70	130	60	12	0.20	2.0	300
7-20-27bd	Hall	3580	90	6	30-90	60	Ss	17	60	43	6	0.14	2.0	210
7-20-27cc	Griffin	3570	105	6	102-105	3	SG	85	90	5	8	1.60	2.0	2,400
7-20-27cdd	Agric Exp Station	3590	159	6	99-159	60	SG	99	110	11	60	5.45	4.0	8,175
7-20-27dad	Scanland	3705	83	6	40-45 80-83	5 3	SG G	30	60	30	15	0.50	1.5	750
7-20-27db	Griffin	3635	172	6	149-172	23	SG	145	167	21	15	0.71	8.0	1,065
7-20-27dc	Frost	3625	109	6	68-70 90-109	2 19	SG tCSG	87	97?	—	20	—	2.0	—
7-20-34	Larson	3645	105	6	104-105	1	SG	90	93	3	9	3.00	3.0	4,500
7-20-34bad	Ford	3590	112	6	100-112	12	SG	80	100	20	15	0.75	1.5	1,125
7-20-34bb	Long	3550	88	6	56-88	32	CSG	56	80	24	15	0.63	3.0	945
7-20-34bd1	Price	3570	120	6	100-110 110-120	10 10	S crSG	75	110	35	10	0.29	1.5	435

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
7-20-34bdc	Zundel	3560	145	6	110-124	14	S	80	126	46	12	0.26	2.0	390
					143-145	2	SG							
7-20-34ca	Unrue	3585	195	6	90-105	15	S	—	160	—	12	—	2.0	—
					188-195	7	SG							
7-20-34db	Young	3610	124	6	80-85	5	G	80	115	35	12	0.34	1.5	510
					120-124	4	G							
7-20-34dd	Blakely	3605	60	6	39-60	21	SG	8	53	45	25	0.56	2.0	840
7-20-35a	Tice	3735	160	6	100-160	60	CtG	70	150	80	12	0.15	2.0	225
7-20-35aa1	Maier	3810	105	6	70-100	30	G	30	—	—	—	—	—	—
7-20-35aa2	Maier	3820	165	6	130-165	35	G	20	—	—	—	—	—	—
7-20-35aa3	Tice	3820	100	6	50-70	20	CG	40	80	20	10	0.50	2.0	750
					70-100	30	CtG							
7-20-35abc	Nicholson	3735	164	6	59-60	1	SG	90	130	40	30	0.75	2.0	1,125
					100-164	64	Ss,G							
7-20-35aca	Spotten	3740	85	6	30-45	15	G	27	65	38	12	0.32	1.5	480
					45-70	25	gC							
					70-85	15	G							
7-20-35ba	Licht	3700	99	6	65-99	34	SG	59	94	35	20	0.57	1.0	855

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
7-20-36cc	Massey	3728	93	6	43-93	50	brSs	20	30	10	50	5.00	2.0	7,500
7-20-36cd	Chambrlain	3835	105	6	40-105	?-	brC	37	90	53	6	0.11	2.0	165
7-20-36dcb	Deether	3830	46	6	10-45	35	brSs	8	44	36	20	0.56	2.0	840

APPENDIX 1.12: WELL LOG INVENTORY FOR HAMILTON HEIGHTS TERRACE AQUIFER

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
6-19-18bdc1	Dutton	4130	80	8	25-40	15	G	25	70	45	10	0.22	2.0	330
					60-80	20	G							
6-19-18bdc2	Vining	4145	61	6	57-61	4	SGB	40	43	3	3	1.00	3.0	1,500
6-20-4ac	Hollibaugh	3545	72	6	37-65	28	G	30	50	20	15	0.75	2.0	1,125
					65-72	7	G							
6-20-4dab	McMillan	3560	100	6	60-80	20	S	46	80	34	8	0.24	2.0	360
					90-100	10	SG							
6-20-4dc	Wright	3570	102	6	54-60	6	SG	48	85	37	12	0.32	2.0	480
					80-102	22	brSs							
6-20-9ab	Geiger	3585	110	6	60-70	10	SG	50	100	50	12	0.24	8.0	360
					110-110	10	G							
6-20-9add	Tubbs	3660	179	6	170-179	9	SG	149	179	30	10	0.33	1.5	495
6-20-9ca1	Lair	3670	80	6	50-76	26	SG	50	—	—	12	—	2.0	—
6-20-9ca2	Blair	3595	76	6	40-76	36	G	54	73	19	15	0.79	2.0	1,185
6-20-9cbb1	Rae	3540	140	6	120-125	5	G	60	120	60	20	0.33	1.5	495
					130-140	10	SG							

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
6-20-9cbb2	Gasvoda	3540	140	6	120-125	5	SG	60	120	60	15	0.25	1.5	375
					130-140	10	SiC							
6-20-9dc	Linendall	3620	81	6	58-81	23	SG	50	75	25	15	0.60	1.0	900
6-20-9dd	Comfort	3680	46	6	23-46	23	SG	23	30	7	12	1.71	1.0	2,565
6-20-10aaa	Cox	3680	240	6	65-240	175	sC	40	56	16	14	0.88	2.0	1,320
6-20-10ad	Tuell	3725	100	6	80-100	20	SG	80	100	20	20	1.00	2.0	1,500
6-20-10bb	Marshall	3640	110	6	85-88	3	iCSG	73	88	15	6	0.40	2.0	600
6-20-10bba	Schoneman	3645	145	6	70-125	55	S	70	120	50	20	0.40	1.5	600
					125-140	15	S							
					140-145	5	G							
6-20-10bbc	Meis	3660	140	6	129-140	11	SG	80	120	40	12	0.30	1.5	450
6-20-10bca	Peterson	3690	170	6	97-105	8	S	95	160	65	12	0.19	1.5	285
					160-167	7	S							
					167-170	3	SG							
6-20-10bd1	Evans	3710	179	6	110-179	69	SG	124	174	50	15	0.30	2.5	450
6-20-10bd2	Trotter	3700	51	6	40-51	11	SG	22	46	24	10	0.42	1.5	630
6-20-10c	Kearns	3725	70	6	69-70	1	crG	49	57	8	7	0.88	2.0	1,320

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
6-20-10ca	Kearns	3735	200	6	69-70	1	SG	130	160	30	20	0.67	2.0	1,005
					110-120	10	fS							
					199-200	1	SG							
6-20-10d	Hicks	3770	121	6	25-50	25	CSG	50	115	65	8	0.12	4.0	180
					60-90	30	St,fS							
					90-121	31	St							
6-20-10ded	Rage	3770	80	6	72-80	8	S	32	60	28	25	0.89	2.0	1,335
6-20-10dca	Fields	3765	80	6	60-80	20	Ss	40	59	19	10	0.53	1.5	795
6-20-10ddb	Bain	3770	180	6	65-70	5	S	60	170	110	10	0.09	2.0	135
					70-180	110	Ss							
6-20-11d	Brown	3810	135	6	80-125	45	St	42	95	53	20	0.38	1.0	570
6-20-11dcb	Reilly	3820	120	6	20-35	15	S	20	40	20	20	1.00	1.0	1,500
					40-45	5	S							
					45-120	75	Ss							
6-20-12cc	Maki	3880	84	6	46-52	6	—	27	63	36	10	0.28	1.0	420
					55-57	2	—							
					65-84	19	—							
6-20-13	Dukelow	3970	77	6	66-77	11	SG	50	72	22	10	0.45	14.0	675
6-20-13bc	Golay	3950	190	6	150-154	4	G	140	175	35	12	0.34	2.0	510
					180-190	10	G							

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
6-20-14ad	Ramsey	3900	130	6	15-40	25	G	5	110	105	8	0.08	2.0	120
					125-130	5	G							
6-20-14ba	Anderson	3845	80	6	25-30	5	G	25	70	45	20	0.44	1.5	660
					50-55	5	G							
					70-72	2	G							
6-20-14bc1	Winkler	3770	124	6	29-31	2	SG	28	—	—	75	—	1.0	—
					51-63	12	S							
					72-94	22	S							
					116-122	6	S							
					122-124	2	SG							
6-20-14bc2	Winkler	3780	186	6	118-121	3	CG	134	185	51	17	0.33	1.0	495
					127-129	2	S							
					176-180	4	SG							
					185-186	1	SG							
6-20-14bc3	Burton	3780	65	6	20-35	15	SG	24	65	41	20	0.49	2.0	735
6-20-14bd	Martin	3845	62	6	10-15	5	SG	28	52	24	25	1.04	2.0	1,560
					15-62	47	Ss							
6-20-14ccc	Byron	3770	105	6	100-105	5	SG	80	95	15	10	0.67	1.0	1,005
6-20-14dd	Taylor	3860	75	6	50-74	24	brSs	30	60	30	9	0.30	3.0	450
					74-75	1	SG							
6-20-15ad	Roney	3765	100	6	41-49	7	SG	29	46	17	20	1.18	1.0	1,770

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
6-20-15bbc	Porsche	3650	150	6	72-73	1	S	63	80	17	11	0.65	6.0	975
					73-100	27	cS, iG							
6-20-15bc	Shuland	3605	80	6	78-80	2	SG	50	65	15	7	0.47	2.0	705
6-20-15bca	Stock	3620	89	6	81-89	7	CSG	52	89	37	20	0.54	0.5	810
6-20-15bcc	Swift	3660	79	6	58-79	21	CSG	49	76	27	8	0.30	4.0	450
6-20-15bdd	Stock	3670	78	6	74-78	4	CSG	31	78	47	9	0.19	1.0	285
6-20-15c1	Yerian	3660	46	6	20-46	26	CSG	9	26	17	30	1.77	3.0	2,655
6-20-15c2	Tintzman	3715	55	6	47-49	2	fS	28	46	18	20	1.11	2.0	1,665
					53-55	2	SG							
6-20-15dda	Rodney	3765	80	6	42-50	8	CfS	42	60	18	25	1.39	3.0	2,085
					55-75	20	CfS							
					79-80	1	SG							
6-20-16a1	Fogachar	3665	140	6	79-139	60	CS	71	139	68	35	0.52	1.0	780
					139-140	1	SG							
6-20-16a2	Anderson	3655	75	6	60-75	15	CSG	42	56	14	7	0.50	1.5	750
6-20-16aa1	Mouplay	3630	74	6	61-66	5	SG	26	45	19	35	1.84	1.0	2,760
					72-74	2	wC, G							
6-20-16aa2	Bishop	3620	82	6	40-82	42	cSG	40	72	32	14	0.44	1.0	660

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Tast Water Leval (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans.. (gpd/ft)
6-20-16aa3	Prowse	3620	124	6	95-100	5	fS	60	110	50	15	0.30	2.0	450
					100-124	24	Ss							
6-20-16aa4	Mousley	3640	103	6	60-103	43	CSG	60	90	30	15	0.50	1.0	750
6-20-16ab	Peterson	3635	94	6	93-94	1	SG	81	86	5	7	1.40	2.0	2,100
6-20-16ac	Branning	3625	70	6	35-70	35	CiG	33	60	27	20	0.74	0.5	1,110
6-20-16acb1	Davis	3625	140	6	100-105	5	S	85	130	45	10	0.22	1.5	330
					120-130	10	SG							
6-20-16acb2	Brown	3625	150	6	100-110	10	S	70	120	50	10	0.20	1.0	300
					120-130	10	rSs							
					130-150	20	bSs							
6-20-16ad1	Marks	3670	110	6	100-110	10	SG	80	105	25	10	0.40	2.0	600
6-20-16ad2	Beardmore	3675	110	6	105-110	5	SG	65	100	35	10	0.29	—	—
6-20-16ba1	Langton	3620	90	6	68-90	22	SG	67	79	12	20	1.67	1.0	2,505
6-20-16ba2	Rummel	3620	97	6	50-97	47	SG	77	96	19	20	1.05	2.0	1,575
6-20-16baa	Spencer	3625	180	6	80-100	20	G	70	170	100	15	0.15	2.0	225
					100-120	20	S							
					140-180	40	CiSiG							

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
6-20-16bca	Shurry	3595	69	6	51-69	18	iCSG	51	65	14	20	1.43	2.0	2,145
6-20-16d	Hicks	3700	71	6	70-71	1	SG	53	70	17	12	0.71	2.0	1,065
6-20-16db	Meuchel	3605	50	6	30-47	17	SG	30	35	5	30	6.00	0.5	9,000
6-20-16dd	Winkler	3710	124	6	18-22	4	SG	28	120	92	75	0.82	1.0	1,230
					29-31	2	SG							
					51-63	12	S							
					72-94	22	S							
					116-122	6	S							
					122-124	2	SG							
6-20-19ddd	Schrech-encust	3600	65	6	49-53	4	fS	37	46	9	17	1.89	3.0	2,835
					64-65	1	SG							
6-20-23b	Zito	3750	140	6	80-140	60	brC	75	130	55	8	0.15	1.0	225
6-20-23bb	Zito	3765	116	6	70-116	46	rSs	65	110	45	10	0.22	1.5	330
6-20-23bc	Frost	3765	99	6	40-99	59	GSs	22	96	74	10	0.14	2.5	210
6-20-30aad	Kniffen	3646	125	6	120-124	4	SG	80	110	30	20	0.67	1.0	1,005
6-20-30ad	Oertli	3650	155	6	120-124	4	SG	80	140	60	25	0.42	2.0	630
					145-155	10	S							

APPENDIX 1.13: WELL LOG INVENTORY FOR EASTSIDE BEDROCK AQUIFER

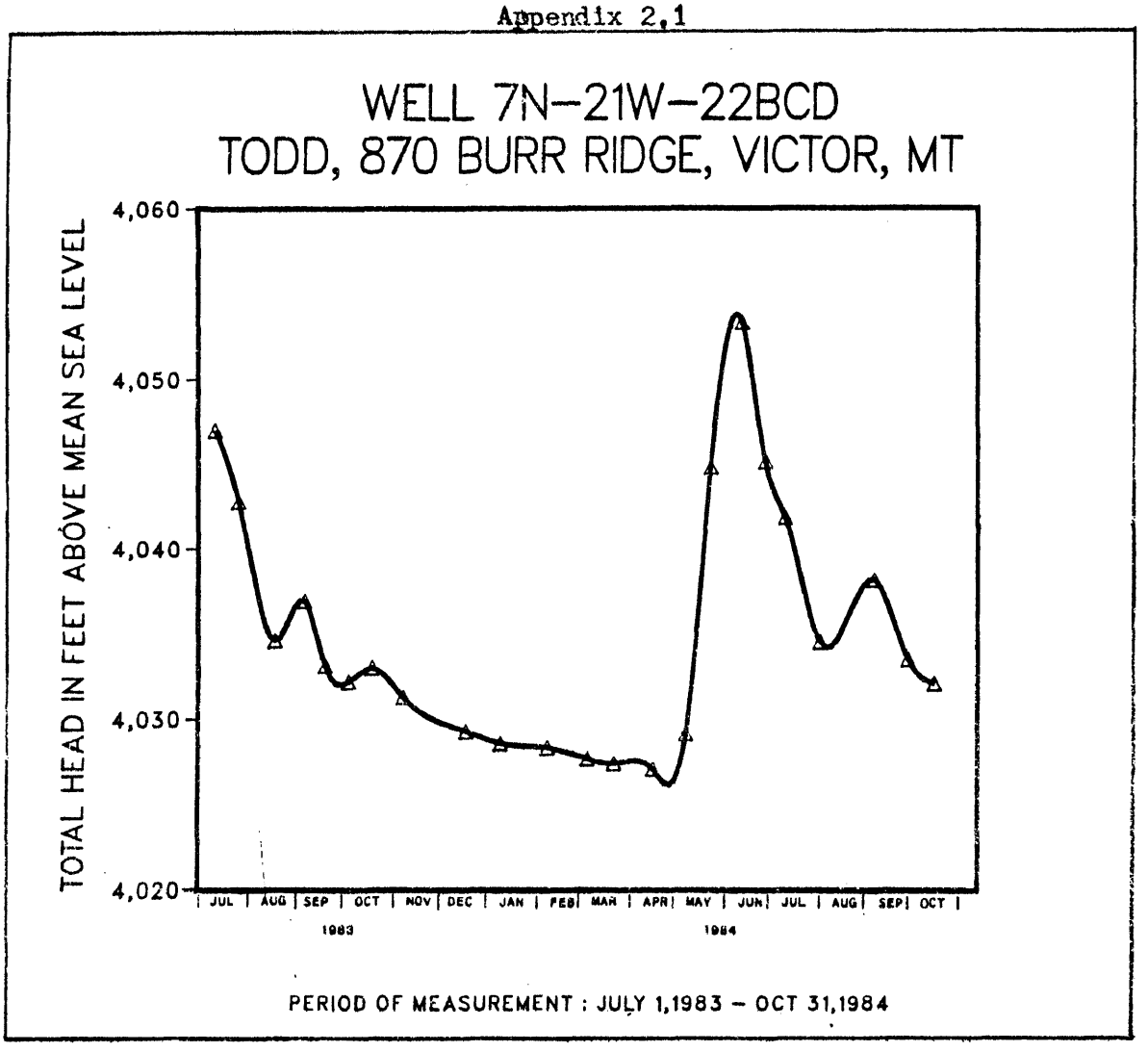
Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
6-19-7aa1	Koch	4120	540	6	160-540	380	fr-bdrk	80	500	420	4	0.10	4.0	15
6-19-7aa2	Goheen	4090	550	6	260-550	290	fr-bdrk	140	520	380	3	0.008	2.0	12
6-19-7dbc	McDowell	4235	240	6	60-240	180	fr-bdrk	28	230	202	5	0.03	1.5	45
6-19-18ac	McDowell	4205	250	6	25-250	225	fr-bdrk	25	220	195	8	0.04	2.0	60
6-19-18cab	Five Ten Dev. Cen	4180	400	6	280-400	120	fr-bdrk	20	380	360	3	0.0008	2.0	1
6-20-1cb	Kreigh	3915	600	6	80-600	520	fr-bdrk	80	100	20	1	0.05	4.0	75
6-20-1cd	Steuer	3833	120	8	40-120	80	fr-bdrk	10	100	90	15	0.17	1.0	255
6-20-1dab	Mason	3990	200	8	40-200	160	fr-bdrk	40	190	150	8	0.05	1.0	75
6-20-13abb	Switzer	3975	240	6	7-240	233	fr-bdrk	7	230	223	3	0.01	2.0	15
6-20-13daa	Trollope	4070	520	6	80-520	440	fr-bdrk	80	500	420	5	0.01	1.0	15
6-20-23ab	Bjerge	3845	120	6	70-120	50	fr-bdrk	65	110	45	5	0.11	2.0	165
7-19-18cda	Bauer	4190	270	6	130-270	140	fr-bdrk	130	260	130	8	0.06	2.0	90
7-19-19cda	Bauer	4515	270	8	135-270	135	fr-bdrk	135	250	115	20	0.17	3.0	255

Well Location (Well Id #)	Well Owner	Apprx Elev. (ft)	Total Depth (ft)	Well Dia. (in)	Aquifer Intrval (ft)	Aquifer Thickness (ft)	Geol Mat.	Static Level (ft)	Pump Test Water Level (ft)	Draw Down (ft)	Pump Rate (gpm)	Specific Capacity (gpm/ft)	Pump Test Duration (hrs)	Trans. (gpd/ft)
7-20-24bdd	Bauer	4015	310	6	120-310	190	fr-bdrk	120	300	180	5	0.03	2.0	45
7-20-24dcb	Bauer	4295	170	6	90-170	80	fr-bdrk	90	130	40	20	0.50	1.5	750

APPENDIX 2

HYDROGRAPHS OF WATER LEVEL FLUCTUATIONS

Appendix 2.1



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 12 1983	13.03 FT	45.97 FT	4046.97 FT
JUL 27 1983	17.23 FT	41.77 FT	4042.77 FT
AUG 19 1983	25.40 FT	33.60 FT	4034.60 FT
SEP 7 1983	23.10 FT	35.90 FT	4036.90 FT
SEP 20 1983	26.86 FT	32.14 FT	4033.14 FT
OCT 5 1983	27.81 FT	31.19 FT	4032.19 FT
OCT 20 1983	27.00 FT	32.00 FT	4033.00 FT
NOV 9 1983	28.70 FT	30.30 FT	4031.30 FT
DEC 19 1983	30.70 FT	28.30 FT	4029.30 FT
JAN 10 1984	31.41 FT	27.59 FT	4028.59 FT
FEB 9 1984	31.65 FT	27.35 FT	4028.35 FT
MAR 8 1984	32.31 FT	26.69 FT	4027.69 FT
MAR 23 1984	32.60 FT	26.40 FT	4027.40 FT
APR 17 1984	32.92 FT	28.08 FT	4027.08 FT
MAY 8 1984	30.83 FT	28.17 FT	4029.17 FT
MAY 24 1984	15.17 FT	43.83 FT	4044.83 FT
JUN 13 1984	6.64 FT	52.36 FT	4053.36 FT
JUN 28 1984	14.84 FT	44.16 FT	4045.16 FT
JUL 11 1984	18.16 FT	40.84 FT	4041.84 FT
AUG 2 1984	25.47 FT	33.53 FT	4034.53 FT
SEP 6 1984	21.83 FT	37.17 FT	4038.17 FT
SEP 28 1984	26.49 FT	32.51 FT	4033.51 FT
OCT 15 1984	27.90 FT	31.10 FT	4032.10 FT

WELL DATA

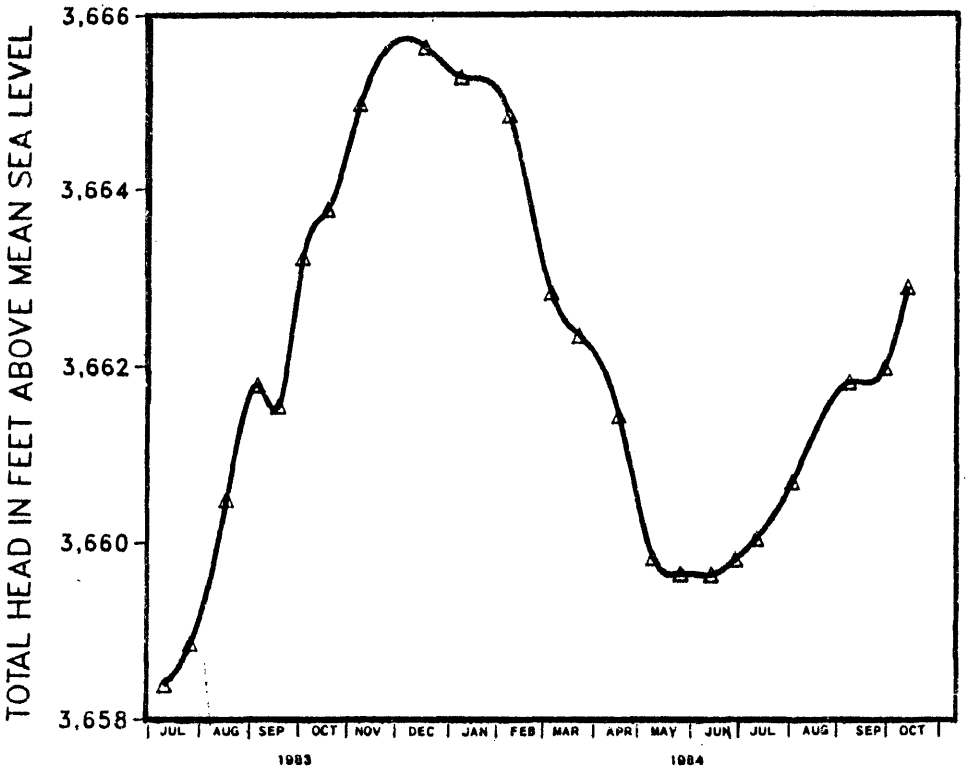
OWNER : PETER TODD
ADDRESS : 870 BURR RIDGE, VICTOR, MT
WELL LOCATION : T7N, R21W, SW NW SEC.22
WELL ID NUMBER : 7N-21W-22BCD
ELEVATION : 4060 FEET
WELL DEPTH : 59 FEET
PUMPING RATE : 12 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 10.7 C OR 51.2 F
PH VALUE : 5.92
CONDUCTANCE VALUE : 43 MICROMHOS
ESTIMATED TDS VALUE : 52 MG/L
ESTIMATED HARDNESS VALUE : 17 MG/L

Appendix 2.2

WELL 7N–21W–23BCB
FOLEY, 2 HUDSON LANE, VICTOR, MT



PERIOD OF MEASUREMENT : JULY 1,1983 – OCT 31,1984

WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 12 1983	104.81 FT	55.39 FT	3658.39 FT
JUL 28 1983	104.14 FT	55.88 FT	3658.98 FT
AUG 19 1983	102.51 FT	57.49 FT	3660.49 FT
SEP 7 1983	101.21 FT	58.79 FT	3661.79 FT
SEP 20 1983	101.45 FT	58.55 FT	3661.55 FT
OCT 6 1983	99.77 FT	60.23 FT	3663.23 FT
OCT 20 1983	99.23 FT	60.77 FT	3663.77 FT
NOV 9 1983	98.03 FT	61.97 FT	3664.97 FT
DEC 19 1983	97.37 FT	62.63 FT	3665.63 FT
JAN 10 1984	97.72 FT	62.28 FT	3665.28 FT
FEB 9 1984	98.16 FT	61.84 FT	3664.84 FT
MAR 6 1984	100.17 FT	59.83 FT	3662.83 FT
MAR 23 1984	100.65 FT	59.35 FT	3662.35 FT
APR 17 1984	101.56 FT	58.44 FT	3661.44 FT
MAY 8 1984	103.17 FT	56.83 FT	3659.83 FT
MAY 25 1984	103.35 FT	56.65 FT	3659.65 FT
JUN 13 1984	103.36 FT	56.64 FT	3659.64 FT
JUN 28 1984	103.19 FT	56.81 FT	3659.81 FT
JUL 11 1984	102.95 FT	57.05 FT	3660.05 FT
AUG 2 1984	102.31 FT	57.69 FT	3660.69 FT
SEP 6 1984	101.18 FT	58.82 FT	3661.82 FT
SEP 28 1984	101.02 FT	58.98 FT	3661.98 FT
OCT 12 1984	100.11 FT	59.89 FT	3662.89 FT

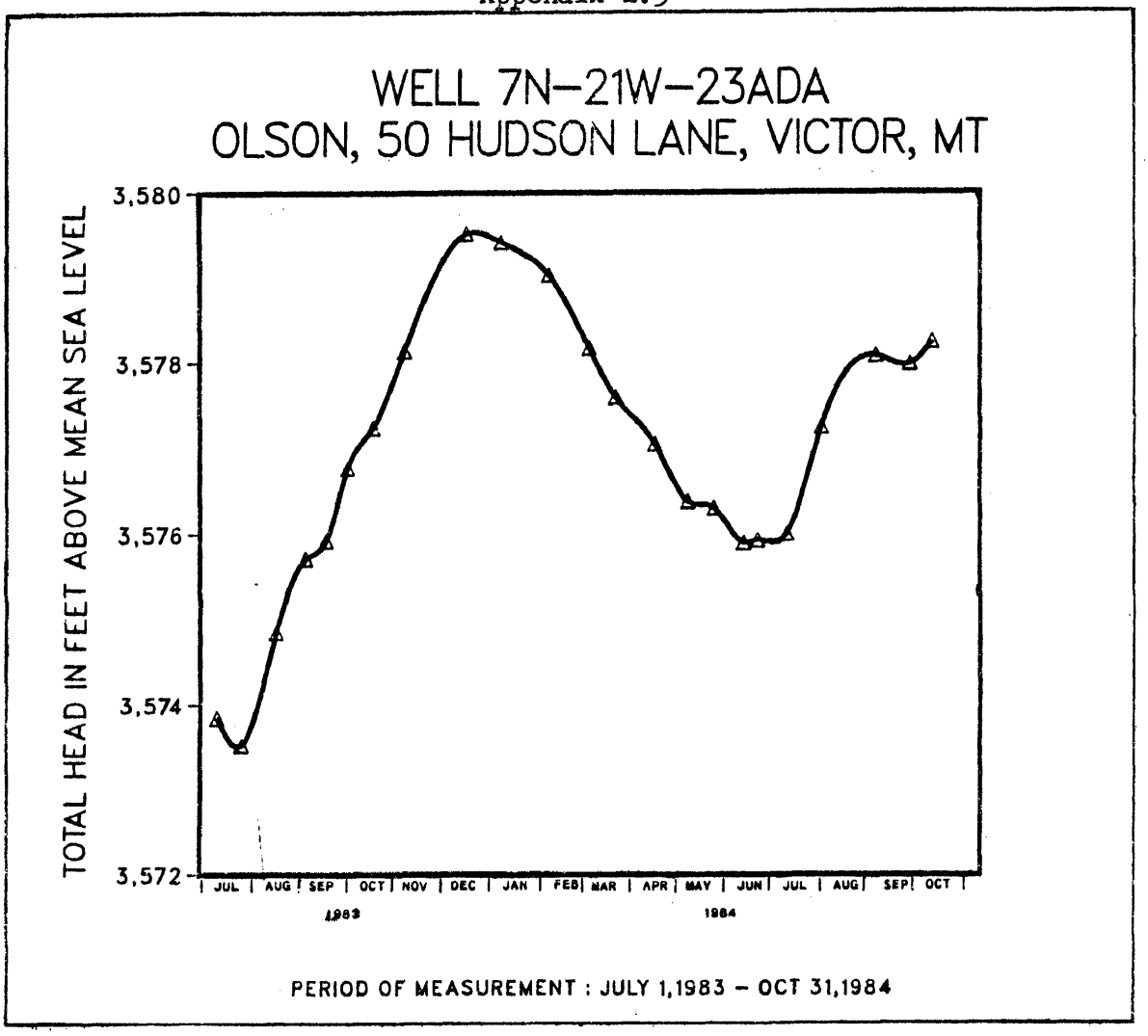
WELL DATA

OWNER : JOHN FOLEY
ADDRESS : 2 HUDSON LANE, VICTOR, MT
WELL LOCATION : T7N, R21W, SW NW SEC.23
WELL ID NUMBER : 7N-21W-23BCB
ELEVATION : 3763 FEET
WELL DEPTH : 180 FEET
PUMPING RATE : 10 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 10.3 C OR 60.5 F
PH VALUE : 7.23
CONDUCTANCE VALUE : 126 MICROMHOS
ESTIMATED TDS VALUE : 107 MG/L
ESTIMATED HARDNESS VALUE : 47 MG/L

Appendix 2.3



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 12 1983	111.15 FT	47.85 FT	3573.85 FT
JUL 28 1983	111.47 FT	47.53 FT	3573.53 FT
AUG 19 1983	110.14 FT	48.86 FT	3574.86 FT
SEP 7 1983	109.28 FT	49.72 FT	3575.72 FT
SEP 20 1983	109.07 FT	49.93 FT	3575.93 FT
OCT 4 1983	108.23 FT	50.77 FT	3576.77 FT
OCT 20 1983	107.76 FT	51.24 FT	3577.24 FT
NOV 9 1983	106.86 FT	52.14 FT	3578.14 FT
DEC 19 1983	105.48 FT	53.52 FT	3579.52 FT
JAN 10 1984	105.58 FT	53.42 FT	3579.42 FT
FEB 9 1984	105.97 FT	53.03 FT	3579.03 FT
MAR 6 1984	106.83 FT	52.17 FT	3578.17 FT
MAR 23 1984	107.41 FT	51.59 FT	3577.59 FT
APR 17 1984	107.96 FT	51.04 FT	3577.04 FT
MAY 8 1984	108.62 FT	50.38 FT	3576.38 FT
MAY 25 1984	108.70 FT	50.30 FT	3576.30 FT
JUN 13 1984	109.10 FT	49.90 FT	3575.90 FT
JUN 22 1984	109.07 FT	49.93 FT	3575.93 FT
JUL 11 1984	109.00 FT	50.00 FT	3576.00 FT
AUG 2 1984	107.76 FT	51.24 FT	3577.24 FT
SEP 6 1984	106.92 FT	52.08 FT	3578.08 FT
SEP 28 1984	107.02 FT	51.98 FT	3577.98 FT
OCT 12 1984	106.76 FT	52.24 FT	3578.24 FT

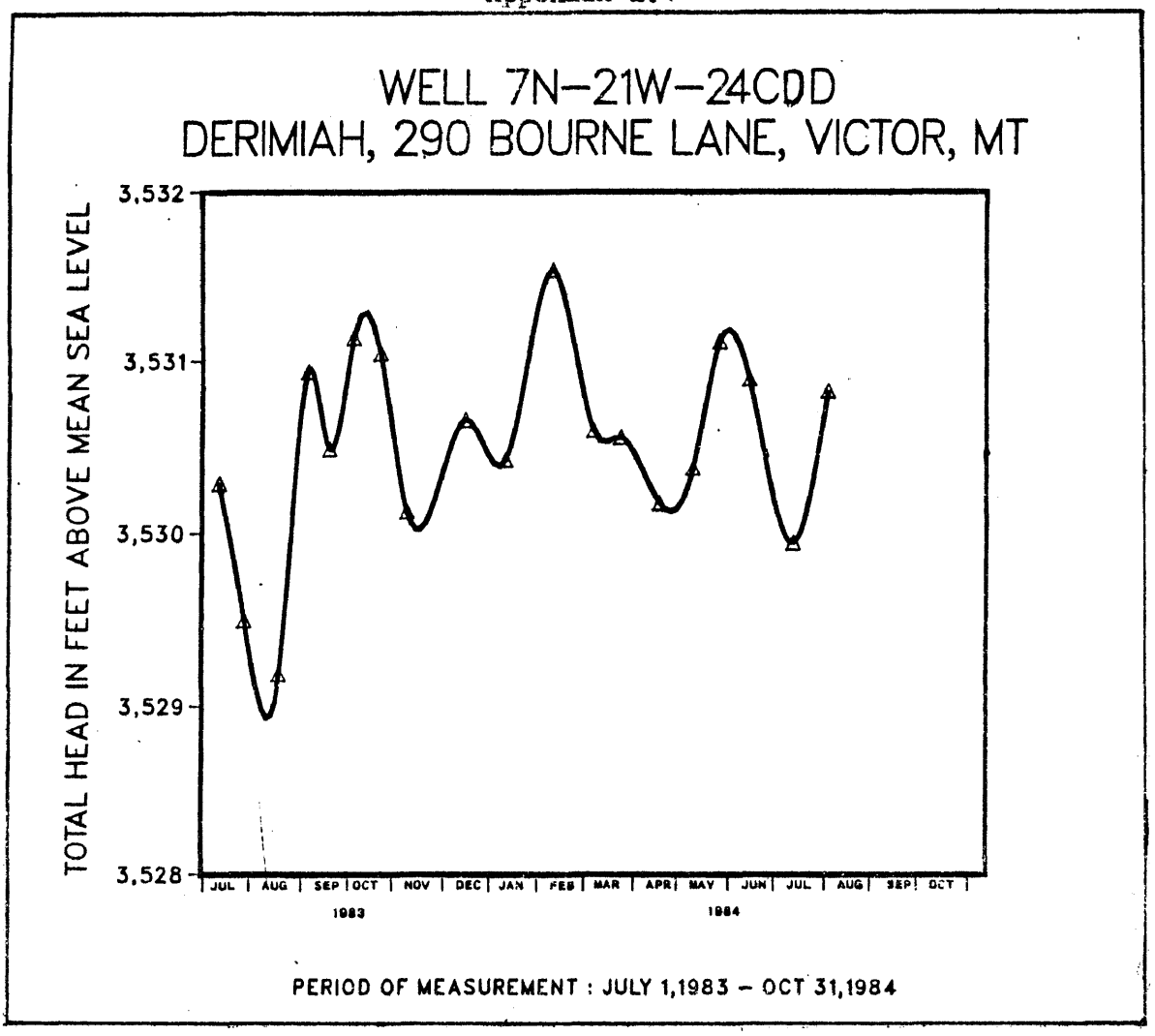
WELL DATA

OWNER : DON OLSON
ADDRESS : 50 HUDSON LANE, VICTOR, MT
WELL LOCATION : T7N, R21W, SE NE SEC.23
WELL ID NUMBER : 7N-21W-23ADA
ELEVATION : 3685 FEET
WELL DEPTH : 159 FEET
PUMPING RATE : 8 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 11.3 C OR 52.3 F
PH VALUE : 7.77
CONDUCTANCE VALUE : 190 MICROMHOS
ACTUAL TDS VALUE : 131.36 MG/L
ACTUAL HARDNESS VALUE : 85.04 MG/L

Appendix 2.4



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 12 1983	33.71 FT	86.29 FT	3530.29 FT
JUL 28 1983	34.50 FT	85.50 FT	3529.50 FT
AUG 19 1983	34.81 FT	85.19 FT	3529.19 FT
SEP 6 1983	33.06 FT	86.94 FT	3530.94 FT
SEP 20 1983	33.51 FT	86.49 FT	3530.49 FT
OCT 5 1983	32.86 FT	87.14 FT	3531.14 FT
OCT 22 1983	32.95 FT	87.05 FT	3531.05 FT
NOV 8 1983	33.87 FT	86.13 FT	3530.13 FT
DEC 15 1983	33.34 FT	86.66 FT	3530.66 FT
JAN 10 1984	33.57 FT	86.43 FT	3530.43 FT
FEB 9 1984	32.46 FT	87.54 FT	3531.54 FT
MAR 6 1984	33.40 FT	86.60 FT	3530.60 FT
MAR 23 1984	33.44 FT	86.56 FT	3530.56 FT
APR 17 1984	33.82 FT	86.18 FT	3530.18 FT
MAY 8 1984	33.62 FT	86.38 FT	3530.38 FT
MAY 25 1984	32.88 FT	87.12 FT	3531.12 FT
JUN 13 1984	33.10 FT	86.90 FT	3530.90 FT
JUL 11 1984	34.05 FT	85.95 FT	3529.95 FT
AUG 2 1984	33.17 FT	86.83 FT	3530.83 FT

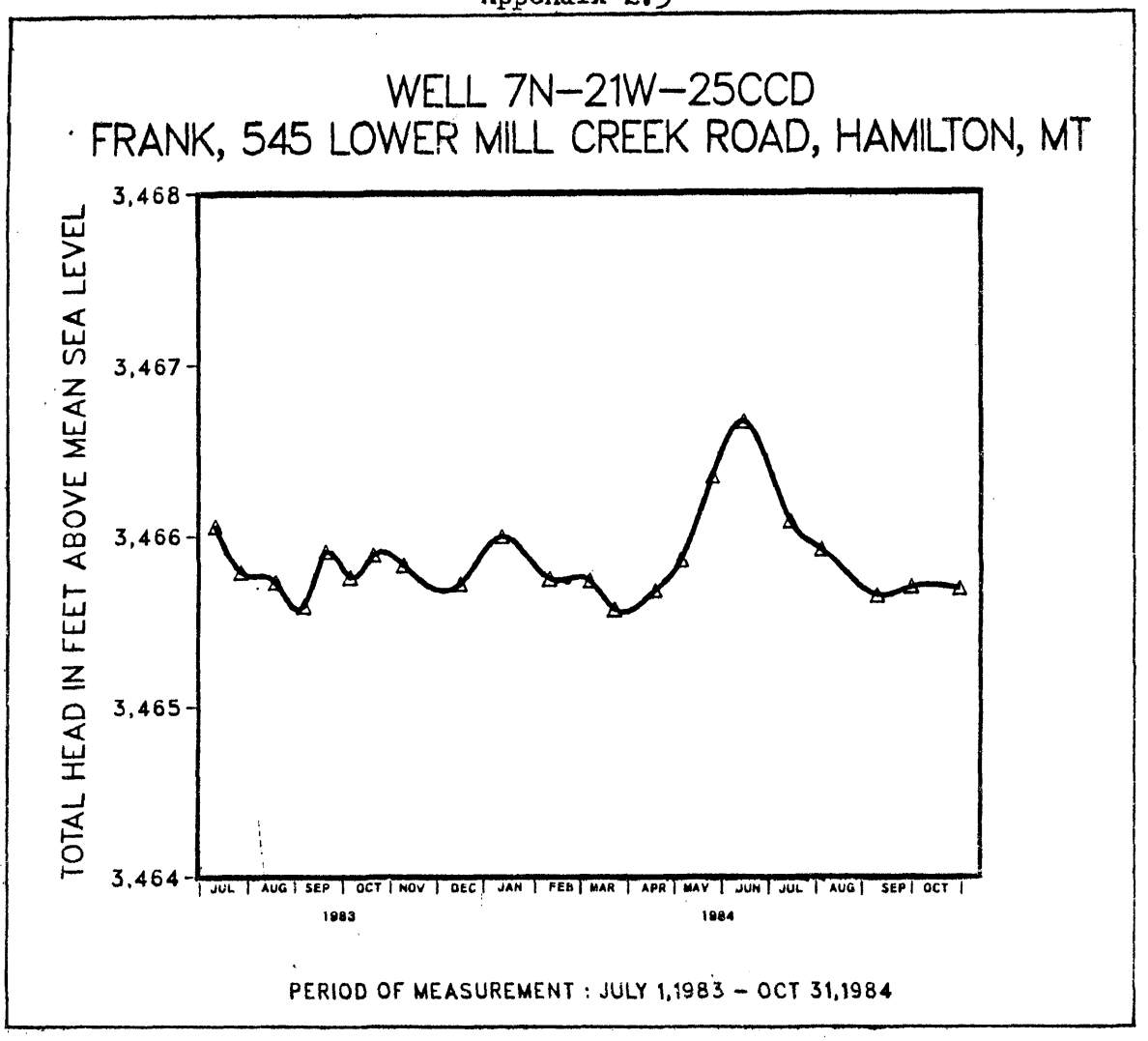
WELL DATA

OWNER : WALTER DERIMIAH
ADDRESS : 290 BOURNE LANE, VICTOR, MT
WELL LOCATION : T7N, R21W, SW SW SEC.24
WELL ID NUMBER : 7N-21W-24CCD
ELEVATION : 3564 FEET
WELL DEPTH : 120 FEET
PUMPING RATE : 20 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 13.2 C OR 55.7 F
PH VALUE : 6.92
CONDUCTANCE VALUE : 128 MICROMHOS
ESTIMATED TOS VALUE : 108 MG/L
ESTIMATED HARDNESS VALUE : 48 MG/L

Appendix 2.5



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 12 1983	53.94 FT	47.06 FT	3466.06 FT
JUL 28 1983	54.21 FT	46.79 FT	3465.79 FT
AUG 19 1983	54.27 FT	46.73 FT	3465.73 FT
SEP 6 1983	54.41 FT	46.59 FT	3465.59 FT
SEP 20 1983	54.09 FT	46.91 FT	3465.91 FT
OCT 5 1983	54.24 FT	46.76 FT	3465.76 FT
OCT 20 1983	54.11 FT	46.89 FT	3465.89 FT
NOV 8 1983	54.17 FT	46.83 FT	3465.83 FT
DEC 14 1983	54.28 FT	46.72 FT	3465.72 FT
JAN 10 1984	54.00 FT	47.00 FT	3466.00 FT
FEB 9 1984	54.25 FT	46.75 FT	3465.75 FT
MAR 6 1984	54.26 FT	46.74 FT	3465.74 FT
MAR 22 1984	54.43 FT	46.57 FT	3465.57 FT
APR 17 1984	54.32 FT	46.68 FT	3465.68 FT
MAY 4 1984	54.14 FT	46.86 FT	3465.86 FT
MAY 24 1984	53.65 FT	47.35 FT	3466.35 FT
JUN 13 1984	53.33 FT	47.67 FT	3466.67 FT
JUL 13 1984	53.91 FT	47.09 FT	3466.09 FT
AUG 2 1984	54.08 FT	46.92 FT	3465.92 FT
SEP 6 1984	54.35 FT	46.65 FT	3465.65 FT
SEP 28 1984	54.30 FT	46.70 FT	3465.70 FT
OCT 29 1984	54.31 FT	46.69 FT	3465.69 FT

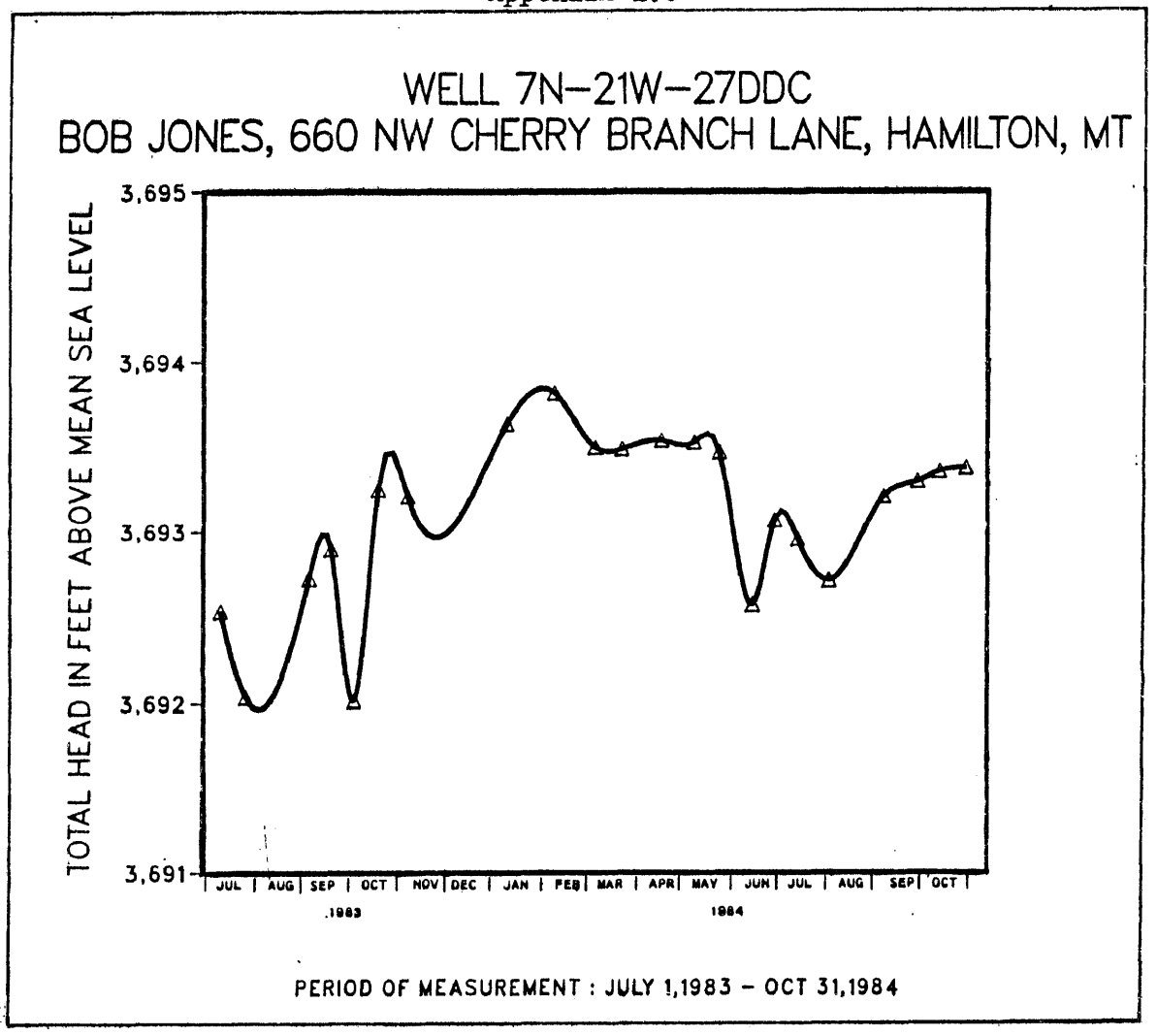
WELL DATA

OWNER : WILTON FRANK
ADDRESS : 545 LOWER MILL CREEK ROAD, HAMILTON, MT
WELL LOCATION : T7N, R21W, SW SW SEC.25
WELL ID NUMBER : 7N-21W-25CCD
ELEVATION : 3520 FEET
WELL DEPTH : 101 FEET
PUMPING RATE : 15 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 15.5 C OR 59.9 F
PH VALUE : 6.37
CONDUCTANCE VALUE : 99 MICROMHOS
ESTIMATED TDS VALUE : 89 MG/L
ESTIMATED HARDNESS VALUE : 37 MG/L

Appendix 2.6



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 12 1983	150.46 FT	13.54 FT	3692.54 FT
JUL 28 1983	150.96 FT	13.04 FT	3692.04 FT
SEP 6 1983	150.27 FT	13.73 FT	3692.73 FT
SEP 20 1983	150.10 FT	13.90 FT	3692.90 FT
OCT 5 1983	150.98 FT	13.02 FT	3692.02 FT
OCT 20 1983	149.75 FT	14.25 FT	3693.25 FT
NOV 8 1983	149.79 FT	14.21 FT	3693.21 FT
JAN 10 1984	149.36 FT	14.64 FT	3693.64 FT
FEB 9 1984	149.18 FT	14.82 FT	3693.82 FT
MAR 6 1984	149.50 FT	14.50 FT	3693.50 FT
MAR 23 1984	149.51 FT	14.49 FT	3693.49 FT
APR 17 1984	149.46 FT	14.54 FT	3693.54 FT
MAY 8 1984	149.47 FT	14.53 FT	3693.53 FT
MAY 24 1984	149.53 FT	14.47 FT	3693.47 FT
JUN 14 1984	150.42 FT	13.58 FT	3692.58 FT
JUN 28 1984	149.93 FT	14.07 FT	3693.07 FT
JUL 13 1984	150.04 FT	13.96 FT	3692.96 FT
AUG 2 1984	150.28 FT	13.72 FT	3692.72 FT
SEP 6 1984	149.79 FT	14.21 FT	3693.21 FT
SEP 28 1984	149.70 FT	14.30 FT	3693.30 FT
OCT 12 1984	149.64 FT	14.36 FT	3693.36 FT
OCT 29 1984	149.62 FT	14.38 FT	3693.38 FT

WELL DATA

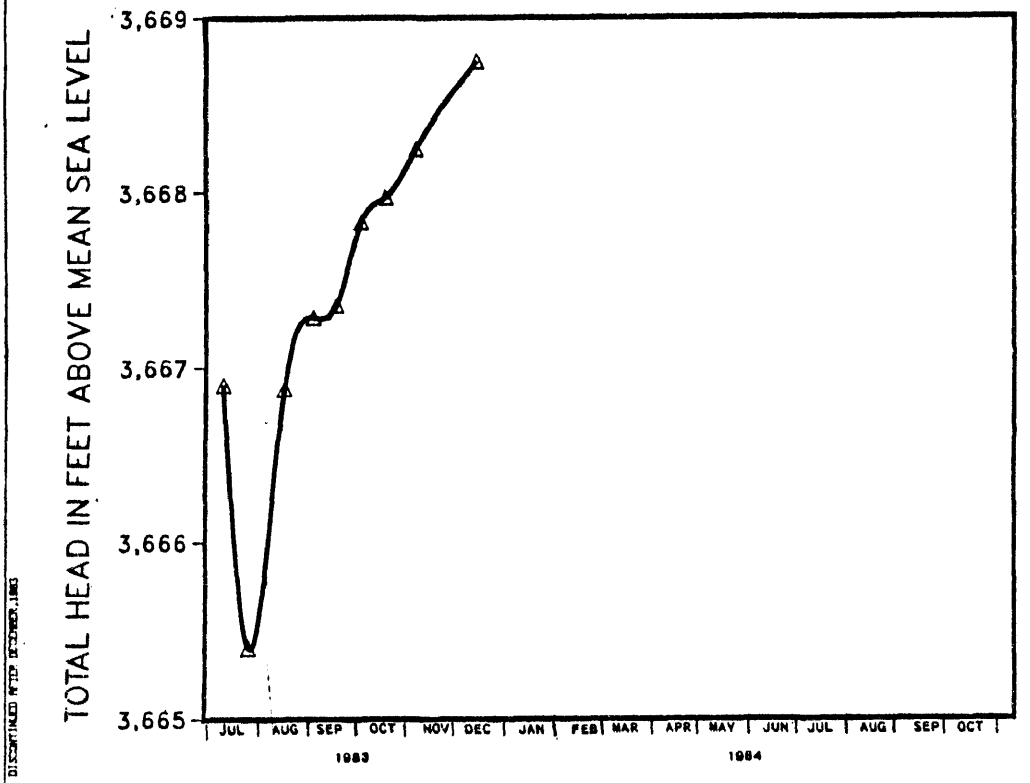
OWNER : ROBERT JONES
ADDRESS : 660 NW CHERRY BRANCH LANE, HAMILTON, MT
WELL LOCATION : T7N, R21W, SE SE SEC.27
WELL ID NUMBER : 7N-21W-27DDC
ELEVATION : 3843 FEET
WELL DEPTH : 164 FEET
PUMPING RATE : 20 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 13.4 C OR 56.1 F
PH VALUE : 6.53
CONDUCTANCE VALUE : 120 MICROMHOS
ESTIMATED TDS VALUE : 103 MG/L
ESTIMATED HARDNESS VALUE : 45 MG/L

Appendix 2.7

WELL 7N-21W-34AAD
RAY JONES, NW 604 CHERRY BRANCH LANE, HAMILTON, MT



PERIOD OF MEASUREMENT : JULY 1,1983 - OCT 31,1984

WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 12 1983	178.10 FT	8.90 FT	3666.90 FT
JUL 28 1983	179.60 FT	7.40 FT	3665.40 FT
AUG 19 1983	178.12 FT	6.88 FT	3666.88 FT
SEP 6 1983	177.71 FT	9.29 FT	3667.29 FT
SEP 20 1983	177.64 FT	9.36 FT	3667.36 FT
OCT 5 1983	177.17 FT	9.83 FT	3667.83 FT
OCT 20 1983	177.03 FT	9.97 FT	3667.97 FT
NOV 8 1983	176.75 FT	10.25 FT	3668.25 FT
DEC 15 1983	176.25 FT	10.75 FT	3668.75 FT

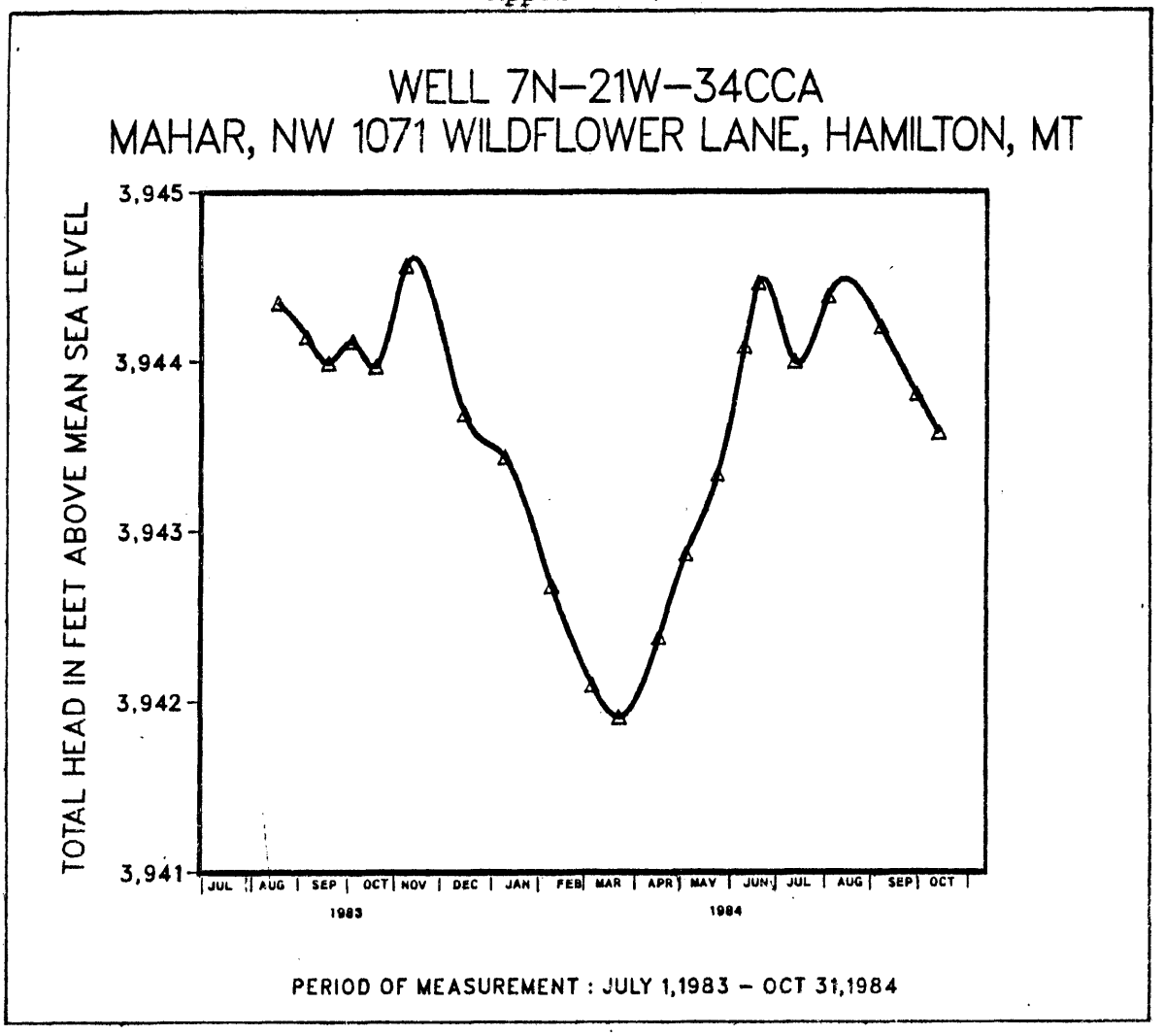
WELL DATA

OWNER : RAY JONES
ADDRESS : NW 604 CHERRY BRANCH LANE, HAMILTON, MT
WELL LOCATION : T7N, R21W, NE NE SEC.24
WELL ID NUMBER : 7N-21W-34AAD
ELEVATION : 3845 FEET
WELL DEPTH : 187 FEET
PUMPING RATE : 8 GAL/MIN

WATER QUALITY DATA

WATER QUALITY UNDETERMINED

Appendix 2.8



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
AUG 19 1983	99.65 FT	27.35 FT	3944.35 FT
SEP 6 1983	99.85 FT	27.15 FT	3944.15 FT
SEP 20 1983	100.01 FT	26.99 FT	3943.99 FT
OCT 5 1983	99.88 FT	27.12 FT	3944.12 FT
OCT 20 1983	100.03 FT	26.97 FT	3943.97 FT
NOV 8 1983	99.43 FT	27.57 FT	3944.57 FT
DEC 15 1983	100.31 FT	26.69 FT	3943.69 FT
JAN 10 1984	100.57 FT	26.43 FT	3943.43 FT
FEB 9 1984	101.32 FT	25.68 FT	3942.68 FT
MAR 6 1984	101.90 FT	25.10 FT	3942.10 FT
MAR 23 1984	102.09 FT	24.91 FT	3941.91 FT
APR 17 1984	101.62 FT	25.38 FT	3942.38 FT
MAY 4 1984	101.13 FT	25.87 FT	3942.87 FT
MAY 24 1984	100.67 FT	26.33 FT	3943.33 FT
JUN 10 1984	99.91 FT	27.09 FT	3944.09 FT
JUN 19 1984	99.53 FT	27.47 FT	3944.47 FT
JUL 12 1984	100.00 FT	27.00 FT	3944.00 FT
AUG 2 1984	99.61 FT	27.39 FT	3944.39 FT
SEP 5 1984	99.79 FT	27.21 FT	3944.21 FT
SEP 28 1984	100.19 FT	26.81 FT	3943.81 FT
OCT 12 1984	100.42 FT	26.58 FT	3943.58 FT

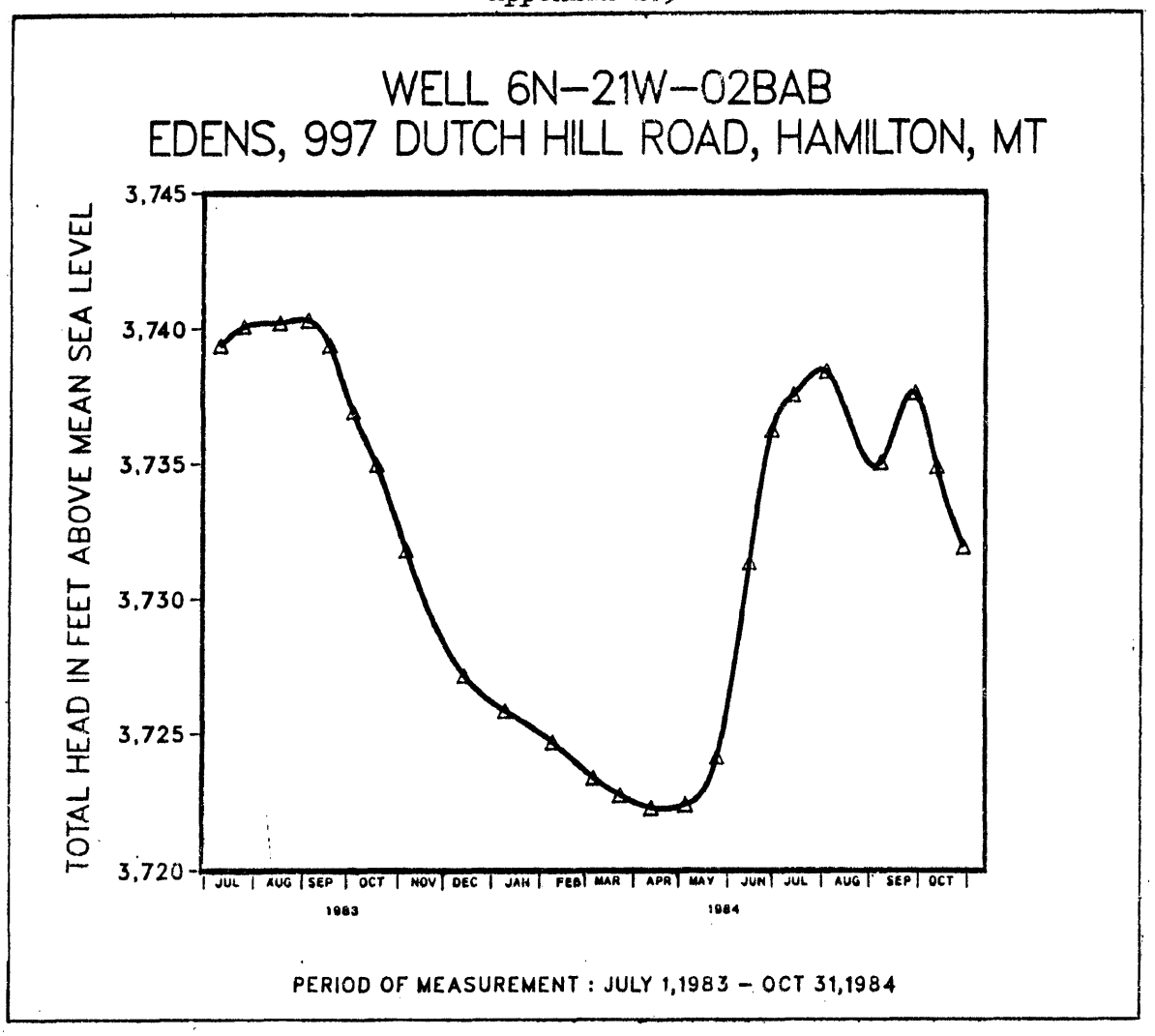
WELL DATA

OWNER : GEOFF MAHAR
ADDRESS : NW 1071 WILDFLOWER LANE, HAMILTON, MT
WELL LOCATION : T7N, R21W, SW SW SEC.34
WELL ID NUMBER : 7N-21W-34CCA
ELEVATION : 4044 FEET
WELL DEPTH : 127 FEET
PUMPING RATE : 10 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 10.9 C OR 51.6 F
PH VALUE : 6.19
CONDUCTANCE VALUE : 121 MICROMHOS
ACTUAL TDS VALUE : 115.73 MG/L
ACTUAL HARDNESS VALUE : 43.97 MG/L

Appendix 2.9



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 12 1983	46.60 FT	38.40 FT	3739.40 FT
JUL 27 1983	45.90 FT	39.10 FT	3740.10 FT
AUG 19 1983	45.77 FT	39.23 FT	3740.23 FT
SEP 6 1983	45.68 FT	39.32 FT	3740.32 FT
SEP 20 1983	46.60 FT	38.40 FT	3739.40 FT
OCT 5 1983	49.06 FT	35.94 FT	3736.94 FT
OCT 20 1983	51.03 FT	33.97 FT	3734.97 FT
NOV 8 1983	54.18 FT	30.82 FT	3731.82 FT
DEC 15 1983	58.84 FT	26.16 FT	3727.16 FT
JAN 10 1984	60.15 FT	24.85 FT	3725.85 FT
FEB 9 1984	61.31 FT	23.69 FT	3724.69 FT
MAR 6 1984	62.61 FT	22.39 FT	3723.39 FT
MAR 23 1984	63.25 FT	21.75 FT	3722.75 FT
APR 12 1984	63.72 FT	21.28 FT	3722.28 FT
MAY 4 1984	63.60 FT	21.40 FT	3722.40 FT
MAY 24 1984	61.86 FT	23.14 FT	3724.14 FT
JUN 14 1984	54.64 FT	30.36 FT	3731.36 FT
JUN 28 1984	49.75 FT	35.25 FT	3736.25 FT
JUL 12 1984	48.45 FT	36.55 FT	3737.55 FT
AUG 2 1984	47.58 FT	37.42 FT	3738.42 FT
SEP 6 1984	50.96 FT	34.04 FT	3735.04 FT
SEP 28 1984	48.38 FT	36.62 FT	3737.62 FT
OCT 12 1984	51.11 FT	33.89 FT	3734.89 FT
OCT 29 1984	54.08 FT	30.92 FT	3731.92 FT

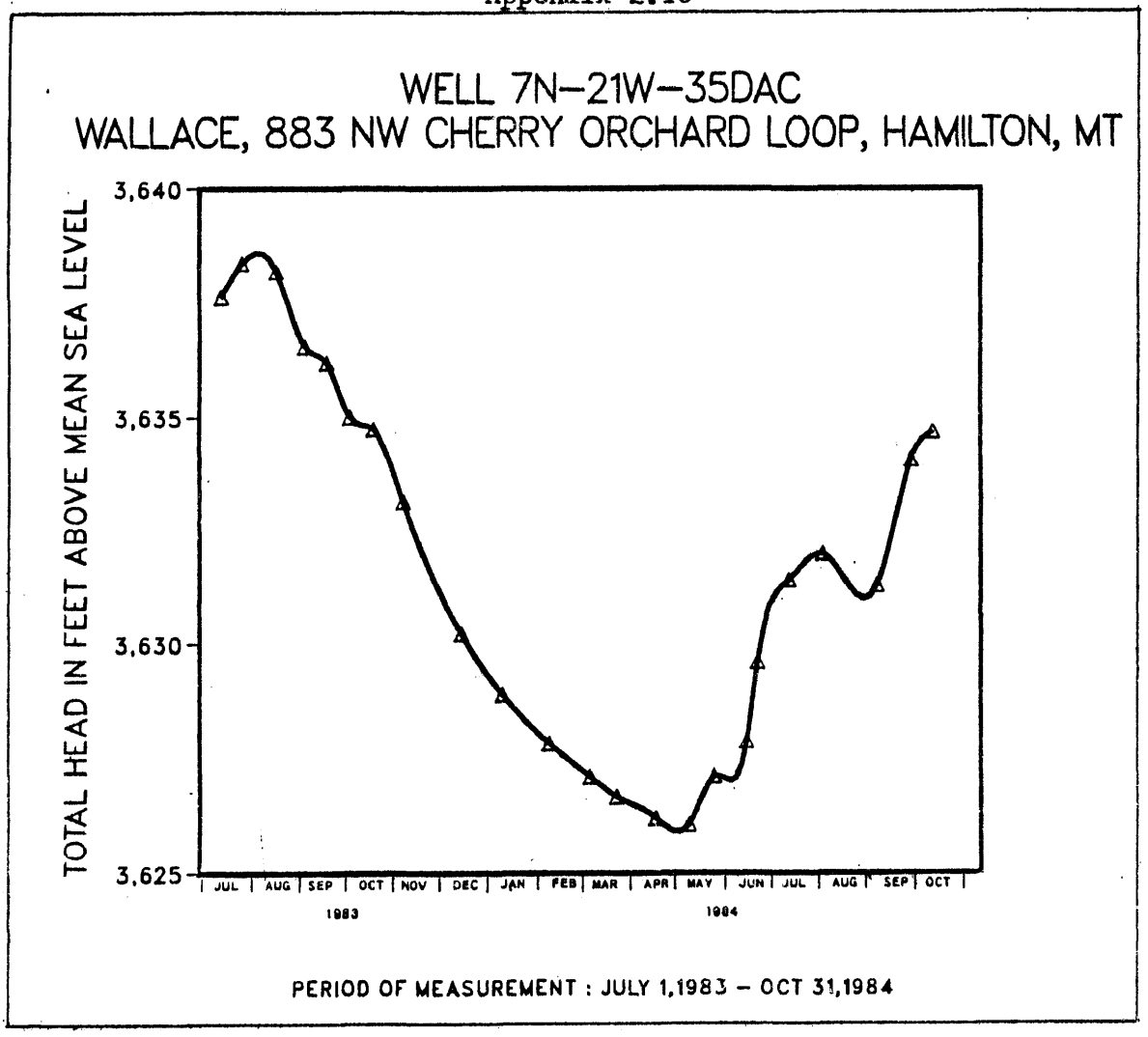
WELL DATA

OWNER : STEVE EDENS
ADDRESS : 997 DUTCH HILL ROAD, HAMILTON, MT
WELL LOCATION : T6N, R21W, NE NW SEC.2
WELL ID NUMBER : 6N-21W-02BAB
ELEVATION : 3786 FEET
WELL DEPTH : 85 FEET
PUMPING RATE : 20 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 10.8 C OR 51.4 F
PH VALUE : 5.84
CONDUCTANCE VALUE : 68 MICROMHOS
ESTIMATED TOS VALUE : 69 MG/L
ESTIMATED HARDNESS VALUE : 28 MG/L

Appendix 2.10



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 15 1983	82.37 FT	44.63 FT	3637.63 FT
JUL 28 1983	81.64 FT	45.36 FT	3638.36 FT
AUG 19 1983	81.82 FT	45.18 FT	3638.18 FT
SEP 6 1983	83.44 FT	43.56 FT	3636.56 FT
SEP 20 1983	83.80 FT	43.20 FT	3636.20 FT
OCT 5 1983	84.98 FT	42.02 FT	3635.02 FT
OCT 20 1983	85.25 FT	41.75 FT	3634.75 FT
NOV 8 1983	86.83 FT	40.17 FT	3633.17 FT
DEC 15 1983	89.77 FT	37.23 FT	3630.23 FT
JAN 10 1984	91.10 FT	35.90 FT	3628.90 FT
FEB 9 1984	92.18 FT	34.82 FT	3627.82 FT
MAR 6 1984	92.91 FT	34.09 FT	3627.09 FT
MAR 23 1984	93.35 FT	33.65 FT	3626.65 FT
APR 17 1984	93.81 FT	33.19 FT	3626.19 FT
MAY 8 1984	93.95 FT	33.05 FT	3626.05 FT
MAY 24 1984	92.90 FT	34.10 FT	3627.10 FT
JUN 14 1984	92.13 FT	34.87 FT	3627.87 FT
JUN 21 1984	90.39 FT	36.61 FT	3629.61 FT
JUL 11 1984	88.57 FT	38.43 FT	3631.43 FT
AUG 2 1984	87.97 FT	39.03 FT	3632.03 FT
SEP 6 1984	88.69 FT	38.31 FT	3631.31 FT
SEP 28 1984	85.90 FT	41.10 FT	3634.10 FT
OCT 12 1984	85.30 FT	41.70 FT	3634.70 FT

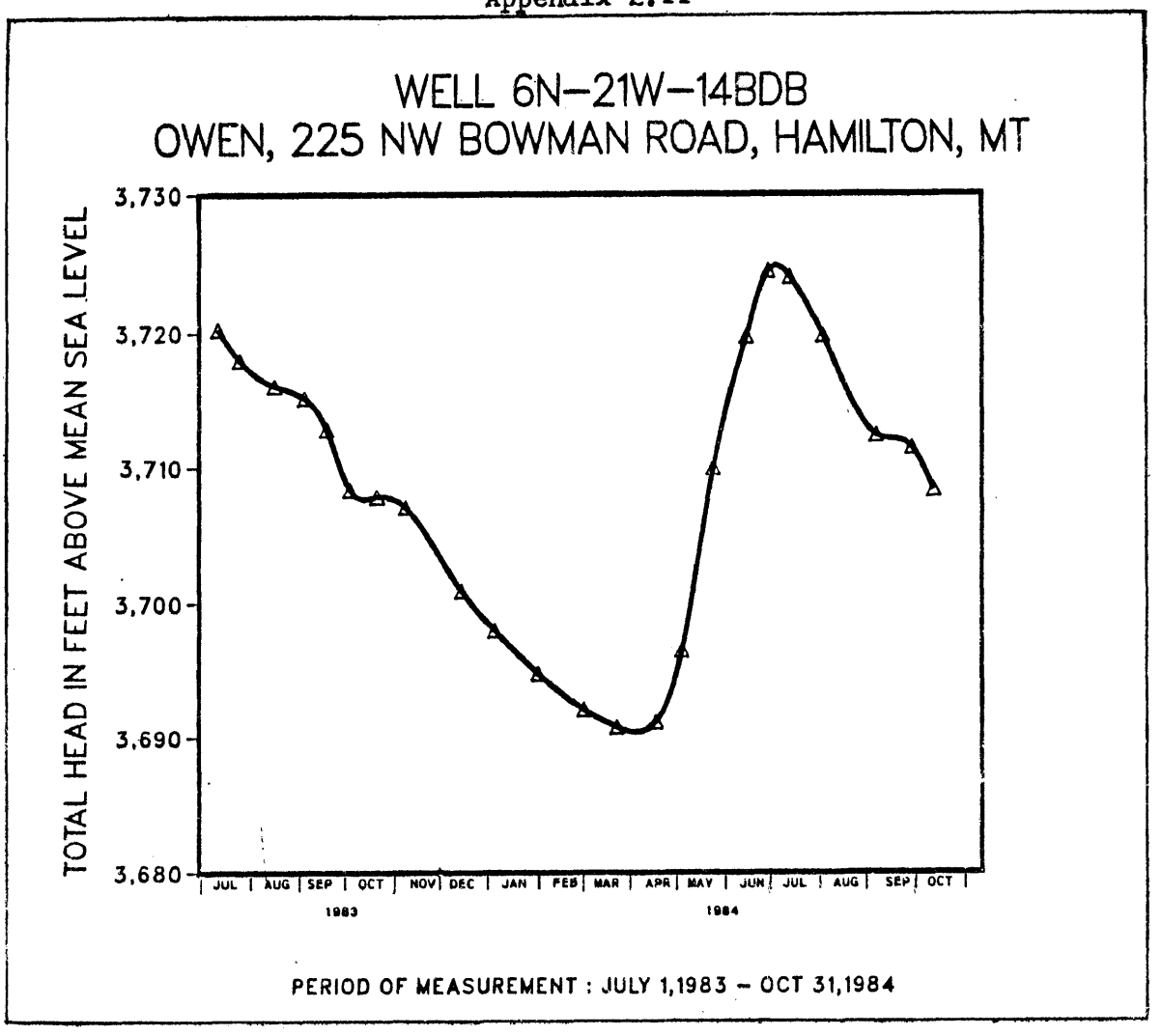
WELL DATA

OWNER : KEN WALLACE
ADDRESS : 883 NW CHERRY ORCHARD LOOP, HAMILTON, MT
WELL LOCATION : T7N, R21W, NE SE SEC.35
WELL ID NUMBER : 7N-21W-35DAC
ELEVATION : 3720 FEET
WELL DEPTH : 127 FEET
PUMPING RATE : 20 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 11.2 C OR 52.1 F
PH VALUE : 6.97
CONDUCTANCE VALUE : 101 MICROMHOS
ACTUAL TDS VALUE : 92.82 MG/L
ACTUAL HARDNESS VALUE : 37.99 MG/L

Appendix 2.11



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 13 1983	60.75 FT	49.25 FT	3720.25 FT
JUL 27 1983	63.02 FT	46.98 FT	3717.98 FT
AUG 18 1983	64.95 FT	45.05 FT	3716.05 FT
SEP 6 1983	65.85 FT	44.15 FT	3715.15 FT
SEP 20 1983	68.17 FT	41.83 FT	3712.83 FT
OCT 5 1983	72.65 FT	37.35 FT	3708.35 FT
OCT 22 1983	73.15 FT	36.85 FT	3707.85 FT
NOV 9 1983	73.94 FT	36.06 FT	3707.06 FT
DEC 15 1983	80.08 FT	29.92 FT	3700.92 FT
JAN 5 1984	82.98 FT	27.02 FT	3698.02 FT
FEB 2 1984	86.20 FT	23.80 FT	3694.80 FT
MAR 2 1984	88.90 FT	21.10 FT	3692.10 FT
MAR 23 1984	90.21 FT	19.79 FT	3690.79 FT
APR 17 1984	89.81 FT	20.19 FT	3691.19 FT
MAY 4 1984	84.45 FT	25.55 FT	3696.55 FT
MAY 24 1984	71.03 FT	38.97 FT	3709.97 FT
JUN 14 1984	61.26 FT	48.74 FT	3719.74 FT
JUN 28 1984	56.52 FT	53.48 FT	3724.48 FT
JUL 12 1984	56.96 FT	53.04 FT	3724.04 FT
AUG 2 1984	61.18 FT	48.82 FT	3719.82 FT
SEP 5 1984	68.62 FT	41.38 FT	3712.38 FT
SEP 28 1984	69.53 FT	40.47 FT	3711.47 FT
OCT 12 1984	72.66 FT	37.34 FT	3708.34 FT

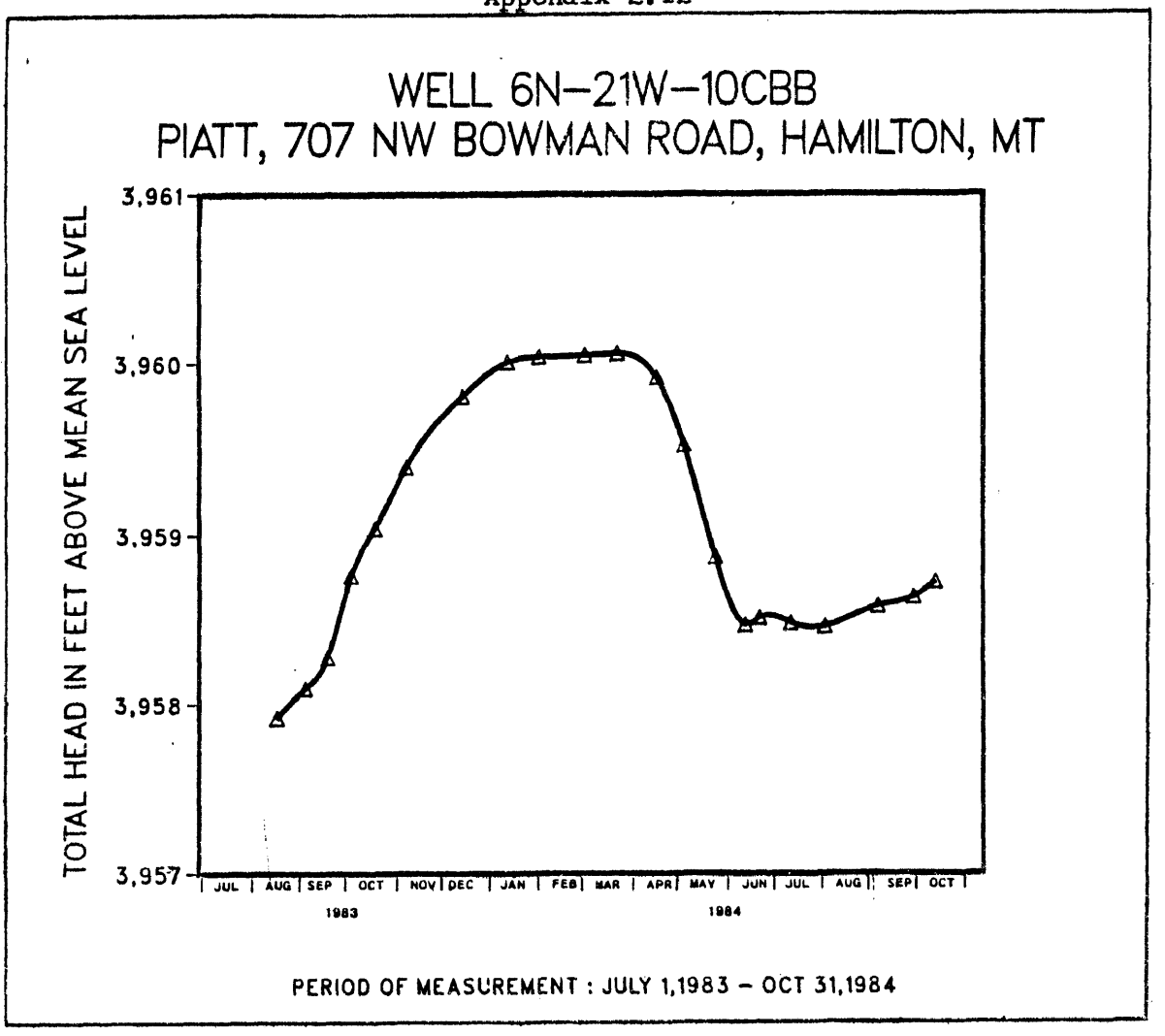
WELL DATA

OWNER : LLOYD OWEN
ADDRESS : 225 NW BOWMAN ROAD, HAMILTON, MT
WELL LOCATION : T6N, R21W, SE NW SEC.14
WELL ID NUMBER : 6N-21W-14BDB
ELEVATION : 3781 FEET
WELL DEPTH : 110 FEET
PUMPING RATE : 15 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 11.8 C OR 53.2 F
PH VALUE : 6.02
CONDUCTANCE VALUE : 54 MICROMHOS
ESTIMATED TDS VALUE : 60 MG/L
ESTIMATED HARDNESS VALUE : 21 MG/L

Appendix 2.12



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
AUG 19 1983	75.08 FT	524.92 FT	3957.92 FT
SEP 6 1983	74.90 FT	525.10 FT	3958.10 FT
SEP 20 1983	74.72 FT	525.28 FT	3958.28 FT
OCT 5 1983	74.24 FT	525.76 FT	3958.76 FT
OCT 20 1983	73.96 FT	526.04 FT	3959.04 FT
NOV 9 1983	73.60 FT	526.40 FT	3959.40 FT
DEC 15 1983	73.19 FT	526.81 FT	3959.81 FT
JAN 13 1984	72.99 FT	527.01 FT	3960.01 FT
FEB 2 1984	72.96 FT	527.04 FT	3960.04 FT
MAR 2 1984	72.95 FT	527.05 FT	3960.05 FT
MAR 23 1984	72.94 FT	527.06 FT	3960.06 FT
APR 17 1984	73.08 FT	526.92 FT	3959.92 FT
MAY 4 1984	73.47 FT	526.53 FT	3959.53 FT
MAY 24 1984	74.13 FT	525.87 FT	3958.87 FT
JUN 12 1984	74.53 FT	525.47 FT	3958.47 FT
JUN 21 1984	74.49 FT	525.51 FT	3958.51 FT
JUL 11 1984	74.52 FT	525.48 FT	3958.48 FT
AUG 2 1984	74.54 FT	525.46 FT	3958.46 FT
SEP 5 1984	74.42 FT	525.58 FT	3958.58 FT
SEP 28 1984	74.37 FT	525.63 FT	3958.63 FT
OCT 12 1984	74.28 FT	525.72 FT	3958.72 FT

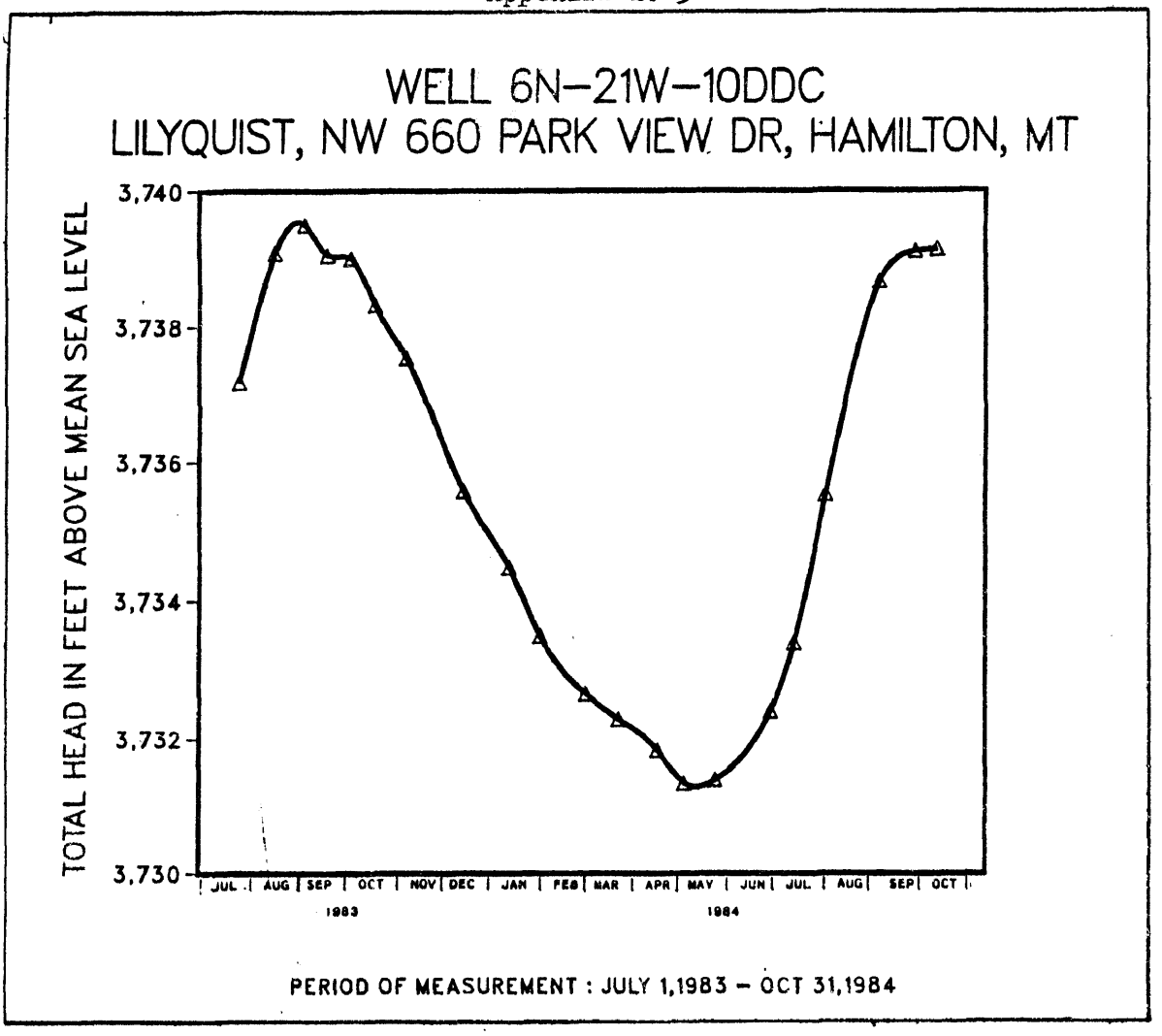
WELL DATA

OWNER : WILLIAM PIATT
ADDRESS : 707 NW BOWMAN ROAD, HAMILTON, MT
WELL LOCATION : T6N, R21W, NW SW SEC.10
WELL ID NUMBER : 6N-21W-10CBB
ELEVATION : 4033 FEET
WELL DEPTH : 600 FEET
PUMPING RATE : 10 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 12.3 C OR 54.1 F
PH VALUE : 10.48
CONDUCTANCE VALUE : 198 MICROMHOS
ACTUAL TDS VALUE : 110.01 MG/L
ACTUAL HARDNESS VALUE : 13.28 MG/L

Appendix 2.13



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 27 1983	47.81 FT	34.19 FT	3737.19 FT
AUG 18 1983	45.91 FT	36.09 FT	3739.09 FT
SEP 6 1983	45.49 FT	36.51 FT	3739.51 FT
SEP 20 1983	45.94 FT	36.06 FT	3739.06 FT
OCT 5 1983	45.99 FT	36.01 FT	3739.01 FT
OCT 20 1983	46.68 FT	35.32 FT	3738.32 FT
NOV 9 1983	47.46 FT	34.54 FT	3737.54 FT
DEC 15 1983	49.42 FT	32.58 FT	3735.58 FT
JAN 13 1984	50.52 FT	31.48 FT	3734.48 FT
FEB 2 1984	51.50 FT	30.50 FT	3733.50 FT
MAR 2 1984	52.33 FT	29.67 FT	3732.67 FT
MAR 23 1984	52.70 FT	29.30 FT	3732.30 FT
APR 17 1984	53.16 FT	28.84 FT	3731.84 FT
MAY 4 1984	53.65 FT	28.35 FT	3731.35 FT
MAY 24 1984	53.60 FT	28.40 FT	3731.40 FT
JUN 28 1984	52.58 FT	29.42 FT	3732.42 FT
JUL 13 1984	51.59 FT	30.41 FT	3733.41 FT
AUG 2 1984	49.46 FT	32.54 FT	3735.54 FT
SEP 5 1984	46.33 FT	35.67 FT	3738.67 FT
SEP 28 1984	45.88 FT	36.12 FT	3739.12 FT
OCT 12 1984	45.85 FT	36.15 FT	3739.15 FT

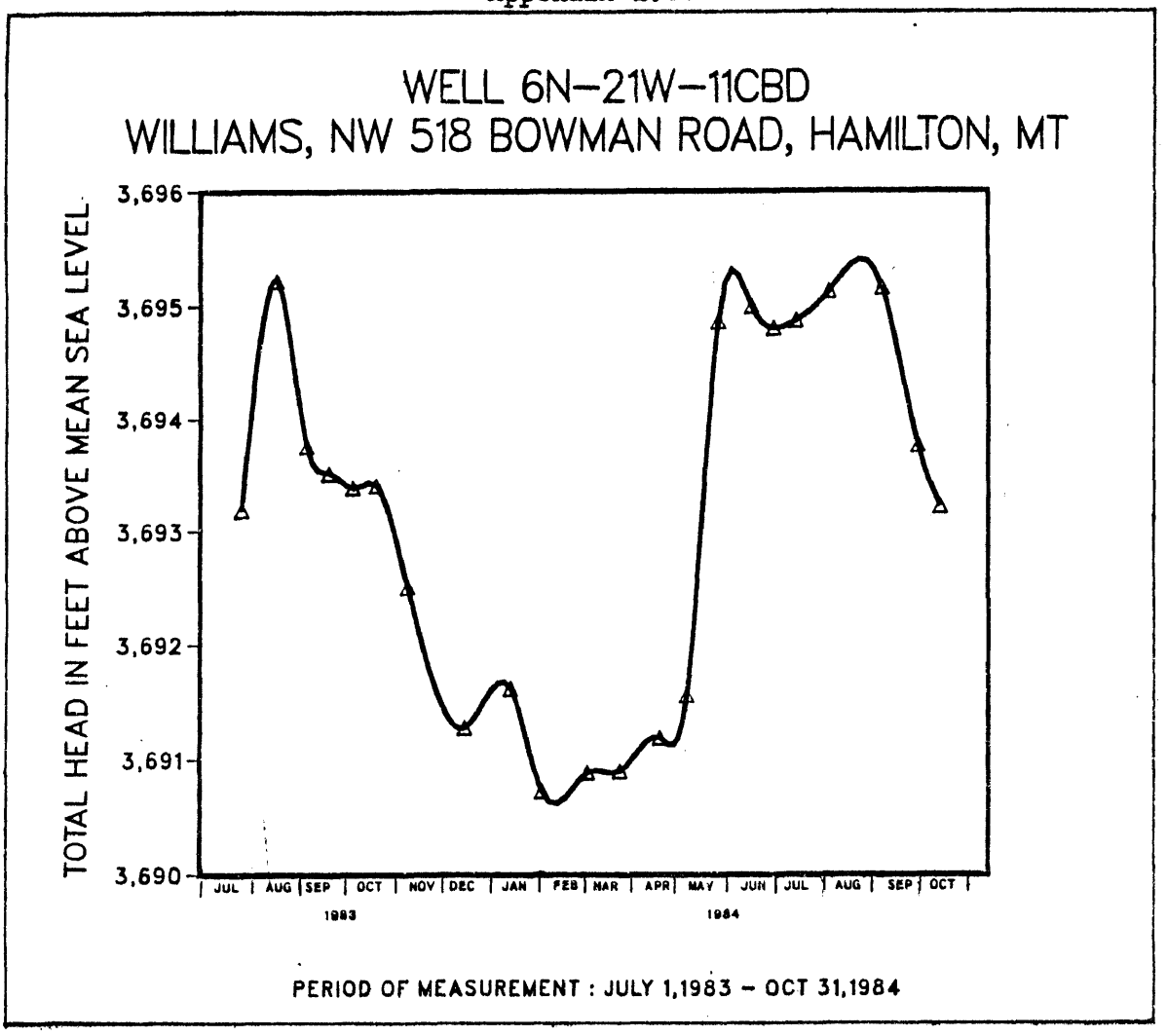
WELL DATA

OWNER : DAVID LILYQUIST
ADDRESS : NW 660 PARK VIEW DR, HAMILTON, MT
WELL LOCATION : T6N, R21W, SW SE SEC.10
WELL ID NUMBER : 6N-21W-10DDC
ELEVATION : 3785 FEET
WELL DEPTH : 82 FEET
PUMPING RATE : 8 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 9.8 C OR 49.6 F
PH VALUE : 6.65
CONDUCTANCE VALUE : 86 MICROMHOS
ESTIMATED TDS VALUE : 81 MG/L
ESTIMATED HARDNESS VALUE : 33 MG/L

Appendix 2.14



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 27 1983	13.81 FT	22.19 FT	3693.19 FT
AUG 18 1983	11.78 FT	24.22 FT	3695.22 FT
SEP 6 1983	13.24 FT	22.76 FT	3693.76 FT
SEP 20 1983	13.48 FT	22.52 FT	3693.52 FT
OCT 5 1983	13.61 FT	22.39 FT	3693.39 FT
OCT 20 1983	13.59 FT	22.41 FT	3693.41 FT
NOV 9 1983	14.49 FT	21.51 FT	3692.51 FT
DEC 15 1983	15.72 FT	20.28 FT	3691.28 FT
JAN 13 1984	15.38 FT	20.62 FT	3691.62 FT
FEB 2 1984	16.27 FT	19.73 FT	3690.73 FT
MAR 2 1984	16.11 FT	19.89 FT	3690.89 FT
MAR 23 1984	16.10 FT	19.90 FT	3690.90 FT
APR 17 1984	15.81 FT	20.19 FT	3691.19 FT
MAY 4 1984	15.44 FT	20.56 FT	3691.56 FT
MAY 24 1984	12.13 FT	23.87 FT	3694.87 FT
JUN 14 1984	12.00 FT	24.00 FT	3695.00 FT
JUN 28 1984	12.19 FT	23.81 FT	3694.81 FT
JUL 12 1984	12.12 FT	23.88 FT	3694.88 FT
AUG 2 1984	11.87 FT	24.13 FT	3695.13 FT
SEP 5 1984	11.84 FT	24.16 FT	3695.16 FT
SEP 28 1984	13.23 FT	22.77 FT	3693.77 FT
OCT 12 1984	13.77 FT	22.23 FT	3693.23 FT

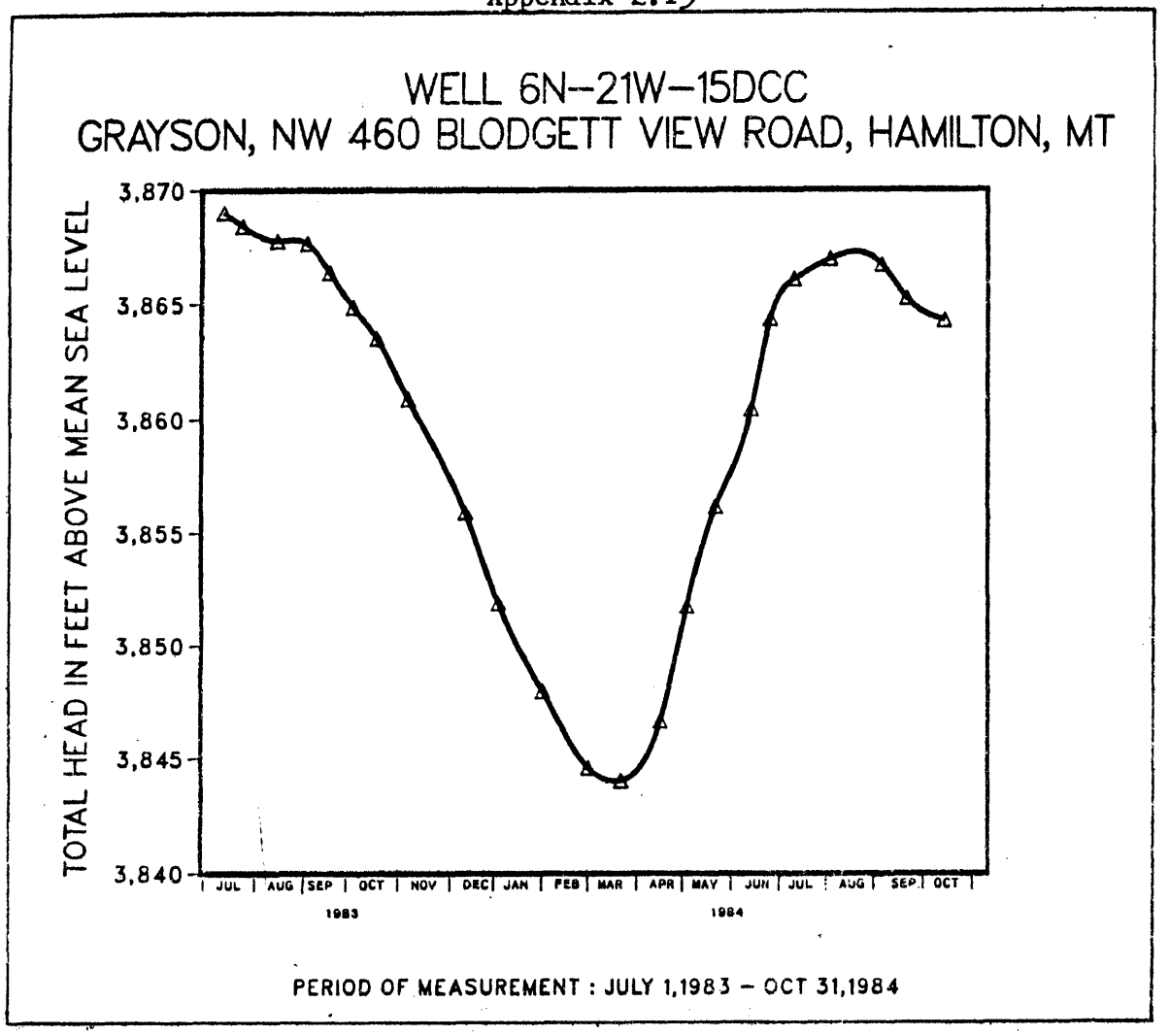
WELL DATA

OWNER : JERRY WILLIAMS
ADDRESS : NW 518 BOWMAN ROAD, HAMILTON, MT
WELL LOCATION : T6N, R21W, NW SW SEC.11
WELL IO NUMBER : 6N-21W-11CBD
ELEVATION : 3707 FEET
WELL DEPTH : 36 FEET
PUMPING RATE : 6 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 11.8 C OR 53.2 F
PH VALUE : 6.28
CONDUCTANCE VALUE : 155 MICROMHOS
ESTIMATED TDS VALUE : 126 MG/L
ESTIMATED HARDNESS VALUE : 58 MG/L

Appendix 2.15



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 15 1983	41.00 FT	79.00 FT	3869.00 FT
JUL 27 1983	41.59 FT	78.41 FT	3868.41 FT
AUG 18 1983	42.25 FT	77.75 FT	3867.75 FT
SEP 6 1983	42.36 FT	77.64 FT	3867.64 FT
SEP 20 1983	43.63 FT	76.37 FT	3866.37 FT
OCT 5 1983	45.12 FT	74.88 FT	3864.88 FT
OCT 20 1983	46.48 FT	73.52 FT	3863.52 FT
NOV 9 1983	49.11 FT	70.89 FT	3860.89 FT
DEC 15 1983	54.08 FT	65.92 FT	3855.92 FT
JAN 5 1984	58.12 FT	61.88 FT	3851.88 FT
FEB 2 1984	62.02 FT	57.98 FT	3847.98 FT
MAR 2 1984	65.41 FT	54.59 FT	3844.59 FT
MAR 23 1984	65.96 FT	54.04 FT	3844.04 FT
APR 17 1984	63.36 FT	56.64 FT	3846.64 FT
MAY 4 1984	58.24 FT	61.76 FT	3851.76 FT
MAY 22 1984	53.83 FT	66.17 FT	3856.17 FT
JUN 14 1984	49.53 FT	70.47 FT	3860.47 FT
JUN 26 1984	45.83 FT	74.37 FT	3864.37 FT
JUL 11 1984	43.92 FT	76.08 FT	3866.08 FT
AUG 3 1984	43.04 FT	76.96 FT	3866.96 FT
SEP 5 1984	43.29 FT	76.71 FT	3866.71 FT
SEP 21 1984	44.75 FT	75.25 FT	3865.25 FT
OCT 15 1984	45.69 FT	74.31 FT	3864.31 FT

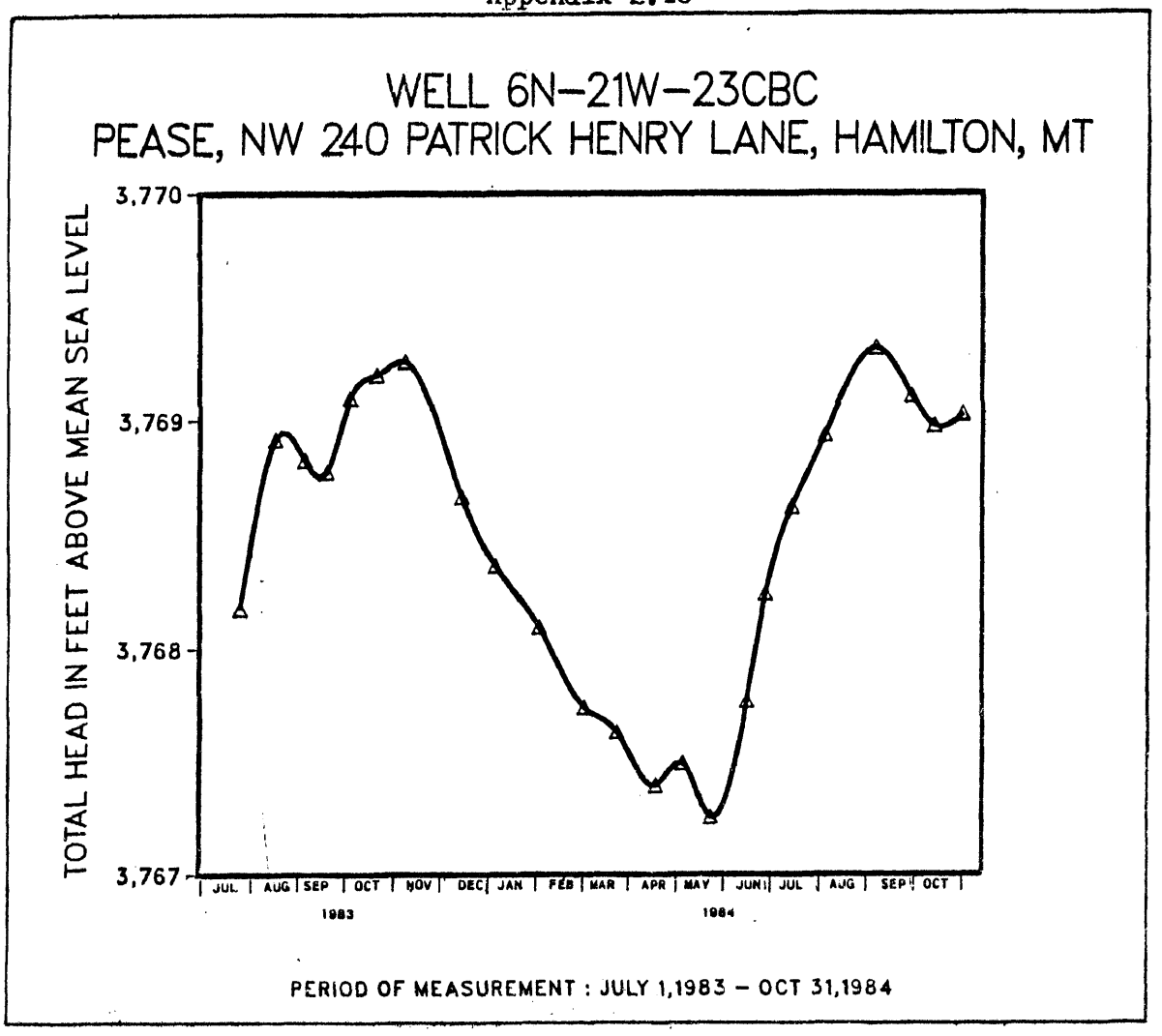
WELL DATA

OWNER : ROGER GRAYSON
ADDRESS : NW 460 BLODGETT VIEW ROAD, HAMILTON, MT
WELL LOCATION : T6N, R21W, SE SW SEC.15
WELL ID NUMBER : 6N-21W-15DCC
ELEVATION : 3910 FEET
WELL DEPTH : 120 FEET
PUMPING RATE : 10 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 10.8 C OR 51.4 F
PH VALUE : 6.17
CONDUCTANCE VALUE : 53 MICROMHOS
ACTUAL TDS VALUE : 59.82 MG/L
ACTUAL HARDNESS VALUE : 19.83 MG/L

Appendix 2.16



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 27 1983	93.82 FT	66.18 FT	3768.18 FT
AUG 18 1983	93.08 FT	66.92 FT	3768.92 FT
SEP 6 1983	93.17 FT	66.83 FT	3768.83 FT
SEP 20 1983	93.22 FT	66.78 FT	3768.78 FT
OCT 5 1983	92.90 FT	67.10 FT	3769.10 FT
OCT 22 1983	92.80 FT	67.20 FT	3769.20 FT
NOV 9 1983	92.74 FT	67.26 FT	3769.26 FT
DEC 15 1983	93.33 FT	66.67 FT	3768.67 FT
JAN 5 1984	93.63 FT	66.37 FT	3768.37 FT
FEB 2 1984	93.90 FT	66.10 FT	3768.10 FT
MAR 2 1984	94.26 FT	65.74 FT	3767.74 FT
MAR 23 1984	94.37 FT	65.63 FT	3767.63 FT
APR 17 1984	94.61 FT	65.39 FT	3767.39 FT
MAY 4 1984	94.51 FT	65.49 FT	3767.49 FT
MAY 22 1984	94.75 FT	65.25 FT	3767.25 FT
JUN 14 1984	94.23 FT	65.77 FT	3767.77 FT
JUN 26 1984	93.75 FT	66.25 FT	3768.25 FT
JUL 13 1984	93.37 FT	66.63 FT	3768.63 FT
AUG 3 1984	93.06 FT	66.94 FT	3768.94 FT
SEP 5 1984	92.68 FT	67.32 FT	3769.32 FT
SEP 28 1984	92.89 FT	67.11 FT	3769.11 FT
OCT 12 1984	93.02 FT	66.98 FT	3768.98 FT
OCT 30 1984	92.97 FT	67.03 FT	3769.03 FT

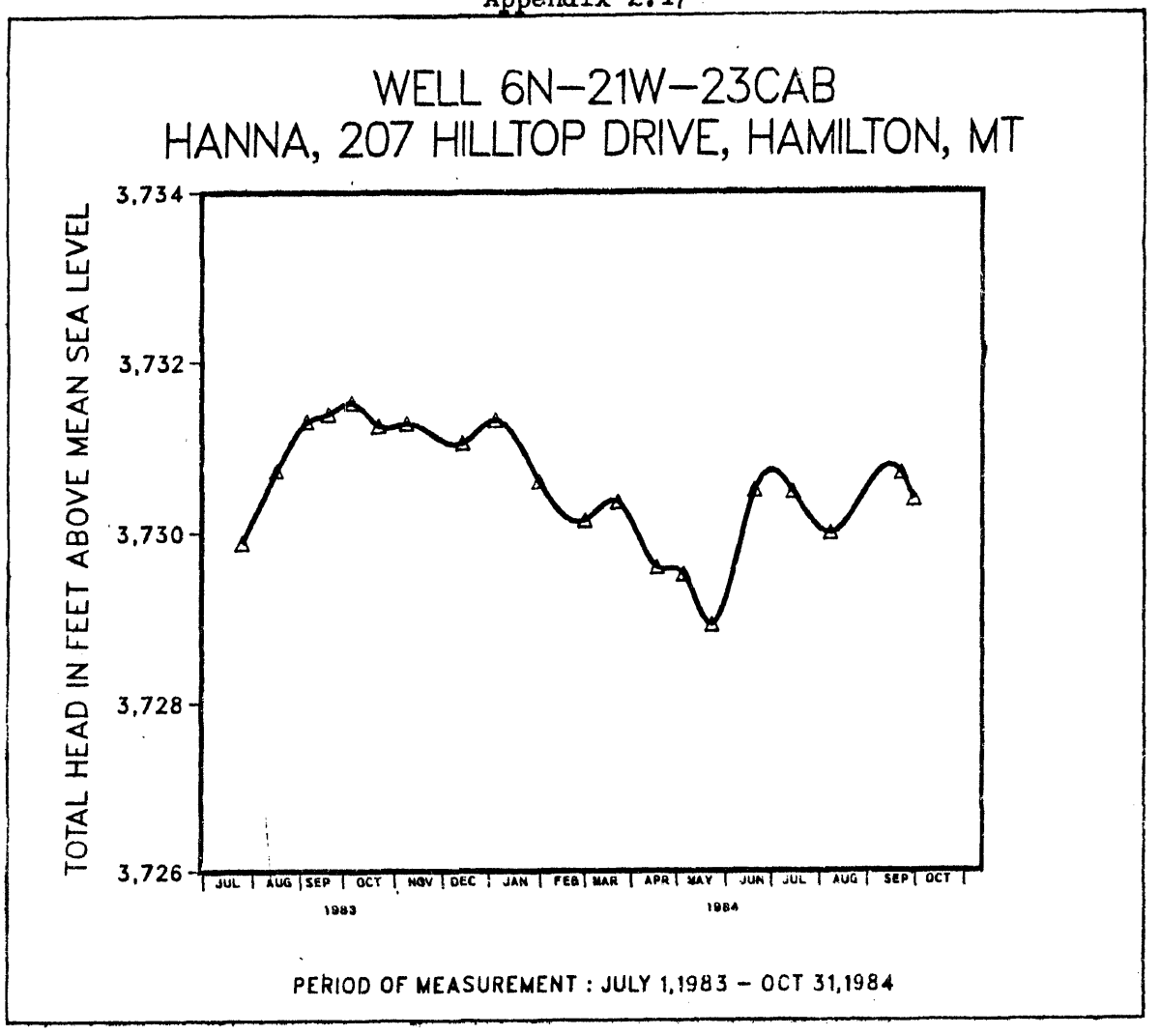
WELL DATA

OWNER : J. LEROY PEASE
ADDRESS : NW 240 PATRICK HENRY LANE, HAMILTON, MT
WELL LOCATION : T6N, R21W, NW SW SEC.23
WELL ID NUMBER : 6N-21W-23CBC
ELEVATION : 3862 FEET
WELL DEPTH : 160 FEET
PUMPING RATE : 10 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 11 C OR 51.8 F
PH VALUE : 6.69
CONDUCTANCE VALUE : 99 MICROMHOS
ACTUAL TDS VALUE : 100.59 MG/L
ACTUAL HARDNESS VALUE : 35.26 MG/L

Appendix 2.17



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 27 1983	99.11 FT	165.89 FT	3729.89 FT
AUG 18 1983	98.26 FT	166.74 FT	3730.74 FT
SEP 6 1983	97.69 FT	167.31 FT	3731.31 FT
SEP 20 1983	97.60 FT	167.40 FT	3731.40 FT
OCT 5 1983	97.47 FT	167.53 FT	3731.53 FT
OCT 22 1983	97.74 FT	167.26 FT	3731.26 FT
NOV 9 1983	97.71 FT	167.29 FT	3731.29 FT
DEC 15 1983	97.94 FT	167.06 FT	3731.06 FT
JAN 5 1984	97.67 FT	167.33 FT	3731.33 FT
FEB 2 1984	98.39 FT	166.61 FT	3730.61 FT
MAR 2 1984	98.85 FT	166.15 FT	3730.15 FT
MAR 23 1984	98.63 FT	166.37 FT	3730.37 FT
APR 17 1984	99.40 FT	165.60 FT	3729.60 FT
MAY 4 1984	99.48 FT	165.52 FT	3729.52 FT
MAY 22 1984	100.07 FT	164.93 FT	3728.93 FT
JUN 18 1984	98.49 FT	166.51 FT	3730.51 FT
JUL 13 1984	98.51 FT	166.49 FT	3730.49 FT
AUG 6 1984	99.00 FT	166.00 FT	3730.00 FT
SEP 21 1984	98.29 FT	166.71 FT	3730.71 FT
SEP 29 1984	98.60 FT	166.40 FT	3730.40 FT

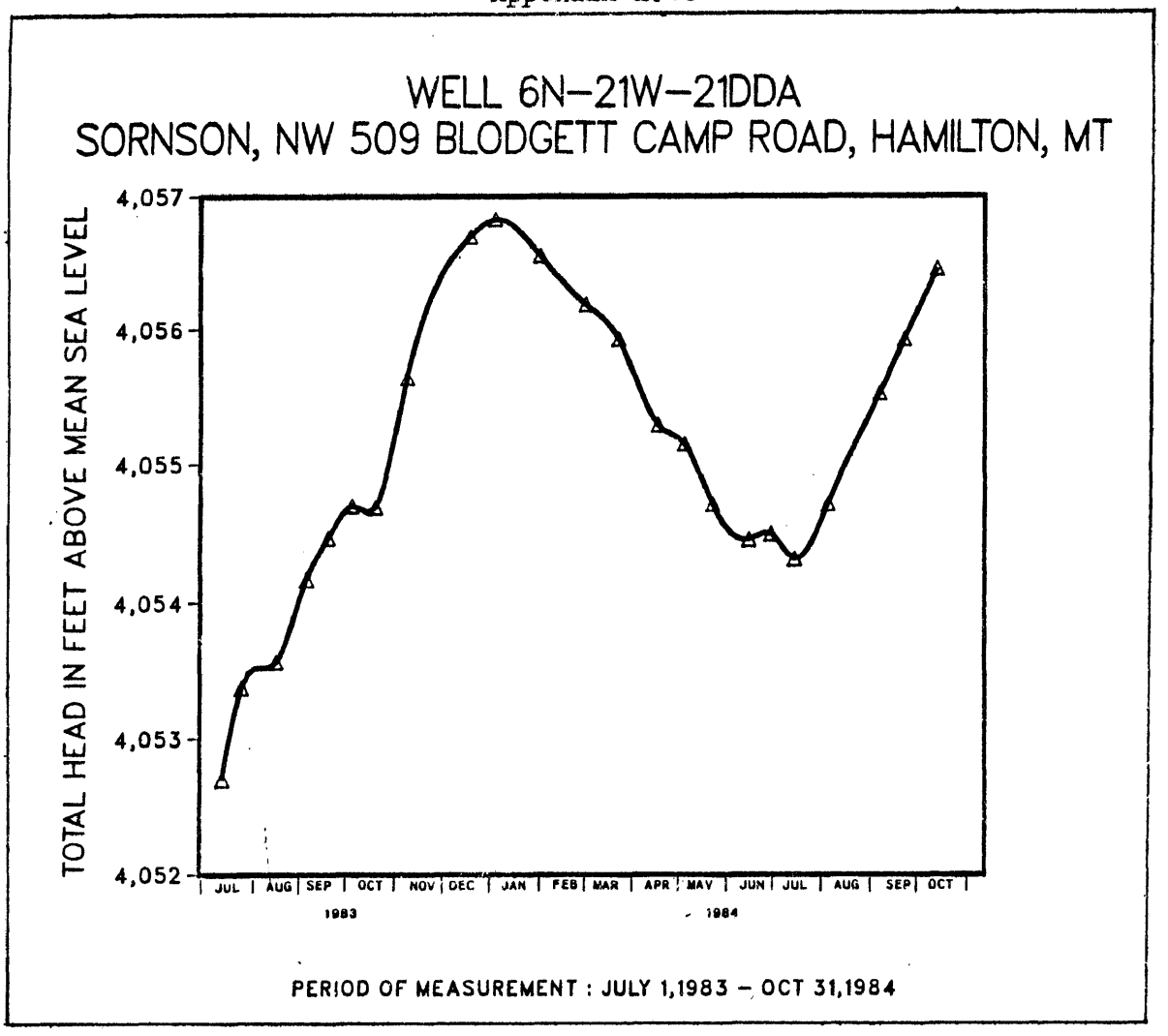
WELL DATA

OWNER : RICHARD HANNA
ADDRESS : 207 HILLTOP DRIVE, HAMILTON, MT
WELL LOCATION : T6N, R21W, SW NW SE.23
WELL ID NUMBER : 6N-21W-23CAB
ELEVATION : 3829 FEET
WELL DEPTH : 265 FEET
PUMPING RATE : 20 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 11 C OR 51.8 F
PH VALUE : 6.23
CONDUCTANCE VALUE : 69 MICROMHOS
ESTIMATED TDS VALUE : 69 MG/L
ESTIMATED HARDNESS VALUE : 27 MG/L

Appendix 2.18



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 15 1983	71.30 FT	9.70 FT	4052.70 FT
JUL 27 1983	70.62 FT	10.38 FT	4053.38 FT
AUG 18 1983	70.43 FT	10.57 FT	4053.57 FT
SEP 6 1983	69.83 FT	11.17 FT	4054.17 FT
SEP 20 1983	69.53 FT	11.47 FT	4054.47 FT
OCT 5 1983	69.30 FT	11.70 FT	4054.70 FT
OCT 20 1983	69.31 FT	11.69 FT	4054.69 FT
NOV 9 1983	68.36 FT	12.64 FT	4055.64 FT
DEC 19 1983	67.30 FT	13.70 FT	4056.70 FT
JAN 4 1984	67.17 FT	13.83 FT	4056.83 FT
FEB 2 1984	67.44 FT	13.56 FT	4056.56 FT
MAR 2 1984	67.81 FT	13.19 FT	4056.19 FT
MAR 23 1984	68.07 FT	12.93 FT	4055.93 FT
APR 17 1984	68.71 FT	12.29 FT	4055.29 FT
MAY 4 1984	68.85 FT	12.15 FT	4055.15 FT
MAY 22 1984	69.29 FT	11.71 FT	4054.71 FT
JUN 14 1984	69.54 FT	11.46 FT	4054.46 FT
JUN 28 1984	69.50 FT	11.50 FT	4054.50 FT
JUL 13 1984	69.68 FT	11.32 FT	4054.32 FT
AUG 3 1984	69.29 FT	11.71 FT	4054.71 FT
SEP 5 1984	68.48 FT	12.52 FT	4055.52 FT
SEP 21 1984	68.07 FT	12.93 FT	4055.93 FT
OCT 12 1984	67.54 FT	13.46 FT	4056.46 FT

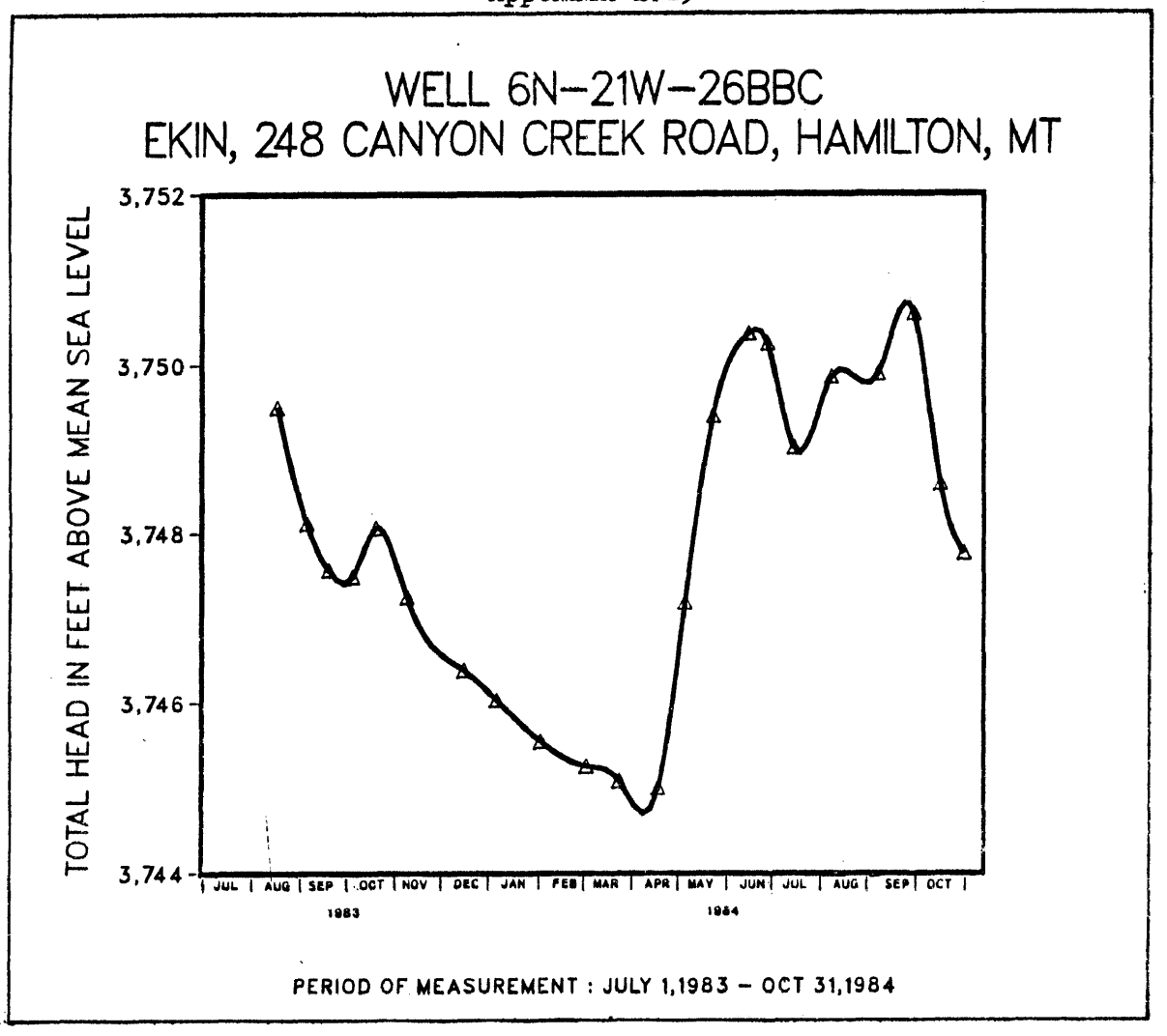
WELL DATA

OWNER : DAVID SORNSON
ADDRESS : NW 509 BLODGETT CAMP ROAD, HAMILTON, MT
WELL LOCATION : T6N, R21W, SE SE SEC.21
WELL ID NUMBER : 6N-21W-21DDA
ELEVATION : 4124 FEET
WELL DEPTH : 81 FEET
PUMPING RATE : 8 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 10 C OR 50 F
PH VALUE : 5.92
CONDUCTANCE VALUE : 92 MICROMHOS
ESTIMATED TDS VALUE : 84 MG/L
ESTIMATED HARDNESS VALUE : 35 MG/L

Appendix 2.19



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
AUG 18 1983	32.51 FT	23.49 FT	3749.49 FT
SEP 6 1983	33.89 FT	22.11 FT	3748.11 FT
SEP 20 1983	34.44 FT	21.56 FT	3747.56 FT
OCT 5 1983	34.52 FT	21.48 FT	3747.48 FT
OCT 20 1983	33.94 FT	22.06 FT	3748.06 FT
NOV 9 1983	34.76 FT	21.24 FT	3747.24 FT
DEC 15 1983	35.62 FT	20.38 FT	3748.38 FT
JAN 5 1984	35.97 FT	20.03 FT	3746.03 FT
FEB 2 1984	36.46 FT	19.54 FT	3745.54 FT
MAR 2 1984	36.75 FT	19.25 FT	3745.25 FT
MAR 23 1984	36.92 FT	19.08 FT	3745.08 FT
APR 17 1984	37.00 FT	19.00 FT	3745.00 FT
MAY 4 1984	34.82 FT	21.18 FT	3747.18 FT
MAY 22 1984	32.61 FT	23.39 FT	3749.39 FT
JUN 14 1984	31.63 FT	24.37 FT	3750.37 FT
JUN 26 1984	31.75 FT	24.25 FT	3750.25 FT
JUL 13 1984	32.99 FT	23.01 FT	3749.01 FT
AUG 6 1984	32.15 FT	23.85 FT	3749.85 FT
SEP 5 1984	32.11 FT	23.89 FT	3749.89 FT
SEP 28 1984	31.40 FT	24.60 FT	3750.60 FT
OCT 15 1984	33.42 FT	22.58 FT	3748.58 FT
OCT 30 1984	34.24 FT	21.76 FT	3747.76 FT

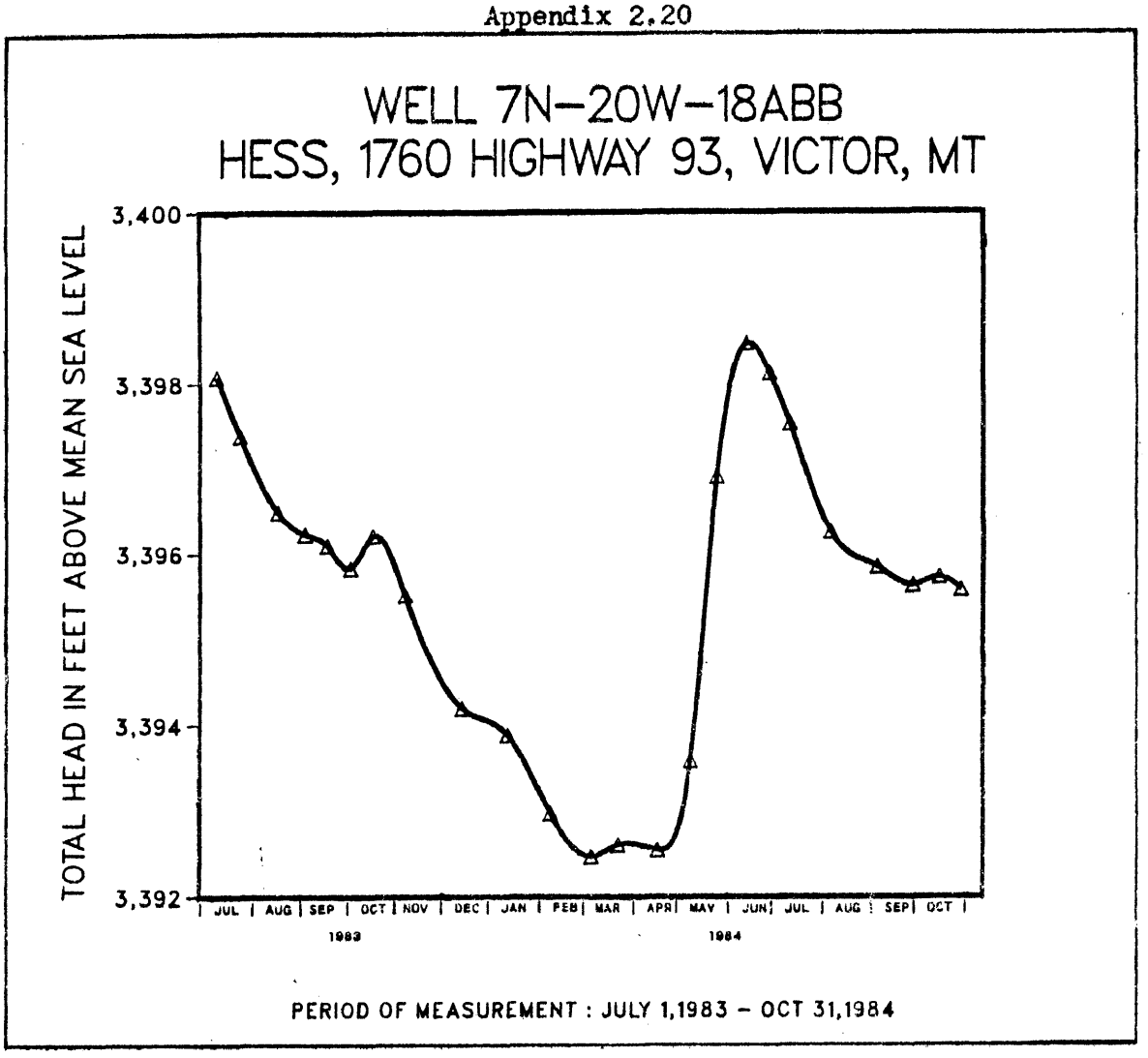
WELL DATA

OWNER : CRAIG EKIN
ADDRESS : 248 CANYON CREEK ROAD, HAMILTON, MT
WELL LOCATION : T6N, R21W, SW NW SEC.26
WELL ID NUMBER : 6N-21W-26BBC
ELEVATION : 3782 FEET
WELL DEPTH : 56 FEET
PUMPING RATE : 20 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 10 C OR 50 F
PH VALUE : 5.86
CONDUCTANCE VALUE : 41 MICROMHOS
ESTIMATED TDS VALUE : 51 MG/L
ESTIMATED HARDNESS VALUE : 16 MG/L

Appendix 2.20



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 12 1983	22.92 FT	21.08 FT	3398.08 FT
JUL 27 1983	23.61 FT	20.39 FT	3397.39 FT
AUG 20 1983	24.51 FT	19.49 FT	3396.49 FT
SEP 6 1983	24.77 FT	19.23 FT	3396.23 FT
SEP 20 1983	24.90 FT	19.10 FT	3396.10 FT
OCT 5 1983	25.17 FT	18.83 FT	3395.83 FT
OCT 19 1983	24.79 FT	19.21 FT	3396.21 FT
NOV 9 1983	25.49 FT	18.51 FT	3395.51 FT
DEC 15 1983	26.80 FT	17.20 FT	3394.20 FT
JAN 13 1984	27.11 FT	16.89 FT	3393.89 FT
FEB 9 1984	28.02 FT	15.98 FT	3392.98 FT
MAR 6 1984	28.53 FT	15.47 FT	3392.47 FT
MAR 23 1984	28.39 FT	15.61 FT	3392.61 FT
APR 17 1984	28.45 FT	15.55 FT	3392.55 FT
MAY 8 1984	27.41 FT	16.59 FT	3393.59 FT
MAY 25 1984	24.09 FT	19.91 FT	3396.91 FT
JUN 13 1984	22.52 FT	21.48 FT	3398.48 FT
JUN 28 1984	22.87 FT	21.13 FT	3398.13 FT
JUL 11 1984	23.47 FT	20.53 FT	3397.53 FT
AUG 6 1984	24.74 FT	19.26 FT	3396.26 FT
SEP 5 1984	25.15 FT	18.85 FT	3395.85 FT
SEP 28 1984	25.37 FT	18.63 FT	3395.63 FT
OCT 15 1984	25.27 FT	18.73 FT	3395.73 FT
OCT 29 1984	25.42 FT	18.58 FT	3395.58 FT

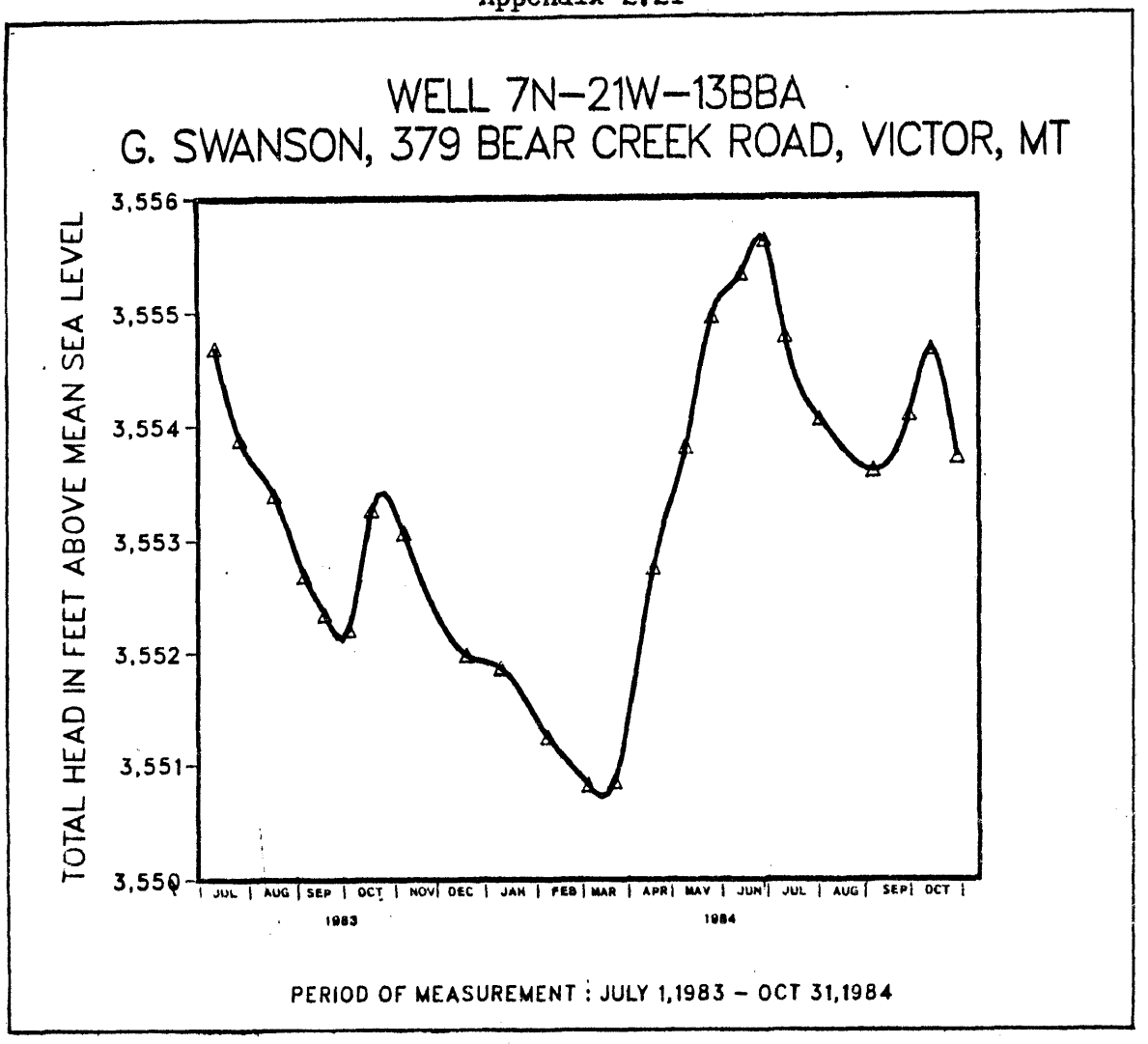
WELL DATA

OWNER : JOHN HESS
ADDRESS : 1760 HIGHWAY 93, VICTOR, MT
WELL LOCATION : T7N, R20W, NW NE SEC. 18
WELL ID NUMBER : 7N-20W-18ABB
ELEVATION : 3421 FEET
WELL DEPTH : 44 FEET
PUMPING RATE : 20 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 11.4 C OR 52.5 F
PH VALUE : 5.94
CONDUCTANCE VALUE : 91 MICROMHOS
ACTUAL TOS VALUE : 78.48 MG/L
ACTUAL HARDNESS VALUE : 40.65 MG/L

Appendix 2.21



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 12 1983	53.31 FT	46.69 FT	3564.69 FT
JUL 28 1983	54.11 FT	45.89 FT	3553.89 FT
AUG 19 1983	54.60 FT	45.40 FT	3553.40 FT
SEP 7 1983	55.31 FT	44.69 FT	3552.69 FT
SEP 20 1983	55.65 FT	44.35 FT	3552.35 FT
OCT 5 1983	56.79 FT	44.21 FT	3552.21 FT
OCT 20 1983	54.73 FT	45.27 FT	3553.27 FT
NOV 9 1983	54.93 FT	45.07 FT	3553.07 FT
DEC 19 1983	56.02 FT	43.98 FT	3551.98 FT
JAN 10 1984	56.14 FT	43.88 FT	3551.88 FT
FEB 9 1984	56.76 FT	43.24 FT	3551.24 FT
MAR 6 1984	57.18 FT	42.82 FT	3550.82 FT
MAR 23 1984	57.15 FT	42.85 FT	3550.85 FT
APR 17 1984	55.24 FT	44.76 FT	3552.76 FT
MAY 8 1984	54.18 FT	45.82 FT	3553.82 FT
MAY 25 1984	53.04 FT	46.96 FT	3554.96 FT
JUN 13 1984	52.67 FT	47.33 FT	3555.33 FT
JUN 28 1984	52.38 FT	47.62 FT	3555.62 FT
JUL 11 1984	53.21 FT	46.79 FT	3554.79 FT
AUG 2 1984	53.94 FT	46.06 FT	3554.06 FT
SEP 5 1984	54.39 FT	45.81 FT	3553.81 FT
SEP 28 1984	53.90 FT	46.10 FT	3554.10 FT
OCT 12 1984	53.33 FT	46.67 FT	3554.67 FT
OCT 29 1984	54.27 FT	45.73 FT	3553.73 FT

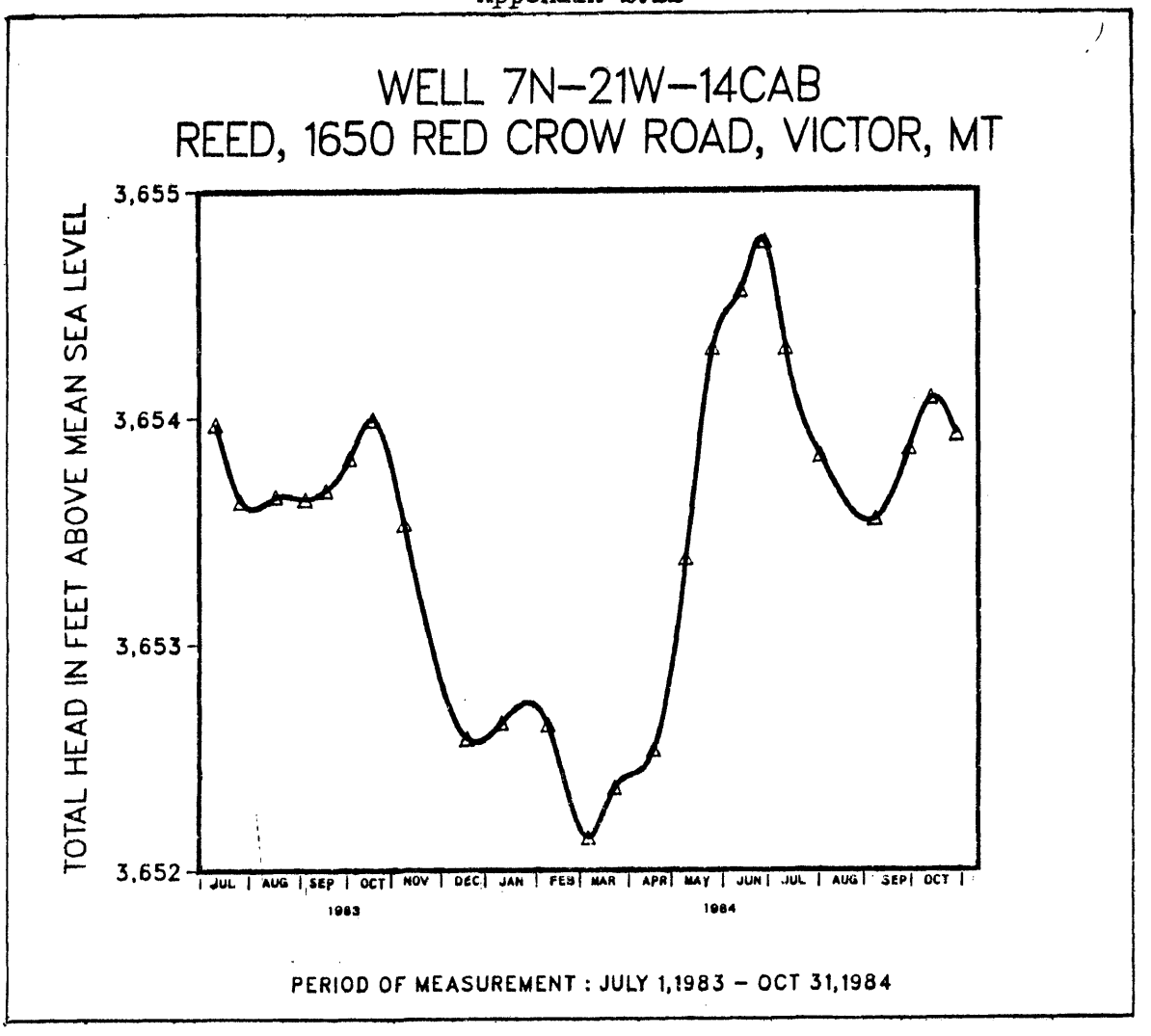
WELL DATA

OWNER : GEORGE SWANSON
ADDRESS : 379 BEAR CREEK ROAD, VICTOR, MT
WELL LOCATION : T7N, R21W, NW NW SEC.13
WELL ID NUMBER : 7N-21W-13BBA
ELEVATION : 3808 FEET
WELL DEPTH : 100 FEET
PUMPING RATE : 15 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 11 C OR 51.8 F
PH VALUE : 6.8
CONDUCTANCE VALUE : 95 MICROMHOS
ESTIMATED TDS VALUE : 86 MG/L
ESTIMATED HARDNESS VALUE : 36 MG/L

Appendix 2.22



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 12 1983	8.03 FT	18.97 FT	3653.97 FT
JUL 28 1983	8.37 FT	18.63 FT	3653.63 FT
AUG 19 1983	8.35 FT	18.65 FT	3653.65 FT
SEP 7 1983	8.36 FT	18.64 FT	3653.64 FT
SEP 20 1983	8.32 FT	18.68 FT	3653.68 FT
OCT 5 1983	8.18 FT	18.82 FT	3653.82 FT
OCT 20 1983	8.01 FT	18.99 FT	3653.99 FT
NOV 9 1983	8.47 FT	18.53 FT	3653.53 FT
DEC 19 1983	9.42 FT	17.58 FT	3652.58 FT
JAN 10 1984	9.35 FT	17.65 FT	3652.65 FT
FEB 9 1984	9.36 FT	17.64 FT	3652.64 FT
MAR 8 1984	9.86 FT	17.14 FT	3652.14 FT
MAR 23 1984	9.64 FT	17.36 FT	3652.36 FT
APR 17 1984	9.47 FT	17.53 FT	3652.53 FT
MAY 8 1984	8.62 FT	18.38 FT	3653.38 FT
MAY 25 1984	7.70 FT	19.30 FT	3654.30 FT
JUN 12 1984	7.45 FT	19.55 FT	3654.55 FT
JUN 28 1984	7.23 FT	19.77 FT	3654.77 FT
JUL 11 1984	7.70 FT	19.30 FT	3654.30 FT
AUG 2 1984	8.17 FT	18.83 FT	3653.83 FT
SEP 6 1984	8.45 FT	18.55 FT	3653.55 FT
SEP 26 1984	8.14 FT	18.86 FT	3653.86 FT
OCT 12 1984	7.92 FT	19.08 FT	3654.08 FT
OCT 29 1984	8.08 FT	18.92 FT	3653.92 FT

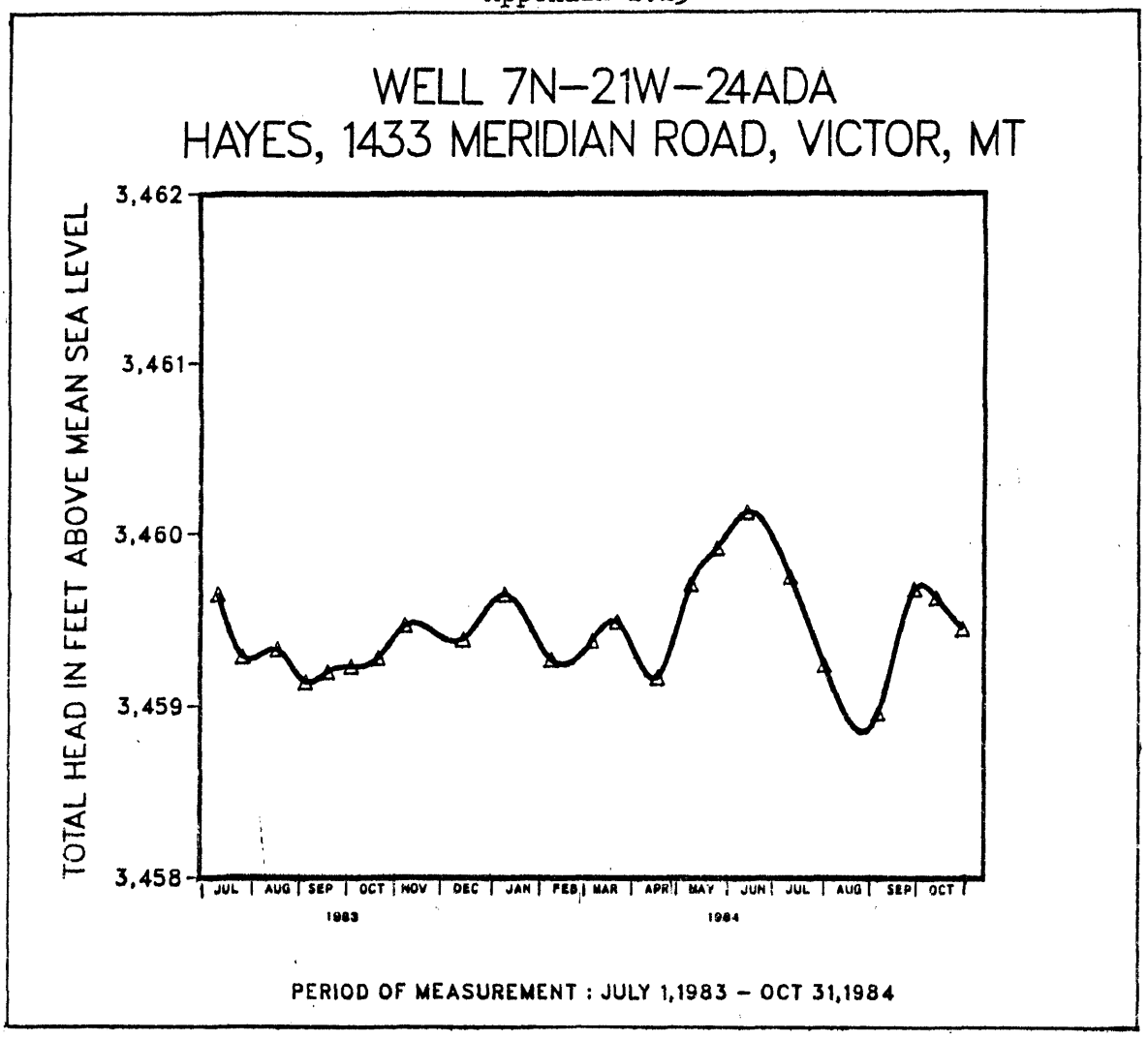
WELL DATA

OWNER : BEN REED
ADDRESS : 1650 RED CROW ROAD, VICTOR, MT
WELL LOCATION : T7N, R21W, NE SW SEC.14
WELL ID NUMBER : 7N-21W-14CAB
ELEVATION : 3662 FEET
WELL DEPTH : 27 FEET
PUMPING RATE : 20 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 7.9 C OR 46.2 F
PH VALUE : 5.03
CONDUCTANCE VALUE : 19 MICROMHOS
ESTIMATED TDS VALUE : 37 MG/L
ESTIMATED HARDNESS VALUE : 9 MG/L

Appendix 2.23



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 12 1983	2.35 FT	37.65 FT	3459.65 FT
JUL 28 1983	2.71 FT	37.29 FT	3459.29 FT
AUG 19 1983	2.67 FT	37.33 FT	3459.33 FT
SEP 6 1983	2.86 FT	37.14 FT	3459.14 FT
SEP 20 1983	2.80 FT	37.20 FT	3459.20 FT
OCT 5 1983	2.77 FT	37.23 FT	3459.23 FT
OCT 22 1983	2.72 FT	37.28 FT	3459.28 FT
NOV 8 1983	2.53 FT	37.47 FT	3459.47 FT
DEC 15 1983	2.61 FT	37.39 FT	3459.39 FT
JAN 10 1984	2.35 FT	37.65 FT	3459.65 FT
FEB 9 1984	2.73 FT	37.27 FT	3459.27 FT
MAR 6 1984	2.62 FT	37.38 FT	3459.38 FT
MAR 22 1984	2.51 FT	37.49 FT	3459.49 FT
APR 17 1984	2.83 FT	37.17 FT	3459.17 FT
MAY 8 1984	2.29 FT	37.71 FT	3459.71 FT
MAY 25 1984	2.08 FT	37.92 FT	3459.92 FT
JUN 13 1984	1.87 FT	38.13 FT	3460.13 FT
JUL 11 1984	2.25 FT	37.75 FT	3459.75 FT
AUG 2 1984	2.76 FT	37.24 FT	3459.24 FT
SEP 5 1984	3.04 FT	36.96 FT	3458.96 FT
SEP 28 1984	2.32 FT	37.68 FT	3459.68 FT
OCT 12 1984	2.37 FT	37.63 FT	3459.63 FT
OCT 29 1984	2.55 FT	37.45 FT	3459.45 FT

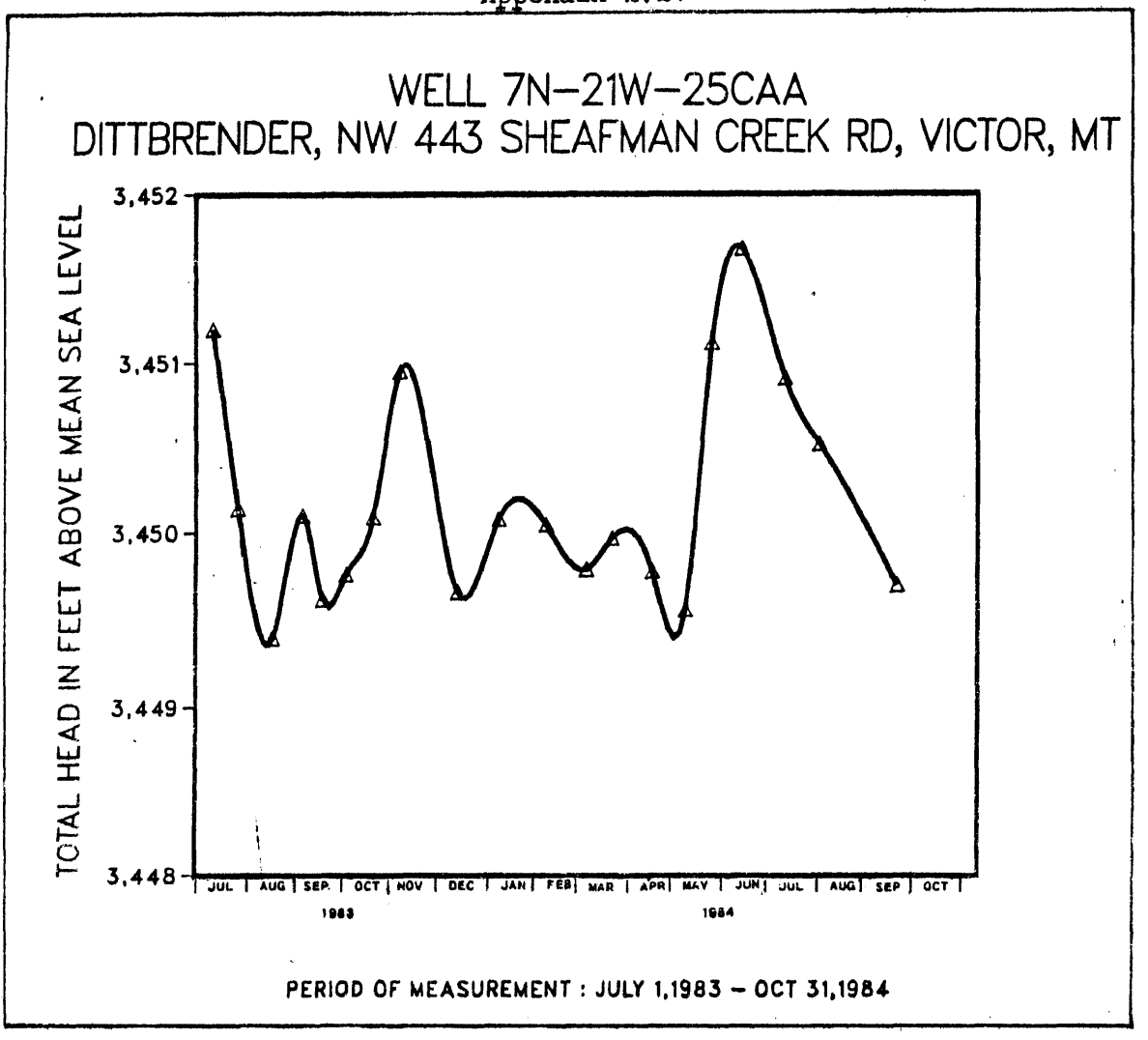
WELL DATA

OWNER : GERALD HAYES
ADDRESS : 1433 MERIDIAN ROAD, VICTOR, MT
WELL LOCATION : T7N, R21W, SE NE SEC. 24
WELL ID NUMBER : 7N-21W-24ADA
ELEVATION : 3462 FEET
WELL DEPTH : 40 FEET
PUMPING RATE : 30 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 10.1 C OR 50.1 F
PH VALUE : 5.37
CONDUCTANCE VALUE : 34 MICROMHOS
ESTIMATED TDS VALUE : 46 MG/L
ESTIMATED HARDNESS VALUE : 14 MG/L

Appendix 2.24



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 12 1983	19.80 FT	20.20 FT	3451.20 FT
JUL 28 1983	20.86 FT	19.14 FT	3450.14 FT
AUG 19 1983	21.60 FT	18.40 FT	3449.40 FT
SEP 7 1983	20.90 FT	19.10 FT	3450.10 FT
SEP 20 1983	21.38 FT	18.62 FT	3449.62 FT
OCT 5 1983	21.24 FT	18.76 FT	3449.76 FT
OCT 22 1983	20.91 FT	19.09 FT	3450.09 FT
NOV 8 1983	20.05 FT	19.95 FT	3450.95 FT
DEC 15 1983	21.34 FT	18.66 FT	3449.66 FT
JAN 10 1984	20.92 FT	19.08 FT	3450.08 FT
FEB 9 1984	20.95 FT	19.05 FT	3450.05 FT
MAR 6 1984	21.21 FT	18.79 FT	3449.79 FT
MAR 22 1984	21.03 FT	18.97 FT	3449.97 FT
APR 17 1984	21.22 FT	18.78 FT	3449.78 FT
MAY 8 1984	21.44 FT	18.56 FT	3449.56 FT
MAY 25 1984	19.88 FT	20.12 FT	3451.12 FT
JUN 13 1984	19.32 FT	20.68 FT	3451.68 FT
JUL 11 1984	20.09 FT	19.91 FT	3450.91 FT
AUG 2 1984	20.48 FT	19.52 FT	3450.52 FT
SEP 21 1984	21.30 FT	18.70 FT	3449.70 FT

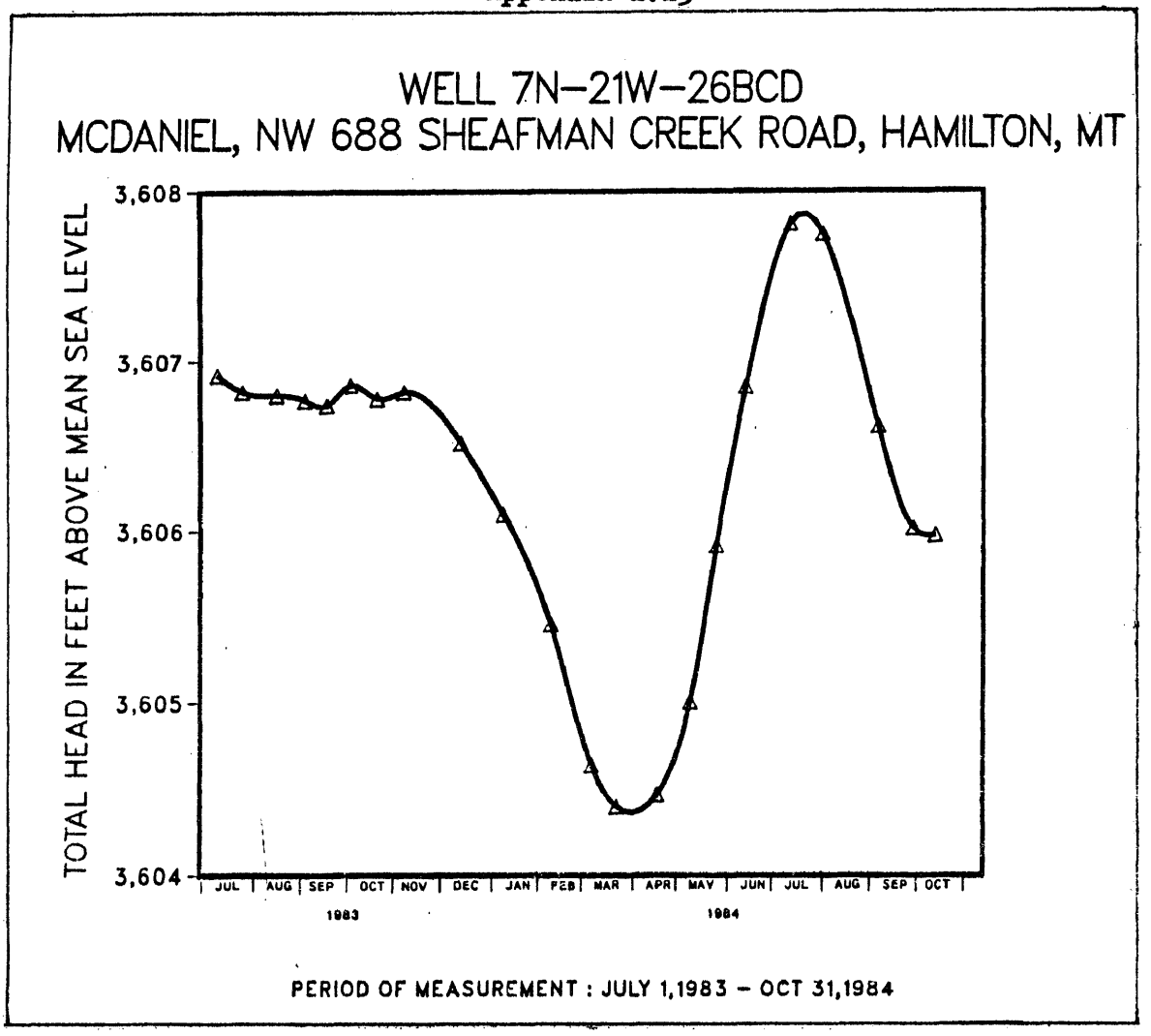
WELL DATA

OWNER : ART DITTBRENDER
ADDRESS : NW 443 SHEAFMAN CREEK RD, VICTOR, MT
WELL LOCATION : T7N, R21W, NE SW SEC.25
WELL ID NUMBER : 7N-21W-25CAA
ELEVATION : 3471 FEET
WELL DEPTH : 40 FEET
PUMPING RATE : 10 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 11.9 C OR 53.4 F
PH VALUE : 6.24
CONDUCTANCE VALUE : 81 MICROMHOS
ESTIMATED TDS VALUE : 77 MG/L
ESTIMATED HARDNESS VALUE : 31 MG/L

Appendix 2.25



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 12 1983	13.08 FT	46.92 FT	3606.92 FT
JUL 28 1983	13.18 FT	46.82 FT	3606.82 FT
AUG 19 1983	13.20 FT	46.80 FT	3606.80 FT
SEP 6 1983	13.23 FT	46.77 FT	3606.77 FT
SEP 20 1983	13.26 FT	46.74 FT	3606.74 FT
OCT 5 1983	13.14 FT	46.86 FT	3606.86 FT
OCT 22 1983	13.22 FT	46.78 FT	3606.78 FT
NOV 8 1983	13.18 FT	46.82 FT	3606.82 FT
DEC 14 1983	13.48 FT	46.52 FT	3606.52 FT
JAN 10 1984	13.90 FT	46.10 FT	3606.10 FT
FEB 9 1984	14.54 FT	45.46 FT	3605.46 FT
MAR 6 1984	15.36 FT	44.64 FT	3604.64 FT
MAR 22 1984	15.60 FT	44.40 FT	3604.40 FT
APR 17 1984	15.53 FT	44.47 FT	3604.47 FT
MAY 8 1984	14.99 FT	45.01 FT	3605.01 FT
MAY 25 1984	14.08 FT	45.92 FT	3605.92 FT
JUN 13 1984	13.15 FT	46.85 FT	3606.85 FT
JUL 12 1984	12.19 FT	47.81 FT	3607.81 FT
AUG 2 1984	12.25 FT	47.75 FT	3607.75 FT
SEP 6 1984	13.38 FT	46.62 FT	3606.62 FT
SEP 28 1984	13.98 FT	46.02 FT	3606.02 FT
OCT 12 1984	14.02 FT	45.98 FT	3605.98 FT

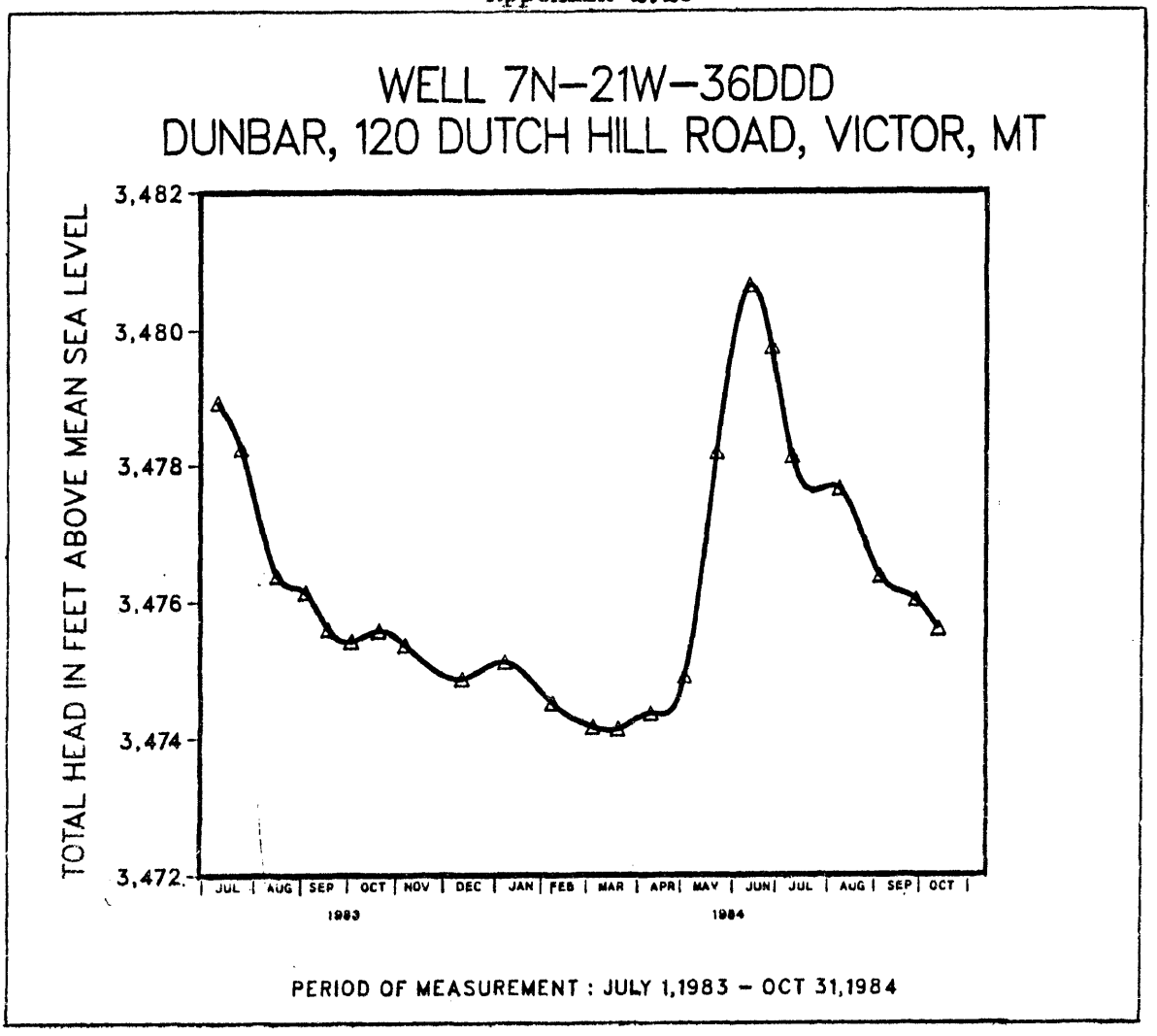
WELL DATA

OWNER : FRANCIS MCDANIEL
ADDRESS : NW 688 SHEAFMAN CREEK ROAD, HAMILTON, MT
WELL LOCATION : T7N, R21W, SW NW SEC.26
WELL ID NUMBER : 7N-21W-26BCD
ELEVATION : 3620 FEET
WELL DEPTH : 60 FEET
PUMPING RATE : 20 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 10 C OR 50 F
PH VALUE : 6.37
CONDUCTANCE VALUE : 137 MICROMHOS
ESTIMATED TDS VALUE : 114 MG/L
ESTIMATED HARDNESS VALUE : 51 MG/L

Appendix 2.26



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 12 1983	8.06 FT	22.94 FT	3478.94 FT
JUL 27 1983	8.75 FT	22.25 FT	3478.25 FT
AUG 19 1983	10.61 FT	20.39 FT	3476.39 FT
SEP 6 1983	10.85 FT	20.15 FT	3476.15 FT
SEP 20 1983	11.39 FT	19.61 FT	3475.61 FT
OCT 5 1983	11.58 FT	19.42 FT	3475.42 FT
OCT 22 1983	11.42 FT	19.58 FT	3475.58 FT
NOV 8 1983	11.63 FT	19.37 FT	3475.37 FT
DEC 14 1983	12.13 FT	18.87 FY	3474.87 FT
JAN 10 1984	11.88 FT	19.12 FT	3475.12 FT
FEB 9 1984	12.48 FT	18.52 FT	3474.52 FT
MAR 6 1984	12.83 FT	18.17 FT	3474.17 FT
MAR 22 1984	12.86 FT	18.14 FT	3474.14 FT
APR 12 1984	12.63 FT	18.37 FT	3474.37 FT
MAY 4 1984	12.09 FT	18.91 FT	3474.91 FT
MAY 24 1984	8.80 FT	22.20 FT	3478.20 FT
JUN 14 1984	6.34 FT	24.66 FT	3480.66 FT
JUN 28 1984	7.24 FT	23.76 FT	3479.76 FT
JUL 11 1984	8.86 FT	22.14 FT	3478.14 FT
AUG 10 1984	9.33 FT	21.67 FT	3477.67 FT
SEP 5 1984	10.61 FT	20.39 FT	3476.39 FT
SEP 28 1984	10.96 FT	20.04 FT	3476.04 FT
OCT 12 1984	11.39 FT	19.61 FT	3475.61 FT

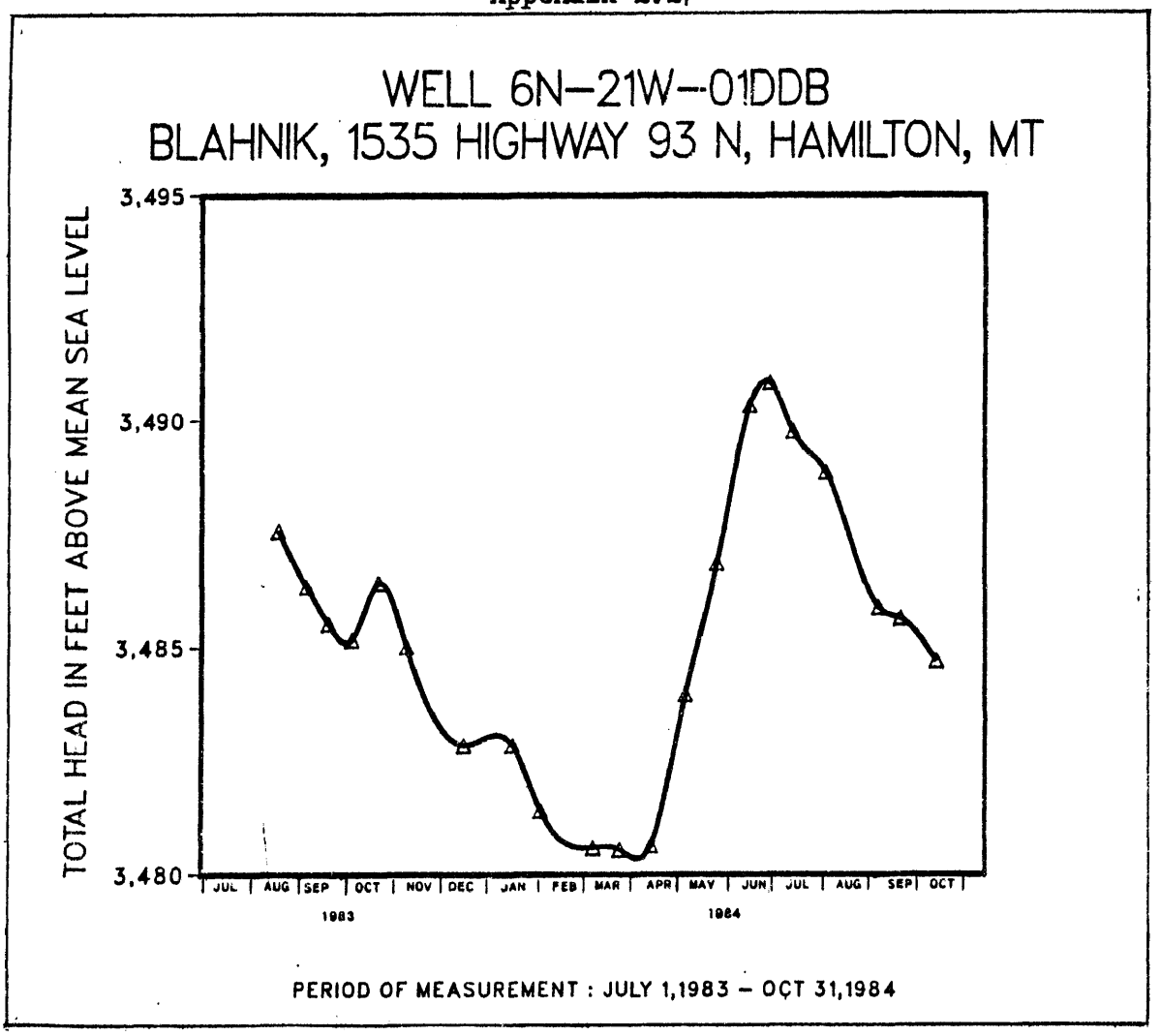
WELL DATA

OWNER : TOM DUNBAR
ADDRESS : 120 DUTCH HILL ROAD, VICTOR, MT
WELL LOCATION : T7N, R21W, SE SE SEC.36
WELL ID NUMBER : 7N-21W-36DDD
ELEVATION : 3487 FEET
WELL DEPTH : 31 FEET
PUMPING RATE : 20 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 10.3 C OR 50.5 F
PH VALUE : 5.48
CONDUCTANCE VALUE : 34 MICROMHOS
ACTUAL TDS VALUE : 33.19 MG/L
ACTUAL HARDNESS VALUE : 11.12 MG/L

Appendix 2.27



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
AUG 19 1983	7.41 FT	52.59 FT	3487.59 FT
SEP 6 1983	8.63 FT	51.37 FT	3486.37 FT
SEP 20 1983	9.46 FT	50.54 FT	3485.54 FT
OCT 5 1983	9.81 FT	50.19 FT	3485.19 FT
OCT 22 1983	8.55 FT	51.45 FT	3486.45 FT
NOV 9 1983	9.97 FT	50.03 FT	3485.03 FT
DEC 15 1983	12.19 FT	47.81 FT	3482.81 FT
JAN 16 1984	12.18 FT	47.82 FT	3482.82 FT
FEB 2 1984	13.62 FT	46.38 FT	3481.38 FT
MAR 6 1984	14.42 FT	45.58 FT	3480.58 FT
MAR 23 1984	14.46 FT	45.54 FT	3480.54 FT
APR 12 1984	14.38 FT	45.62 FT	3480.62 FT
MAY 4 1984	11.03 FT	48.97 FT	3483.97 FT
MAY 24 1984	8.10 FT	51.90 FT	3486.90 FT
JUN 14 1984	4.66 FT	55.34 FT	3490.34 FT
JUN 27 1984	4.15 FT	55.85 FT	3490.85 FT
JUL 12 1984	5.23 FT	54.77 FT	3489.77 FT
AUG 2 1984	6.13 FT	53.87 FT	3488.87 FT
SEP 5 1984	9.08 FT	50.92 FT	3485.92 FT
SEP 19 1984	9.32 FT	50.68 FT	3485.68 FT
OCT 12 1984	10.27 FT	49.73 FT	3484.73 FT

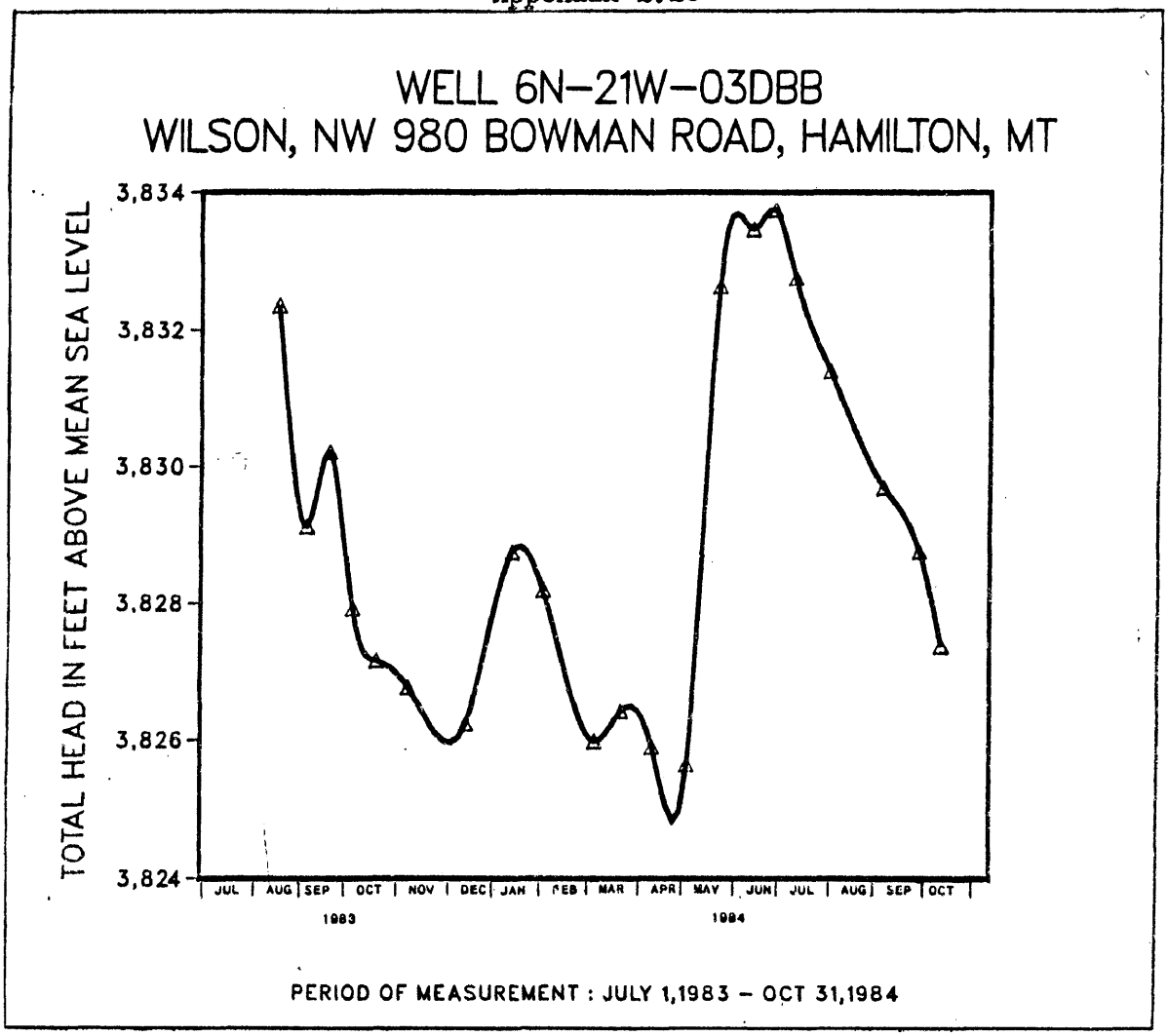
WELL DATA

OWNER : JOHN BLAHNIK
ADDRESS : 1535 HIGHWAY 93 N, HAMILTON, MT
WELL LOCATION : T6N, R21W, NE SE SEC.1
WELL ID NUMBER : 6N-21W-01DDB
ELEVATION : 3495 FEET
WELL DEPTH : 60 FEET
PUMPING RATE : 15 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 11.8 C OR 53.2 F
PH VALUE : 5.98
CONDUCTANCE VALUE : 63 MICROMHOS
ESTIMATED TDS VALUE : 66 MG/L
ESTIMATED HARDNESS VALUE : 25 MG/L

Appendix 2.28



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
AUG 19 1983	5.64 FT	37.36 FT	3832.36 FT
SEP 6 1983	8.87 FT	34.13 FT	3829.13 FT
SEP 20 1983	7.79 FT	35.21 FT	3830.21 FT
OCT 5 1983	10.08 FT	32.92 FT	3827.92 FT
OCT 20 1983	10.84 FT	32.16 FT	3827.16 FT
NOV 9 1983	11.23 FT	31.77 FT	3826.77 FT
DEC 15 1983	11.76 FT	31.24 FT	3826.24 FT
JAN 13 1984	9.24 FT	33.76 FT	3828.76 FT
FEB 2 1984	9.80 FT	33.20 FT	3828.20 FT
MAR 6 1984	12.02 FT	30.98 FT	3825.98 FT
MAR 23 1984	11.58 FT	31.42 FT	3826.42 FT
APR 12 1984	12.10 FT	30.90 FT	3825.90 FT
MAY 4 1984	12.36 FT	30.64 FT	3825.64 FT
MAY 24 1984	5.35 FT	37.65 FT	3832.65 FT
JUN 14 1984	4.53 FT	38.47 FT	3833.47 FT
JUN 28 1984	4.25 FT	38.75 FT	3833.75 FT
JUL 11 1984	5.23 FT	37.77 FT	3832.77 FT
AUG 2 1984	6.59 FT	36.41 FT	3831.41 FT
SEP 5 1984	8.29 FT	34.71 FT	3829.71 FT
SEP 28 1984	9.22 FT	33.78 FT	3828.78 FT
OCT 12 1984	10.62 FT	32.38 FT	3827.38 FT

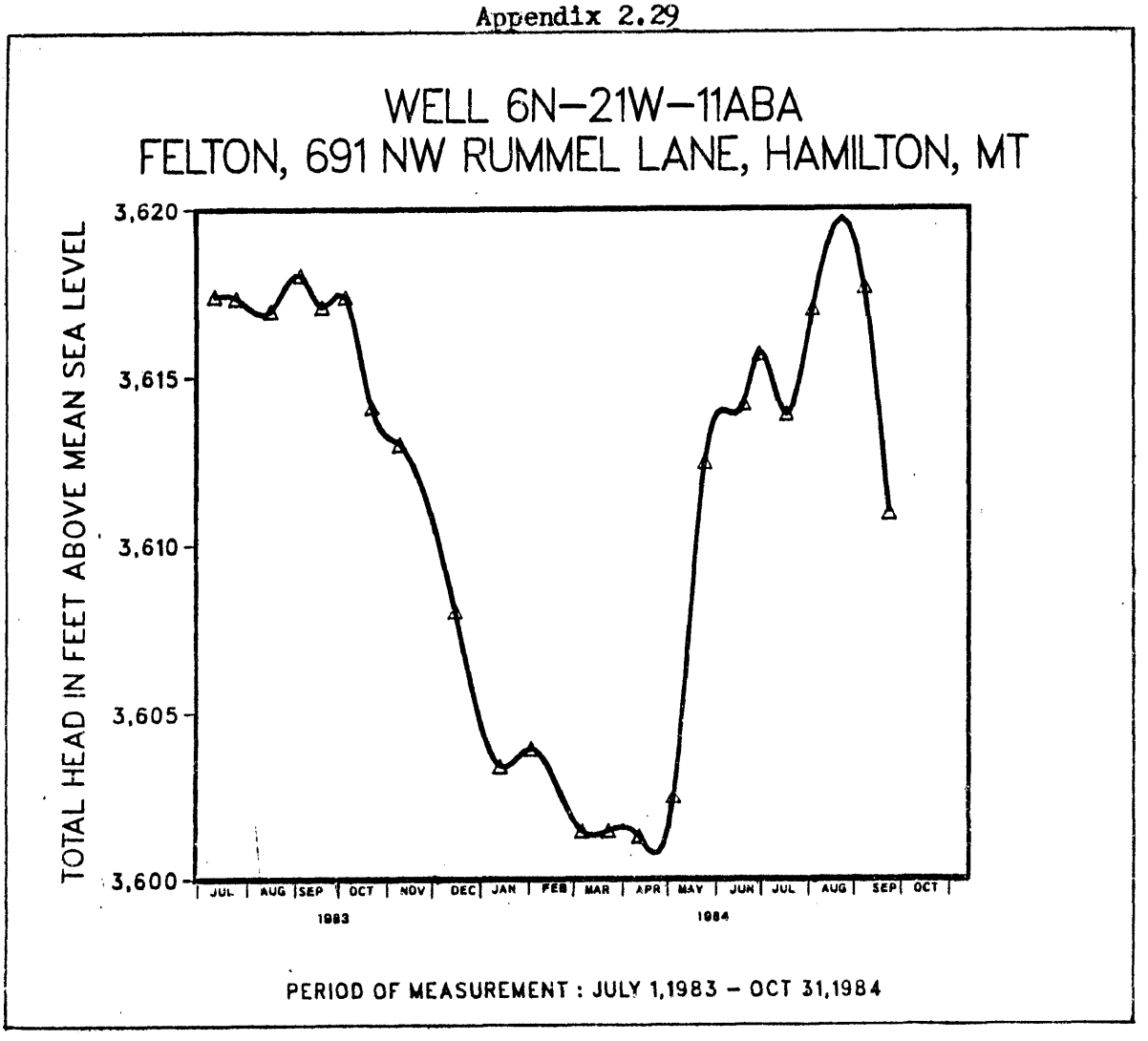
WELL DATA

OWNER : STEVE WILSON
ADDRESS : NW 980 BOWMAN ROAD, HAMILTON, MT
WELL LOCATION : T6N, R21W, NW SE SEC.3
WELL ID NUMBER : 6N-21W-03DBB
ELEVATION : 3838 FEET
WELL DEPTH : 43 FEET
PUMPING RATE : 12 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 10.2 C OR 50.3 F
PH VALUE : 5.54
CONDUCTANCE VALUE : 144 MICROMHOS
ESTIMATED TDS VALUE : 119 MG/L
ESTIMATED HARDNESS VALUE : 54 MG/L

Appendix 2.29



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 13 1983	14.57 FT	121.43 FT	3617.43 FT
JUL 27 1983	14.64 FT	121.36 FT	3617.36 FT
AUG 18 1983	15.02 FT	120.98 FT	3616.98 FT
SEP 6 1983	13.95 FT	122.05 FT	3618.05 FT
SEP 20 1983	14.90 FT	121.10 FT	3617.10 FT
OCT 5 1983	14.60 FT	121.40 FT	3617.40 FT
OCT 22 1983	17.89 FT	118.11 FT	3614.11 FT
NOV 9 1983	19.00 FT	117.00 FT	3613.00 FT
DEC 15 1983	23.95 FT	112.05 FT	3608.05 FT
JAN 13 1984	28.60 FT	107.40 FT	3603.40 FT
FEB 2 1984	28.07 FT	107.93 FT	3603.93 FT
MAR 8 1984	30.56 FT	105.44 FT	3601.44 FT
MAR 23 1984	30.55 FT	105.45 FT	3601.45 FT
APR 12 1984	30.71 FT	105.29 FT	3601.29 FT
MAY 4 1984	29.51 FT	106.49 FT	3602.49 FT
MAY 24 1984	19.53 FT	116.47 FT	3612.47 FT
JUN 18 1984	17.79 FT	118.21 FT	3614.21 FT
JUN 28 1984	16.30 FT	119.70 FT	3615.70 FT
JUL 16 1984	18.10 FT	117.90 FT	3613.90 FT
AUG 2 1984	14.97 FT	121.03 FT	3617.03 FT
SEP 5 1984	14.32 FT	121.68 FT	3617.68 FT
SEP 21 1984	21.05 FT	114.95 FT	3610.95 FT

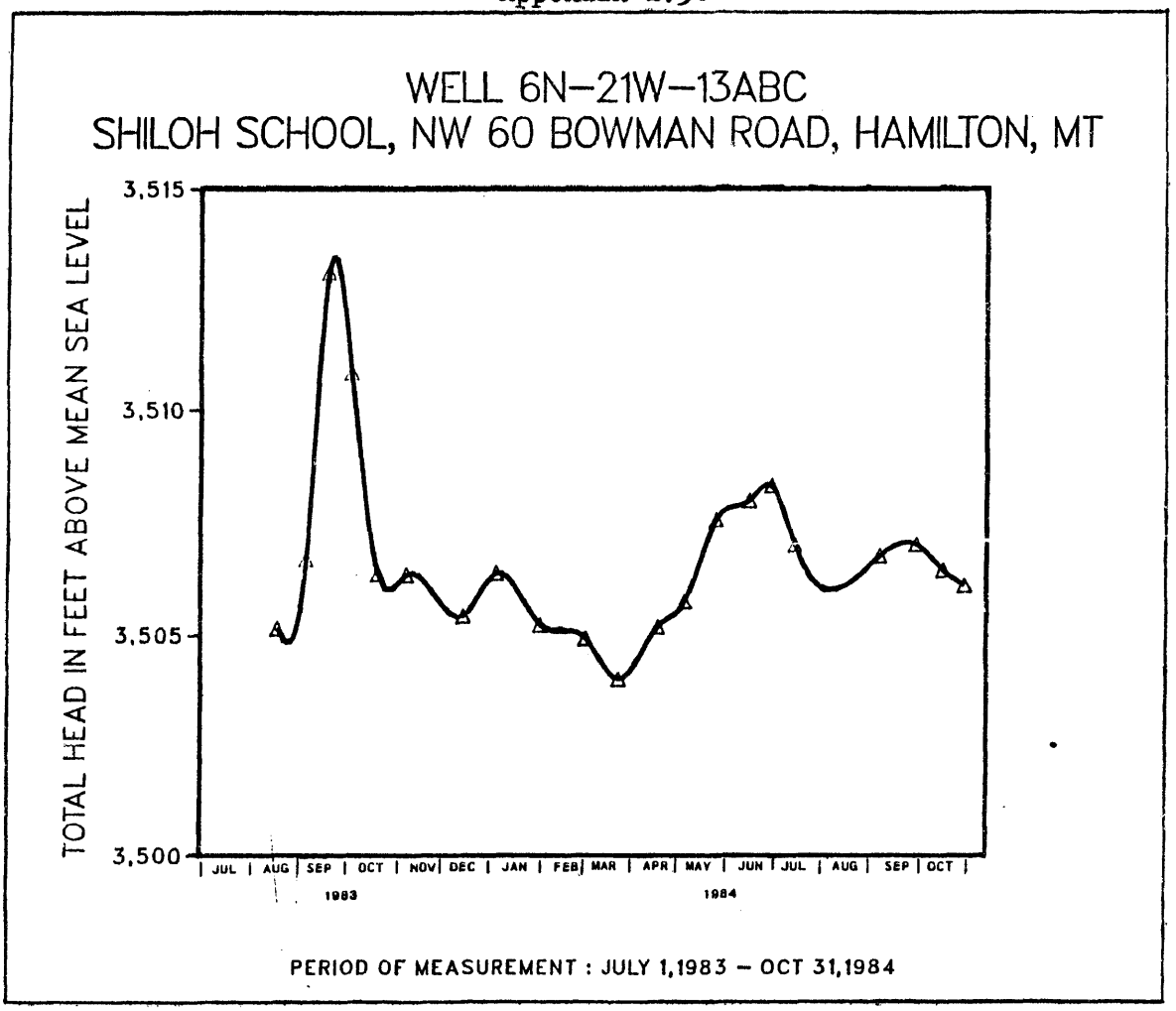
WELL DATA

OWNER : DON FELTON
ADDRESS : 691 NW RUMMEL LANE, HAMILTON, MT
WELL LOCATION : T6N, R21W, NW NE SEC.11
WELL ID NUMBER : 6N-21W-11ABA
ELEVATION : 3632 FEET
WELL DEPTH : 136 FEET
PUMPING RATE : 7 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 11.6 C OR 52.7 F
PH VALUE : 6.78
CONDUCTANCE VALUE : 102 MICROMHOS
ACTUAL TDS VALUE : 108.9 MG/L
ACTUAL HARDNESS VALUE : 21.57 MG/L

Appendix 2.30



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
AUG 19 1983	51.85 FT	49.15 FT	3505.15 FT
SEP 6 1983	50.30 FT	50.70 FT	3506.70 FT
SEP 20 1983	43.92 FT	57.08 FT	3513.08 FT
OCT 5 1983	46.18 FT	54.82 FT	3510.82 FT
OCT 22 1983	50.62 FT	50.38 FT	3506.38 FT
NOV 9 1983	50.64 FT	50.36 FT	3506.36 FT
DEC 15 1983	51.56 FT	49.44 FT	3505.44 FT
JAN 5 1984	50.60 FT	50.40 FT	3506.40 FT
FEB 2 1984	51.76 FT	49.24 FT	3505.24 FT
MAR 2 1984	52.06 FT	48.94 FT	3504.94 FT
MAR 23 1984	52.99 FT	48.01 FT	3504.01 FT
APR 17 1984	51.80 FT	49.20 FT	3505.20 FT
MAY 4 1984	51.23 FT	49.77 FT	3505.77 FT
MAY 24 1984	49.42 FT	51.58 FT	3507.58 FT
JUN 14 1984	49.00 FT	52.00 FT	3508.00 FT
JUN 28 1984	48.67 FT	52.33 FT	3508.33 FT
JUL 13 1984	49.97 FT	51.03 FT	3507.03 FT
SEP 5 1984	50.22 FT	50.78 FT	3506.78 FT
SEP 28 1984	49.96 FT	51.04 FT	3507.04 FT
OCT 15 1984	50.52 FT	50.48 FT	3506.48 FT
OCT 29 1984	50.86 FT	50.14 FT	3506.14 FT

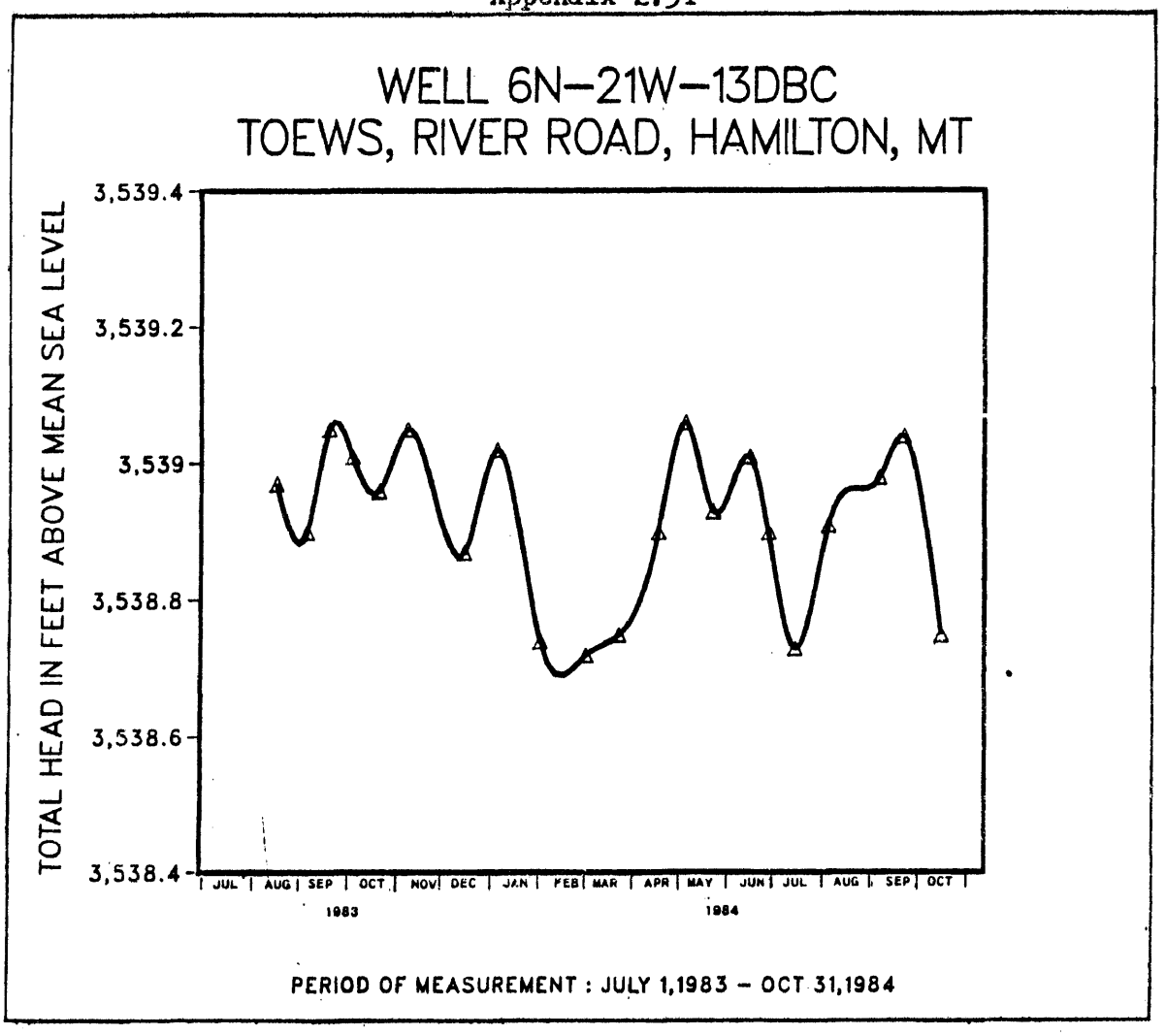
WELL DATA

OWNER : SHILOH CHRISTIAN SCHOOL
ADDRESS : NW 60 BOWMAN ROAD, HAMILTON, MT
WELL LOCATION : T6N, R21W, NE NW SEC.13
WELL ID NUMBER : 6N-21W-13ABC
ELEVATION : 3557 FEET
WELL DEPTH : 101 FEET
PUMPING RATE : 40 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 12.5 C OR 54.5 F
PH VALUE : 7.33
CONDUCTANCE VALUE : 157 MICROMHOS
ESTIMATED TDS VALUE : 127 MG/L
ESTIMATED HARDNESS VALUE : 59 MG/L

Appendix 2.31



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
AUG 18 1983	14.03 FT	50.97 FT	3538.97 FT
SEP 6 1983	14.10 FT	50.90 FT	3538.90 FT
SEP 20 1983	13.95 FT	51.05 FT	3539.05 FT
OCT 5 1983	13.99 FT	51.01 FT	3539.01 FT
OCT 22 1983	14.04 FT	50.96 FT	3538.96 FT
NOV 9 1983	13.95 FT	51.05 FT	3539.05 FT
DEC 15 1983	14.13 FT	50.87 FT	3538.87 FT
JAN 5 1984	13.98 FT	51.02 FT	3539.02 FT
FEB 2 1984	14.26 FT	50.74 FT	3538.74 FT
MAR 2 1984	14.28 FT	50.72 FT	3538.72 FT
MAR 23 1984	14.25 FT	50.75 FT	3538.75 FT
APR 17 1984	14.10 FT	50.90 FT	3538.90 FT
MAY 4 1984	13.94 FT	51.06 FT	3539.06 FT
MAY 22 1984	14.07 FT	50.93 FT	3538.93 FT
JUN 14 1984	13.99 FT	51.01 FT	3539.01 FT
JUN 26 1984	14.10 FT	50.90 FT	3538.90 FT
JUL 13 1984	14.27 FT	50.73 FT	3538.73 FT
AUG 3 1984	14.09 FT	50.91 FT	3538.91 FT
SEP 5 1984	14.02 FT	50.98 FT	3538.98 FT
SEP 21 1984	13.96 FT	51.04 FT	3539.04 FT
OCT 15 1984	14.25 FT	50.75 FT	3538.75 FT

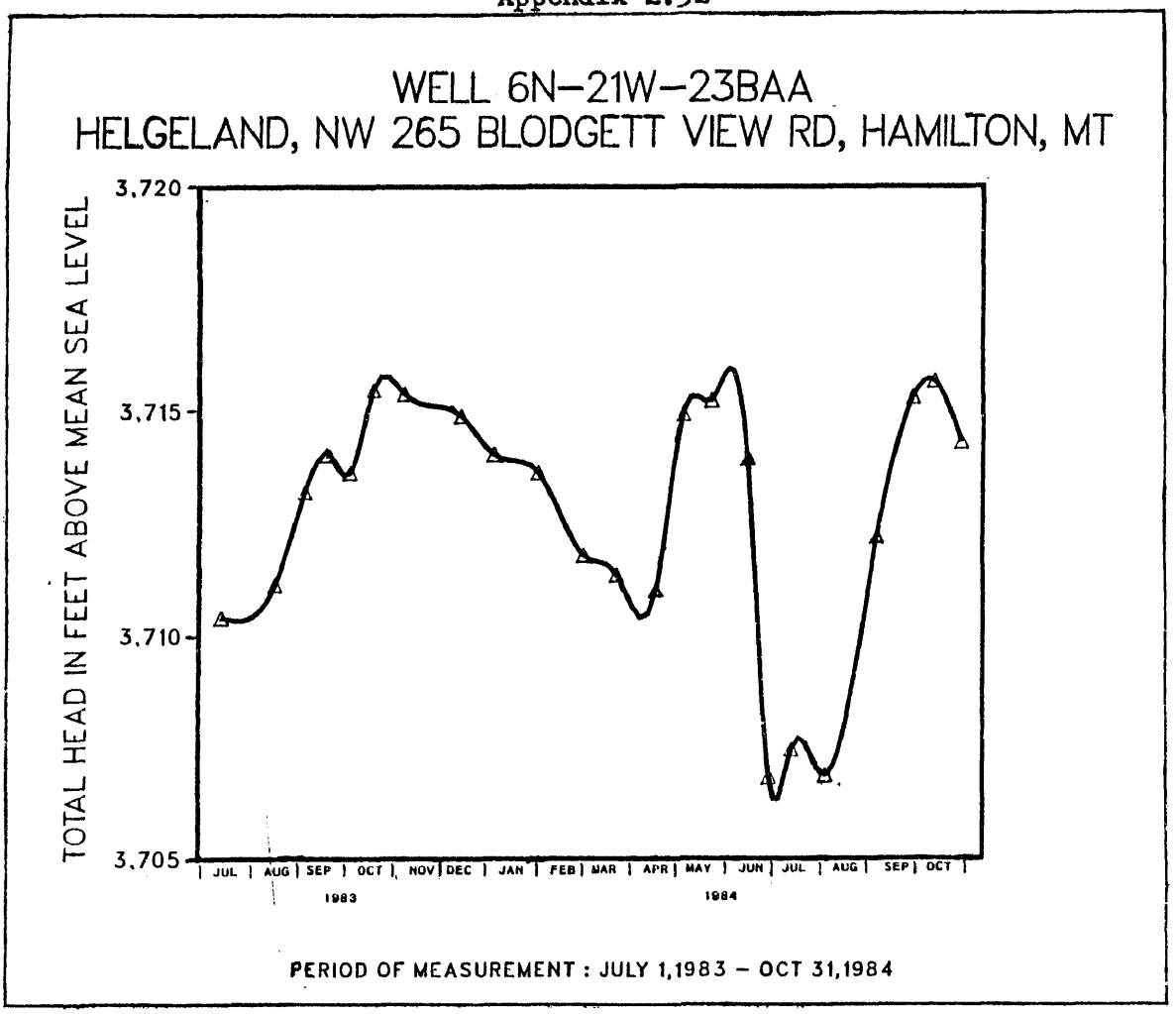
WELL DATA

OWNER : LUCILLE TOEWS
ADDRESS : RIVER ROAD, HAMILTON, MT
WELL LOCATION : T6N, R21W, SE SW SEC.13
WELL ID NUMBER : 6N-21W-13DBC
ELEVATION : 3553 FEET
WELL DEPTH : 65 FEET
PUMPING RATE : 10 GAL/MIN

WATER QUALITY DATA

WATER QUALITY UNDETERMINED

Appendix 2.32



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 15 1983	20.59 FT	179.41 FT	3710.41 FT
AUG 18 1983	19.85 FT	180.15 FT	3711.15 FT
SEP 6 1983	17.79 FT	182.21 FT	3713.21 FT
SEP 20 1983	16.97 FT	183.03 FT	3714.03 FT
OCT 5 1983	17.36 FT	182.64 FT	3713.64 FT
OCT 20 1983	15.53 FT	184.47 FT	3715.47 FT
NOV 9 1983	15.61 FT	184.39 FT	3715.39 FT
DEC 15 1983	16.10 FT	183.90 FT	3714.90 FT
JAN 5 1984	16.95 FT	183.05 FT	3714.05 FT
FEB 2 1984	17.36 FT	182.64 FT	3713.64 FT
MAR 2 1984	19.19 FT	180.81 FT	3711.81 FT
MAR 23 1984	19.63 FT	180.37 FT	3711.37 FT
APR 17 1984	19.96 FT	180.04 FT	3711.04 FT
MAY 4 1984	16.06 FT	183.94 FT	3714.94 FT
MAY 22 1984	15.76 FT	184.24 FT	3715.24 FT
JUN 14 1984	17.04 FT	182.96 FT	3713.96 FT
JUN 28 1984	24.20 FT	175.80 FT	3706.80 FT
JUL 12 1984	23.58 FT	176.42 FT	3707.42 FT
AUG 3 1984	24.15 FT	175.85 FT	3706.85 FT
SEP 5 1984	18.78 FT	181.22 FT	3712.22 FT
SEP 28 1984	15.69 FT	184.31 FT	3715.31 FT
OCT 12 1984	15.33 FT	184.67 FT	3715.67 FT
OCT 29 1984	16.68 FT	183.32 FT	3714.32 FT

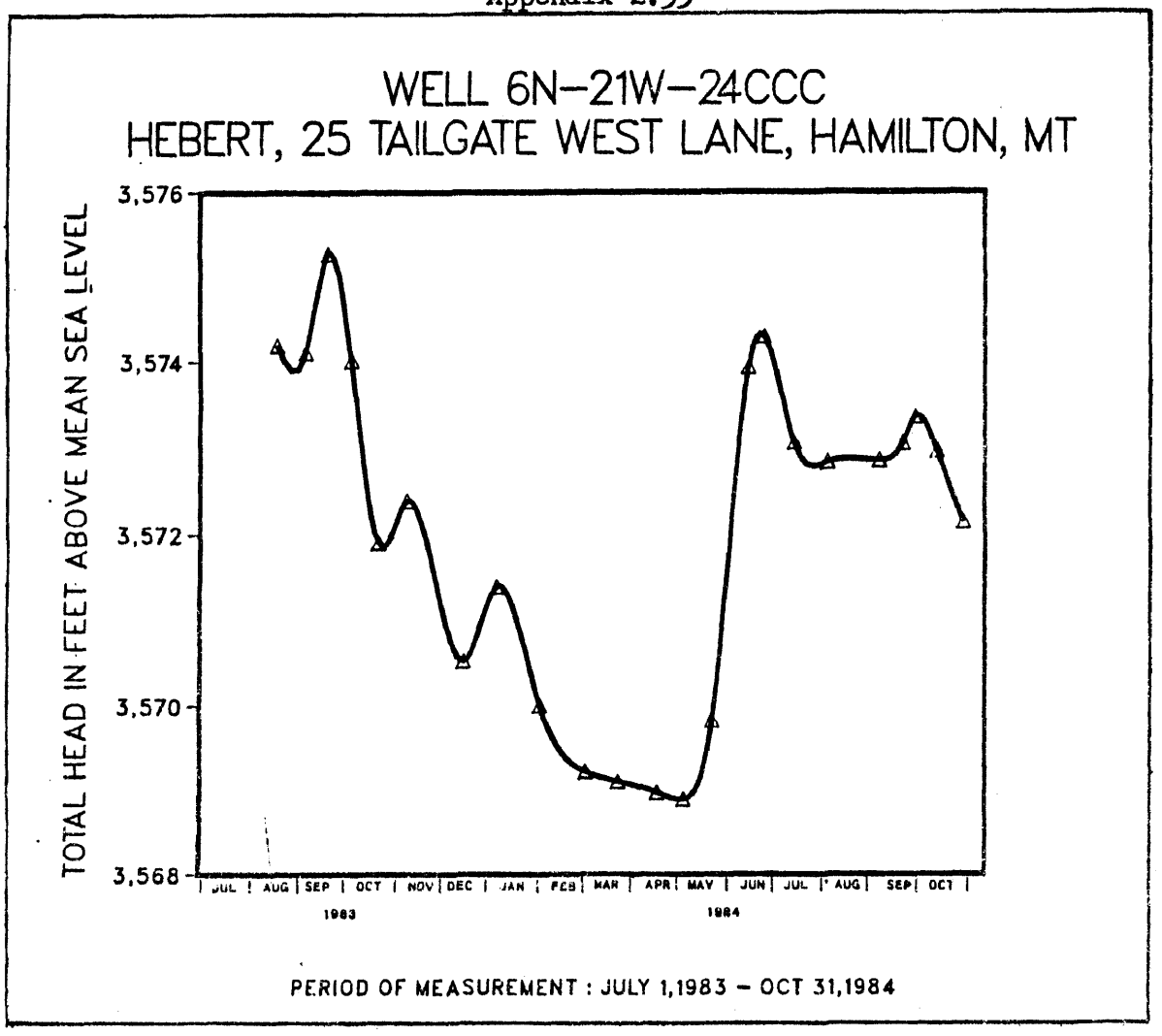
WELL DATA

OWNER : ORRIN HELGELAND
ADDRESS : NW 265 BLODGETT VIEW DRIVE, HAMILTON, MT
WELL LOCATION : T6N, R21W, NE NW SEC.23
WELL ID NUMBER : 6N-21W-23BAA
ELEVATION : 3731 FEET
WELL DEPTH : 200 FEET
PUMPING RATE : 30 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 12.3 C OR 54.1 F
PH VALUE : 7.59
CONDUCTANCE VALUE : 127 MICROMHOS
ESTIMATED TDS VALUE : 107 MG/L
ESTIMATED HARDNESS VALUE : 48 MG/L

Appendix 2.33



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
AUG 19 1983	13.81 FT	29.19 FT	3574.19 FT
SEP 6 1983	13.89 FT	29.11 FT	3574.11 FT
SEP 20 1983	12.73 FT	30.27 FT	3575.27 FT
OCT 5 1983	13.99 FT	29.01 FT	3574.01 FT
OCT 22 1983	16.09 FT	26.91 FT	3571.91 FT
NOV 9 1983	15.61 FT	27.39 FT	3572.39 FT
DEC 15 1983	17.47 FT	25.53 FT	3570.53 FT
JAN 5 1984	16.61 FT	26.39 FT	3571.39 FT
FEB 2 1984	17.99 FT	25.01 FT	3570.01 FT
MAR 2 1984	18.78 FT	24.22 FT	3569.22 FT
MAR 23 1984	18.90 FT	24.10 FT	3569.10 FT
APR 17 1984	19.03 FT	23.97 FT	3568.97 FT
MAY 4 1984	19.11 FT	23.89 FT	3568.89 FT
MAY 22 1984	18.17 FT	24.83 FT	3569.83 FT
JUN 14 1984	14.06 FT	28.94 FT	3573.94 FT
JUN 24 1984	13.70 FT	29.30 FT	3574.30 FT
JUL 13 1984	14.93 FT	28.07 FT	3573.07 FT
AUG 3 1984	15.16 FT	27.84 FT	3572.84 FT
SEP 5 1984	15.14 FT	27.86 FT	3572.86 FT
SEP 20 1984	14.94 FT	28.06 FT	3573.06 FT
SEP 28 1984	14.64 FT	28.36 FT	3573.36 FT
OCT 12 1984	15.03 FT	27.97 FT	3572.97 FT
OCT 29 1984	15.85 FT	27.15 FT	3572.15 FT

WELL DATA

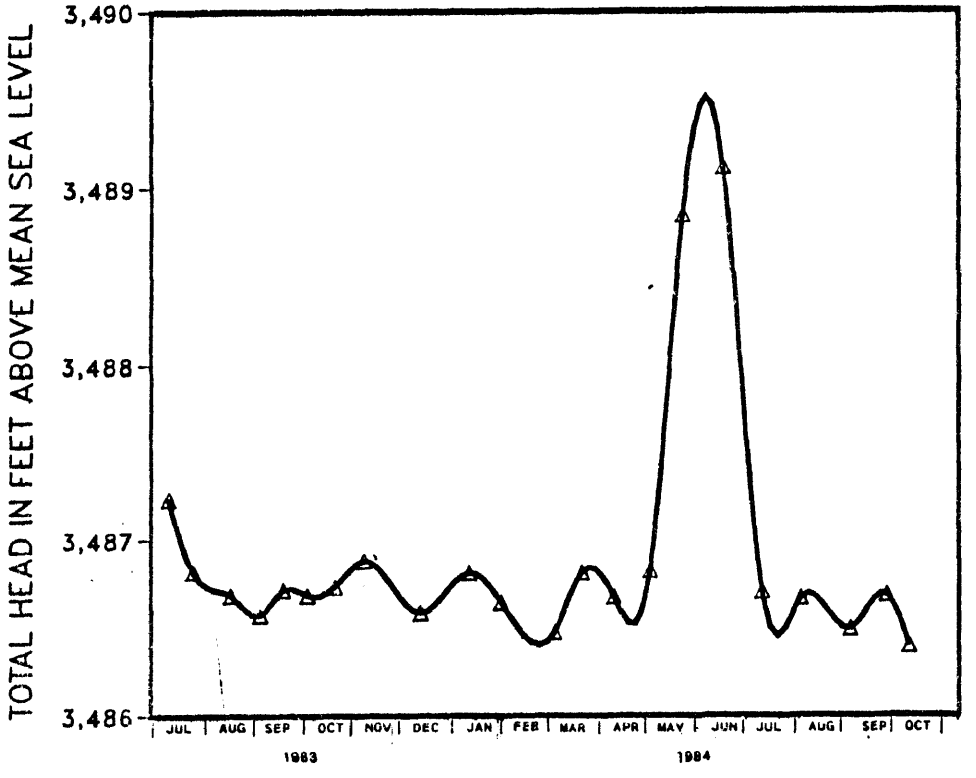
OWNER : TERRY HEBERT
ADDRESS : 25 TAILGATE WEST LANE, HAMILTON, MT
WELL LOCATION : T6N, R21W, SW SW SEC.24
WELL ID NUMBER : 6N-21W-24CCC
ELEVATION : 3588 FEET
WELL DEPTH : 43 FEET
PUMPING RATE : 15 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 11 C OR 51.8 F
PH VALUE : 5.78
CONDUCTANCE VALUE : 72 MICROMHOS
ACTUAL TDS VALUE : 67.81 MG/L
ACTUAL HARDNESS VALUE : 24.13 MG/L

Appendix 2.34

WELL 6N-21W-12DBD
PRESTON, 2366 HWY 93 N, HAMILTON, MT



PERIOD OF MEASUREMENT : JULY 1,1983 – OCT 31,1984

WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 12 1983	5.76 FT	44.24 FT	3467.24 FT
JUL 27 1983	6.18 FT	43.82 FT	3486.82 FT
AUG 19 1983	6.32 FT	43.68 FT	3486.68 FT
SEP 6 1983	6.43 FT	43.57 FT	3486.57 FT
SEP 20 1983	6.29 FT	43.71 FT	3486.71 FT
OCT 5 1983	6.32 FT	43.68 FT	3486.68 FT
OCT 22 1983	6.27 FT	43.73 FT	3486.73 FT
NOV 9 1983	6.12 FT	43.88 FT	3486.88 FT
DEC 14 1983	6.42 FT	43.58 FT	3486.58 FT
JAN 13 1984	6.19 FT	43.81 FT	3486.81 FT
FEB 2 1984	6.36 FT	43.64 FT	3486.64 FT
MAR 6 1984	6.53 FT	43.47 FT	3486.47 FT
MAR 23 1984	6.19 FT	43.81 FT	3486.81 FT
APR 12 1984	6.33 FT	43.67 FT	3486.67 FT
MAY 4 1984	6.18 FT	43.82 FT	3486.82 FT
MAY 24 1984	4.15 FT	45.85 FT	3488.85 FT
JUN 18 1984	3.88 FT	46.12 FT	3489.12 FT
JUL 12 1984	6.30 FT	43.70 FT	3486.70 FT
AUG 5 1984	6.34 FT	43.66 FT	3486.66 FT
SEP 5 1984	6.51 FT	43.49 FT	3486.49 FT
SEP 28 1984	6.32 FT	43.68 FT	3486.68 FT
OCT 12 1984	6.61 FT	43.39 FT	3486.39 FT

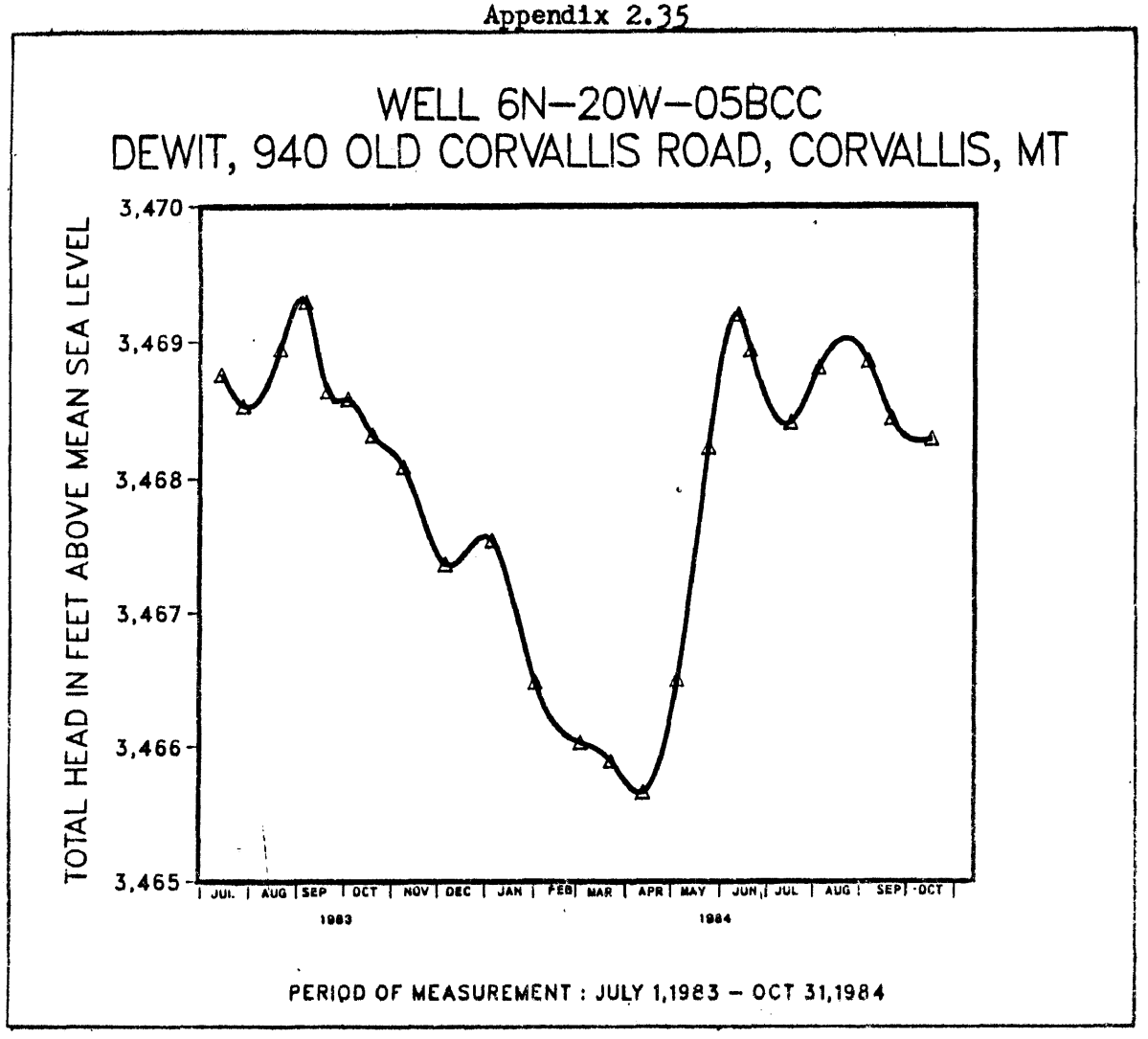
WELL DATA

OWNER : WILLIAM PRESTON
ADDRESS : 2366 HWY 93 N, HAMILTON, MT
WELL LOCATION : T6N, R21W, NW SE SEC.12
WELL ID NUMBER : 6N-21W-12DBD
ELEVATION : 3493 FEET
WELL DEPTH : 50 FEET
PUMPING RATE : 10 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 10.8 C OR 51.4 F
PH VALUE : 6.72
CONDUCTANCE VALUE : 134 MICROMHOS
ACTUAL TDS VALUE : 100.13 MG/L
ACTUAL HARDNESS VALUE : 54.51 MG/L

Appendix 2.35



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 15 1983	5.24 FT	38.76 FT	3468.76 FT
JUL 29 1983	5.47 FT	38.53 FT	3468.53 FT
AUG 22 1983	5.05 FT	38.95 FT	3468.95 FT
SEP 7 1983	4.71 FT	39.29 FT	3469.29 FT
SEP 21 1983	5.36 FT	38.64 FT	3468.64 FT
OCT 4 1983	5.42 FT	38.58 FT	3468.58 FT
OCT 20 1983	5.68 FT	38.32 FT	3468.32 FT
NOV 9 1983	5.91 FT	38.09 FT	3468.09 FT
DEC 6 1983	6.63 FT	37.37 FT	3467.37 FT
JAN 5 1984	6.45 FT	37.55 FT	3467.55 FT
FEB 2 1984	7.52 FT	36.48 FT	3466.48 FT
MAR 2 1984	7.97 FT	36.03 FT	3466.03 FT
MAR 22 1984	8.11 FT	35.89 FT	3465.89 FT
APR 12 1984	8.34 FT	35.66 FT	3465.66 FT
MAY 4 1984	7.50 FT	36.50 FT	3466.50 FT
MAY 24 1984	5.77 FT	38.23 FT	3468.23 FT
JUN 12 1984	4.80 FT	39.20 FT	3469.20 FT
JUN 20 1984	5.06 FT	38.94 FT	3468.94 FT
JUL 16 1984	5.59 FT	38.41 FT	3468.41 FT
AUG 3 1984	5.19 FT	38.81 FT	3468.81 FT
SEP 4 1984	5.14 FT	38.86 FT	3468.86 FT
SEP 19 1984	5.56 FT	38.44 FT	3468.44 FT
OCT 15 1984	5.71 FT	38.29 FT	3468.29 FT

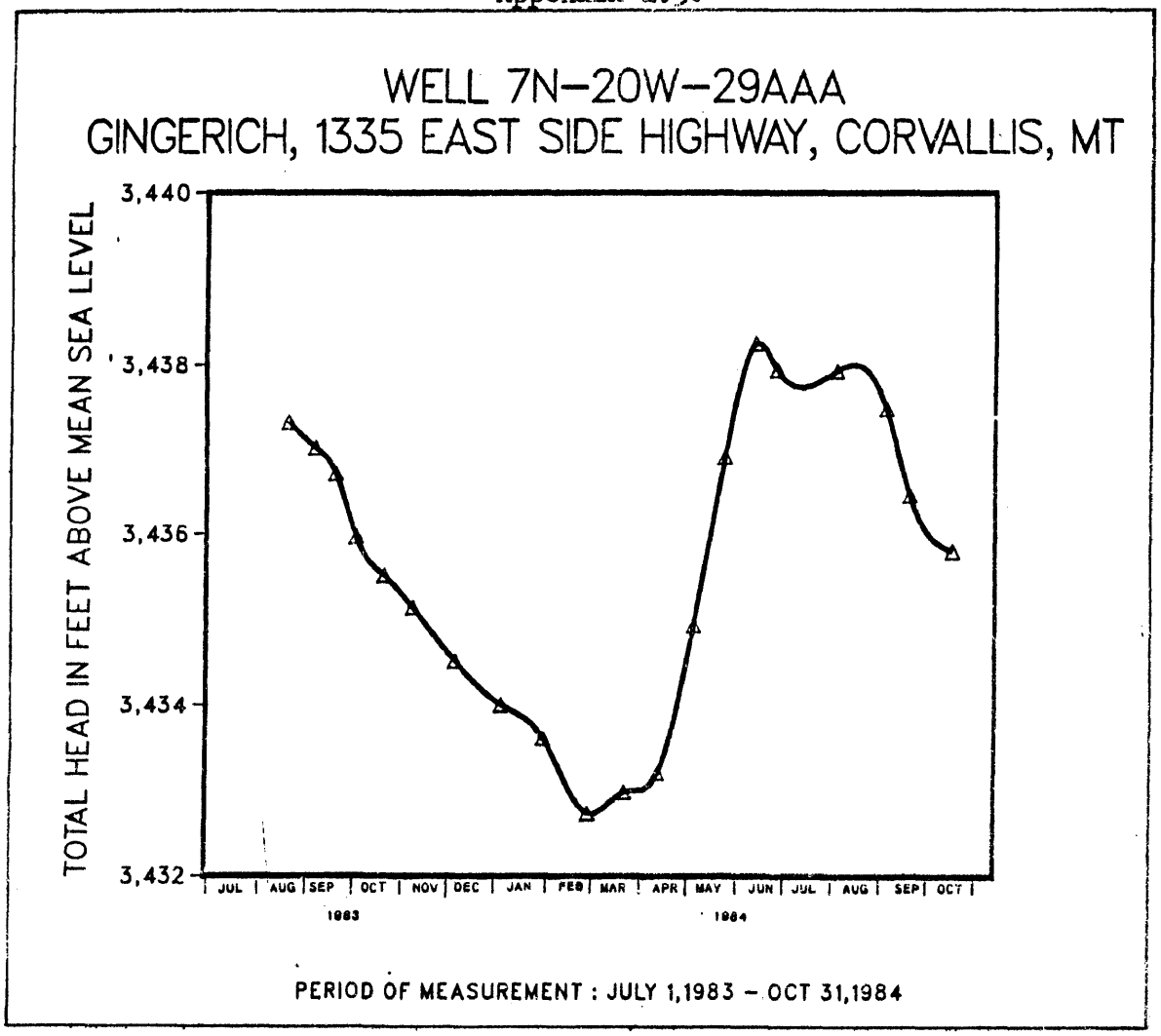
WELL DATA

OWNER : CORNELIUS DEWIT
ADDRESS : 940 OLD CORVALLIS ROAD, CORVALLIS, MT
WELL LOCATION : T6N, R20W, SW NW SEC.5
WELL ID NUMBER : 6N-20W-05BCC
ELEVATION : 3474 FEET
WELL DEPTH : 44 FEET
PUMPING RATE : 25 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 9.5 C OR 49.1 F
PH VALUE : 6.69
CONDUCTANCE VALUE : 259 MICROMHOS
ACTUAL TDS VALUE : 166.43 MG/L
ACTUAL HARDNESS VALUE : 128.58 MG/L

Appendix 2.36



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
AUG 22 1983	3.69 FT	37.31 FT	3437.31 FT
SEP 8 1983	3.99 FT	37.01 FT	3437.01 FT
SEP 21 1983	4.29 FT	36.71 FT	3436.71 FT
OCT 4 1983	5.03 FT	35.97 FT	3435.97 FT
OCT 22 1983	5.48 FT	35.52 FT	3435.52 FT
NOV 9 1983	5.85 FT	35.15 FT	3435.15 FT
DEC 6 1983	6.47 FT	34.53 FT	3434.53 FT
JAN 4 1984	6.99 FT	34.01 FT	3434.01 FT
JAN 31 1984	7.39 FT	33.61 FT	3433.61 FT
FEB 28 1984	8.27 FT	32.73 FT	3432.73 FT
MAR 22 1984	8.02 FT	32.98 FT	3432.98 FT
APR 12 1984	7.80 FT	33.20 FT	3433.20 FT
MAY 4 1984	6.05 FT	34.95 FT	3434.95 FT
MAY 24 1984	4.09 FT	36.91 FT	3436.91 FT
JUN 12 1984	2.74 FT	38.26 FT	3438.26 FT
JUN 26 1984	3.05 FT	37.95 FT	3437.95 FT
AUG 3 1984	3.06 FT	37.94 FT	3437.94 FT
SEP 4 1984	3.52 FT	37.48 FT	3437.48 FT
SEP 19 1984	4.54 FT	36.46 FT	3436.46 FT
OCT 16 1984	5.19 FT	35.81 FT	3435.81 FT

WELL DATA

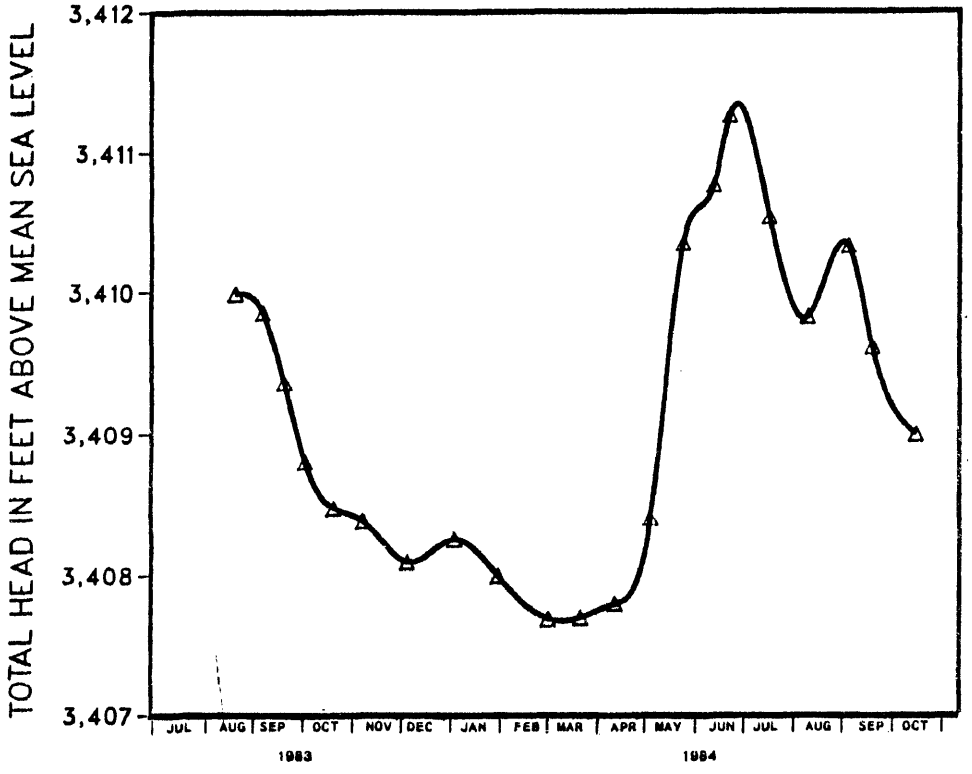
OWNER : ROBERT GINGERICH
ADDRESS : 1335 EAST SIDE HIGHWAY, CORVALLIS, MT
WELL LOCATION : T7N, R20W, NE NE SEC.29
WELL ID NUMBER : 7N-20W-29AAA
ELEVATION : 3441 FEET
WELL DEPTH : 41 FEET
PUMPING RATE : 50 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 10 C OR 50 F
PH VALUE : 7.14
CONDUCTANCE VALUE : 346 MICROMHOS
ESTIMATED TDS VALUE : 225 MG/L
ESTIMATED HARDNESS VALUE : 166 MG/L

Appendix 2.37

WELL 7N–20W–17DAD
HAMILTON, 1745 CHAFFIN LANE, CORVALLIS, MT



PERIOD OF MEASUREMENT : JULY 1,1983 – OCT 31,1984

WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
AUG 22 1983	4.01 FT	64.99 FT	3409.99 FT
SEP 8 1983	4.14 FT	64.86 FT	3409.86 FT
SEP 21 1983	4.63 FT	64.37 FT	3409.37 FT
OCT 4 1983	5.19 FT	63.81 FT	3408.81 FT
OCT 22 1983	5.52 FT	63.48 FT	3408.48 FT
NOV 9 1983	5.61 FT	63.39 FT	3408.39 FT
DEC 6 1983	5.90 FT	63.10 FT	3408.10 FT
JAN 4 1984	5.74 FT	63.26 FT	3408.26 FT
JAN 31 1984	6.00 FT	63.00 FT	3408.00 FT
MAR 2 1984	6.31 FT	62.69 FT	3407.69 FT
MAR 22 1984	6.30 FT	62.70 FT	3407.70 FT
APR 12 1984	6.20 FT	62.80 FT	3407.80 FT
MAY 4 1984	5.59 FT	63.41 FT	3408.41 FT
MAY 24 1984	3.65 FT	65.35 FT	3410.35 FT
JUN 12 1984	3.23 FT	65.77 FT	3410.77 FT
JUN 22 1984	2.73 FT	66.27 FT	3411.27 FT
JUL 17 1984	3.46 FT	65.54 FT	3410.54 FT
AUG 10 1984	4.17 FT	64.83 FT	3409.83 FT
SEP 4 1984	3.67 FT	65.33 FT	3410.33 FT
SEP 19 1984	4.38 FT	64.62 FT	3409.62 FT
OCT 16 1984	5.00 FT	64.00 FT	3409.00 FT

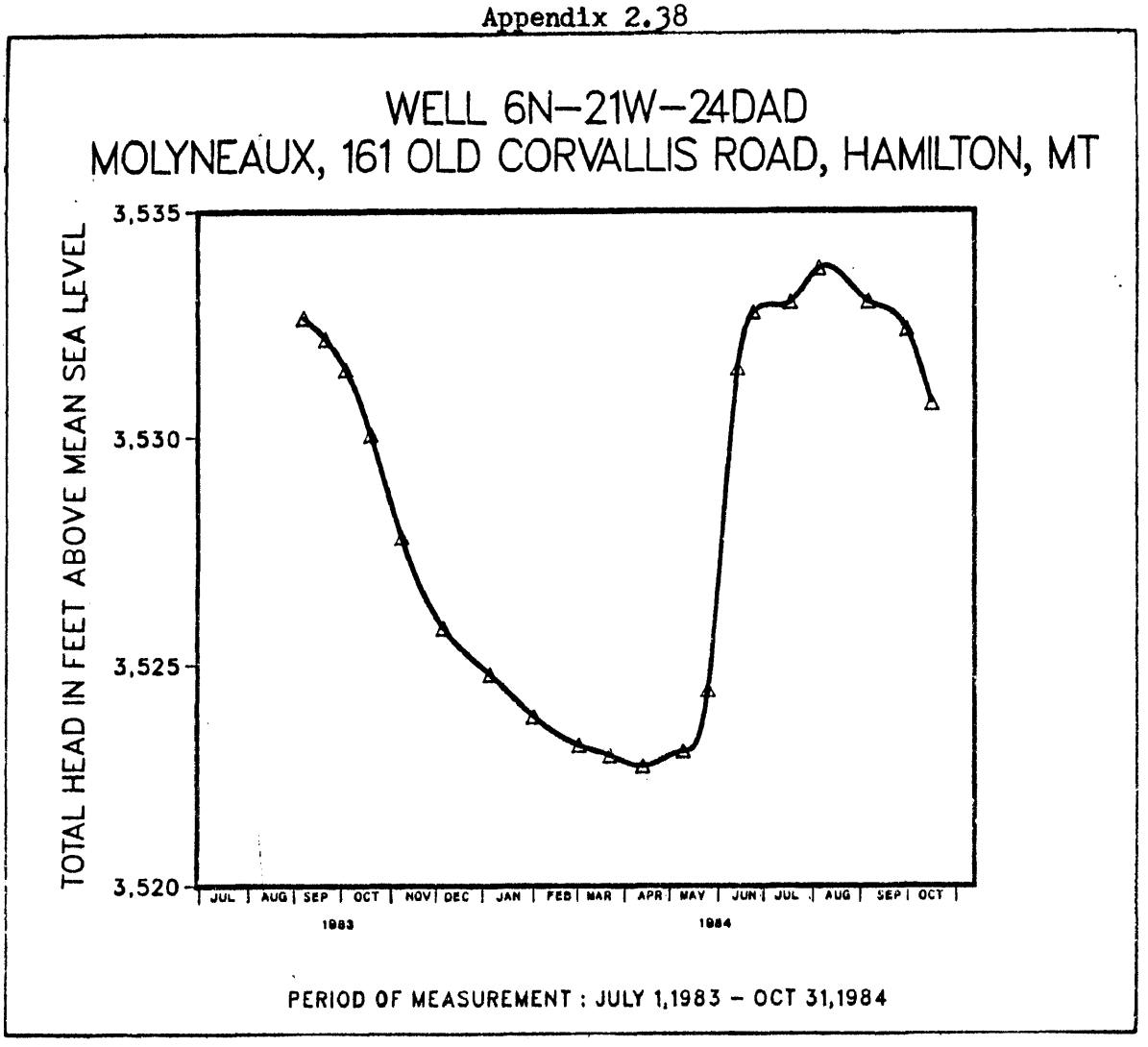
WELL DATA

OWNER : JAMES HAMILTON
ADDRESS : 1745 CHAFFIN LANE, CORVALLIS, MT
WELL LOCATION : T7N, R20W, NE SE SEC.17
WELL IO NUMBER : 7N-20W-17DAD
ELEVATION : 3414 FEET
WELL DEPTH : 69 FEET
PUMPING RATE : 60 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 11 C OR 51.8 F
PH VALUE : 6.84
CONDUCTANCE VALUE : 362 MICROMHOS
ACTUAL TDS VALUE : 230.61 MG/L
ACTUAL HARDNESS VALUE : 166.37 MG/L

Appendix 2.38



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
SEP 7 1983	9.34 FT	30.66 FT	3532.66 FT
SEP 21 1983	9.82 FT	30.18 FT	3532.18 FT
OCT 4 1983	10.49 FT	29.51 FT	3531.51 FT
OCT 20 1983	11.93 FT	28.07 FT	3530.07 FT
NOV 9 1983	14.19 FT	25.81 FT	3527.81 FT
DEC 6 1983	16.18 FT	23.82 FT	3525.82 FT
JAN 5 1984	17.21 FT	22.79 FT	3524.79 FT
FEB 2 1984	18.15 FT	21.85 FT	3523.85 FT
MAR 2 1984	18.80 FT	21.20 FT	3523.20 FT
MAR 22 1984	19.04 FT	20.96 FT	3522.96 FT
APR 12 1984	19.28 FT	20.72 FT	3522.72 FT
MAY 8 1984	18.93 FT	21.07 FT	3523.07 FT
MAY 24 1984	17.55 FT	22.45 FT	3524.45 FT
JUN 12 1984	10.47 FT	29.53 FT	3531.53 FT
JUN 22 1984	9.22 FT	30.78 FT	3532.78 FT
JUL 16 1984	9.00 FT	31.00 FT	3533.00 FT
AUG 3 1984	8.28 FT	31.74 FT	3533.74 FT
SEP 4 1984	8.99 FT	31.01 FT	3533.01 FT
SEP 29 1984	9.61 FT	30.39 FT	3532.39 FT
OCT 15 1984	11.25 FT	28.75 FT	3530.75 FT

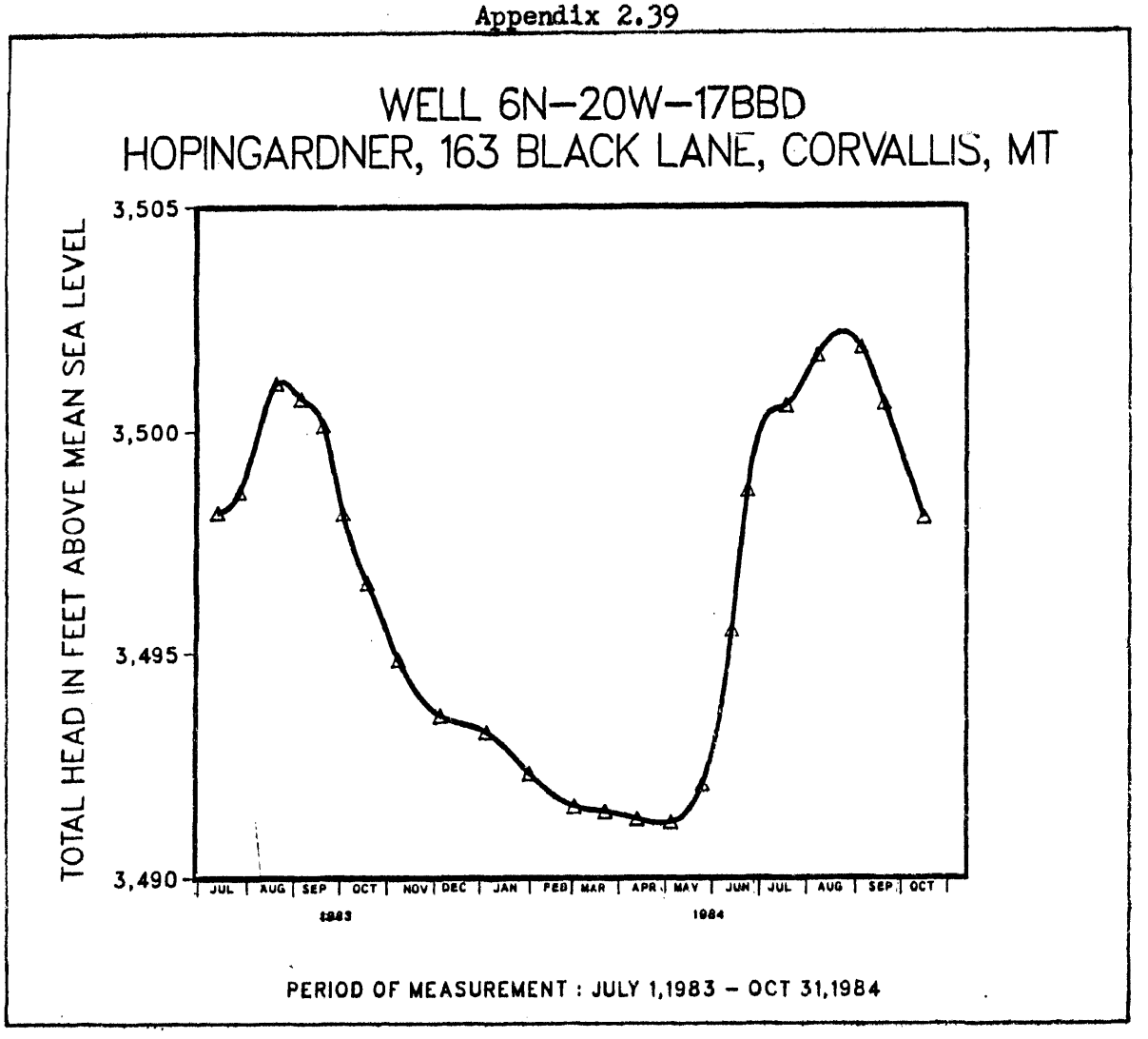
WELL DATA

OWNER : ALFRED MOLYNEAUX
ADDRESS : 161 OLD CORVALLIS ROAD, HAMILTON, MT
WELL LOCATION : T6N, R21W, NE SE SEC.24
WELL ID NUMBER : 6N-21W-24DAD
ELEVATION : 3542 FEET
WELL DEPTH : 40 FEET
PUMPING RATE : 10 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 11.8 C OR 53.2 F
PH VALUE : 6.94
CONDUCTANCE VALUE : 282 MICROMHOS
ACTUAL TDS VALUE : 172.24 MG/L
ACTUAL HARDNESS VALUE : 141.51 MG/L

Appendix 2.39



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 15 1983	17.83 FT	42.17 FT	3498.17 FT
JUL 29 1983	17.36 FT	42.64 FT	3498.64 FT
AUG 22 1983	14.91 FT	45.09 FT	3501.09 FT
SEP 7 1983	15.25 FT	44.75 FT	3500.75 FT
SEP 21 1983	15.85 FT	44.15 FT	3500.15 FT
OCT 4 1983	17.85 FT	42.15 FT	3498.15 FT
OCT 20 1983	19.43 FT	40.57 FT	3496.57 FT
NOV 9 1983	21.13 FT	38.87 FT	3494.87 FT
DEC 6 1983	22.37 FT	37.63 FT	3493.63 FT
JAN 5 1984	22.74 FT	37.26 FT	3493.26 FT
FEB 2 1984	23.66 FT	36.34 FT	3492.34 FT
MAR 2 1984	24.40 FT	35.60 FT	3491.60 FT
MAR 22 1984	24.51 FT	35.49 FT	3491.49 FT
APR 12 1984	24.68 FT	35.32 FT	3491.32 FT
MAY 4 1984	24.75 FT	35.25 FT	3491.25 FT
MAY 24 1984	23.91 FT	36.09 FT	3492.09 FT
JUN 12 1984	20.47 FT	39.53 FT	3495.53 FT
JUN 22 1984	17.31 FT	42.69 FT	3498.69 FT
JUL 17 1984	15.40 FT	44.60 FT	3500.60 FT
AUG 6 1984	14.28 FT	45.72 FT	3501.72 FT
SEP 4 1984	14.10 FT	45.90 FT	3501.90 FT
SEP 19 1984	15.36 FT	44.64 FT	3500.64 FT
OCT 15 1984	17.94 FT	42.06 FT	3498.06 FT

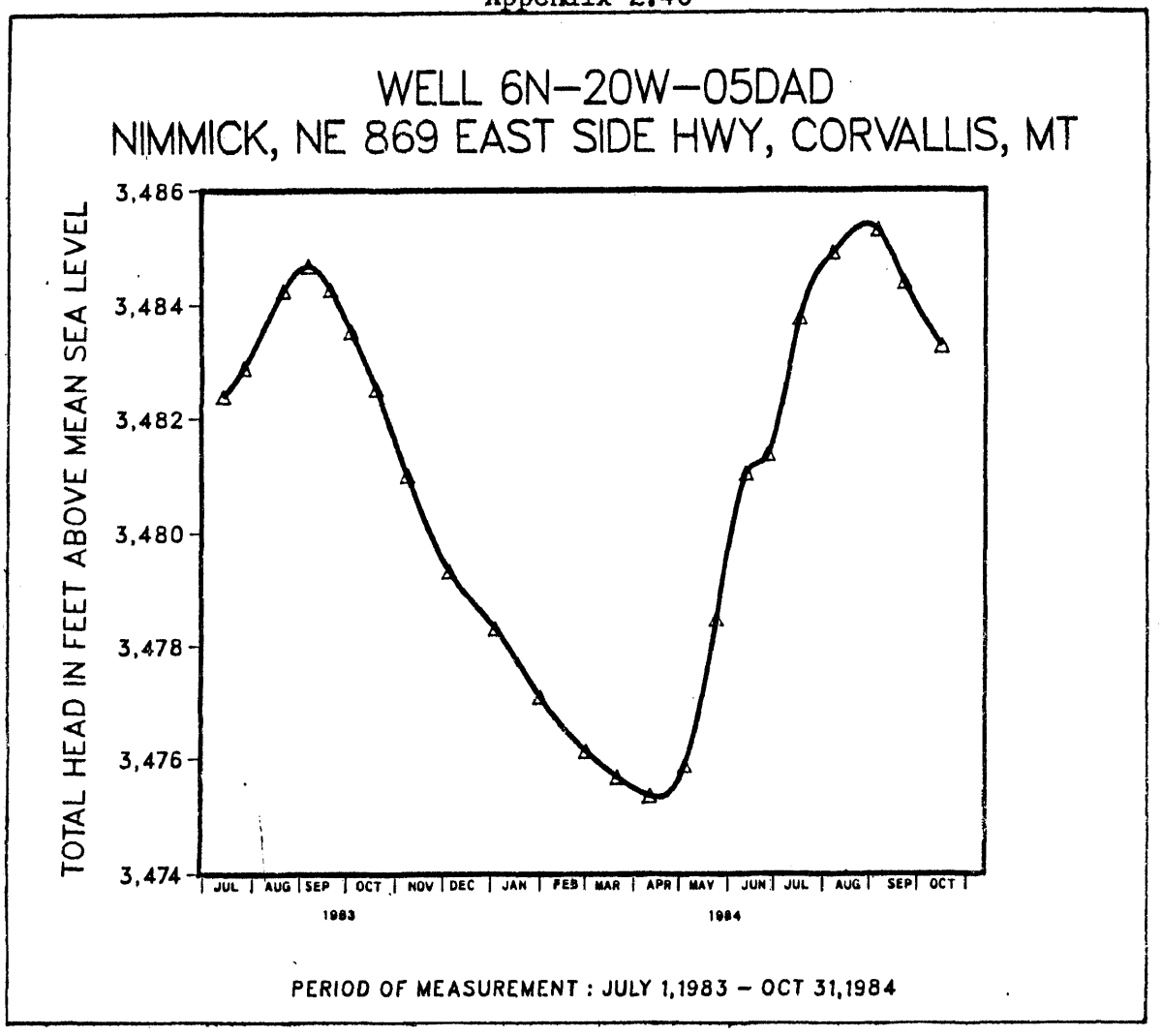
WELL DATA

OWNER : KREG HOPINGARDNER
ADDRESS : 163 BLACK LANE, CORVALLIS, MT
WELL LOCATION : T6N, R20W, NW NW SEC.17
WELL ID NUMBER : 6N-20W-17BBC
ELEVATION : 3516 FEET
WELL DEPTH : 60 FEET
PUMPING RATE : 20 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 12 C OR 53.6 F
PH VALUE : 7.14
CONDUCTANCE VALUE : 272 MICROMHOS
ACTUAL TDS VALUE : 180.36 MG/L
ACTUAL HARDNESS VALUE : 137.65 MG/L

Appendix 2.40



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 15 1983	11.60 FT	28.40 FT	3482.40 FT
JUL 28 1983	11.10 FT	28.90 FT	3482.90 FT
AUG 22 1983	9.75 FT	30.25 FT	3484.25 FT
SEP 7 1983	9.32 FT	30.68 FT	3484.68 FT
SEP 21 1983	9.73 FT	30.27 FT	3484.27 FT
OCT 4 1983	10.46 FT	29.54 FT	3483.54 FT
OCT 20 1983	11.47 FT	28.53 FT	3482.53 FT
NOV 9 1983	12.99 FT	27.01 FT	3481.01 FT
DEC 6 1983	14.67 FT	25.33 FT	3479.33 FT
JAN 4 1984	15.68 FT	24.32 FT	3478.32 FT
FEB 2 1984	16.91 FT	23.09 FT	3477.09 FT
MAR 2 1984	17.87 FT	22.13 FT	3476.13 FT
MAR 22 1984	18.32 FT	21.68 FT	3475.68 FT
APR 12 1984	18.65 FT	21.35 FT	3475.35 FT
MAY 4 1984	18.12 FT	21.88 FT	3475.88 FT
MAY 24 1984	15.51 FT	24.49 FT	3478.49 FT
JUN 12 1984	12.95 FT	27.05 FT	3481.05 FT
JUN 26 1984	12.61 FT	27.39 FT	3481.39 FT
JUL 16 1984	10.23 FT	29.77 FT	3483.77 FT
AUG 8 1984	9.09 FT	30.91 FT	3484.91 FT
SEP 4 1984	8.70 FT	31.30 FT	3485.30 FT
SEP 21 1984	9.61 FT	30.39 FT	3484.39 FT
OCT 15 1984	10.72 FT	29.28 FT	3483.28 FT

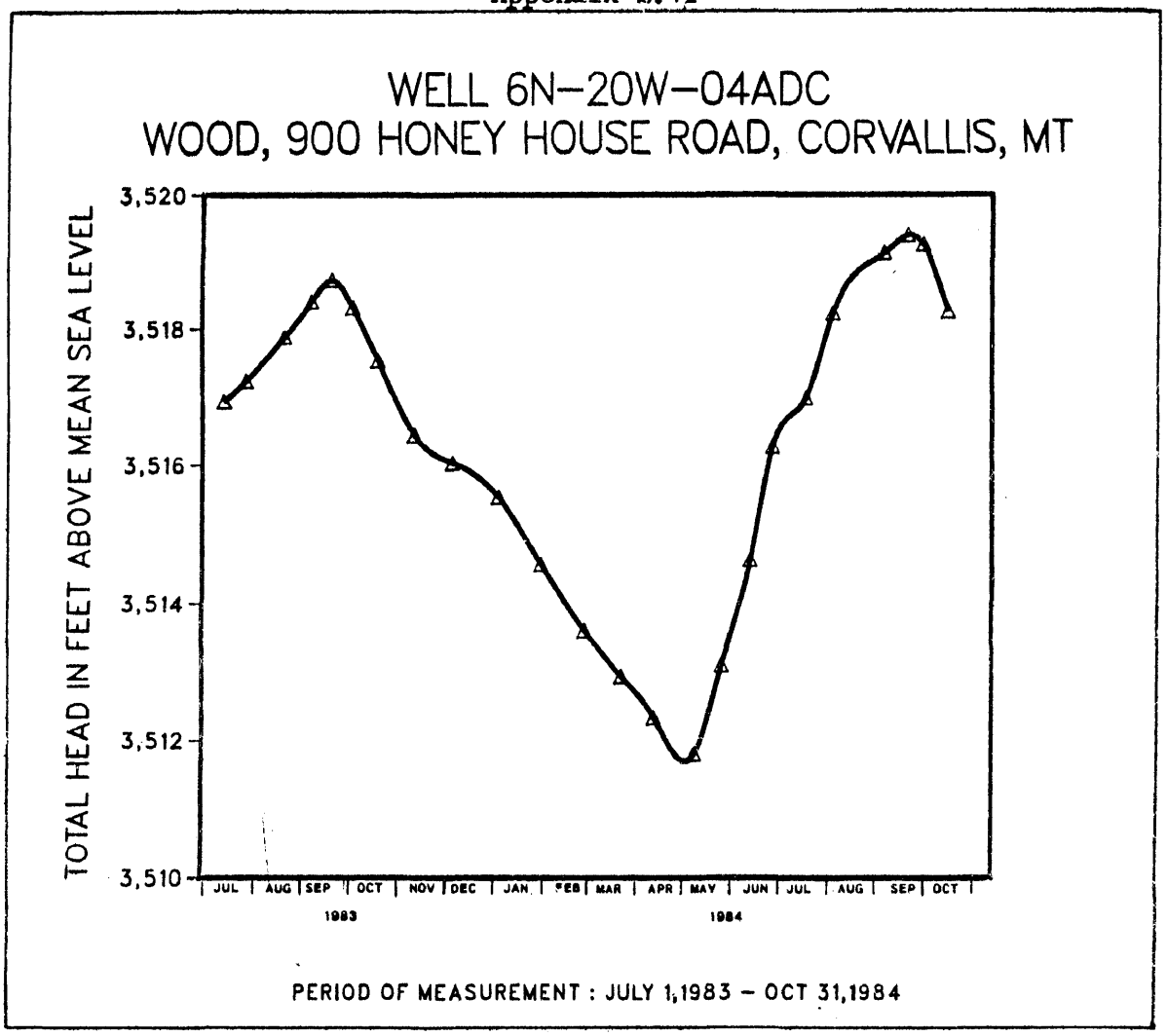
WELL DATA

OWNER : FRED NIMMICK
ADDRESS : NE 869 EAST SIDE HWY, CORVALLIS, MT
WELL LOCATION : T6N, R20W, NE SE SEC.5
WELL ID NUMBER : 6N-20W-05DAD
ELEVATION : 3494 FEET
WELL DEPTH : 40 FEET
PUMPING RATE : 40 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 11 C OR 51.8 F
PH VALUE : 7.15
CONDUCTANCE VALUE : 351 MICROMHOS
ESTIMATED TDS VALUE : 228 MG/L
ESTIMATED HARDNESS VALUE : 168 MG/L

Appendix 2.41



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 15 1983	21.08 FT	78.92 FT	3516.92 FT
JUL 29 1983	20.78 FT	79.22 FT	3517.22 FT
AUG 22 1983	20.13 FT	79.87 FT	3517.87 FT
SEP 8 1983	19.60 FT	80.40 FT	3518.40 FT
SEP 21 1983	19.27 FT	80.73 FT	3518.73 FT
OCT 4 1983	19.69 FT	80.31 FT	3518.31 FT
OCT 20 1983	20.48 FT	79.52 FT	3517.52 FT
NOV 12 1983	21.57 FT	78.43 FT	3516.43 FT
DEC 6 1983	21.97 FT	78.03 FT	3516.03 FT
JAN 4 1984	22.46 FT	77.54 FT	3515.54 FT
JAN 31 1984	23.43 FT	76.57 FT	3514.57 FT
FEB 28 1984	24.39 FT	75.61 FT	3513.61 FT
MAR 22 1984	25.06 FT	74.94 FT	3512.94 FT
APR 12 1984	25.68 FT	74.34 FT	3512.34 FT
MAY 8 1984	26.20 FT	73.80 FT	3511.80 FT
MAY 25 1984	24.89 FT	75.11 FT	3513.11 FT
JUN 12 1984	23.38 FT	76.84 FT	3514.64 FT
JUN 26 1984	21.73 FT	78.27 FT	3516.27 FT
JUL 17 1984	21.03 FT	78.97 FT	3516.97 FT
AUG 3 1984	19.77 FT	80.23 FT	3518.23 FT
SEP 4 1984	18.86 FT	81.14 FT	3519.14 FT
SEP 19 1984	18.59 FT	81.41 FT	3519.41 FT
SEP 29 1984	18.73 FT	81.27 FT	3519.27 FT
OCT 15 1984	19.74 FT	80.26 FT	3518.26 FT

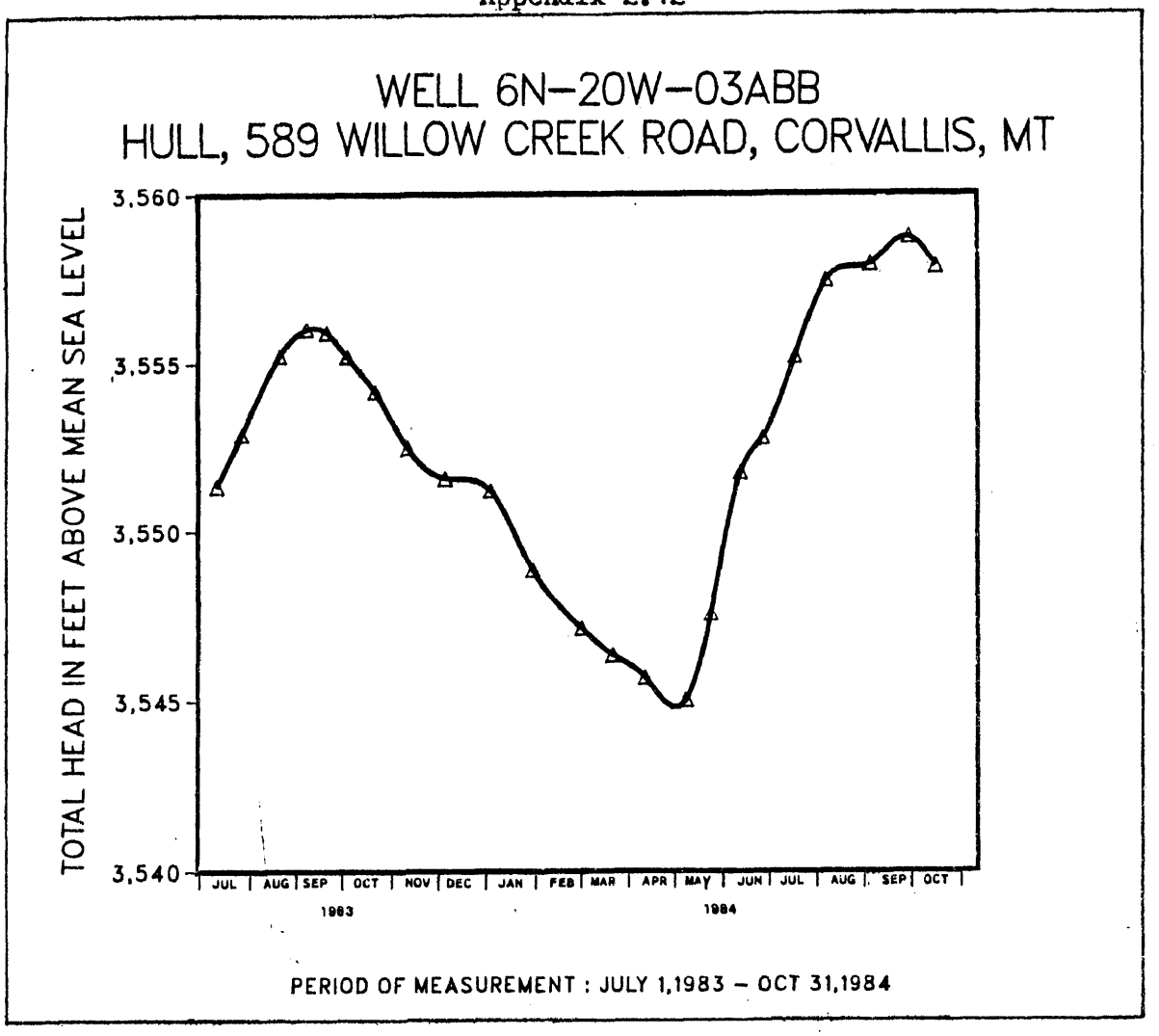
WELL DATA

OWNER : JOHN WOOD
ADDRESS : 900 HONEY HOUSE ROAD, CORVALLIS, MT
WELL LOCATION : T6N, R20W, SE NE SEC.4
WELL ID NUMBER : 6N-20W-04ADC
ELEVATION : 3538 FEET
WELL DEPTH : 100 FEET
PUMPING RATE : 10 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 13 C OR 55.4 F
PH VALUE : 7.67
CONDUCTANCE VALUE : 322 MICROMHOS
ESTIMATED TDS VALUE : 210 MG/L
ESTIMATED HARDNESS VALUE : 157 MG/L

Appendix 2.42



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 13 1983	31.66 FT	27.34 FT	3551.34 FT
JUL 29 1983	30.12 FT	28.88 FT	3552.88 FT
AUG 22 1983	27.75 FT	31.25 FT	3555.25 FT
SEP 8 1983	26.95 FT	32.05 FT	3556.05 FT
SEP 21 1983	27.04 FT	31.96 FT	3555.96 FT
OCT 4 1983	27.77 FT	31.23 FT	3555.23 FT
OCT 22 1983	28.83 FT	30.17 FT	3554.17 FT
NOV 12 1983	30.52 FT	28.48 FT	3552.48 FT
DEC 6 1983	31.43 FT	27.57 FT	3551.57 FT
JAN 4 1984	31.79 FT	27.21 FT	3551.21 FT
JAN 31 1984	34.12 FT	24.88 FT	3548.88 FT
MAR 2 1984	35.84 FT	23.16 FT	3547.16 FT
MAR 22 1984	36.63 FT	22.37 FT	3546.37 FT
APR 12 1984	37.29 FT	21.71 FT	3545.71 FT
MAY 8 1984	37.96 FT	21.04 FT	3545.04 FT
MAY 24 1984	35.41 FT	23.59 FT	3547.59 FT
JUN 12 1984	31.25 FT	27.75 FT	3551.75 FT
JUN 26 1984	30.22 FT	28.78 FT	3552.78 FT
JUL 17 1984	27.79 FT	31.21 FT	3555.21 FT
AUG 6 1984	25.52 FT	33.48 FT	3557.48 FT
SEP 4 1984	25.04 FT	33.96 FT	3557.96 FT
SEP 29 1984	24.25 FT	34.75 FT	3558.75 FT
OCT 16 1984	25.11 FT	33.89 FT	3557.89 FT

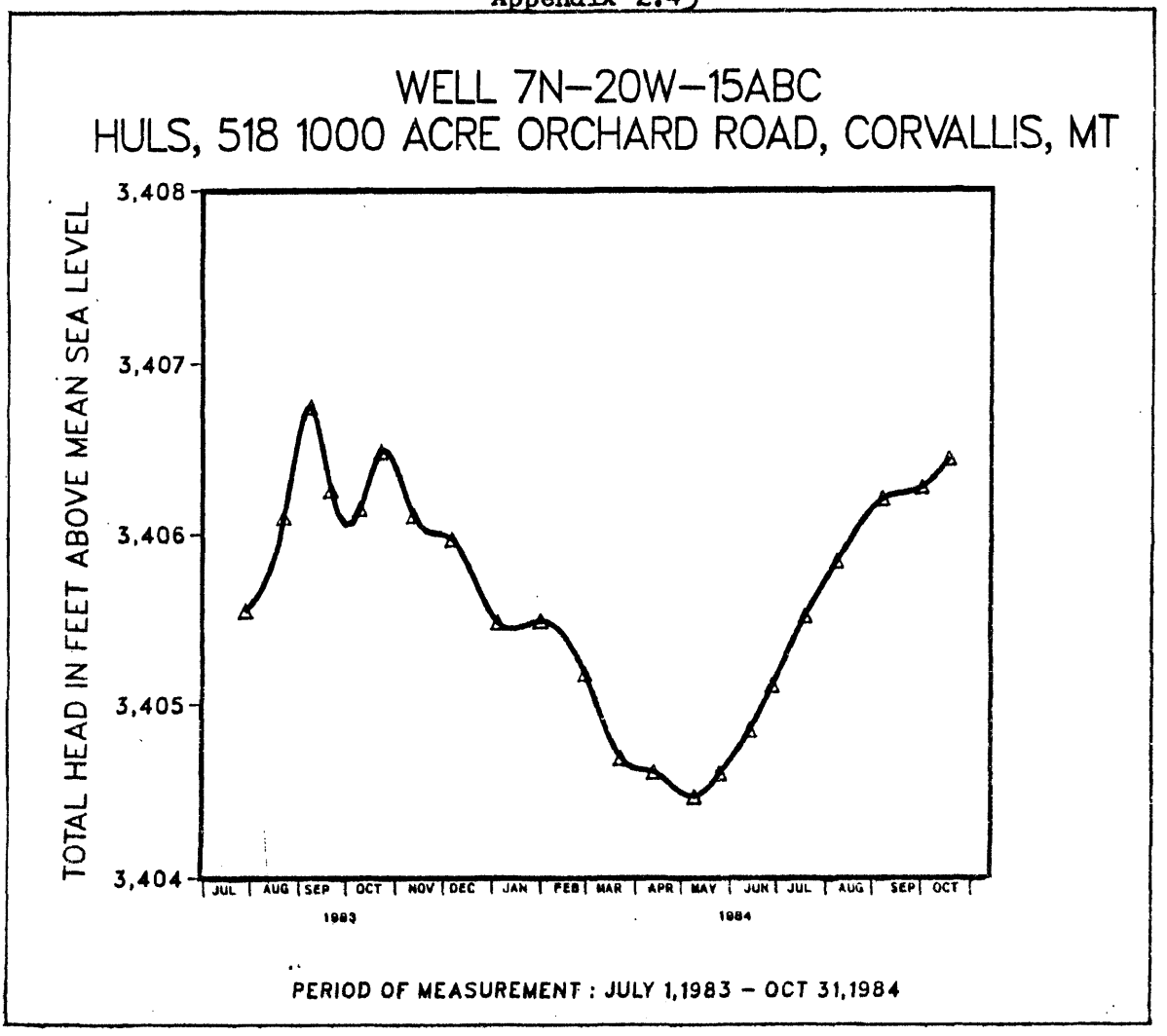
WELL DATA

OWNER : LEWIS HULL
ADDRESS : 589 WILLOW CREEK ROAD, CORVALLIS, MT
WELL LOCATION : T6N, R20W, NW NE SEC.3
WELL ID NUMBER : 6N-20W-03ABB
ELEVATION : 3583 FEET
WELL DEPTH : 59 FEET
PUMPING RATE : 17 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 11 C OR 51.8 F
PH VALUE : 7.17
CONDUCTANCE VALUE : 498 MICROMHOS
ACTUAL TDS VALUE : 327.77 MG/L
ACTUAL HARDNESS VALUE : 230.87 MG/L

Appendix 2.43



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 29 1983	111.45 FT	26.55 FT	3405.55 FT
AUG 22 1983	110.90 FT	27.10 FT	3406.10 FT
SEP 8 1983	110.25 FT	27.75 FT	3406.75 FT
SEP 21 1983	110.74 FT	27.26 FT	3406.26 FT
OCT 9 1983	110.85 FT	27.15 FT	3406.15 FT
OCT 22 1983	110.51 FT	27.49 FT	3406.49 FT
NOV 12 1983	110.89 FT	27.11 FT	3406.11 FT
DEC 6 1983	111.03 FT	26.97 FT	3405.97 FT
JAN 4 1984	111.52 FT	26.48 FT	3405.48 FT
JAN 31 1984	111.51 FT	26.49 FT	3405.49 FT
FEB 28 1984	111.82 FT	26.18 FT	3405.18 FT
MAR 22 1984	112.31 FT	25.69 FT	3404.69 FT
APR 12 1984	112.39 FT	25.61 FT	3404.61 FT
MAY 8 1984	112.53 FT	25.47 FT	3404.47 FT
MAY 24 1984	112.40 FT	25.60 FT	3404.60 FT
JUN 12 1984	112.15 FT	25.85 FT	3404.85 FT
JUN 26 1984	111.89 FT	26.11 FT	3405.11 FT
JUL 17 1984	111.48 FT	26.52 FT	3405.52 FT
AUG 6 1984	111.16 FT	26.84 FT	3405.84 FT
SEP 4 1984	110.79 FT	27.21 FT	3406.21 FT
SEP 29 1984	110.72 FT	27.28 FT	3406.28 FT
OCT 16 1984	110.55 FT	27.45 FT	3406.45 FT

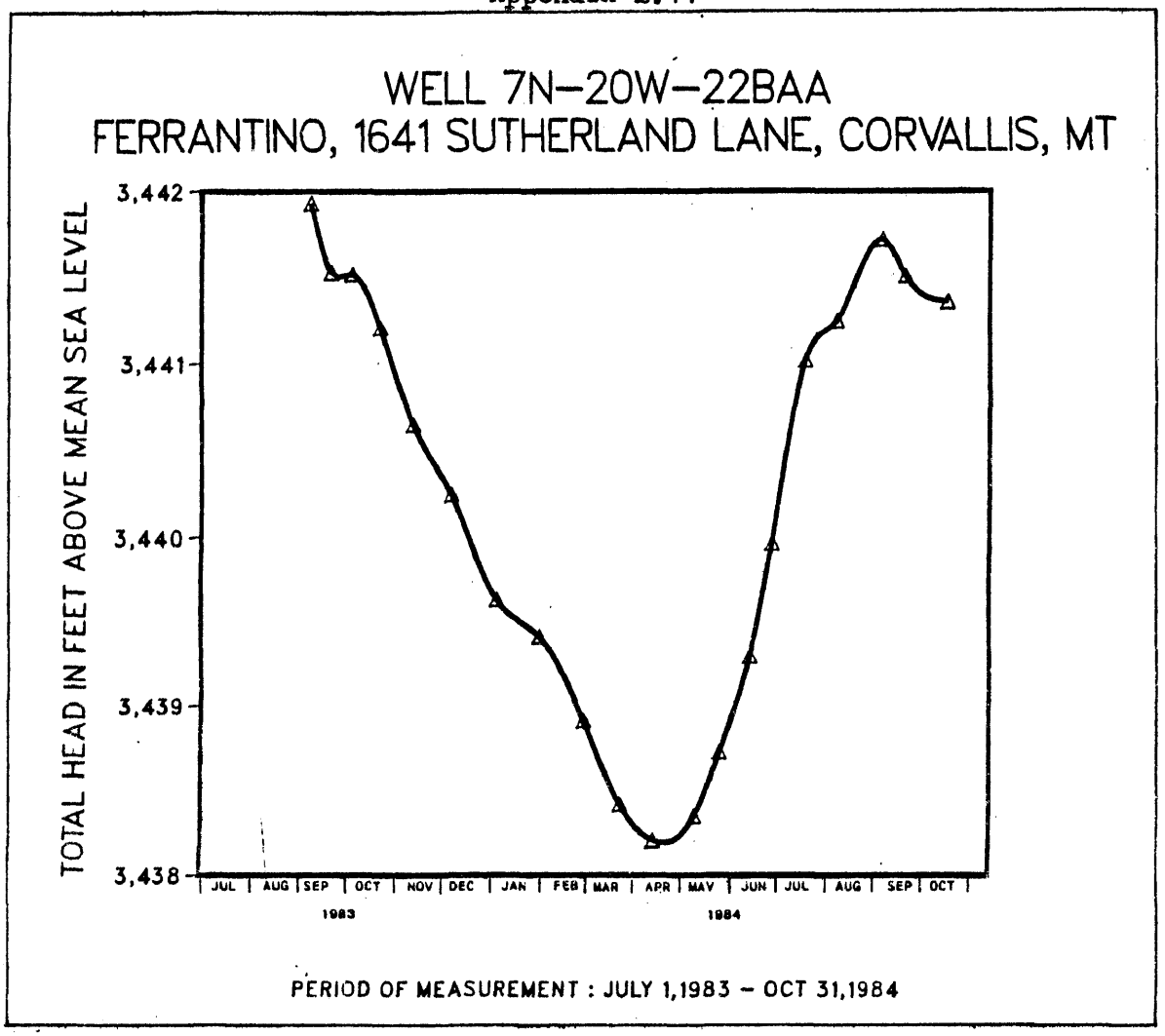
WELL DATA

OWNER : JEFF HULS
ADDRESS : 518 1000 ACRE ORCHARD ROAD, CORVALLIS, MT
WELL LOCATION : T7N, R20W, NW NE SEC.15
WELL ID NUMBER : 7N-20W-15ABC
ELEVATION : 3517 FEET
WELL DEPTH : 138 FEET
PUMPING RATE : 30 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 10.5 C OR 50.9 F
PH VALUE : 7.26
CONDUCTANCE VALUE : 633 MICROMHOS
ESTIMATED TDS VALUE : 404 MG/L
ESTIMATED HARDNESS VALUE : 274 MG/L

Appendix 2.44



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
SEP 8 1983	70.07 FT	27.93 FT	3441.93 FT
SEP 21 1983	70.47 FT	27.53 FT	3441.53 FT
OCT 4 1983	70.48 FT	27.52 FT	3441.52 FT
OCT 22 1983	70.79 FT	27.21 FT	3441.21 FT
NOV 12 1983	71.35 FT	26.65 FT	3440.65 FT
DEC 6 1983	71.75 FT	26.25 FT	3440.25 FT
JAN 4 1984	72.36 FT	25.64 FT	3439.64 FT
JAN 31 1984	72.58 FT	25.42 FT	3439.42 FT
FEB 28 1984	73.09 FT	24.91 FT	3438.91 FT
MAR 22 1984	73.59 FT	24.41 FT	3438.41 FT
APR 12 1984	73.80 FT	24.20 FT	3438.20 FT
MAY 8 1984	73.66 FT	24.34 FT	3438.34 FT
MAY 24 1984	73.28 FT	24.72 FT	3438.72 FT
JUN 12 1984	72.70 FT	25.30 FT	3439.30 FT
JUN 26 1984	72.03 FT	25.97 FT	3439.97 FT
JUL 17 1984	70.98 FT	27.02 FT	3441.02 FT
AUG 6 1984	70.75 FT	27.25 FT	3441.25 FT
SEP 4 1984	70.28 FT	27.72 FT	3441.72 FT
SEP 19 1984	70.49 FT	27.51 FT	3441.51 FT
OCT 16 1984	70.64 FT	27.36 FT	3441.36 FT

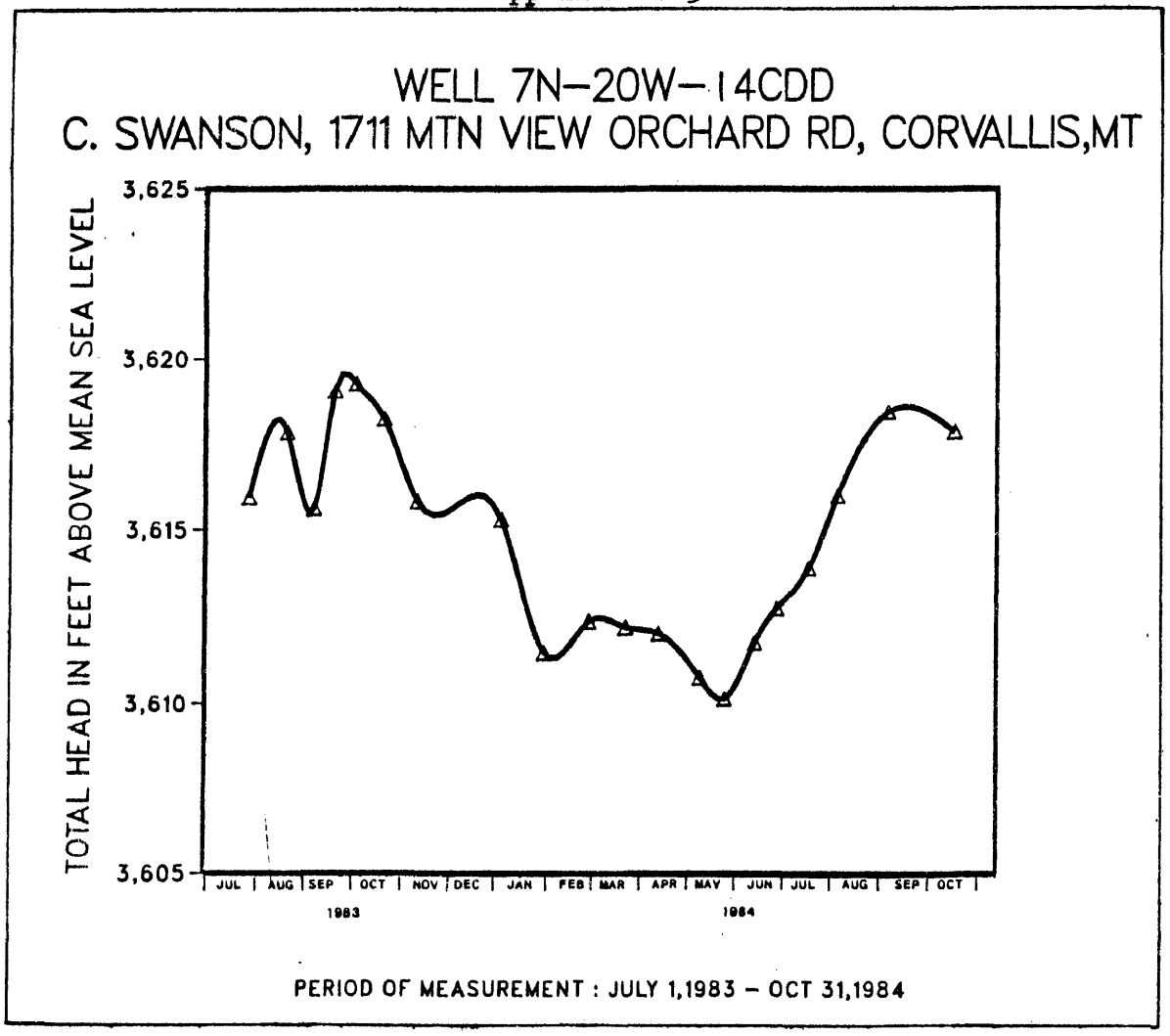
WELL DATA

OWNER : JOHN FERRANTINO
ADDRESS : 1641 SUTHERLAND LANE, CORVALLIS, MT
WELL LOCATION : T7N, R20W, NE NW SEC.22
WELL ID NUMBER : 7N-20W-22BAA
ELEVATION : 3512 FEET
WELL DEPTH : 98 FEET
PUMPING RATE : 25 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 11.5 C OR 52.7 F
PH VALUE : 7.42
CONDUCTANCE VALUE : 501 MICROMHOS
ESTIMATED TDS VALUE : 321 MG/L
ESTIMATED HARDNESS VALUE : 224 MG/L

Appendix 2.45



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 29 1983	31.04 FT	92.96 FT	3615.96 FT
AUG 22 1983	29.13 FT	94.87 FT	3617.87 FT
SEP 8 1983	31.36 FT	92.64 FT	3615.64 FT
SEP 21 1983	27.92 FT	96.08 FT	3619.08 FT
OCT 4 1983	27.70 FT	96.30 FT	3619.30 FT
OCT 22 1983	28.73 FT	95.27 FT	3618.27 FT
NOV 12 1983	31.15 FT	92.85 FT	3615.85 FT
JAN 4 1984	31.68 FT	92.32 FT	3615.32 FT
JAN 31 1984	35.50 FT	88.50 FT	3611.50 FT
FEB 28 1984	34.61 FT	89.39 FT	3612.39 FT
MAR 22 1984	34.78 FT	89.22 FT	3612.22 FT
APR 12 1984	34.96 FT	89.04 FT	3612.04 FT
MAY 8 1984	36.22 FT	87.78 FT	3610.78 FT
MAY 24 1984	36.84 FT	87.16 FT	3610.16 FT
JUN 12 1984	35.22 FT	88.78 FT	3611.78 FT
JUN 26 1984	34.24 FT	89.76 FT	3612.76 FT
JUL 16 1984	33.08 FT	90.92 FT	3613.92 FT
AUG 3 1984	30.98 FT	93.02 FT	3616.02 FT
SEP 4 1984	28.51 FT	95.49 FT	3618.49 FT
OCT 16 1984	29.09 FT	94.91 FT	3617.91 FT

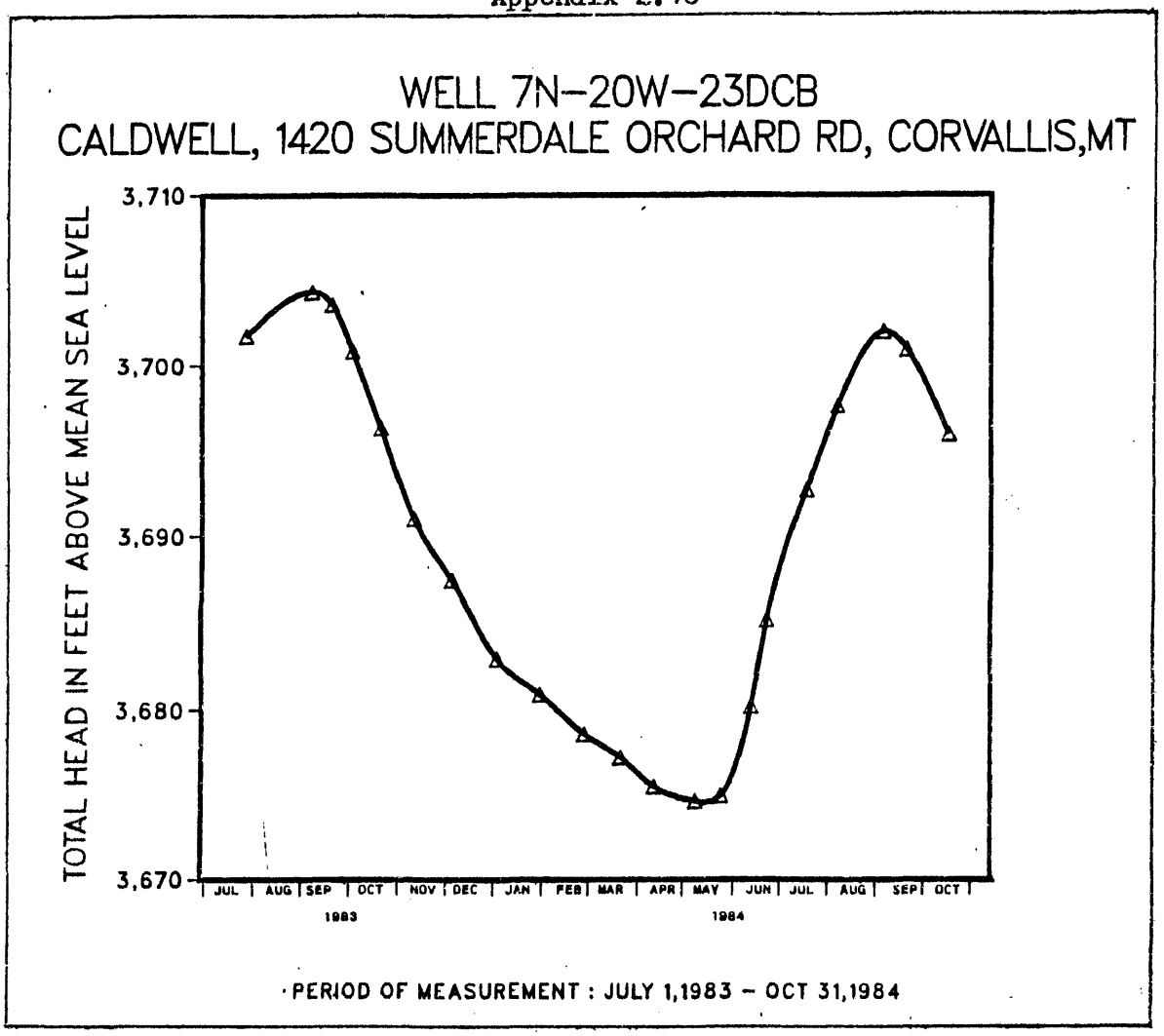
WELL DATA

OWNER : CARL SWANSON
ADDRESS : 1711 MOUNTAIN VIEW ORCHARDS ROAD, CORVALLIS, MT
WELL LOCATION : T7N, R2DW, SE SW SEC.14
WELL ID NUMBER : 7N-2DW-14CDD
ELEVATION : 3647 FEET
WELL DEPTH : 124' FEET
PUMPING RATE : 6 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 11.5 C OR 52.7 F
PH VALUE : 7.78
CONDUCTANCE VALUE : 1034 MICROMHOS
ESTIMATED TDS VALUE : 652 MG/L
ESTIMATED HARDNESS VALUE : 425 MG/L

Appendix 2.46



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 29 1983	18.26 FT	57.74 FT	3701.74 FT
SEP 8 1983	15.68 FT	60.32 FT	3704.32 FT
SEP 21 1983	16.43 FT	59.57 FT	3703.57 FT
OCT 4 1983	19.15 FT	56.85 FT	3700.85 FT
OCT 22 1983	23.73 FT	52.27 FT	3696.27 FT
NOV 12 1983	28.97 FT	47.03 FT	3691.03 FT
DEC 6 1983	32.53 FT	43.47 FT	3687.47 FT
JAN 4 1984	37.02 FT	38.98 FT	3682.98 FT
JAN 31 1984	39.07 FT	36.93 FT	3680.93 FT
FEB 28 1984	41.38 FT	34.62 FT	3678.62 FT
MAR 22 1984	42.73 FT	33.27 FT	3677.27 FT
APR 12 1984	44.44 FT	31.56 FT	3675.56 FT
MAY 8 1984	45.30 FT	30.70 FT	3674.70 FT
MAY 24 1984	44.98 FT	31.02 FT	3675.02 FT
JUN 12 1984	39.76 FT	36.24 FT	3680.24 FT
JUN 22 1984	34.80 FT	41.20 FT	3685.20 FT
JUL 17 1984	27.27 FT	48.73 FT	3692.73 FT
AUG 6 1984	22.37 FT	53.63 FT	3697.63 FT
SEP 4 1984	17.99 FT	58.01 FT	3702.01 FT
SEP 19 1984	19.02 FT	56.98 FT	3700.98 FT
OCT 16 1984	24.07 FT	51.93 FT	3695.93 FT

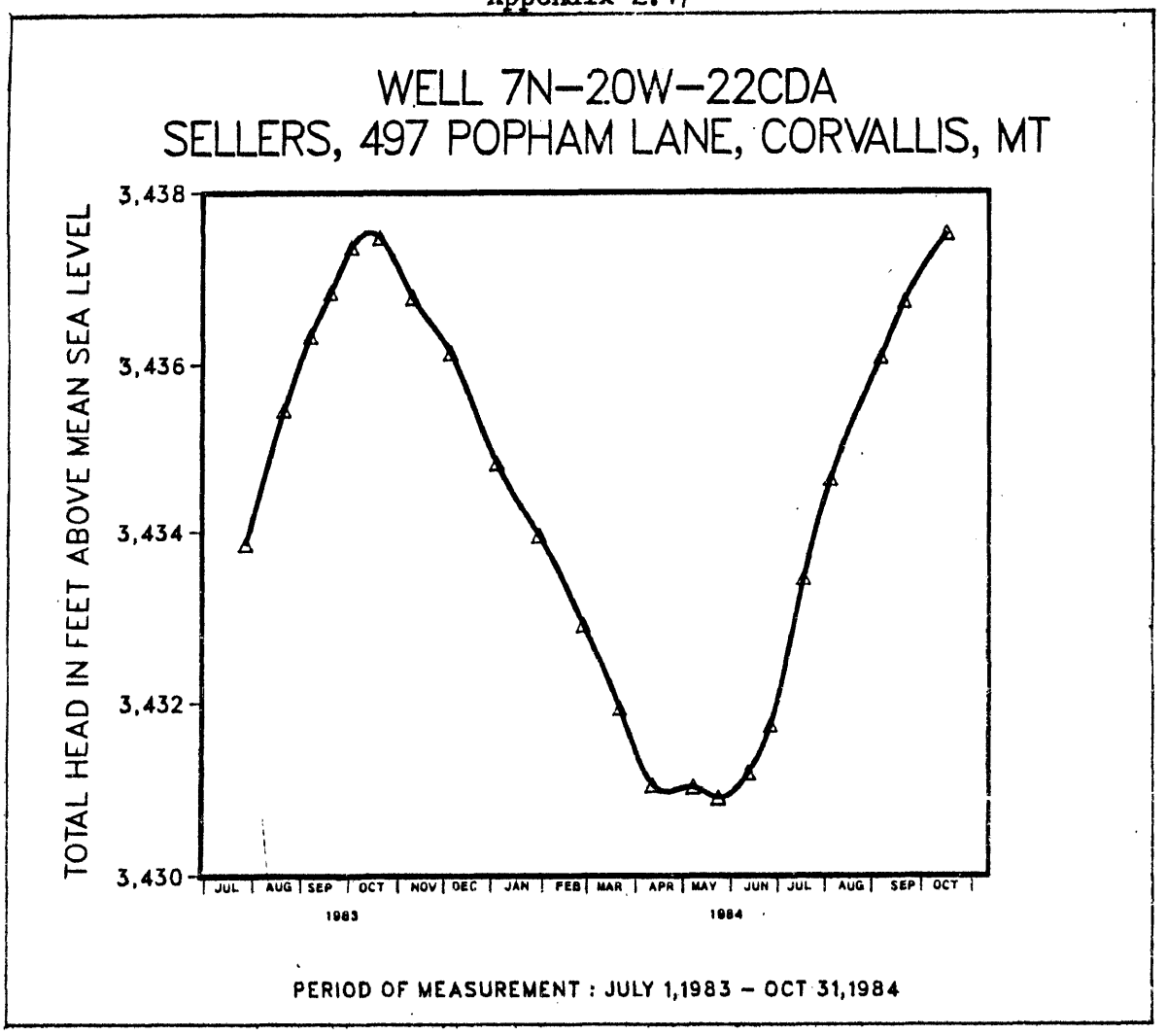
WELL DATA

OWNER : TONY CALDWELL
ADDRESS : 1420 SUMMERDALE ORCHARD RD, CORVALLIS, MT
WELL LOCATION : T7N, R20W, SW SE SEC.23
WELL ID NUMBER : 7N-20W-23DCB
ELEVATION : 3720 FEET
WELL DEPTH : 76 FEET
PUMPING RATE : 12 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 11.5 C OR 52.7 F
PH VALUE : 7.72
CONDUCTANCE VALUE : 502 MICROMHOS
ACTUAL TDS VALUE : 339.35 MG/L
ACTUAL HARDNESS VALUE : 227.9 MG/L

Appendix 2.47



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 29 1983	89.14 FT	40.86 FT	3433.86 FT
AUG 22 1983	87.54 FT	42.46 FT	3435.46 FT
SEP 8 1983	86.66 FT	43.34 FT	3436.34 FT
SEP 21 1983	86.15 FT	43.85 FT	3436.85 FT
OCT 4 1983	85.63 FT	44.37 FT	3437.37 FT
OCT 22 1983	85.52 FT	44.48 FT	3437.48 FT
NOV 12 1983	86.21 FT	43.79 FT	3436.79 FT
DEC 6 1983	86.86 FT	43.14 FT	3436.14 FT
JAN 4 1984	88.18 FT	41.82 FT	3434.82 FT
JAN 31 1984	89.04 FT	40.96 FT	3433.96 FT
FEB 28 1984	90.09 FT	39.91 FT	3432.91 FT
MAR 22 1984	91.06 FT	38.94 FT	3431.94 FT
APR 12 1984	91.95 FT	38.05 FT	3431.05 FT
MAY 8 1984	91.97 FT	38.03 FT	3431.03 FT
MAY 24 1984	92.10 FT	37.90 FT	3430.90 FT
JUN 12 1984	91.81 FT	38.19 FT	3431.19 FT
JUN 26 1984	91.26 FT	38.74 FT	3431.74 FT
JUL 17 1984	89.55 FT	40.45 FT	3433.45 FT
AUG 3 1984	88.37 FT	41.63 FT	3434.63 FT
SEP 4 1984	86.91 FT	43.09 FT	3436.09 FT
SEP 19 1984	86.26 FT	43.74 FT	3436.74 FT
OCT 16 1984	85.48 FT	44.52 FT	3437.52 FT

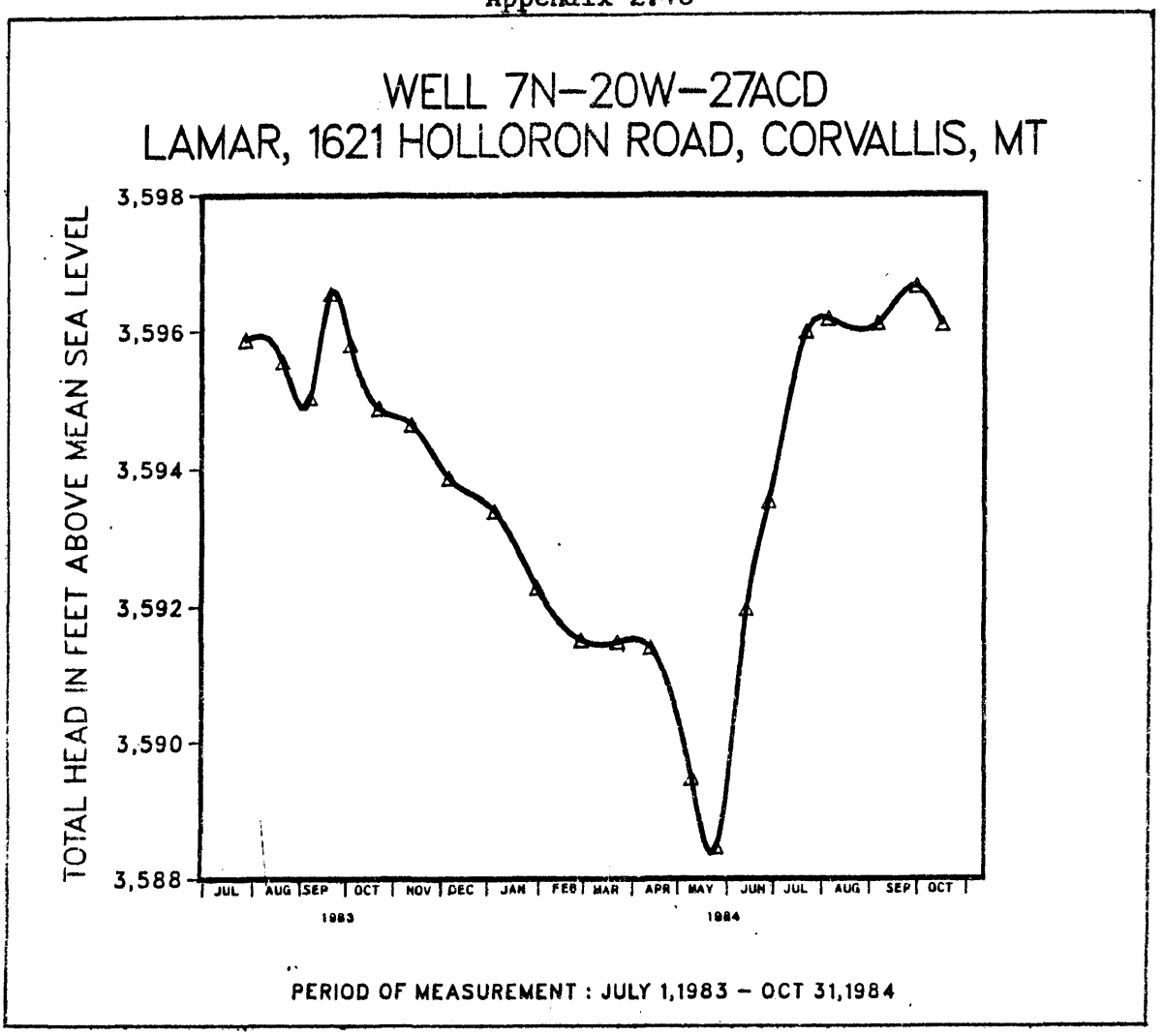
WELL DATA

OWNER : DAN SELLERS
ADDRESS : 497 POPHAM LANE, CORVALLIS, MT
WELL LOCATION : T7N, R20W, SE SW SEC.22
WELL ID NUMBER : 7N-20W-22CDA
ELEVATION : 3523 FEET
WELL DEPTH : 130 FEET
PUMPING RATE : 20 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 12.5 C OR 54.5 F
PH VALUE : 7.45
CONDUCTANCE VALUE : 416 MICROMHOS
ESTIMATED TDS VALUE : 269 MG/L
ESTIMATED HARDNESS VALUE : 192 MG/L

Appendix 2.48



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 29 1983	36.12 FT	113.88 FT	3595.88 FT
AUG 22 1983	36.44 FT	113.56 FT	3595.56 FT
SEP 8 1983	36.96 FT	113.04 FT	3595.04 FT
SEP 21 1983	35.45 FT	114.55 FT	3596.55 FT
OCT 4 1983	36.19 FT	113.81 FT	3595.81 FT
OCT 22 1983	37.12 FT	112.88 FT	3594.88 FT
NOV 12 1983	37.35 FT	112.65 FT	3594.65 FT
DEC 6 1983	38.13 FT	111.87 FT	3593.87 FT
JAN 4 1984	38.61 FT	111.39 FT	3593.39 FT
JAN 31 1984	39.72 FT	110.28 FT	3592.28 FT
FEB 28 1984	40.49 FT	109.51 FT	3591.51 FT
MAR 22 1984	40.52 FT	109.48 FT	3591.48 FT
APR 12 1984	40.60 FT	109.40 FT	3591.40 FT
MAY 8 1984	42.53 FT	107.47 FT	3589.47 FT
MAY 24 1984	43.54 FT	106.46 FT	3588.46 FT
JUN 12 1984	40.03 FT	109.97 FT	3591.97 FT
JUN 26 1984	38.47 FT	111.53 FT	3593.53 FT
JUL 20 1984	36.01 FT	113.99 FT	3595.99 FT
AUG 3 1984	35.82 FT	114.18 FT	3596.18 FT
SEP 4 1984	35.89 FT	114.11 FT	3596.11 FT
SEP 20 1984	35.35 FT	114.65 FT	3596.65 FT
OCT 16 1984	35.91 FT	114.09 FT	3596.09 FT

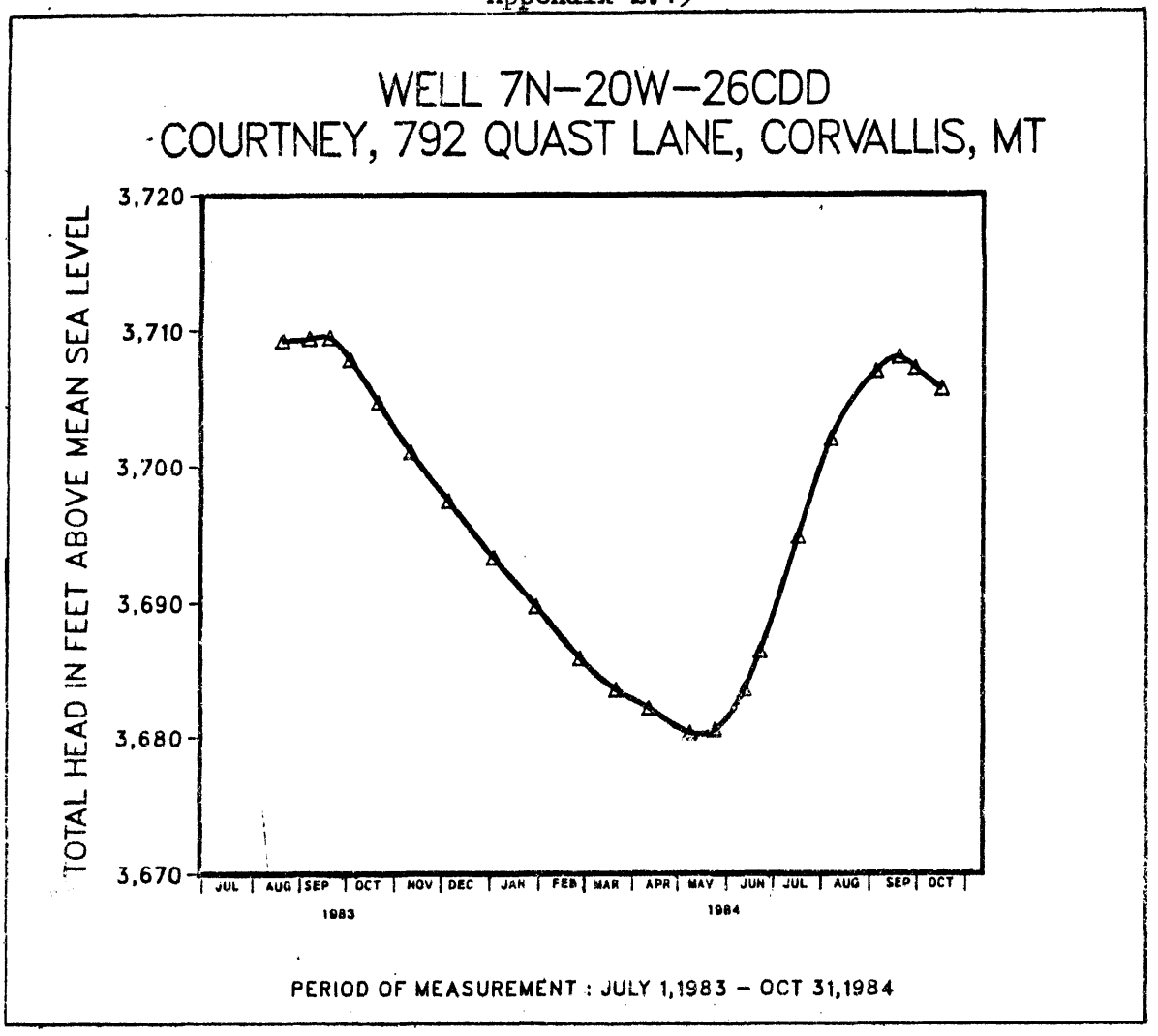
WELL DATA

OWNER : JESS LAMAR
ADDRESS : 1621 HOLLDRON ROAD, CORVALLIS, MT
WELL LOCATION : T7N, R20W, SW NE SEC.27
WELL ID NUMBER : 7N-20W-27ACD
ELEVATION : 3632 FEET
WELL DEPTH : 150 FEET
PUMPING RATE : 12 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 13 C OR 55.4 F
PH VALUE : 7.83
CONDUCTANCE VALUE : 444 MICROMHOS
ESTIMATED TDS VALUE : 286 MG/L
ESTIMATED HARDNESS VALUE : 203 MG/L

Appendix 2.49



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
AUG 22 1983	32.72 FT	72.28 FT	3709.28 FT
SEP 8 1983	32.57 FT	72.43 FT	3709.43 FT
SEP 21 1983	32.51 FT	72.49 FT	3709.49 FT
OCT 4 1983	34.14 FT	70.86 FT	3707.86 FT
OCT 22 1983	37.28 FT	67.72 FT	3704.72 FT
NOV 12 1983	40.92 FT	64.08 FT	3701.08 FT
DEC 6 1983	44.52 FT	60.48 FT	3697.48 FT
JAN 4 1984	48.64 FT	56.36 FT	3693.36 FT
JAN 31 1984	52.20 FT	52.80 FT	3689.80 FT
FEB 28 1984	56.04 FT	48.96 FT	3685.96 FT
MAR 22 1984	58.36 FT	46.64 FT	3683.64 FT
APR 12 1984	59.76 FT	45.24 FT	3682.24 FT
MAY 8 1984	61.63 FT	43.37 FT	3680.37 FT
MAY 24 1984	61.39 FT	43.61 FT	3680.61 FT
JUN 12 1984	58.33 FT	46.67 FT	3683.67 FT
JUN 22 1984	55.49 FT	49.51 FT	3686.51 FT
JUL 16 1984	47.11 FT	57.89 FT	3694.89 FT
AUG 6 1984	39.96 FT	65.04 FT	3702.04 FT
SEP 4 1984	34.98 FT	70.02 FT	3707.02 FT
SEP 19 1984	33.93 FT	71.07 FT	3708.07 FT
SEP 29 1984	34.74 FT	70.26 FT	3707.26 FT
OCT 16 1984	36.29 FT	68.71 FT	3705.71 FT

WELL DATA

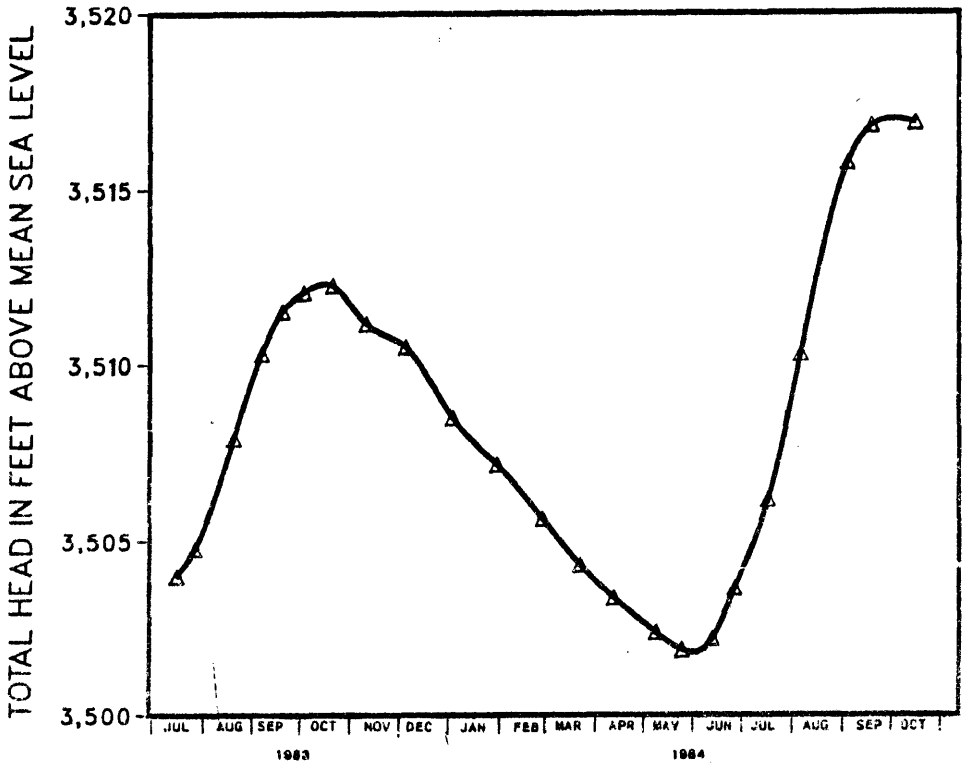
OWNER : WILLIAM COURTNEY
ADDRESS : 792 QUAST LANE, CORVALLIS, MT
WELL LOCATION : T7N, R20W, SE SW SEC.28
WELL ID NUMBER : 7N-20W-26CDD
ELEVATION : 3742 FEET
WELL DEPTH : 105 FEET
PUMPING RATE : 15 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 10.8 C OR 51.4 F
PH VALUE : 7.53
CONDUCTANCE VALUE : 380 MICROMHOS
ACTUAL TDS VALUE : 250.14 MG/L
ACTUAL HARDNESS VALUE : 170.93 MG/L

Appendix 2,50

WELL 7N–20W–34BAD
FORD, 1115 HONEY HOUSE LANE, CORVALLIS, MT



PERIOD OF MEASUREMENT : JULY 1,1983 – OCT 31,1984

WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 18 1983	86.01 FT	25.99 FT	3503.99 FT
JUL 29 1983	85.22 FT	26.78 FT	3504.78 FT
AUG 22 1983	82.05 FT	29.95 FT	3507.95 FT
SEP 8 1983	79.69 FT	32.31 FT	3510.31 FT
SEP 21 1983	78.49 FT	33.51 FT	3511.51 FT
OCT 4 1983	77.96 FT	34.04 FT	3512.04 FT
OCT 22 1983	77.77 FT	34.23 FT	3512.23 FT
NOV 12 1983	78.85 FT	33.15 FT	3511.15 FT
DEC 6 1983	79.50 FT	32.50 FT	3510.50 FT
JAN 4 1984	81.47 FT	30.53 FT	3508.53 FT
JAN 31 1984	82.79 FT	29.21 FT	3507.21 FT
FEB 28 1984	84.34 FT	27.66 FT	3505.66 FT
MAR 22 1984	85.69 FT	26.31 FT	3504.31 FT
APR 12 1984	86.65 FT	25.35 FT	3503.35 FT
MAY 8 1984	87.66 FT	24.34 FT	3502.34 FT
MAY 24 1984	88.17 FT	23.83 FT	3501.83 FT
JUN 12 1984	87.85 FT	24.15 FT	3502.15 FT
JUN 26 1984	86.38 FT	25.62 FT	3503.62 FT
JUL 17 1984	83.80 FT	28.20 FT	3506.20 FT
AUG 6 1984	79.71 FT	32.29 FT	3510.29 FT
SEP 4 1984	74.22 FT	37.78 FT	3515.78 FT
SEP 19 1984	73.18 FT	38.82 FT	3516.82 FT
OCT 16 1984	73.10 FT	38.90 FT	3516.90 FT

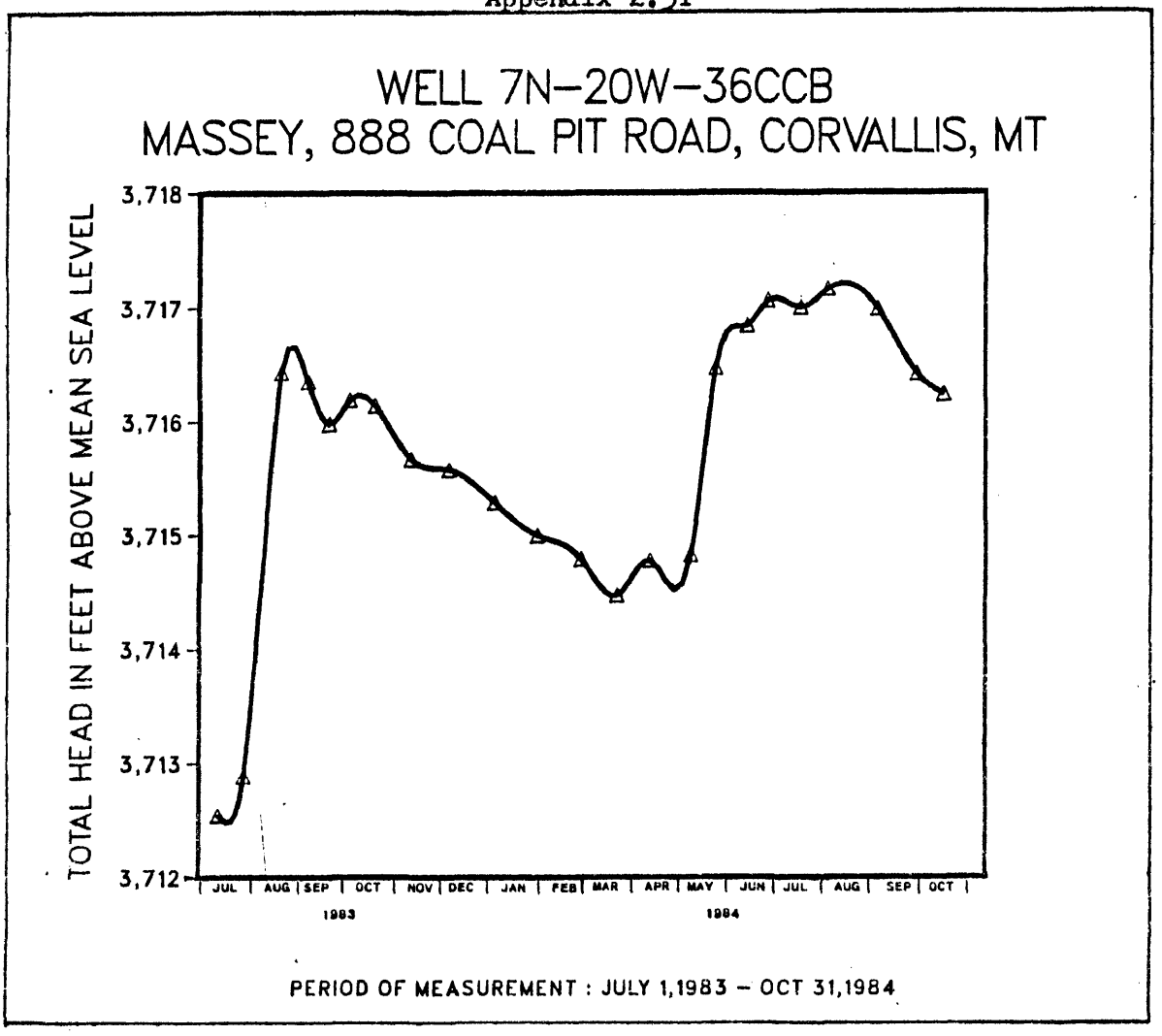
WELL DATA

OWNER : CHARLES FORD
ADDRESS : 1115 HONEY HOUSE LANE, CORVALLIS, MT
WELL LOCATION : T7N, R20W, SE NW SEC.34
WELL ID NUMBER : 7N-20W-34BAD
ELEVATION : 3590 FEET
WELL DEPTH : 112 FEET
PUMPING RATE : 15 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 11 C OR 51.8 F
PH VALUE : 7.22
CONDUCTANCE VALUE : 526 MICROMHOS
ESTIMATED TDS VALUE : 337 MG/L
ESTIMATED HARDNESS VALUE : 234 MG/L

Appendix 2.51



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 13 1983	15.45 FT	77.55 FT	3712.55 FT
JUL 29 1983	15.11 FT	77.89 FT	3712.89 FT
AUG 22 1983	11.57 FT	81.43 FT	3716.43 FT
SEP 8 1983	11.65 FT	81.35 FT	3716.35 FT
SEP 21 1983	12.02 FT	80.98 FT	3715.98 FT
OCT 4 1983	11.81 FT	81.19 FT	3716.19 FT
OCT 20 1983	11.86 FT	81.14 FT	3716.14 FT
NOV 12 1983	12.33 FT	80.67 FT	3715.67 FT
DEC 6 1983	12.42 FT	80.58 FT	3715.58 FT
JAN 4 1984	12.71 FT	80.29 FT	3715.29 FT
JAN 31 1984	13.00 FT	80.00 FT	3715.00 FT
FEB 28 1984	13.21 FT	79.79 FT	3714.79 FT
MAR 22 1984	13.53 FT	79.47 FT	3714.47 FT
APR 12 1984	13.22 FT	79.78 FT	3714.78 FT
MAY 8 1984	13.17 FT	79.83 FT	3714.83 FT
MAY 24 1984	11.53 FT	81.47 FT	3716.47 FT
JUN 13 1984	11.16 FT	81.84 FT	3716.84 FT
JUN 26 1984	10.94 FT	82.06 FT	3717.06 FT
JUL 17 1984	11.00 FT	82.00 FT	3717.00 FT
AUG 3 1984	10.84 FT	82.16 FT	3717.16 FT
SEP 4 1984	11.01 FT	81.99 FT	3716.99 FT
SEP 29 1984	11.58 FT	81.42 FT	3716.42 FT
OCT 16 1984	11.76 FT	81.24 FT	3716.24 FT

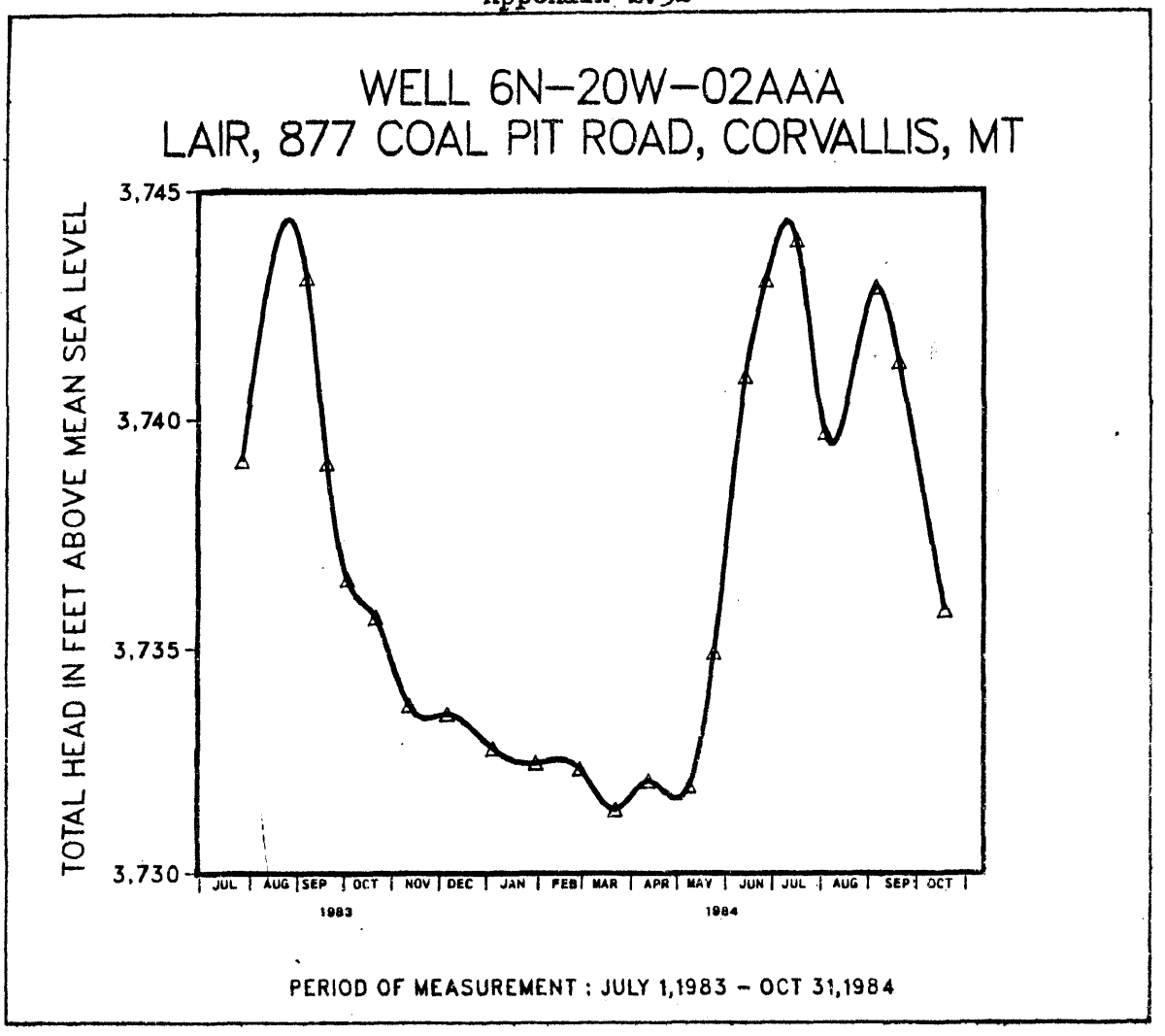
WELL DATA

OWNER : CAMPBELL MASSEY
ADDRESS : 888 COAL PIT ROAD, CORVALLIS, MT
WELL LOCATION : T7N, R20W, SW SW SEC.36
WELL ID NUMBER : 7N-20W-36CCB
ELEVATION : 3728 FEET
WELL DEPTH : 93 FEET
PUMPING RATE : 50 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 12 C OR 53.6 F
PH VALUE : 7.8
CONDUCTANCE VALUE : 343 MICROMHOS
ESTIMATED TDS VALUE : 223 MG/L
ESTIMATED HARDNESS VALUE : 165 MG/L

Appendix 2.52



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 29 1983	15.89 FT	104.11 FT	3739.11 FT
SEP 8 1983	11.90 FT	108.10 FT	3743.10 FT
SEP 21 1983	15.95 FT	104.05 FT	3739.05 FT
OCT 4 1983	18.45 FT	101.55 FT	3736.55 FT
OCT 22 1983	19.29 FT	100.71 FT	3735.71 FT
NOV 12 1983	21.28 FT	98.72 FT	3733.72 FT
DEC 6 1983	21.48 FT	98.52 FT	3733.52 FT
JAN 4 1984	22.26 FT	97.74 FT	3732.74 FT
JAN 31 1984	22.58 FT	97.42 FT	3732.42 FT
FEB 28 1984	22.70 FT	97.30 FT	3732.30 FT
MAR 22 1984	23.60 FT	96.40 FT	3731.40 FT
APR 12 1984	22.97 FT	97.03 FT	3732.03 FT
MAY 8 1984	23.09 FT	96.91 FT	3731.91 FT
MAY 24 1984	20.09 FT	99.91 FT	3734.91 FT
JUN 13 1984	14.07 FT	105.93 FT	3740.93 FT
JUN 26 1984	11.96 FT	108.04 FT	3743.04 FT
JUL 18 1984	11.09 FT	108.91 FT	3743.91 FT
AUG 3 1984	15.29 FT	104.71 FT	3739.71 FT
SEP 4 1984	12.12 FT	107.88 FT	3742.88 FT
SEP 19 1984	13.76 FT	106.24 FT	3741.24 FT
OCT 18 1984	19.15 FT	100.85 FT	3735.85 FT

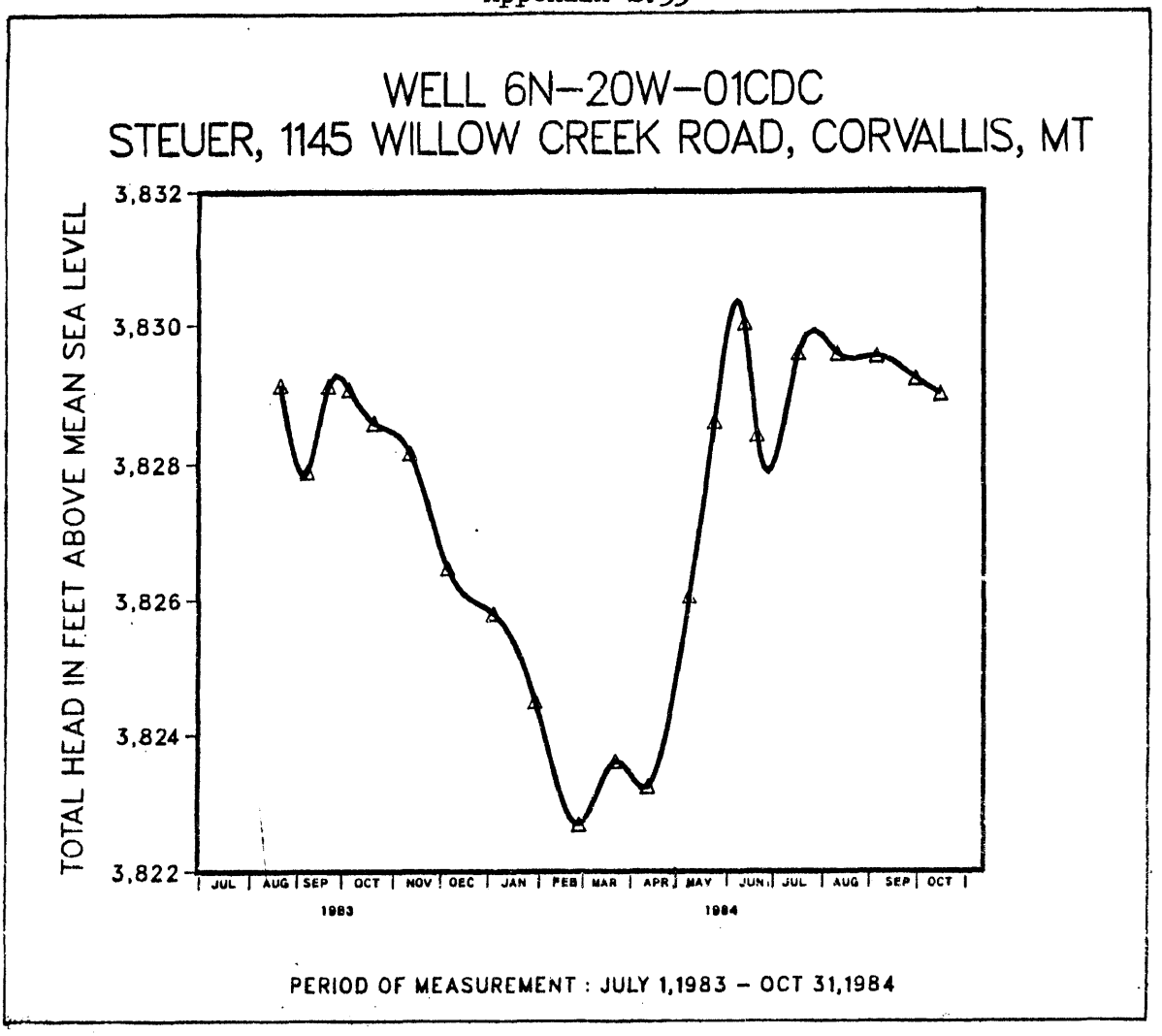
WELL DATA

OWNER : JAMES LAIR
ADDRESS : 877 COAL PIT ROAD, CORVALLIS, MT
WELL LOCATION : T6N, R20W, NE NE SEC.2
WELL ID NUMBER : 6N-20W-02AAA
ELEVATION : 3755 FEET
WELL DEPTH : 120 FEET
PUMPING RATE : 4 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 14 C OR 57.2 F
PH VALUE : 7.84
CONDUCTANCE VALUE : 583 MICROMHOS
ESTIMATED TDS VALUE : 372 MG/L
ESTIMATED HARDNESS VALUE : 255 MG/L

Appendix 2.53



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
AUG 22 1983	3.86 FT	116.14 FT	3829.14 FT
SEP 8 1983	5.10 FT	114.90 FT	3827.90 FT
SEP 21 1983	3.87 FT	116.13 FT	3829.13 FT
OCT 4 1983	3.92 FT	116.08 FT	3829.08 FT
OCT 20 1983	4.40 FT	115.60 FT	3828.60 FT
NOV 12 1983	4.83 FT	115.17 FT	3828.17 FT
DEC 6 1983	6.51 FT	113.49 FT	3826.49 FT
JAN 4 1984	7.19 FT	112.81 FT	3825.81 FT
JAN 31 1984	8.49 FT	111.51 FT	3824.51 FT
FEB 28 1984	10.31 FT	109.69 FT	3822.69 FT
MAR 22 1984	9.39 FT	110.61 FT	3823.61 FT
APR 12 1984	9.76 FT	110.24 FT	3823.24 FT
MAY 8 1984	6.93 FT	113.07 FT	3826.07 FT
MAY 24 1984	4.38 FT	115.62 FT	3826.62 FT
JUN 12 1984	2.97 FT	117.03 FT	3830.03 FT
JUN 20 1984	4.57 FT	115.43 FT	3828.43 FT
JUL 16 1984	3.41 FT	116.59 FT	3829.59 FT
AUG 10 1984	3.42 FT	116.58 FT	3829.58 FT
SEP 4 1984	3.45 FT	116.55 FT	3829.55 FT
SEP 29 1984	3.77 FT	116.23 FT	3829.23 FT
OCT 15 1984	3.99 FT	116.01 FT	3829.01 FT

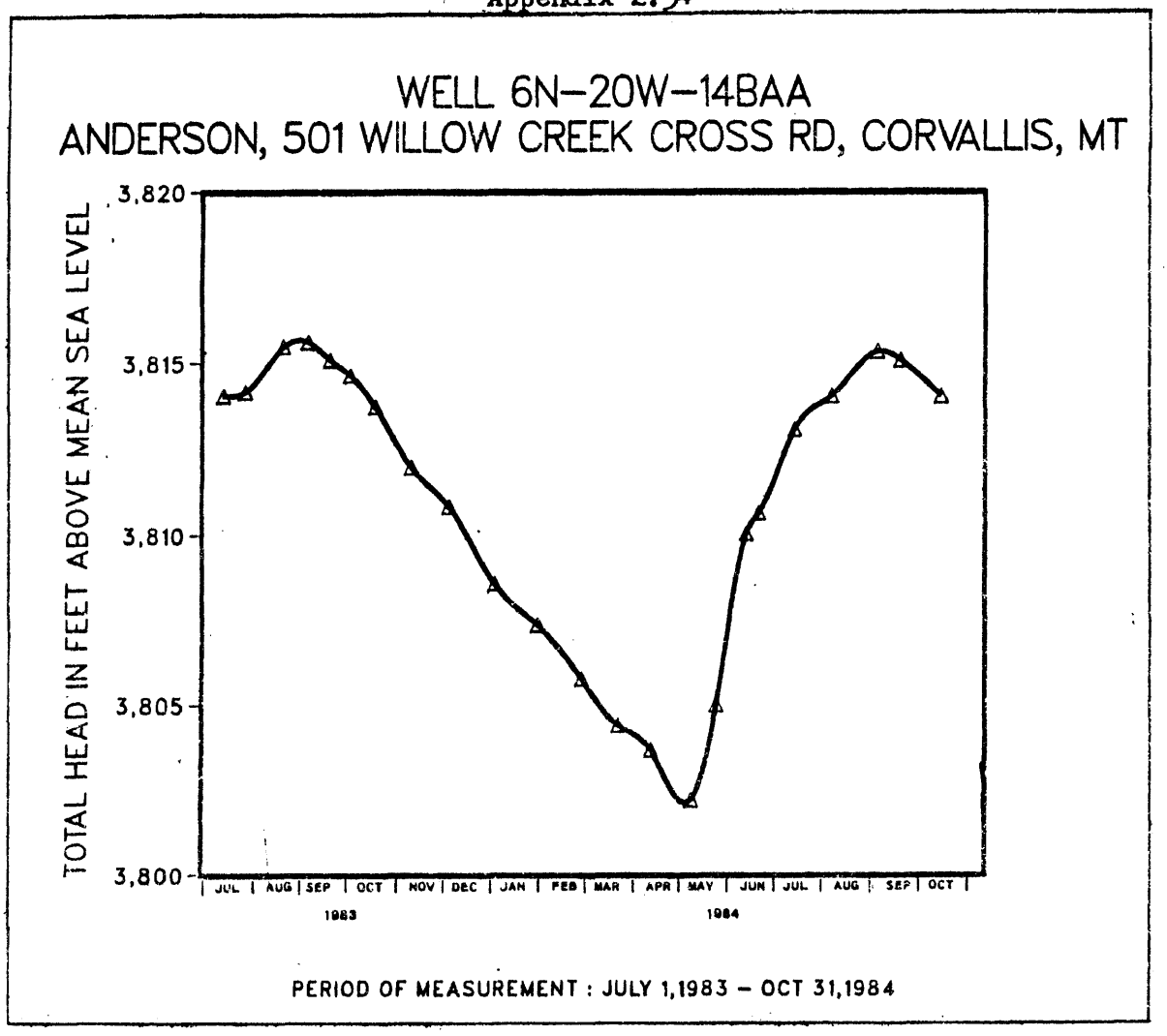
WELL DATA

OWNER : GUY STEUER
ADDRESS : 1145 WILLOW CREEK ROAD, CORVALLIS, MT
WELL LOCATION : T6N, R20W, SE SW SEC.1
WELL ID NUMBER : 6N-20W-01CDC
ELEVATION : 3833 FEET
WELL DEPTH : 120 FEET
PUMPING RATE : 15 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 9.5 C OR 49.1 F
PH VALUE : 7.21
CONDUCTANCE VALUE : 413 MICROMHOS
ACTUAL TDS VALUE : 268.9 MG/L
ACTUAL HARDNESS VALUE : 193 MG/L

Appendix 2.54



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 15 1983	30.95 FT	49.05 FT	3814.05 FT
JUL 29 1983	30.84 FT	49.16 FT	3814.16 FT
AUG 22 1983	29.53 FT	50.47 FT	3815.47 FT
SEP 7 1983	29.39 FT	50.61 FT	3815.61 FT
SEP 21 1983	29.91 FT	50.09 FT	3815.09 FT
OCT 4 1983	30.36 FT	49.64 FT	3814.64 FT
OCT 20 1983	31.27 FT	48.73 FT	3813.73 FT
NOV 12 1983	33.03 FT	46.97 FT	3811.97 FT
DEC 6 1983	34.17 FT	45.83 FT	3810.83 FT
JAN 4 1984	36.42 FT	43.58 FT	3808.58 FT
JAN 31 1984	37.63 FT	42.37 FT	3807.37 FT
FEB 28 1984	39.23 FT	40.77 FT	3805.77 FT
MAR 22 1984	40.60 FT	39.40 FT	3804.40 FT
APR 12 1984	41.33 FT	38.67 FT	3803.67 FT
MAY 8 1984	42.79 FT	37.21 FT	3802.21 FT
MAY 24 1984	40.00 FT	40.00 FT	3805.00 FT
JUN 12 1984	34.95 FT	45.05 FT	3810.05 FT
JUN 20 1984	34.36 FT	45.64 FT	3810.64 FT
JUL 13 1984	31.93 FT	48.07 FT	3813.07 FT
AUG 6 1984	30.96 FT	49.04 FT	3814.04 FT
SEP 4 1984	29.67 FT	50.33 FT	3815.33 FT
SEP 19 1984	29.92 FT	50.08 FT	3815.08 FT
OCT 15 1984	30.97 FT	49.03 FT	3814.03 FT

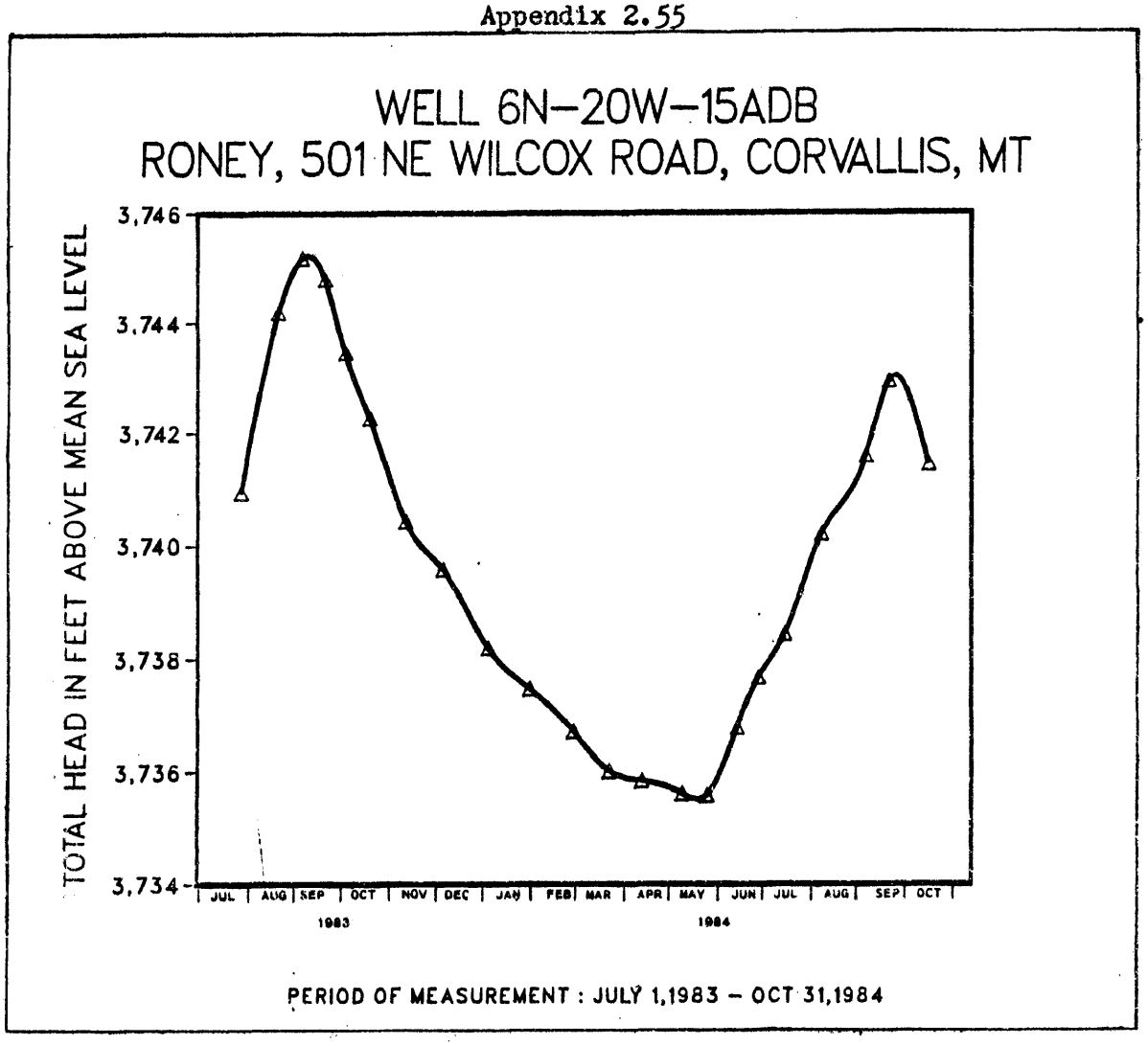
WELL DATA

OWNER : TOM ANDERSON
ADDRESS : 501 WILLOW CREEK CROSS ROAD, CORVALLIS, MT
WELL LOCATION : T6N, R20W, NE NW SEC.14
WELL ID NUMBER : 6N-20W-14BAA
ELEVATION : 3845 FEET
WELL DEPTH : 80 FEET
PUMPING RATE : 20 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 9.8 C OR 49.6 F
PH VALUE : 7.65
CONDUCTANCE VALUE : 650 MICROMHOS
ACTUAL TDS VALUE : 396.41 MG/L
ACTUAL HARDNESS VALUE : 276.35 MG/L

Appendix 2.55



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 28 1983	22.06 FT	26.94 FT	3740.94 FT
AUG 22 1983	18.81 FT	30.19 FT	3744.19 FT
SEP 6 1983	17.81 FT	31.19 FT	3745.19 FT
SEP 21 1983	18.19 FT	30.81 FT	3744.81 FT
OCT 4 1983	19.55 FT	29.45 FT	3743.45 FT
OCT 20 1983	20.73 FT	28.27 FT	3742.27 FT
NOV 12 1983	22.57 FT	26.43 FT	3740.43 FT
DEC 6 1983	23.41 FT	25.59 FT	3739.59 FT
JAN 4 1984	24.79 FT	24.21 FT	3738.21 FT
JAN 31 1984	25.52 FT	23.48 FT	3737.48 FT
FEB 28 1984	26.27 FT	22.73 FT	3736.73 FT
MAR 22 1984	26.98 FT	22.02 FT	3736.02 FT
APR 12 1984	27.15 FT	21.85 FT	3735.85 FT
MAY 0 1984	27.38 FT	21.62 FT	3735.62 FT
MAY 24 1984	27.41 FT	21.59 FT	3735.59 FT
JUN 12 1984	26.21 FT	22.79 FT	3736.79 FT
JUN 26 1984	25.32 FT	23.68 FT	3737.68 FT
JUL 13 1984	24.55 FT	24.45 FT	3738.45 FT
AUG 6 1984	22.79 FT	26.21 FT	3740.21 FT
SEP 4 1984	21.41 FT	27.59 FT	3741.59 FT
SEP 19 1984	20.07 FT	28.93 FT	3742.93 FT
OCT 15 1984	21.56 FT	27.44 FT	3741.44 FT

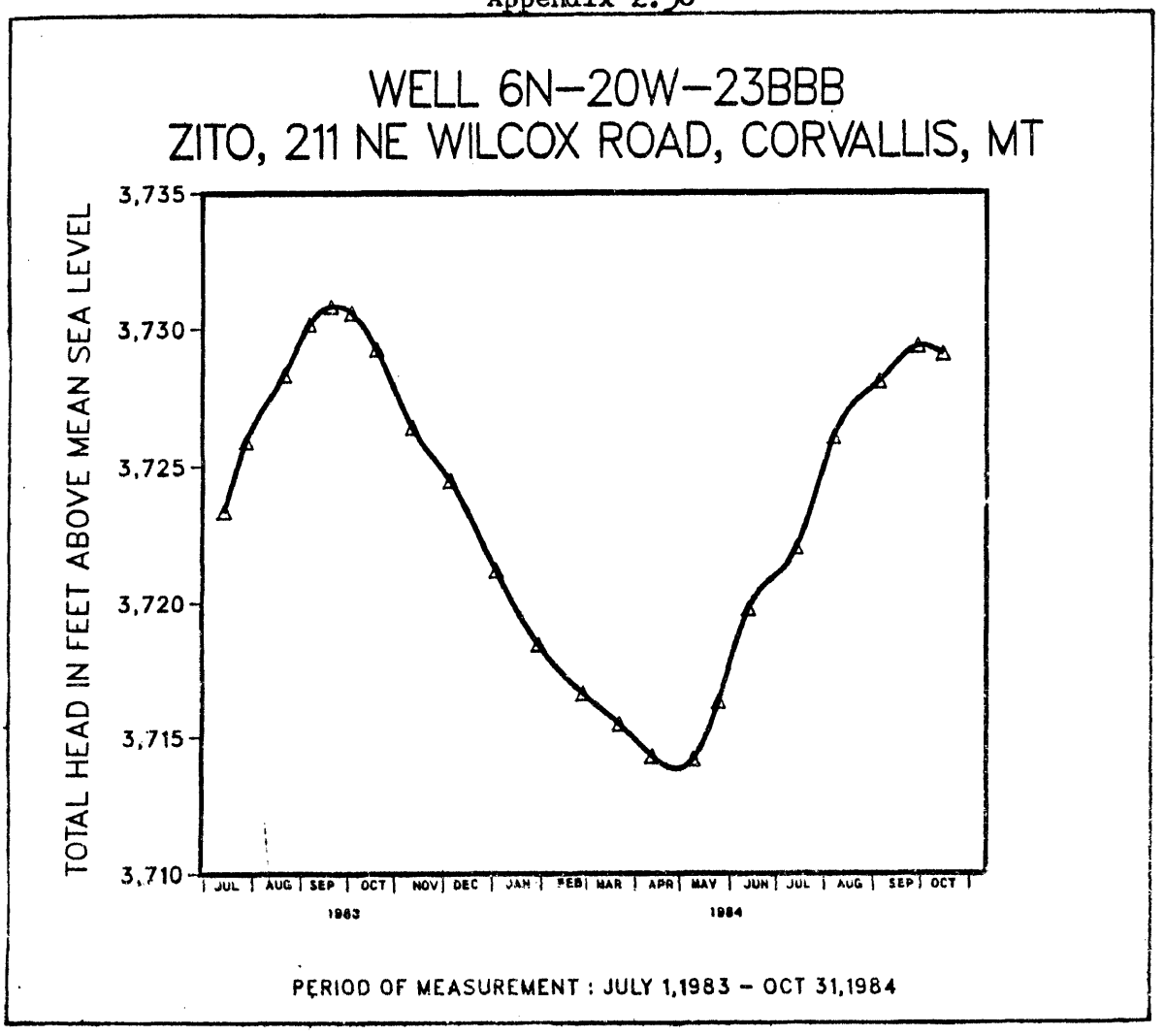
WELL DATA

OWNER : JANICE RONEY
ADDRESS : 501 NE WILCOX ROAD, CORVALLIS, MT
WELL LOCATION : T6N, R20W, SE NE SEC.15
WELL ID NUMBER : 6N-20W-15AOB
ELEVATION : 3763 FEET
WELL DEPTH : 49 FEET
PUMPING RATE : 20 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 9.7 C OR 49.4 F
PH VALUE : 7.61
CONDUCTANCE VALUE : 695 MICROMHOS
ESTIMATED TDS VALUE : 442 MG/L
ESTIMATED HARDNESS VALUE : 297 MG/L

Appendix 2.56



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 15 1983	39.61 FT	76.39 FT	3723.39 FT
JUL 29 1983	37.07 FT	78.93 FT	3725.93 FT
AUG 22 1983	34.67 FT	81.33 FT	3728.33 FT
SEP 7 1983	32.83 FT	83.17 FT	3730.17 FT
SEP 21 1983	32.18 FT	83.82 FT	3730.82 FT
OCT 4 1983	32.41 FT	83.59 FT	3730.58 FT
OCT 20 1983	33.73 FT	82.27 FT	3729.27 FT
NOV 12 1983	36.57 FT	79.43 FT	3726.43 FT
DEC 6 1983	38.51 FT	77.49 FT	3724.49 FT
JAN 4 1984	41.78 FT	74.22 FT	3721.22 FT
JAN 31 1984	44.53 FT	71.47 FT	3718.47 FT
FEB 28 1984	46.37 FT	69.63 FT	3716.63 FT
MAR 22 1984	47.50 FT	68.50 FT	3715.50 FT
APR 12 1984	48.69 FT	67.31 FT	3714.31 FT
MAY 8 1984	48.80 FT	67.20 FT	3714.20 FT
MAY 24 1984	46.67 FT	69.33 FT	3716.33 FT
JUN 12 1984	43.20 FT	72.80 FT	3719.80 FT
JUL 13 1984	40.93 FT	75.07 FT	3722.07 FT
AUG 6 1984	36.92 FT	79.08 FT	3726.08 FT
SEP 4 1984	34.90 FT	81.10 FT	3728.10 FT
SEP 29 1984	33.62 FT	82.38 FT	3729.38 FT
OCT 15 1984	33.91 FT	82.09 FT	3729.09 FT

WELL DATA

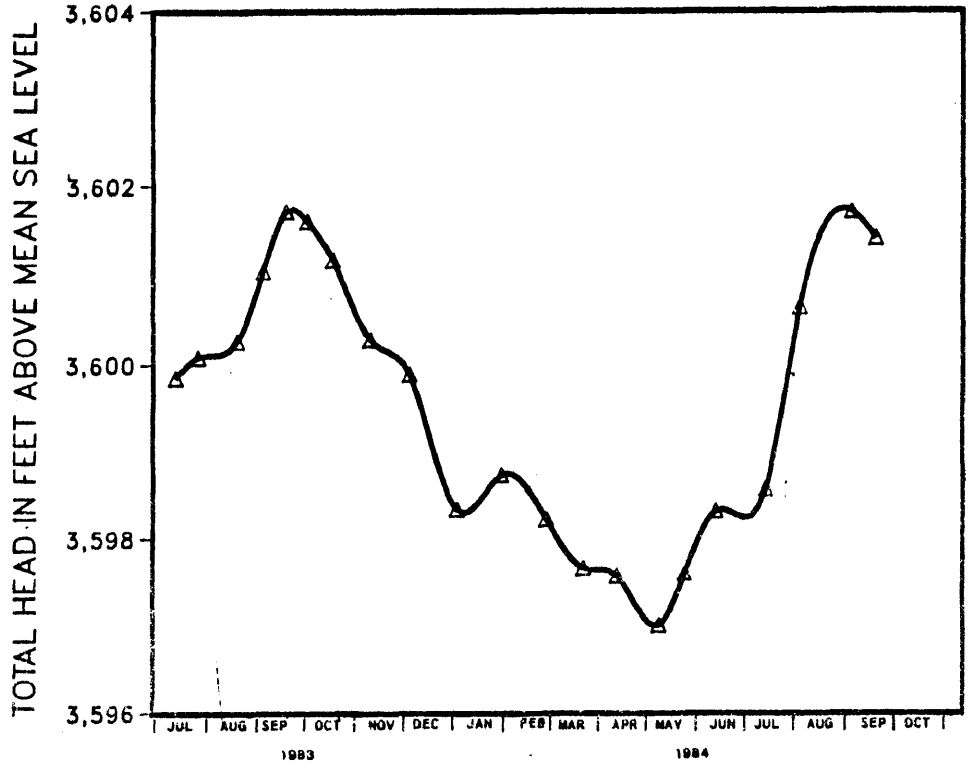
OWNER : DARWEN ZITO
ADDRESS : 211 NE WILCOX ROAD, CORVALLIS, MT
WELL LOCATION : T6N, R20W, NW NW SEC.23
WELL ID NUMBER : 6N-20W-23BBB
ELEVATION : 3763 FEET
WELL DEPTH : 116 FEET
PUMPING RATE : 10 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 10.5 C OR 50.9 F
PH VALUE : 7.57
CONDUCTANCE VALUE : 529 MICROMHOS
ESTIMATED TDS VALUE : 339 MG/L
ESTIMATED HARDNESS VALUE : 235 MG/L

Appendix 2.57

WELL 6N-20W-16ADC
BEARDMORE, 670 JOSHUA WAY, CORVALLIS, MT



PERIOD OF MEASUREMENT : JULY 1,1983 – OCT 31,1984

WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 15 1983	73.15 FT	36.85 FT	3599.85 FT
JUL 29 1983	72.92 FT	37.08 FT	3600.08 FT
AUG 22 1983	72.74 FT	37.26 FT	3600.26 FT
SEP 7 1983	71.96 FT	38.04 FT	3601.04 FT
SEP 21 1983	71.29 FT	38.71 FT	3601.71 FT
OCT 4 1983	71.40 FT	38.60 FT	3601.60 FT
OCT 20 1983	71.83 FT	38.17 FT	3601.17 FT
NOV 12 1983	72.72 FT	37.28 FT	3600.28 FT
DEC 6 1983	73.11 FT	36.89 FT	3599.89 FT
JAN 4 1984	74.66 FT	35.34 FT	3598.34 FT
JAN 31 1984	74.26 FT	35.74 FT	3598.74 FT
FEB 28 1984	74.77 FT	35.23 FT	3598.23 FT
MAR 22 1984	75.34 FT	34.66 FT	3597.66 FT
APR 12 1984	75.43 FT	34.57 FT	3597.57 FT
MAY 8 1984	76.00 FT	34.00 FT	3597.00 FT
MAY 24 1984	75.40 FT	34.60 FT	3597.60 FT
JUN 12 1984	74.68 FT	35.32 FT	3598.32 FT
JUL 13 1984	74.42 FT	35.58 FT	3598.58 FT
AUG 3 1984	72.36 FT	37.64 FT	3600.64 FT
SEP 4 1984	71.29 FT	38.71 FT	3601.71 FT
SEP 18 1984	71.59 FT	38.41 FT	3601.41 FT

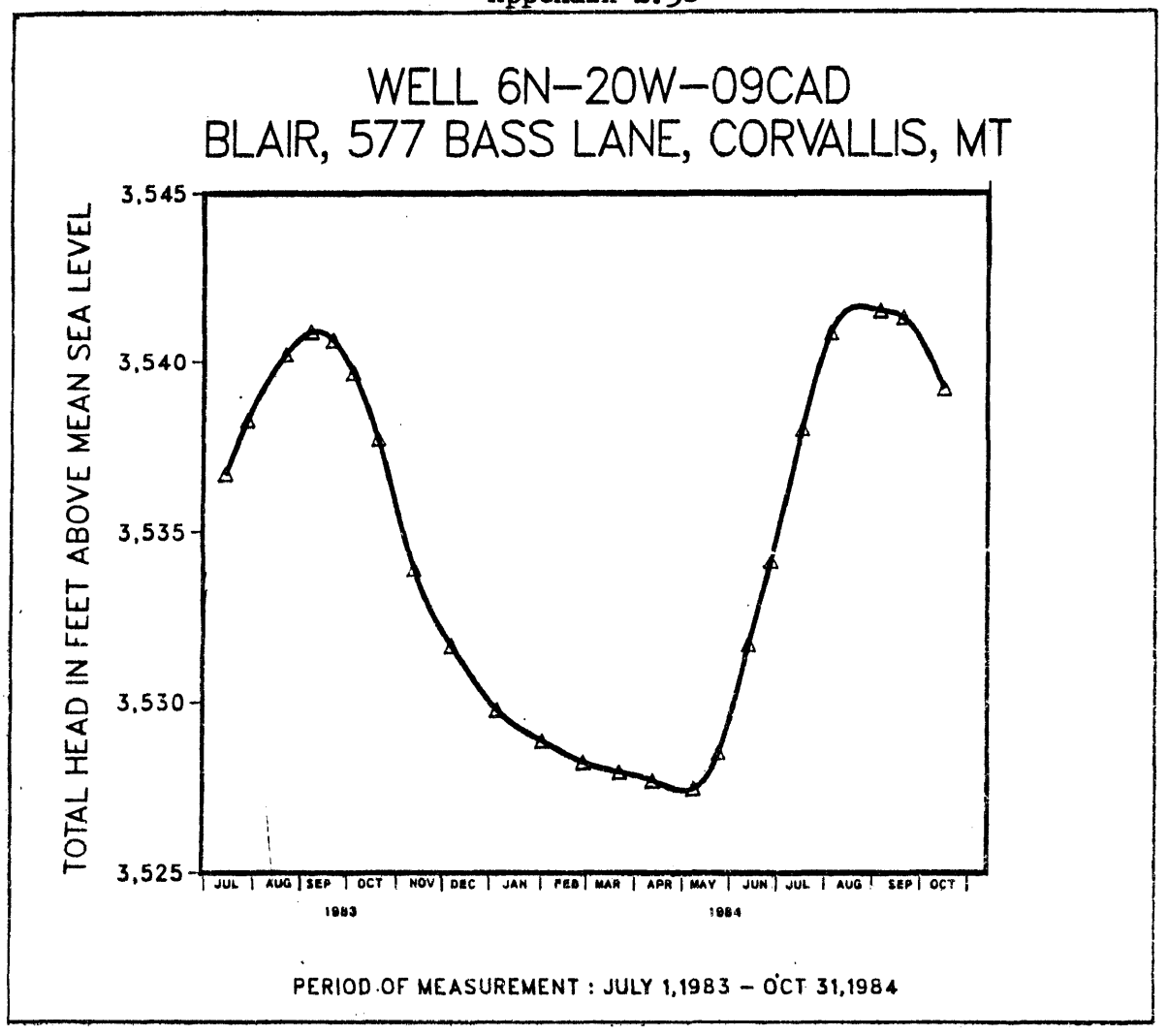
WELL DATA

OWNER : HOWARD BEARDMORE
ADDRESS : 670 JOSHUA WAY, CORVALLIS, MT
WELL LOCATION : T6N, R20W, SE NE SEC.16
WELL ID NUMBER : 6N-20W-16ADC
ELEVATION : 3673 FEET
WELL DEPTH : 110 FEET
PUMPING RATE : 10 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 11.5 C OR 52.7 F
PH VALUE : 7.53
CONDUCTANCE VALUE : 555 MICROMHOS
ESTIMATED TDS VALUE : 355 MG/L
ESTIMATED HARDNESS VALUE : 245 MG/L

Appendix 2.58



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 15 1983	58.30 FT	17.70 FT	3536.70 FT
JUL 29 1983	56.72 FT	19.28 FT	3538.28 FT
AUG 22 1983	54.77 FT	21.23 FT	3540.23 FT
SEP 7 1983	54.10 FT	21.90 FT	3540.90 FT
SEP 21 1983	54.35 FT	21.65 FT	3540.65 FT
OCT 4 1983	55.31 FT	20.69 FT	3539.69 FT
OCT 20 1983	57.27 FT	18.73 FT	3537.73 FT
NOV 12 1983	61.07 FT	14.93 FT	3533.93 FT
DEC 6 1983	63.32 FT	12.68 FT	3531.68 FT
JAN 4 1984	65.21 FT	10.79 FT	3529.79 FT
FEB 2 1984	66.14 FT	9.86 FT	3528.86 FT
FEB 28 1984	66.77 FT	9.23 FT	3528.23 FT
MAR 22 1984	67.06 FT	8.94 FT	3527.94 FT
APR 12 1984	67.31 FT	8.69 FT	3527.69 FT
MAY 8 1984	67.54 FT	8.46 FT	3527.46 FT
MAY 24 1984	66.49 FT	9.51 FT	3528.51 FT
JUN 12 1984	63.27 FT	12.73 FT	3531.73 FT
JUN 26 1984	60.84 FT	15.16 FT	3534.16 FT
JUL 16 1984	56.97 FT	19.03 FT	3538.03 FT
AUG 3 1984	54.11 FT	21.89 FT	3540.89 FT
SEP 4 1984	53.45 FT	22.55 FT	3541.55 FT
SEP 19 1984	53.66 FT	22.34 FT	3541.34 FT
OCT 15 1984	55.77 FT	20.23 FT	3539.23 FT

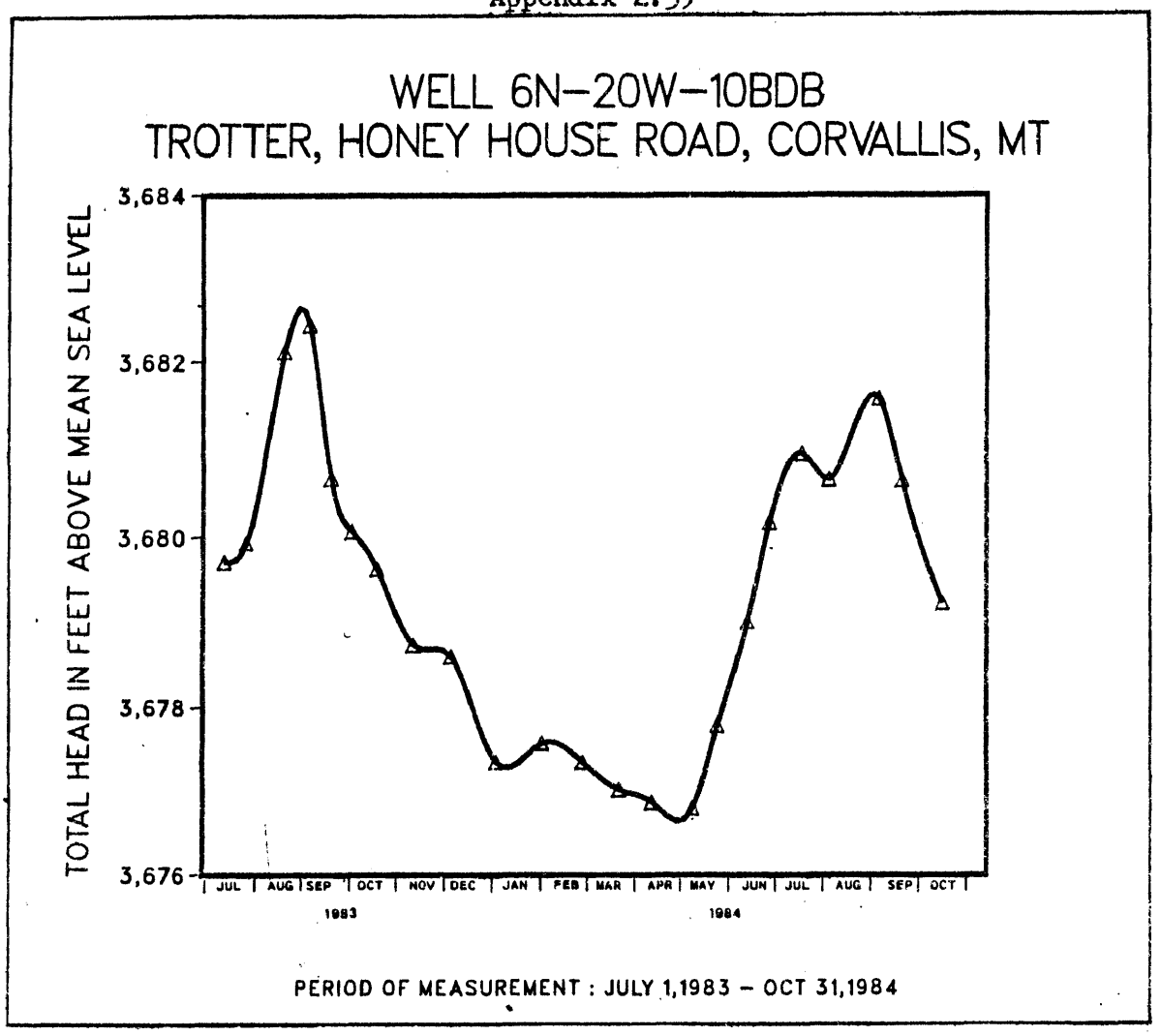
WELL DATA

OWNER : JOE BLAIR
ADDRESS : 577 BASS LANE, CORVALLIS, MT
WELL LOCATION : T8N, R20W, NE SW SEC.9
WELL ID NUMBER : 8N-20W-09CAD
ELEVATION : 3595 FEET
WELL DEPTH : 76 FEET
PUMPING RATE : 15 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 12 C OR 53.6 F
PH VALUE : 7.54
CONDUCTANCE VALUE : 422 MICROMHOS
ESTIMATED TDS VALUE : 273 MG/L
ESTIMATED HARDNESS VALUE : 195 MG/L

Appendix 2.59



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 15 1983	18.28 FT	32.72 FT	3679.72 FT
JUL 29 1983	18.06 FT	32.94 FT	3679.94 FT
AUG 22 1983	15.88 FT	35.12 FT	3682.12 FT
SEP 7 1983	15.56 FT	35.44 FT	3682.44 FT
SEP 21 1983	17.33 FT	33.67 FT	3680.67 FT
OCT 4 1983	17.93 FT	33.07 FT	3680.07 FT
OCT 20 1983	18.36 FT	32.64 FT	3679.64 FT
NOV 12 1983	19.25 FT	31.75 FT	3678.75 FT
DEC 6 1983	19.39 FT	31.61 FT	3678.61 FT
JAN 4 1984	20.66 FT	30.34 FT	3677.34 FT
FEB 2 1984	20.43 FT	30.57 FT	3677.57 FT
FEB 28 1984	20.66 FT	30.34 FT	3677.34 FT
MAR 22 1984	20.99 FT	30.01 FT	3677.01 FT
APR 12 1984	21.14 FT	29.86 FT	3676.86 FT
MAY 8 1984	21.21 FT	29.79 FT	3676.79 FT
MAY 24 1984	20.22 FT	30.78 FT	3677.78 FT
JUN 12 1984	18.98 FT	32.02 FT	3679.02 FT
JUN 26 1984	17.83 FT	33.17 FT	3680.17 FT
JUL 17 1984	17.05 FT	33.95 FT	3680.95 FT
AUG 3 1984	17.34 FT	33.66 FT	3680.66 FT
SEP 4 1984	16.42 FT	34.58 FT	3681.58 FT
SEP 19 1984	17.35 FT	33.65 FT	3680.65 FT
OCT 15 1984	18.76 FT	32.24 FT	3679.24 FT

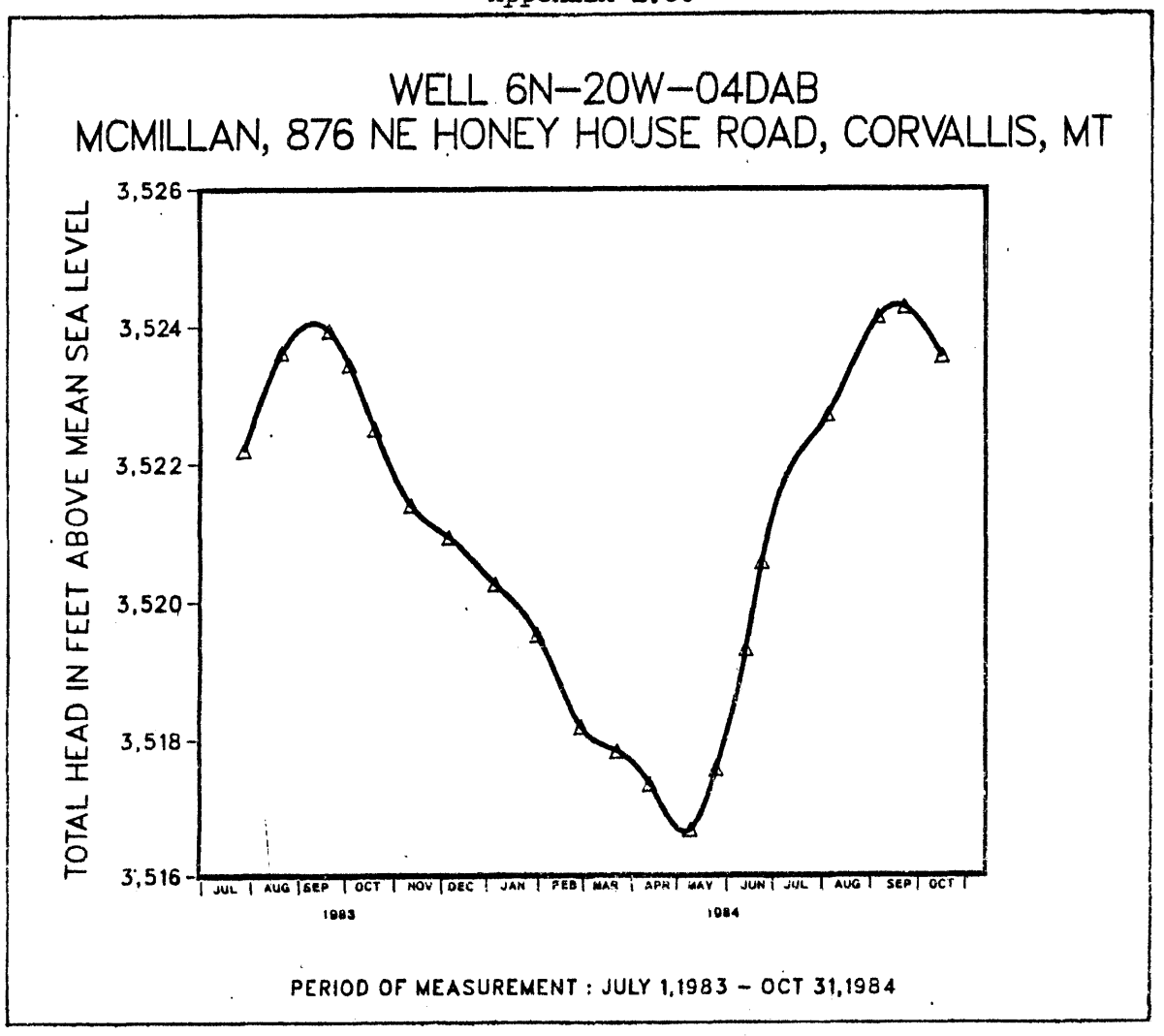
WELL DATA

OWNER : ROY TROTTER
ADDRESS : HONEY HOUSE ROAD, CORVALLIS, MT
WELL LOCATION : T6N, R20W, SE NW SEC.10
WELL ID NUMBER : 6N-20W-10BDB
ELEVATION : 3698 FEET
WELL DEPTH : 51 FEET
PUMPING RATE : 10 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 11 C OR 51.8 F
PH VALUE : 7.94
CONDUCTANCE VALUE : 468 MICROMHOS
ESTIMATED TDS VALUE : 301 MG/L
ESTIMATED HARDNESS VALUE : 212 MG/L

Appendix 2.60



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 29 1983	39.80 FT	60.20 FT	3522.20 FT
AUG 22 1983	38.38 FT	61.62 FT	3523.62 FT
SEP 21 1983	38.06 FT	61.94 FT	3523.94 FT
OCT 4 1983	38.56 FT	61.44 FT	3523.44 FT
OCT 20 1983	39.49 FT	60.51 FT	3522.51 FT
NOV 12 1983	40.59 FT	59.41 FT	3521.41 FT
DEC 6 1983	41.05 FT	58.95 FT	3520.95 FT
JAN 4 1984	41.73 FT	58.27 FT	3520.27 FT
JAN 31 1984	42.46 FT	57.54 FT	3519.54 FT
FEB 28 1984	43.81 FT	56.19 FT	3518.19 FT
MAR 22 1984	44.17 FT	55.83 FT	3517.83 FT
APR 12 1984	44.65 FT	55.35 FT	3517.35 FT
MAY 8 1984	45.32 FT	54.68 FT	3516.68 FT
MAY 24 1984	44.43 FT	55.57 FT	3517.57 FT
JUN 12 1984	42.67 FT	57.33 FT	3519.33 FT
JUN 22 1984	41.40 FT	58.60 FT	3520.60 FT
AUG 3 1984	39.28 FT	60.72 FT	3522.72 FT
SEP 4 1984	37.85 FT	62.15 FT	3524.15 FT
SEP 21 1984	37.71 FT	62.29 FT	3524.29 FT
OCT 15 1984	38.43 FT	61.57 FT	3523.57 FT

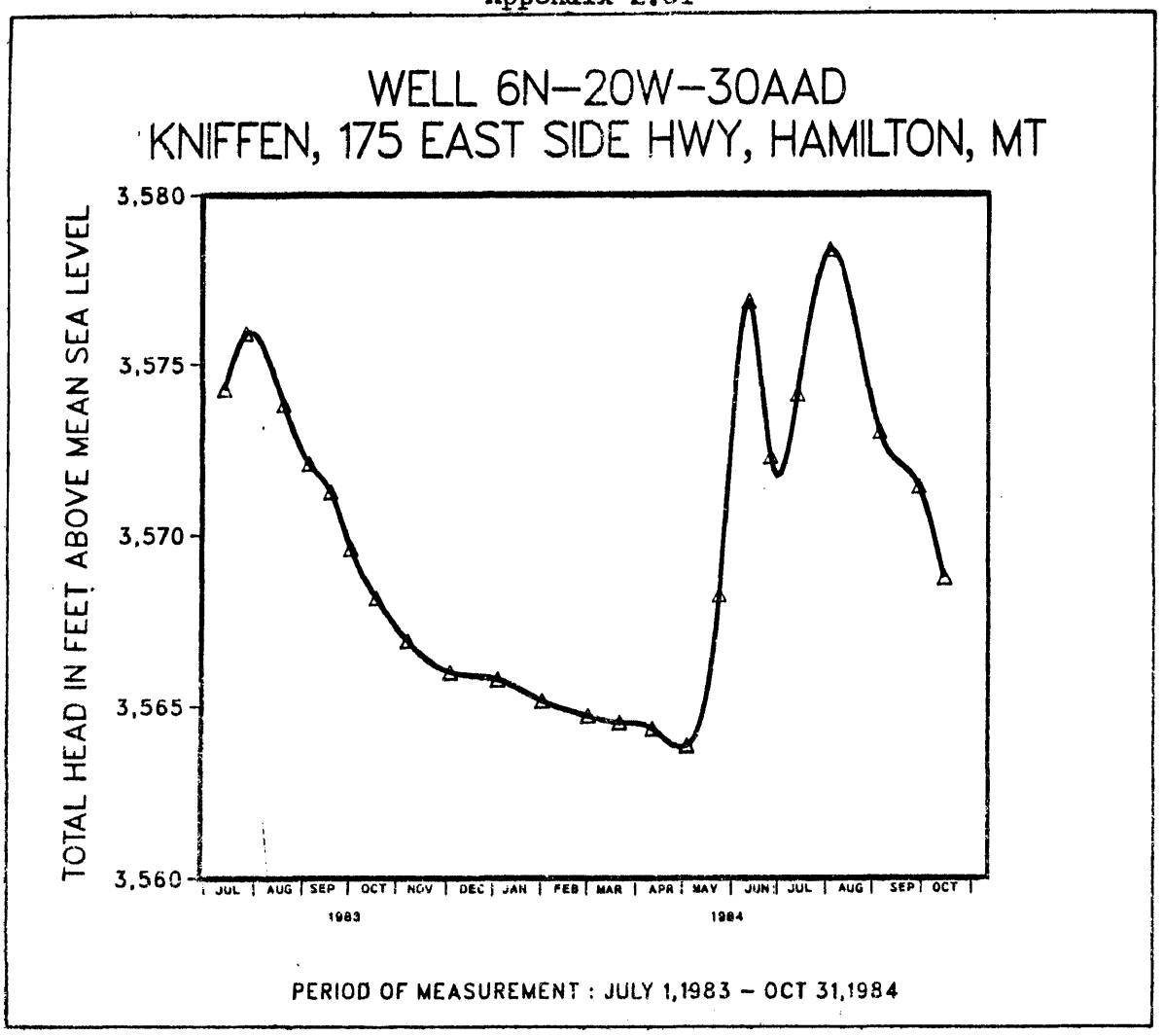
WELL DATA

OWNER : ROBERT MCMILLAN
ADDRESS : 876 NE HONEY HOUSE ROAD, CORVALLIS, MT
WELL LOCATION : T6N, R20W, SE NE SEC.4
WELL ID NUMBER : 6N-20W-04DAB
ELEVATION : 3562 FEET
WELL DEPTH : 100 FEET
PUMPING RATE : 8 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 11.8 C OR 53.2 F
PH VALUE : 7.46
CONDUCTANCE VALUE : 322 MICROMHOS
ACTUAL TDS VALUE : 216.91 MG/L
ACTUAL HARDNESS VALUE : 165.29 MG/L

Appendix 2.61



WELL WATER FLUCTUATIONS

DATE	STATIC LEVEL	WELL WATER DEPTH	TOTAL HEAD
JUL 15 1983	71.73 FT	49.27 FT	3574.27 FT
JUL 29 1983	70.08 FT	50.92 FT	3575.92 FT
AUG 22 1983	72.17 FT	48.83 FT	3573.83 FT
SEP 7 1983	73.92 FT	47.08 FT	3572.08 FT
SEP 21 1983	74.74 FT	46.26 FT	3571.26 FT
OCT 4 1983	76.38 FT	44.62 FT	3569.62 FT
OCT 20 1983	77.83 FT	43.17 FT	3568.17 FT
NOV 9 1983	79.08 FT	41.92 FT	3566.92 FT
DEC 6 1983	78.99 FT	41.01 FT	3566.01 FT
JAN 5 1984	80.20 FT	40.80 FT	3565.80 FT
FEB 2 1984	80.83 FT	40.17 FT	3565.17 FT
MAR 2 1984	81.27 FT	39.73 FT	3564.73 FT
MAR 22 1984	81.47 FT	39.53 FT	3564.53 FT
APR 12 1984	81.64 FT	39.36 FT	3564.36 FT
MAY 4 1984	82.15 FT	38.85 FT	3563.85 FT
MAY 24 1984	77.74 FT	43.26 FT	3568.26 FT
JUN 12 1984	69.14 FT	51.86 FT	3576.86 FT
JUN 26 1984	73.71 FT	47.29 FT	3572.29 FT
JUL 13 1984	71.87 FT	49.13 FT	3574.13 FT
AUG 3 1984	67.61 FT	53.39 FT	3578.39 FT
SEP 4 1984	72.98 FT	48.02 FT	3573.02 FT
SEP 28 1984	74.58 FT	46.42 FT	3571.42 FT
OCT 15 1984	77.22 FT	43.78 FT	3568.78 FT

WELL DATA

OWNER : WILLIAM KNIFFEN
ADDRESS : 175 EAST SIDE HWY, HAMILTON, MT
WELL LOCATION : T6N, R20W, NE NE SEC.30
WELL ID NUMBER : 6N-20W 30AAD
ELEVATION : 3646 FEET
WELL DEPTH : 121 FEET
PUMPING RATE : 20 GAL/MIN

WATER QUALITY DATA

GROUND WATER TEMPERATURE : 13 C OR 55.4 F
PH VALUE : 7.47
CONDUCTANCE VALUE : 273 MICROMHOS
ESTIMATED TDS VALUE : 180 MG/L
ESTIMATED HARDNESS VALUE : 138 MG/L

APPENDIX 3

WATER QUALITY ANALYSIS REPORTS

FROM MONTANA BUREAU OF MINES AND GEOLOGY, BUTTE, MONTANA

SUMMARY OF WATER CHEMISTRY PARAMETERS

WELL ID #	TEMP (°C)	FIELD pH	SPEC COND (μmhos/cm)	TDS (mg/l)	HARD (ppm)
WESTSIDE QUATERNARY HIGH-TERRACE AQUIFERS					
6-21-15ddd	10.8	6.17	53.00	59.92	19.83
6-21-23cb	11.0	6.69	99.00	100.59	35.26
7-21-23ad	11.3	7.77	180.00	131.36	85.04
7-21-34cc	10.9	6.19	121.00	115.73	43.97
7-21-35dac	11.2	6.97	101.00	92.82	37.99
6-21-10cbb	12.3	10.48	198.00	110.01	13.28
WESTSIDE QUATERNARY MID-TERRACE AQUIFERS					
6-21-11ab	11.5	6.78	102.00	108.90	21.57
6-21-24cc	11.0	5.78	72.00	67.81	24.13
7-20-18ab	11.4	5.94	91.00	78.48	40.65
QUATERNARY RIVER TERRACE AQUIFERS					
7-21-36ddd	10.3	5.48	34.00	33.19	11.12
6-21-12dbd	10.8	6.72	134.00	100.13	54.51
6-20-5bc	9.5	6.69	259.00	166.43	128.58
6-20-17bbd2	12.0	7.14	272.00	180.36	137.65
6-21-24da	11.8	6.94	282.00	172.24	141.51
7-20-17da	11.0	6.84	362.00	230.61	166.37
6-20-3ab	11.0	7.17	496.00	327.77	230.87

EASTSIDE TERTIARY HIGH-TERRACE AQUIFERS					
7-20-26cdd	10.8	7.53	380.00	250.14	170.93
7-20-23dc	11.5	7.72	502.00	339.35	227.90
6-20-14ba	9.8	7.65	650.00	396.41	276.35
6-20-4dab	11.8	7.46	322.00	216.91	165.29
6-20-1cd	9.5	7.21	413.00	268.90	193.00
BIG DITCH IRRIGATION CANAL					
7-20-36bb	14.5	7.91	37.00	26.94	16.28

SUMMARY OF DISSOLVED IONIC CONSTITUENTS

WELL ID #	Ca	Mg	Na	K	Fe	Mn	SiO_2	HCO_3	SO_4	NO_3	Cl
	(milligrams per liter)										
WESTSIDE QUATERNARY HIGH-TERRACE AQUIFERS											
6-21-15ddd	5.8	1.3	3.4	0.6	0.019	0.007	30.8	34.0	0.7	0.15	0.3
6-21-23cb	10.0	2.5	9.1	0.7	0.010	0.008	44.8	62.5	1.5	0.28	0.6
7-21-23ad	24.0	6.1	7.3	0.8	0.004	0.003	31.8	117.0	2.3	0.42	0.4
7-21-34cc	12.5	3.1	9.4	1.0	0.010	0.017	50.2	77.6	0.6	0.38	0.3
7-21-35dac	10.6	2.8	5.7	0.6	0.002	0.001	41.8	56.5	2.1	0.78	0.5
6-21-10cbb	4.0	0.8	42.9	0.6	0.007	0.003	0.8	85.6	0.2	0.03	0.7

WELL ID #	Ca	Mg	Na	K	Fe	Mn	SiO_2	HCO_3	SO_4	NO_3	Cl
	(milligrams per liter)										
WESTSIDE QUATERNARY MID-TERRACE AQUIFERS											
6-21-11ab	6.0	1.6	12.4	1.6	0.86	0.12	54.8	59.0	1.6	0.06	0.6
6-21-24cc	6.2	2.1	5.5	2.1	0.13	0.007	28.1	41.8	1.5	0.38	1.2
7-20-18ab	11.5	2.9	4.0	2.0	0.076	0.006	27.4	55.3	1.7	0.36	1.2
QUATERNARY RIVER TERRACE AQUIFERS											
7-21-36ddd	3.3	0.7	2.4	1.0	0.035	0.003	14.4	20.0	0.9	0.10	0.4
6-21-12dbd	15.4	3.9	9.2	1.2	0.012	0.004	25.9	82.5	2.5	0.47	0.8
6-20-5bc	38.8	7.7	6.3	2.8	0.23	0.003	22.6	167.0	4.2	0.23	1.2
6-20-17bbd	42.6	7.6	7.3	2.5	<.002	0.002	26.5	177.0	4.4	0.67	1.4
6-21-24da	39.2	10.6	5.7	3.3	<.002	<.001	19.2	177.0	3.9	1.35	1.6
7-20-17da	54.1	7.6	15.7	3.0	0.002	0.002	28.4	226.0	7.0	1.08	2.3
6-20-3ab	79.6	7.8	29.0	3.1	0.005	<.001	28.1	321.0	14.1	1.39	6.3
EASTSIDE TERTIARY HIGH-TERRACE AQUIFERS											
7-20-26cdd	46.2	13.5	16.5	4.0	0.003	0.010	44.8	228.0	8.5	0.51	3.0
7-20-23dc	61.6	18.0	28.2	5.2	0.008	0.001	47.6	342.0	7.0	0.67	1.5
6-20-14ba	69.3	25.1	39.4	5.5	0.002	0.001	26.2	401.0	29.4	0.97	1.9
6-20-4dab	56.8	5.7	7.7	2.8	0.004	0.002	29.5	194.0	11.1	0.94	6.5
6-20-1cd	55.7	13.1	18.6	2.2	0.010	0.001	38.9	260.0	7.2	1.81	2.7
BIG DITCH IRRIGATION CANAL											
7-20-36bb	5.2	0.8	1.3	0.5	0.004	0.001	6.0	24.4	0.8	0.02	0.3

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE,MONTANA 59701 (406)496-4101

WATER QUALITY ANALYSIS
LAB NO. 8400433

STATE	MONTANA	COUNTY	RAVALLI
LATITUDE-LONGITUDE	46D15'35"N 114D11'44"W	SITE LOCATION	06N 21W 23 CBCB 01
UTM COORDINATES	Z N E	MBMG SITE	
TOPOGRAPHIC MAP	HAMILTON NORTH 7 1/2'	STATION ID	461535114114401
GEOLOGIC SOURCE	120SDMS* *	SAMPLE SOURCE	WELL
DRAINAGE BASIN	PE	LAND SURFACE ALTITUDE	3068 FT < 10
AGENCY + SAMPLER	UM W*CU	SUSTAINED YIELD	10. GPM
BOTTLE NUMBER		YIELD MEAS METHOD	REPORTED
DATE SAMPLED	18-JUN-84	TOTAL DEPTH OF WELL	160. FT (R)
TIME SAMPLED	1445 HOURS	SWL ABOVE(-) OR BELOW GS	94.78 FT (M)
LAB + ANALYST	MBMG*GAL	CASING DIAMETER	6 IN (R)
DATE ANALYZED	18-JUL-84	CASING TYPE	STEEL
SAMPLE HANDLING	3120	COMPLETION TYPE	02*
METHOD SAMPLED	PUMPED	PERFORATION INTERVAL	140 TO 160 FT (R)
WATER USE	DOMESTIC		

SAMPLING SITE PEASE, LEROY * HAMILTON, MT
GEOLOGIC SOURCE SEDIMENTS (TERTIARY)

		MG/L	MEQ/L			MG/L	MEQ/L
CALCIUM	(CA)	10.	0.50	BICARBONATE	(HCO3)	62.5	1.02
MAGNESIUM	(MG)	2.5	0.21	CARBONATE	(CO3)	0.	
SODIUM	(NA)	9.1	0.40	CHLORIDE	(CL)	.6	0.02
POTASSIUM	(K)	.7	0.02	SULFATE	(SO4)	1.5	0.03
IRON	(FE)	.010	0.00	NITRATE	(AS N)	.38	0.02
MANGANESE	(MN)	.008	0.00	FLUORIDE	(F)	.3	0.02
SILICA	(SIO2)	44.8		PHOSPHATE TOT	(AS P)		
TOTAL CATIONS			1.12	TOTAL ANIONS			1.11

STANDARD DEVIATION OF ANION-CATION BALANCE (SIGMA) -0.09

CALCULATED DISSOLVED SOLIDS	100.59	TOTAL HARDNESS AS CACO3	35.26
SUM OF DISS. CONSTITUENT	132.30	TOTAL ALKALINITY AS CACO3	51.24
FIELD CNDUCTVY, MICROMHOS	99.	FIELD ALKALINITY AS CACO3	
LAB CNDUCTVY, MICROMHOS	104.2	RYZNAR STABILITY INDEX	10.45
FIELD PH	6.69	LANGLIER SATURATION INDEX	-1.66
LABORATORY PH	7.13	SODIUM ADSORPTION RATIO	0.67

PARAMETER	VALUE	PARAMETER	VALUE
FIELD TEMP, AIR	25.9 C	FIELD TEMP, WATER	11. C
ALUMINUM, DISS (UG/L-AL)	<30.	NICKEL,DISS (UG/L AS NI)	<10.
SILVER, DISS(UG/L AS AG)	<2.	PHOSPHATE,TO,DIS(MG/L-P)	.3
BORON,DISS (UG/L AS B)	<20.	STRONTIUM,DISS (UG/L-SR)	120.
CADMIUM,DISS(UG/L AS CD)	7.	TITANIUM DIS(UG/L AS TI)	<1.
CHROMIUM, DISS (UG/L-CR)	2.	VANADIUM,DISS(UG/L AS V)	5.
COPPER,DISS (UG/L AS CU)	2.	ZINC, DISS (UG/L AS ZN)	460.
LITHIUM,DISS(UG/L AS LI)	11.	ZIRCONIUM DIS(UG/L AS ZR	<4.
MOLYBDENUM,DISS(UG/L-MO)	<20.	BROMIDE,DISS(MG/L AS BR)	<.1
O-PHOSPHATE,DISS(MG/L-P)	<.1		

REMARKS: OWNER'S ADDRESS: HW 240 PATRICK HENRY LANE, HAMILTON, MT

EXPLANATION: MG/L = MILLIGRAMS PER LITER; UG/L = MICROGRAMS PER LITER; MEQ/L = MILLIEQUIVELENTS PER LITER. FT = FEET; MT = METERS. (M) = MEASURED; (E) = ESTIMATED, (R) = REPORTED. TR = TOTAL RECOVERABLE. TOT = TOTAL. BIO = BIOLOGICALLY AVAILABLE.

	QW	WA	S2	WI	OW	PW	AT	OTHER
OTHER AVAILABLE DATA		Y						

OTHER FILE NUMBERS:

PROJECT: COST:
LAST EDIT DATE: 09-AUG-84 BY: TP *BCS
PROCESSING PROGRAM: F1730P V3 (09/1/83) PRINTED: 09-AUG-84

PERCENT MEQ/L (FOR PIPER PLOT)

CA	MG	NA	K	CL	SO4	HCO3	CO3
44.6	18.4	35.4	1.3	1.3	2.9	95.5	0.0

NOTE: IN CORRESPONDENCE, PLEASE REFER TO LAB NUMBER: 8400433

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE,MONTANA 59701 (406)496-4101

WATER QUALITY ANALYSIS
LAB NO. B4Q0435

STATE	MONTANA	COUNTY	RAVALLI
LATITUDE-LONGITUDE	46D16'10"N 114D12'35"W	SITE LOCATION	06N 21W 15 CDDC 01
UTM COORDINATES	Z N E	MBMG SITE	
TOPOGRAPHIC MAP	HAMILTON NORTH 7 1/2'	STATION ID	461610114123501
GEOLOGIC SOURCE	120SDMS* *	SAMPLE SOURCE	WELL
DRAINAGE BASIN	PE	LAND SURFACE ALTITUDE	3910. FT < 10
AGENCY + SAMPLER	UM *WCU	SUSTAINED YIELD	10. GPM
BOTTLE NUMBER		YIELD MEAS METHOD	REPORTED
DATE SAMPLED	18-JUN-84	TOTAL DEPTH OF WELL	120. FT (R)
TIME SAMPLED	13:00 HOURS	SWL ABOVE(-) OR BELOW GS	48.23 FT (M)
LAB + ANALYST	MBMO*GAL	CASING DIAMETER	6 IN (R)
DATE ANALYZED	18-JUL-84	CASING TYPE	STEEL
SAMPLE HANDLING	3120	COMPLETION TYPE	02*
METHOD SAMPLED	PUMPED	PERFORATION INTERVAL	70 TO 100 FT (R)
WATER USE	DOMESTIC AND STOCK		

SAMPLING SITE GRAYSON, ROGER * HAMILTON, MT
GEOLOGIC SOURCE SEDIMENTS (TERTIARY)

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	5.8	0.29	BICARBONATE (HCO3)	34.	0.56
MAGNESIUM (MG)	1.3	0.11	CARBONATE (CO3)	0.	
SODIUM (NA)	3.4	0.15	CHLORIDE (CL)	.3	0.01
POTASSIUM (K)	.6	0.02	SULFATE (SO4)	.7	0.01
IRON (FE)	.019	0.00	NITRATE (AS N)	.15	0.01
MANGANESE (MN)	.007	0.00	FLUORIDE (F)	.1	0.01
SILICA (SIO2)	30.8		PHOSPHATE TOT (AS P)		
TOTAL CATIONS		0.56	TOTAL ANIONS		0.60

STANDARD DEVIATION OF ANION-CATION BALANCE (SIGMA) 0.31

CALCULATED DISSOLVED SOLIDS	59.92	TOTAL HARDNESS AS CACO3	19.83
SUM OF DISS. CONSTITUENT	77.18	TOTAL ALKALINITY AS CACO3	27.89
FIELD CNDUCTVY, MICROMHOS	53.	FIELD ALKALINITY AS CACO3	
LAB CNDUCTVY, MICROMHOS	60.9	RYZNAR STABILITY INDEX	11.70
FIELD PH	6.17	LANGLIER SATURATION INDEX	-2.46
LABORATORY PH	8.78	SODIUM ADSORPTION RATIO	0.33

PARAMETER	VALUE	PARAMETER	VALUE
FIELD TEMP, AIR	28.5 C	FIELD TEMP, WATER	10.8 C
ALUMINUM, DISS (UG/L-AL)	<30.	NICKEL,DISS (UG/L AS NI)	<10.
SILVER, DISS(UG/L AS AG)	4.	PHOSPHATE,TO,DIS(MG/L-P)	.4
BORON,DISS (UG/L AS B)	<20.	STRONTIUM,DISS (UG/L-SR)	60.
CADMIUM,DISS(UG/L AS CD)	8.	TITANIUM DIS(UG/L AS TI)	<1.
CHROMIUM, DISS (UG/L-CR)	3.	VANADIUM,DISS(UG/L AS V)	3.
COPPER,DISS (UG/L AS CU)	6.	ZINC, DISS (UG/L AS ZN)	200.
LITHIUM,DISS(UG/L AS LI)	2.	ZIRCONIUM DIS(UG/L AS ZR	4.
MOLYBDENUM,DISS(UG/L-MO)	<20.	BROMIDE,DISS(MG/L AS BR)	<.1
O-PHOSPHATE,DISS(MG/L-P)	<.1		

REMARKS: OWNER'S ADDRESS: NW 460 BLODGETT VIEW ROAD, HAMILTON, MT

EXPLANATION: MG/L = MILLIGRAMS PER LITER, UG/L = MICROGRAMS PER LITER, MEQ/L = MILLIEQUIVELENTS PER LITER, FT = FEET, MT = METERS, (M) = MEASURED, (E) = ESTIMATED, (R) = REPORTED, TR = TOTAL RECOVERABLE, TOT = TOTAL, BIO = BIOLOGICALLY AVAILABLE.

	QW	WA	S2	WI	OW	PW	AT	OTHER
OTHER AVAILABLE DATA		Y						

OTHER FILE NUMBERS:

PROJECT:		COST:	
LAST EDIT DATE:	09-AUG-84	BY:	TP *BCS
PROCESSING PROGRAM:	F1730P V3 (09/1/83)	PRINTED:	09-AUG-84

PERCENT MEQ/L (FOR PIPER PLOT)

CA	MG	NA	K	CL	SO4	HCO3	CO3
51.7	19.1	26.4	2.8	1.5	2.5	96.0	0.0

NOTE: IN CORRESPONDENCE, PLEASE REFER TO LAB NUMBER: B4Q0435

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE,MONTANA 59701 (406)496-4101

WATER QUALITY ANALYSIS
LAB NO. 8400437

STATE	MONTANA	COUNTY	RAVALLI
LATITUDE-LONGITUDE	46D17'26"N 114D13'54"W	SITE LOCATION	06N 21W 10*CBB 01
UTM COORDINATES	Z N E	MINE SITE	
TOPOGRAPHIC MAP	HAMILTON NORTH 7 1/2'	STATION ID	461726114133401
GEOLOGIC SOURCE	211DBTL* *	SAMPLE SOURCE	WELL
DRAINAGE BASIN	PE	LAND SURFACE ALTITUDE	4033. FT < 50
AGENCY + SAMPLER	UN *WCU	SUSTAINED YIELD	
BOTTLE NUMBER		YIELD MEAS METHOD	
DATE SAMPLED	19-JUN-84	TOTAL DEPTH OF WELL	600. FT (R)
TIME SAMPLED	1:30 HOURS	SWL ABOVE(-) OR BELOW SS	74.74 FT (M)
LAB + ANALYST	MBMG*CAL	CASING DIAMETER	6 IN (R)
DATE ANALYZED	02-AUG-84	CASING TYPE	STEEL
SAMPLE HANDLING	3120	COMPLETION TYPE	02*
METHOD SAMPLED	PUMPED	PERFORATION INTERVAL	420 TO 590 FT (R)
WATER USE	UNUSED		

SAMPLING SITE PIATT, WILLIAM
GEOLOGIC SOURCE IDAHO BATHOLITH

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	4.	0.20	BICARBONATE (HCO3)	85.6	1.40
MAGNESIUM (MG)	.8	0.07	CARBONATE (CO3)	15.7	0.52
SODIUM (NA)	42.9	1.87	CHLORIDE (CL)	.7	0.02
POTASSIUM (K)	.6	0.02	SULFATE (SO4)	.2	0.00
IRON (FE)	.007	0.00	NITRATE (AS N)	.03	0.00
MANGANESE (MN)	.003	0.00	FLUORIDE (F)	2.1	0.11
SILICA (SIO2)	0.8		PHOSPHATE TOT (AS P)		
TOTAL CATIONS		2.15	TOTAL ANIONS		2.06

STANDARD DEVIATION OF ANION-CATION BALANCE (SIGMA) -0.62

CALCULATED DISSOLVED SOLIDS	110.01	TOTAL HARDNESS AS CACO3	13.28
SUM OF DISS. CONSTITUENT	153.44	TOTAL ALKALINITY AS CACO3	96.39
FIELD CNDUCTVY, MICROMHOS	198.	FIELD ALKALINITY AS CACO3	
LAB CNDUCTVY, MICROMHOS	193.4	RYZNAR STABILITY INDEX	8.40
FIELD PH	10.48	LANGLIER SATURATION INDEX	0.52
LABORATORY PH	9.43	SODIUM ADSORPTION RATIO	5.12

PARAMETER	VALUE	PARAMETER	VALUE
FIELD TEMP, AIR	24.5 C	FIELD TEMP, WATER	12.3 C
ALUMINUM, DISS (UG/L-AL)	<30.	NICKEL,DISS (UG/L AS NI)	<10.
SILVER, DISS(UG/L AS AG)	<2.	PHOSPHATE,TO,DIS(MG/L-P)	.5
BORON,DISS (UG/L AS B)	110.	STRONTIUM,DISS (UG/L-SR)	180.
CADMIUM,DISS(UG/L AS CD)	4.	TITANIUM DIS(UG/L AS TI)	<1.
CHROMIUM, DISS (UG/L-CR)	<2.	VANADIUM,DISS(UG/L AS V)	3.
COPPER,DISS (UG/L AS CU)	<2.	ZINC, DISS (UG/L AS ZN)	<3.
LITHIUM,DISS(UG/L AS LI)	45.	ZIRCONIUM DIS(UG/L AS ZR	<4.
MOLYBDENUM,DISS(UG/L-MO)	30.	BROMIDE,DISS(MG/L AS BR)	<.1
O-PHOSPHATE,DISS(MG/L-P)	<.1		

REMARKS: VERY TURBID, PUMPED FROM UNUSED TEST WELL ON PROPOSED SUBDIVISION
OWNER'S ADDRESS: 707 NW BOWMAN ROAD, HAMILTON, MT

EXPLANATION: MG/L = MILLIGRAMS PER LITER, UG/L = MICROGRAMS PER LITER, MEQ/L = MILLIEQUIVALENTS PER LITER, FT = FEET, MT = METERS, (M) = MEASURED, (E) = ESTIMATED, (R) = REPORTED, TR = TOTAL RECOVERABLE, TOT = TOTAL, BIO = BIOLOGICALLY AVAILABLE.

	QW	WA	S2	WI	OW	PW	AT	OTHER
OTHER AVAILABLE DATA		Y						

OTHER FILE NUMBERS:

PROJECT:		COST:	
LAST EDIT DATE:	05-SEP-84	BY:	TP *BCS
PROCESSING PROGRAM:	F1730P V3 (09/1/83)	PRINTED:	06-SEP-84

PERCENT MEQ/L (FOR PIPER PLOT)

CA	MG	NA	K	CL	SO4	HCO3	CO3
9.3	3.1	86.9	0.7	1.0	0.2	71.9	26.8

NOTE: IN CORRESPONDENCE, PLEASE REFER TO LAB NUMBER: 8400437

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE,MONTANA 59701 (406)496-4101

WATER QUALITY ANALYSIS
LAB NO. 8400430

STATE	MONTANA	COUNTY	RAVALLI
LATITUDE-LONGITUDE	46D18'55"N 114D12'30"W	SITE LOCATION	07N 21W 34 CDB 01
UTM COORDINATES	Z N E	MBMG SITE	
TOPOGRAPHIC MAP	HAMILTON NORTH 7 1/2'	STATION ID	461855114123001
GEOLOGIC SOURCE	120SDMS* *	SAMPLE SOURCE	WELL
DRAINAGE BASIN	PE	LAND SURFACE ALTITUDE	4044. FT < 10
AGENCY + SAMPLER	UM *WCU	SUSTAINED YIELD	10. GPM
BOTTLE NUMBER		YIELD MEAS METHOD	REPORTED
DATE SAMPLED	19-JUN-84	TOTAL DEPTH OF WELL	127. FT (R)
TIME SAMPLED	1515 HOURS	SWL ABOVE(-) OR BELOW GS	99.61 FT (M)
LAB + ANALYST	MBMG*GAL	CASING DIAMETER	6 IN (R)
DATE ANALYZED	18-JUL-84	CASING TYPE	STEEL
SAMPLE HANDLING	3120	COMPLETION TYPE	02*
METHOD SAMPLED	PUMPED	PERFORATION INTERVAL	119 TO 125 FT (R)
WATER USE	DOMESTIC		

SAMPLING SITE MAHAR, GEOFF # HAMILTON, MT
GEOLOGIC SOURCE SEDIMENTS (TERTIARY)

		MG/L	MEQ/L			MG/L	MEQ/L
CALCIUM	(CA)	12.5	0.62	BICARBONATE	(HCO3)	77.6	1.27
MAGNESIUM	(MG)	3.1	0.26	CARBONATE	(CO3)	0.	
SODIUM	(NA)	9.4	0.41	CHLORIDE	(CL)	.3	0.01
POTASSIUM	(K)	1.	0.03	SULFATE	(SO4)	.6	0.01
IRON	(FE)	.010	0.00	NITRATE	(AS N)	.38	0.03
MANGANESE	(MN)	.017	0.00	FLUORIDE	(F)	<.1	
SILICA	(SIO2)	50.2		PHOSPHATE TOT	(AS P)		
TOTAL CATIONS			1.31	TOTAL ANIONS			1.32

STANDARD DEVIATION OF ANION-CATION BALANCE (SIGMA) 0.04

CALCULATED DISSOLVED SOLIDS	115.73	TOTAL HARDNESS AS CACO3	43.97
SUM OF DISS. CONSTITUENT	155.11	TOTAL ALKALINITY AS CACO3	63.65
FIELD CNDUCTVY, MICROMHOS	121.	FIELD ALKALINITY AS CACO3	
LAB CNDUCTVY, MICROMHOS	128.9	RYZNAR STABILITY INDEX	10.19
FIELD PH	6.19	LANGLIER SATURATION INDEX	-1.59
LABORATORY PH	7.01	SODIUM ADSORPTION RATIO	0.62

PARAMETER	VALUE	PARAMETER	VALUE
FIELD TEMP, AIR	21. C	FIELD TEMP, WATER	10.9 C
ALUMINUM, DISS (UG/L-AL)	<30.	NICKEL,DISS (UG/L AS NI)	<10.
SILVER, DISS(UG/L AS AG)	3.	PHOSPHATE,TO,DIS(MG/L-P)	<.1
BORON,DISS (UG/L AS B)	<20.	STRONTIUM,DISS (UG/L-SR)	120.
CADMIUM,DISS(UG/L AS CD)	6.	TITANIUM DIS(UG/L AS TI)	2.
CHROMIUM, DISS (UG/L-CR)	<2.	VANADIUM,DISS(UG/L AS V)	<1.
COPPER,DISS (UG/L AS CU)	3.	ZINC, DISS (UG/L AS ZN)	360.
LITHIUM,DISS(UG/L AS LI)	17.	ZIRCONIUM DIS(UG/L AS ZR	<4.
MOLYBDENUM,DISS(UG/L-MO)	<20.	BROMIDE,DISS(MG/L AS BR)	<.1
O-PHOSPHATE,DISS(MG/L-P)	.2		

REMARKS: OWNER'S ADDRESS: NW 1071 WILDFLOWER LANE, HAMILTON, MT

EXPLANATION: MG/L = MILLIGRAMS PER LITER, UG/L = MICROGRAMS PER LITER, MEQ/L = MILLIEQUIVELENTS PER LITER, FT = FEET, MT = METERS, (M) = MEASURED, (E) = ESTIMATED, (R) = REPORTED, TR = TOTAL RECOVERABLE, TOT = TOTAL, BIO = BIOLOGICALLY AVAILABLE.

OW WA S2 WI OW PW AT OTHER

OTHER AVAILABLE DATA
OTHER FILE NUMBERS:

PROJECT:
LAST EDIT DATE: 09-AUG-84
PROCESSING PROGRAM: F1730P V3 (09/1/83)

COST:
BY: TP *BCS
PRINTED: 09-AUG-84

PERCENT MEQ/L (FOR PIPER PLOT)

CA	MG	NA	K	CL	SO4	HCO3	CO3
47.5	19.4	31.1	2.0	0.7	1.0	98.4	0.0

NOTE: IN CORRESPONDENCE, PLEASE REFER TO LAB NUMBER: 8400430

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE,MONTANA 59701 (406)496-4101

WATER QUALITY ANALYSIS
LAB NO. 8400441

STATE	MONTANA	COUNTY	RAVALLI
LATITUDE-LONGITUDE	46D19'03"N 114D10'42"W	SITE LOCATION	07N 21W 35*DAC 01
UTM COORDINATES	Z N E	MBMG SITE	
TOPOGRAPHIC MAP	HAMILTON NORTH 7 1/2'	STATION ID	461903114104201
GEOLOGIC SOURCE	120SDMS* *	SAMPLE SOURCE	WELL
DRAINAGE BASIN	PE	LAND SURFACE ALTITUDE	3730. FT < 10
AGENCY + SAMPLER	UM *WCU	SUSTAINED YIELD	30. GPM
BOTTLE NUMBER		YIELD MEAS METHOD	REPORTED
DATE SAMPLED	19-JUN-84	TOTAL DEPTH OF WELL	127. FT (R)
TIME SAMPLED	16:30 HOURS	SWL ABOVE(-) OR BELOW GS	90.89 FT (M)
LAB + ANALYST	MBMG*GAL	CASING DIAMETER	6 IN (R)
DATE ANALYZED	19-JUL-84	CASING TYPE	STEEL
SAMPLE HANDLING	3120	COMPLETION TYPE	12*
METHOD SAMPLED	PUMPED	PERFORATION INTERVAL	
WATER USE	DOMESTIC AND STOCK		

SAMPLING SITE WALLACE, KEN * HAMILTON, MT
GEOLOGIC SOURCE SEDIMENTS (TERTIARY)

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	10.6	0.53	BICARBONATE (HCO3)	56.5	0.93
MAGNESIUM (MG)	2.8	0.23	CARBONATE (CO3)	0.	
SODIUM (NA)	5.7	0.25	CHLORIDE (CL)	.5	0.01
POTASSIUM (K)	.6	0.02	SULFATE (SO4)	2.1	0.04
IRON (FE)	.002	0.00	NITRATE (AS N)	.73	0.06
MANGANESE (MN)	.001	0.00	FLUORIDE (F)	.1	0.01
SILICA (SIO2)	41.8		PHOSPHATE TOT (AS P)		
TOTAL CATIONS		1.02	TOTAL ANIONS		1.04

STANDARD DEVIATION OF ANION-CATION BALANCE (SIGMA) 0.18

CALCULATED DISSOLVED SOLIDS	92.82	TOTAL HARDNESS AS CACO3	37.99
SUM OF DISS. CONSTITUENT	121.48	TOTAL ALKALINITY AS CACO3	46.34
FIELD CNDUCTVY, MICROMHOS	101.	FIELD ALKALINITY AS CACO3	
LAB CNDUCTVY, MICROMHOS	98.0	RYZNAR STABILITY INDEX	10.35
FIELD PH	6.97	LANGLIER SATURATION INDEX	-1.54
LABORATORY PH	7.27	SODIUM ADSORPTION RATIO	0.40

PARAMETER	VALUE	PARAMETER	VALUE
FIELD TEMP, AIR	27. C	FIELD TEMP, WATER	11.2 C
ALUMINUM, DISS (UG/L-AL)	30.	NICKEL,DISS (UG/L AS NI)	<10.
SILVER, DISS(UG/L AS AG)	2.	PHOSPHATE,TO,DIS(MG/L-P)	.4
BORON,DISS (UG/L AS B)	<20.	STRONTIUM,DISS (UG/L-SR)	94.
CADMIUM,DISS(UG/L AS CD)	2.	TITANIUM DIS(UG/L AS TI)	<1.
CHROMIUM, DISS (UG/L-CR)	4.	VANADIUM,DISS(UG/L AS V)	3.
COPPER,DISS (UG/L AS CU)	4.	ZINC, DISS (UG/L AS ZN)	100.
LITHIUM,DISS(UG/L AS LI)	3.	ZIRCONIUM DIS(UG/L AS ZR	<4.
MOLYBDENUM,DISS(UG/L-MO)	<20.	BROMIDE,DISS(MG/L AS BR)	<.1
O-PHOSPHATE,DISS(MG/L-P)	<.1		

REMARKS: OWNER'S ADDRESS: 883 NW CHERRY ORCHARD LOOP, HAMILTON, MT * ORIGINAL OWNER JACOBSON, LINDA *

EXPLANATION: MG/L = MILLIGRAMS PER LITER, UG/L = MICROGRAMS PER LITER, MEQ/L = MILLIEQUIVELENTS PER LITER, FT = FEET, MT = METERS, (M) = MEASURED, (E) = ESTIMATED, (R) = REPORTED, TR = TOTAL RECOVERABLE, TOT = TOTAL, BIO = BIOLOGICALLY AVAILABLE.

	QW	WA	SD	WI	ON	PW	AT	OTHER
OTHER AVAILABLE DATA		Y						
OTHER FILE NUMBERS:								

PROJECT: COST:
LAST EDIT DATE: 09-AUG-84 BY: TP *BCS
PROCESSING PROGRAM: F1730P V3 (09/1/83) PRINTED: 09-AUG-84

PERCENT MEQ/L (FOR PIPER PLOT)

CA	MG	NA	K	CL	SO4	HCO3	CO3
51.7	22.5	24.2	1.5	1.4	4.4	94.1	0.0

NOTE: IN CORRESPONDENCE, PLEASE REFER TO LAB NUMBER: 8400441

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406)496-4101

WATER QUALITY ANALYSIS
LAB NO. 8400440

STATE	MONTANA	COUNTY	RAVALLI
LATITUDE-LONGITUDE	46D21'07"N 114D10'47"W	SITE LOCATION	07N 21W 23*ADB 01
UTM COORDINATES	Z N E	MBMG SITE	
TOPOGRAPHIC MAP	HAMILTON NORTH 7 1/2'	STATION ID	462107114104701
GEOLOGIC SOURCE	120SDMS* *	SAMPLE SOURCE	WELL
DRAINAGE BASIN	PE	LAND SURFACE ALTITUDE	3683. FT < 10
AGENCY + SAMPLER	UM *WCU	SUSTAINED YIELD	
BOTTLE NUMBER		YIELD MEAS METHOD	
DATE SAMPLED	12-JUN-84	TOTAL DEPTH OF WELL	159. FT (R)
TIME SAMPLED	13:45 HOURS	SWL ABOVE(-) OR BELOW GS	109.32 FT (M)
LAB + ANALYST	MBMG*GAL	CASING DIAMETER	6 IN (R)
DATE ANALYZED	19-JUL-84	CASING TYPE	STEEL
SAMPLE HANDLING	3120	COMPLETION TYPE	02*
METHOD SAMPLED	PUMPED	PERFORATION INTERVAL	151 TO 156 FT (R)
WATER USE	DOMESTIC AND STOCK		

SAMPLING SITE OLSON, DON * VICTOR, MT
GEOLOGIC SOURCE SEDIMENTS (TERTIARY)

		MG/L	MEQ/L			MG/L	MEQ/L
CALCIUM	(CA)	24.	1.20	BICARBONATE	(HCO3)	117.	1.92
MAGNESIUM	(MG)	6.1	0.50	CARBONATE	(CO3)	0.	
SODIUM	(NA)	7.3	0.32	CHLORIDE	(CL)	.4	0.01
POTASSIUM	(K)	.8	0.02	SULFATE	(SO4)	2.3	0.05
IRON	(FE)	.004	0.00	NITRATE	(AS N)	.42	0.03
MANGANESE	(MN)	.003	0.00	FLUORIDE	(F)	.6	0.03
SILICA	(SIO2)	31.8		PHOSPHATE TOT	(AS P)		
TOTAL CATIONS			2.04	TOTAL ANIONS			2.04

STANDARD DEVIATION OF ANION-CATION BALANCE (SIGMA) 0.00

CALCULATED DISSOLVED SOLIDS	131.36	TOTAL HARDNESS AS CACO3	85.04
SUM OF DISS. CONSTITUENT	190.73	TOTAL ALKALINITY AS CACO3	95.96
FIELD CNDUCTVY, MICROMHOS	180.	FIELD ALKALINITY AS CACO3	
LAB CNDUCTVY, MICROMHOS	187.9	RYZNAR STABILITY INDEX	8.67
FIELD PH	7.77	LANGLIER SATURATION INDEX	-0.53
LABORATORY PH	7.61	SODIUM ADSORPTION RATIO	0.34

PARAMETER	VALUE	PARAMETER	VALUE
FIELD TEMP, AIR	24. C	FIELD TEMP, WATER	11.3 C
ALUMINUM, DISS (UG/L-AL)	<30.	NICKEL,DISS (UG/L AS NI)	<10.
SILVER, DISS(UG/L AS AG)	2.	PHOSPHATE,TO,DIS(MG/L-P)	.4
BORON,DISS (UG/L AS B)	<20.	STRONTIUM,DISS (UG/L-SR)	120.
CADMIUM,DISS(UG/L AS CD)	<2.	TITANIUM DIS(UG/L AS TI)	1.
CHROMIUM, DISS (UG/L-CR)	2.	VANADIUM,DISS(UG/L AS V)	6.
COPPER,DISS (UG/L AS CU)	5.	ZINC, DISS (UG/L AS ZN)	250.
LITHIUM,DISS(UG/L AS LI)	3.	ZIRCONIUM DIS(UG/L AS ZR	<4.
MOLYBDENUM,DISS(UG/L-MO)	<20.	BROMIDE,DISS(MG/L AS BR)	.1
O-PHOSPHATE,DISS(MG/L-P)	<.1		

REMARKS: OWNER'S ADDRESS: 50 HUDSON LANE, VICTOR, MT

EXPLANATION: MG/L = MILLIGRAMS PER LITER, UG/L = MICROGRAMS PER LITER, MEQ/L = MILLIEQUIVELENTS PER LITER. FT = FEET, MT = METERS. (M) = MEASURED, (E) = ESTIMATED, (R) = REPORTED. TR = TOTAL RECOVERABLE. TOT = TOTAL. BIO = BIOLOGICALLY AVAILABLE.

	QW	WA	S2	WI	OW	PW	AT	OTHER
OTHER AVAILABLE DATA		Y						
OTHER FILE NUMBERS:								

PROJECT:
LAST EDIT DATE: 09-AUG-84 COST:
BY: TP *BCS
PROCESSING PROGRAM: F1730P V3 (09/1/83) PRINTED: 09-AUG-84

PERCENT MEQ/L (FOR PIPER PLOT)

CA	MG	NA	K	CL	SO4	HCO3	CO3
58.8	24.6	15.6	1.0	0.5	2.4	97.0	0.0

NOTE: IN CORRESPONDENCE, PLEASE REFER TO LAB NUMBER: 8400440

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE,MONTANA 59701 (406)496-4101

WATER QUALITY ANALYSIS
LAB NO. 8400443

STATE	MONTANA	COUNTY	RAVALLI
LATITUDE-LONGITUDE	46D15'20"N 114D10'28"W	SITE LOCATION	06N 21W 24*CCCB 01
UTM COORDINATES	Z N E	NBMG SITE	
TOPOGRAPHIC MAP	HAMILTON NORTH 7 1/2'	STATION ID	461520114102801
GEOLOGIC SOURCE	110ALVM* *	SAMPLE SOURCE	WELL
DRAINAGE BASIN	PE	LAND SURFACE ALTITUDE	3588. FT < 10
AGENCY + SAMPLER	UM *WCU	SUSTAINED YIELD	15. GPM
BOTTLE NUMBER		YIELD MEAS METHOD	REPORTED
DATE SAMPLED	18-JUN-84	TOTAL DEPTH OF WELL	43. FT (R)
TIME SAMPLED	1700 HOURS	SWL ABOVE(-) OR BELOW GS	13.80 FT (M)
LAB + ANALYST	NBMG*GAL	CASING DIAMETER	6 IN (R)
DATE ANALYZED	19-JUL-84	CASING TYPE	STEEL
SAMPLE HANDLING	3120	COMPLETION TYPE	01*
METHOD SAMPLED	PUMPED	PERFORATION INTERVAL	
WATER USE	DOMESTIC		

SAMPLING SITE HEBERT, TERRY * HAMILTON, MT
GEOLOGIC SOURCE ALLUVIUM (QUATERNARY)

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	6.2	0.31	BICARBONATE (HCO3)	41.8	0.69
MAGNESIUM (MG)	2.1	0.17	CARBONATE (CO3)	0.	
SODIUM (NA)	5.5	0.24	CHLORIDE (CL)	1.2	0.03
POTASSIUM (K)	2.1	0.05	SULFATE (SO4)	1.5	0.03
IRON (FE)	.13	0.01	NITRATE (AS N)	.38	0.03
MANGANESE (MN)	.007	0.00	FLUORIDE (F)	<.1	
SILICA (SIO2)	28.1		PHOSPHATE TOT (AS P)		
TOTAL CATIONS		0.78	TOTAL ANIONS		0.78

STANDARD DEVIATION OF ANION-CATION BALANCE (SIGMA) -0.05

CALCULATED DISSOLVED SOLIDS	67.81	TOTAL HARDNESS AS CACO3	24.13
SUM OF DISS. CONSTITUENT	89.02	TOTAL ALKALINITY AS CACO3	34.28
FIELD CNDUCTVY, MICROMHOS	72.	FIELD ALKALINITY AS CACO3	
LAB CNDUCTVY, MICROMHOS	75.3	RYZNAR STABILITY INDEX	11.72
FIELD PH	5.78	LANGLIER SATURATION INDEX	-2.59
LABORATORY PH	6.53	SODIUM ADSORPTION RATIO	0.49

PARAMETER	VALUE	PARAMETER	VALUE
FIELD TEMP. AIR	24. C	FIELD TEMP. WATER	11. C
ALUMINUM, DISS (UG/L-AL)	<30.	NICKEL,DISS (UG/L AS NI)	<10.
SILVER, DISS(UG/L AS AG)	4.	PHOSPHATE,TO,DIS(MG/L-P)	.7
BORON,DISS (UG/L AS B)	20.	STRONTIUM,DISS (UG/L-SR)	100.
CADMIUM,DISS(UG/L AS CD)	<2.	TITANIUM DIS(UG/L AS TI)	3.
CHROMIUM, DISS (UG/L-CR)	4.	VANADIUM,DISS(UG/L AS V)	4.
COPPER,DISS (UG/L AS CU)	12.	ZINC, DISS (UG/L AS ZN)	35.
LITHIUM,DISS(UG/L AS LI)	6.	ZIRCONIUM DIS(UG/L AS ZR	5.
MOLYBDENUM,DISS(UG/L-MO)	<20.	BROMIDE,DISS(MG/L AS BR)	<.1
O-PHOSPHATE,DISS(MG/L-P)	<.1		

REMARKS: SLIGHT IRON TASTE
OWNER'S ADDRESS: 25 TAILGATE WEST LANE, HAMILTON, MT

EXPLANATION: MG/L = MILLIGRAMS PER LITER, UG/L = MICROGRAMS PER LITER, MEQ/L = MILLIEQUIVELENTS PER LITER. FT = FEET, MT = METERS. (M) = MEASURED, (E) = ESTIMATED, (R) = REPORTED. TR = TOTAL RECOVERABLE. TOT = TOTAL.
BIO = BIOLOGICALLY AVAILABLE.

	QW	WA	S2	WI	QW	PW	AT	OTHER
OTHER AVAILABLE DATA								
OTHER FILE NUMBERS:								

PROJECT:
LAST EDIT DATE: 07-AUG-84
PROCESSING PROGRAM: F1730P V3 (09/1/83)

COST:
BY: TP *BCS
PRINTED: 09-AUG-84

PERCENT MEQ/L (FOR PIPER PLOT)

CA	MG	NA	K	CL	SO4	HCO3	CO3
39.9	22.3	30.9	7.0	4.5	4.2	91.3	0.0

NOTE: IN CORRESPONDENCE, PLEASE REFER TO LAB NUMBER: 8400443

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE,MONTANA 59701 (406)496-4101

WATER QUALITY ANALYSIS
LAB NO. 8400439

STATE	MONTANA	COUNTY	RAVALLI
LATITUDE-LONGITUDE	46D17'52"N 114D10'48"W	SITE LOCATION	06N 21W 11*ABAA 01
UTM COORDINATES	Z N E	MBMG SITE	
TOPOGRAPHIC MAP	HAMILTON NORTH 7 1/2'	STATION ID	461752114104801
GEOLOGIC SOURCE	1205DNS* *	* SAMPLE SOURCE	WELL
DRAINAGE BASIN	PE	LAND SURFACE ALTITUDE	3632. FT < 10
AGENCY + SAMPLER	UM *WCU	SUSTAINED YIELD	
BOTTLE NUMBER		YIELD MEAS METHOD	
DATE SAMPLED	18-JUN-84	TOTAL DEPTH OF WELL	136. FT (R)
TIME SAMPLED	11:15 HOURS	SWL ABOVE(-) OR BELOW GS	17.94 FT (M)
LAB + ANALYST	MBMG*GAL	CASING DIAMETER	6 IN (R)
DATE ANALYZED	19-JUL-84	CASING TYPE	STEEL
SAMPLE HANDLING	3120	COMPLETION TYPE	02*
METHOD SAMPLED	PUMPED	PERFORATION INTERVAL	128 TO 133 FT (R)
WATER USE	DOMESTIC		

SAMPLING SITE FELTON, DON * HAMILTON, MT
GEOLOGIC SOURCE SEDIMENTS (TERTIARY)

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	6.	0.30	BICARBONATE (HCO3)	59.	0.97
MAGNESIUM (MG)	1.6	0.13	CARBONATE (CO3)	0.	
SODIUM (NA)	12.4	0.54	CHLORIDE (CL)	.6	0.02
POTASSIUM (K)	1.6	0.04	SULFATE (SO4)	1.6	0.03
IRON (FE)	.86	0.05	NITRATE (AS N)	.06	0.00
MANGANESE (MN)	.12	0.00	FLUORIDE (F)	.2	0.01
SILICA (SIO2)	54.8		PHOSPHATE TOT (AS P)		
TOTAL CATIONS		1.06	TOTAL ANIONS		1.03

STANDARD DEVIATION OF ANION-CATION BALANCE (SIGMA) -0.25

CALCULATED DISSOLVED SOLIDS	108.90	TOTAL HARDNESS AS CACO3	21.57
SUM OF DISS. CONSTITUENT	138.84	TOTAL ALKALINITY AS CACO3	48.39
FIELD CNDUCTVY, MICROMHOS	102.	FIELD ALKALINITY AS CACO3	
LAB CNDUCTVY, MICROMHOS	95.7	RYZNAR STABILITY INDEX	10.94
FIELD PH	6.78	LANGLIER SATURATION INDEX	-1.91
LABORATORY PH	7.13	SODIUM ADSORPTION RATIO	1.16

PARAMETER	VALUE	PARAMETER	VALUE
FIELD TEMP, AIR	22.5 C	FIELD TEMP, WATER	11.5 C
ALUMINUM, DISS (UG/L-AL)	40.	NICKEL,DISS (UG/L AS NI)	<10.
SILVER, DISS(UG/L AS AG)	4.	PHOSPHATE,TO,DIS(MG/L-P)	.4
BORON,DISS (UG/L AS B)	<20.	STRONTIUM,DISS (UG/L-SR)	110.
CADMIUM,DISS(UG/L AS CD)	<2.	TITANIUM DIS(UG/L AS TI)	<1.
CHROMIUM, DISS (UG/L-CR)	6.	VANADIUM,DISS(UG/L AS V)	2.
COPPER,DISS (UG/L AS CU)	3.	ZINC, DISS (UG/L AS ZN)	15.
LITHIUM,DISS(UG/L AS LI)	4.	ZIRCONIUM DIS(UG/L AS ZR	<4.
MOLYBDENUM,DISS(UG/L-MO)	<20.	BROMIDE,DISS(MG/L AS BR)	<.1
O-PHOSPHATE,DISS(MG/L-P)	<.1		

REMARKS: STRONG IRON AND HYDROGEN SULFIDE TASTE
OWNER'S ADDRESS: 691 NW RUMMEL LANE, HAMILTON, MT

EXPLANATION: MG/L = MILLIGRAMS PER LITER, UG/L = MICROGRAMS PER LITER, MEQ/L = MILLIEQUIVELENTS PER LITER, FT = FEET, MT = METERS, (M) = MEASURED, (E) = ESTIMATED, (R) = REPORTED, TR = TOTAL RECOVERABLE, TOT = TOTAL, BIO = BIOLOGICALLY AVAILABLE.

	QW	WA	S2	WI	OW	PW	AT	OTHER
OTHER AVAILABLE DATA		Y						

OTHER FILE NUMBERS:

PROJECT:		COST:	
LAST EDIT DATE:	09-AUG-84	BY:	TP *BCS
PROCESSING PROGRAM:	F1730P V3 (09/1/83)	PRINTED:	09-AUG-84

PERCENT MEQ/L (FOR PIPER PLOT)

CA	MG	NA	K	CL	SO4	HCO3	CO3
29.6	13.0	53.3	4.1	1.7	3.3	95.1	0.0

NOTE: IN CORRESPONDENCE, PLEASE REFER TO LAB NUMBER: 8400439

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE,MONTANA 59701 (406)496-4101

WATER QUALITY ANALYSIS
LAB NO. 84Q0436

STATE	MONTANA	COUNTY	RAVALLI
LATITUDE-LONGITUDE	46D22'13"N 114D08'33"W	SITE LOCATION	07N 20W 18*ABBD 01
UTM COORDINATES	Z N E	MBMG SITE	
TOPOGRAPHIC MAP	HAMILTON NORTH 7 1/2'	STATION ID	462213114083301
GEOLOGIC SOURCE	110ALVM* *	SAMPLE SOURCE	WELL
DRAINAGE BASIN	PE	LAND SURFACE ALTITUDE	342$. FT < 10
AGENCY + SAMPLER	UN *WCU	SUSTAINED YIELD	
BOTTLE NUMBER		YIELD MEAS METHOD	
DATE SAMPLED	19-JUN-84	TOTAL DEPTH OF WELL	44. FT (R)
TIME SAMPLED	11:00 HOURS	SWL ABOVE(-) OR BELOW GS	23.56 FT (M)
LAB + ANALYST	MBMG3GAL	CASING DIAMETER	6 IN (R)
DATE ANALYZED	18-JUL-84	CASING TYPE	STEEL
SAMPLE HANDLING	3120	COMPLETION TYPE	02*
METHOD SAMPLED	PUMPED	PERFORATION INTERVAL	39 TO 44 FT (R)
WATER USE	DOMESTIC AND STOCK		

SAMPLING SITE HESS, JOHN * VICTOR, MT
GEOLOGIC SOURCE ALLUVIUM (QUATERNARY)

		MG/L	MEQ/L			MG/L	MEQ/L
CALCIUM	(CA)	11.5	0.57	BICARBONATE	(HCO3)	55.3	0.91
MAGNESIUM	(MG)	2.9	0.24	CARBONATE	(CO3)	0.	
SODIUM	(NA)	4.	0.17	CHLORIDE	(CL)	1.2	0.03
POTASSIUM	(K)	2.	0.05	SULFATE	(SO4)	1.7	0.04
IRON	(FE)	.076	0.00	NITRATE	(AS N)	.36	0.03
MANGANESE	(MN)	.006	0.00	FLUORIDE	(F)	.1	0.01
SILICA	(SIO2)	27.4		PHOSPHATE TOT	(AS P)		
TOTAL CATIONS			1.04	TOTAL ANIONS			1.01

STANDARD DEVIATION OF ANION-CATION BALANCE (SIGMA) -0.29

CALCULATED DISSOLVED SOLIDS	78.48	TOTAL HARDNESS AS CACO3	40.65
SUM OF DISS. CONSTITUENT	106.34	TOTAL ALKALINITY AS CACO3	45.36
FIELD CNDUCTVY, MICROMHOS	91.	FIELD ALKALINITY AS CACO3	
LAB CNDUCTVY, MICROMHOS	104.6	RYZNAR STABILITY INDEX	10.61
FIELD PH	5.94	LANGLIER SATURATION INDEX	-1.87
LABORATORY PH	6.86	SODIUM ADSORPTION RATIO	0.27

PARAMETER	VALUE	PARAMETER	VALUE
FIELD TEMP, AIR	22. C	FIELD TEMP, WATER	11.4 C
ALUMINUM, DISS (UG/L-AL)	<30.	NICKEL,DISS (UG/L AS NI)	30.
SILVER, DISS(UG/L AS AG)	10.	PHOSPHATE,TO,DIS(MG/L-P)	.2
BORON,DISS (UG/L AS B)	40.	STRONTIUM,DISS (UG/L-SR)	130.
CADMIUM,DISS(UG/L AS CD)	7.	TITANIUM DIS(UG/L AS TI)	2.
CHROMIUM, DISS (UG/L-CR)	6.	VANADIUM,DISS(UG/L AS V)	9.
COPPER,DISS (UG/L AS CU)	10.	ZINC, DISS (UG/L AS ZN)	87.
LITHIUM,DISS(UG/L AS LI)	14.	ZIRCONIUM DIS(UG/L AS ZR	14.
MOLYBDENUM,DISS(UG/L-MO)	<20.	BROMIDE,DISS(MG/L AS BR)	<.1
O-PHOSPHATE,DISS(MG/L-P)	<.1		

REMARKS: SLIGHT IRON TASTE
OWNER'S ADDRESS: 1760 HIGHWAY 93, VICTOR, MT

EXPLANATION: MG/L = MILLIGRAMS PER LITER, UG/L = MICROGRAMS PER LITER, MEQ/L = MILLIEQUIVELENTS PER LITER. FT = FEET, MT = METERS. (M) = MEASURED, (E) = ESTIMATED, (R) = REPORTED. TR = TOTAL RECOVERABLE. TOT = TOTAL. BIO = BIOLOGICALLY AVAILABLE.

QW WA S2 WI QW FW AT OTHER

OTHER AVAILABLE DATA
OTHER FILE NUMBERS:

PROJECT:		COST:	
LAST EDIT DATE:	09-AUG-84	BY:	TP *BCS
PROCESSING PROGRAM:	F1730P V3 (09/1/83)	PRINTED:	09-AUG-84

PERCENT MEQ/L (FOR PIPER PLOT)

CA	MG	NA	K	CL	SO4	HCO3	CO3
55.3	23.0	16.8	5.0	3.5	3.6	92.9	0.0

NOTE: IN CORRESPONDENCE, PLEASE REFER TO LAB NUMBER: 84Q0436

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE, MONTANA 59701 (406)496-4101

WATER QUALITY ANALYSIS
LAB NO. 8400448

STATE	MONTANA	COUNTY	RAVALLI
LATITUDE-LONGITUDE	46D15'35"N 114D09'18"W	SITE LOCATION	06N 21W 24*DADA 01
UTM COORDINATES	Z N E	MBMG SITE	
TOPOGRAPHIC MAP	HAMILTON NORTH 7 1/2'	STATION ID	461535114091801
GEOLOGIC SOURCE	110ALVM* *	SAMPLE SOURCE	WELL
DRAINAGE BASIN	PE	LAND SURFACE ALTITUDE	3560. FT < 10
AGENCY + SAMPLER	UM *WCU	SUSTAINED YIELD	
BOTTLE NUMBER		YIELD MEAS METHOD	
DATE SAMPLED	22-JUN-84	TOTAL DEPTH OF WELL	
TIME SAMPLED	13:15 HOURS	SWL ABOVE(-) OR BELOW GS	9.02 FT (M)
LAB + ANALYST	MBMG*GAL	CASING DIAMETER	6 IN (R)
DATE ANALYZED	19-JUL-84	CASING TYPE	STEEL
SAMPLE HANDLING	3120	COMPLETION TYPE	*
METHOD SAMPLED	PUMPED	PERFORATION INTERVAL	
WATER USE	DOMESTIC		

SAMPLING SITE MOLYNEAUX, ALFRED * HAMILTON, MT
GEOLOGIC SOURCE ALLUVIUM (QUATERNARY)

		MG/L	MEQ/L			MG/L	MEQ/L
CALCIUM	(CA)	39.2	1.96	BICARBONATE	(HCO3)	177.	2.90
MAGNESIUM	(MG)	10.6	0.87	CARBONATE	(CO3)	0.	
SODIUM	(NA)	5.7	0.25	CHLORIDE	(CL)	1.6	0.05
POTASSIUM	(K)	3.3	0.08	SULFATE	(SO4)	3.9	0.08
IRON	(FE)	<.002		NITRATE	(AS N)	1.35	0.10
MANGANESE	(MN)	<.001		FLUORIDE	(F)	.2	0.01
SILICA	(SIO2)	19.2		PHOSPHATE TOT	(AS P)		
TOTAL CATIONS			3.16	TOTAL ANIONS			3.13

STANDARD DEVIATION OF ANION-CATION BALANCE (SIGMA) -0.18

CALCULATED DISSOLVED SOLIDS	172.24	TOTAL HARDNESS AS CACO3	141.51
SUM OF DISS. CONSTITUENT	262.05	TOTAL ALKALINITY AS CACO3	145.17
FIELD CNDUCTVY, MICROMHOS	282.	FIELD ALKALINITY AS CACO3	
LAB CNDUCTVY, MICROMHOS	290.4	RYZNAR STABILITY INDEX	8.24
FIELD PH	6.94	LANGLIER SATURATION INDEX	-0.49
LABORATORY PH	7.25	SODIUM ADSORPTION RATIO	0.21

PARAMETER	VALUE	PARAMETER	VALUE
FIELD TEMP. AIR	22.7 C	FIELD TEMP. WATER	11.8 C
ALUMINUM, DISS (UG/L-AL)	<30.	NICKEL,DISS (UG/L AS NI)	<10.
SILVER, DISS(UG/L AS AG)	<2.	PHOSPHATE,TO,DIS(MG/L-P)	<.1
BORON,DISS (UG/L AS B)	40.	STRONTIUM,DISS (UG/L-SR)	83.
CADMIUM,DISS(UG/L AS CD)	<2.	TITANIUM DIS(UG/L AS TI)	1.
CHROMIUM, DISS (UG/L-CR)	3.	VANADIUM,DISS(UG/L AS V)	1.
COPPER,DISS (UG/L AS CU)	4.	ZINC, DISS (UG/L AS ZN)	10.
LITHIUM,DISS(UG/L AS LI)	<2.	ZIRCONIUM DIS(UG/L AS ZR	<4.
MOLYBDENUM,DISS(UG/L-MO)	<20.	BROMIDE,DISS(MG/L AS BR)	<.1
O-PHOSPHATE,DISS(MG/L-P)	<.1		

REMARKS: OWNER'S ADDRESS: 141 OLD CORVALLIS ROAD, HAMILTON, MT

EXPLANATION: MG/L = MILLIGRAMS PER LITER, UG/L = MICROGRAMS PER LITER, MEQ/L = MILLIEQUIVELENTS PER LITER. FT = FEET, MT = METERS. (M) = MEASURED, (E) = ESTIMATED, (R) = REPORTED. TR = TOTAL RECOVERABLE. TOT = TOTAL. BIO = BIOLOGICALLY AVAILABLE.

OW WA S2 WI OW PW AT OTHER

OTHER AVAILABLE DATA
OTHER FILE NUMBERS:

PROJECT:		COST:	
LAST EDIT DATE:	09-AUG-84	BY:	TP *BCS
PROCESSING PROGRAM:	F1730P V3 (09/1/83)	PRINTED:	09-AUG-84

PERCENT MEQ/L (FOR PIPER PLOT)

CA	MG	NA	K	CL	SO4	HCO3	CO3
61.9	27.6	7.8	2.7	1.5	2.7	95.8	0.0

NOTE: IN CORRESPONDENCE, PLEASE REFER TO LAB NUMBER: 8400448

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE,MONTANA 59701 (406)496-4101

WATER QUALITY ANALYSIS
LAB NO. 8400434

STATE	MONTANA	COUNTY	RAVALLI
LATITUDE-LONGITUDE	46D17'20"N 114D09'39"W	SITE LOCATION	06N 21W 12 DBDA 01
UTM COORDINATES	Z N E	MBMG SITE	
TOPOGRAPHIC MAP	HAMILTON NORTH 7 1/2'	STATION ID	461720114093901
GEOLOGIC SOURCE	110ALVM* *	SAMPLE SOURCE	WELL
DRAINAGE BASIN	PE	LAND SURFACE ALTITUDE	3493. FT < 10
AGENCY + SAMPLER	UM *WCU	SUSTAINED YIELD	10. GPM
BOTTLE NUMBER		YIELD MEAS METHOD	REPORTED
DATE SAMPLED	18-JUN-84	TOTAL DEPTH OF WELL	50. FT (R)
TIME SAMPLED	1730 HOURS	SWL ABOVE(-) OR BELOW GS	4.13 FT (M)
LAB + ANALYST	MBMG*GAL	CASING DIAMETER	6 IN (R)
DATE ANALYZED	18-JUL-84	CASING TYPE	STEEL
SAMPLE HANDLING	3120	COMPLETION TYPE	01*
METHOD SAMPLED	PUMPED	PERFORATION INTERVAL	
WATER USE	DOMESTIC		

SAMPLING SITE PRESTON, WILLIAM * HAMILTON, MT
GEOLOGIC SOURCE ALLUVIUM (QUATERNARY)

	MG/L	MEQ/L			MG/L	MEQ/L
CALCIUM (CA)	15.4	0.77	BICARBONATE	(HCO3)	82.5	1.35
MAGNESIUM (MG)	3.9	0.32	CARBONATE	(CO3)	0.	
SODIUM (NA)	9.2	0.40	CHLORIDE	(CL)	.8	0.02
POTASSIUM (K)	1.2	0.03	SULFATE	(SO4)	2.5	0.05
IRON (FE)	.012	0.00	NITRATE	(AS N)	.47	0.03
MANGANESE (MN)	.004	0.00	FLUORIDE	(F)	.1	0.01
SILICA (SIO2)	25.9		PHOSPHATE TOT	(AS P)		
TOTAL CATIONS		1.52	TOTAL ANIONS			1.47

STANDARD DEVIATION OF ANION-CATION BALANCE (SIGMA) -0.43

CALCULATED DISSOLVED SOLIDS	100.13	TOTAL HARDNESS AS CACO3	54.51
SUM OF DISS. CONSTITUENT	141.99	TOTAL ALKALINITY AS CACO3	67.66
FIELD CNDUCTVY, MICROMHOS	134.	FIELD ALKALINITY AS CACO3	
LAB CNDUCTVY, MICROMHOS	146.9	RYZNAR STABILITY INDEX	9.58
FIELD PH	6.72	LANGLIER SATURATION INDEX	-1.10
LABORATORY PH	7.30	SODIUM ADSORPTION RATIO	0.54

PARAMETER	VALUE	PARAMETER	VALUE
FIELD TEMP, AIR	21.2 C	FIELD TEMP, WATER	10.3 C
ALUMINUM, DISS (UG/L-AL)	<30.	NICKEL,DISS (UG/L AS NI)	<10.
SILVER, DISS(UG/L AS AG)	<2.	PHOSPHATE,TO,DIS(MG/L-P)	<.1
BORON,DISS (UG/L AS B)	<20.	STRONTIUM,DISS (UG/L-SR)	100.
CADMIUM,DISS(UG/L AS CD)	2.	TITANIUM DIS(UG/L AS TI)	1.
CHROMIUM, DISS (UG/L-CR)	<2.	VANADIUM,DISS(UG/L AS V)	2.
COPPER,DISS (UG/L AS CU)	35.	ZINC, DISS (UG/L AS ZN)	150.
LITHIUM,DISS(UG/L AS LI)	<2.	ZIRCONIUM DIS(UG/L AS ZR	<4.
MOLYBDENUM,DISS(UG/L-MO)	<20.	BROMIDE,DISS(MG/L AS BR)	<.1
O-PHOSPHATE,DISS(MG/L-P)	<.1		

REMARKS: OWNER'S ADDRESS: 2366 HIGHWAY 93, HAMILTON, MT

EXPLANATION: MG/L = MILLIGRAMS PER LITER, UG/L = MICROGRAMS PER LITER, MEQ/L = MILLIEQUIVELENTS PER LITER, FT = FEET, MT = METERS, (M) = MEASURED, (E) = ESTIMATED, (R) = REPORTED, TR = TOTAL RECOVERABLE, TOT = TOTAL, BIO = BIOLOGICALLY AVAILABLE.

	QW	WA	S2	WI	OW	PW	AT	OTHER
OTHER AVAILABLE DATA		Y						

OTHER FILE NUMBERS:

PROJECT:
LAST EDIT DATE: 09-AUG-84 COST: BY: TP *BCS
PROCESSING PROGRAM: F1730P V3 (09/1/83) PRINTED: 09-AUG-84

PERCENT MEQ/L (FOR PIPER PLOT)

CA	MG	NA	K	CL	SO4	HCO3	CO3
50.3	21.1	26.3	2.0	1.6	3.6	94.8	0.0

NOTE: IN CORRESPONDENCE, PLEASE REFER TO LAB NUMBER: 8400434

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE,MONTANA 59701 (406)496-4101

WATER QUALITY ANALYSIS
LAB NO. 8400449

STATE	MONTANA	COUNTY	RAVALLI
LATITUDE-LONGITUDE	46D16'55"N 114D07'50"W	SITE LOCATION	06N 20W 17*BBCA 01
UTM COORDINATES	Z N E	MBMG SITE	
TOPOGRAPHIC MAP	HAMILTON NORTH 7 1/2'	STATION ID	461655114075001
GEOLOGIC SOURCE	110ALVM* *	SAMPLE SOURCE	WELL
DRAINAGE BASIN	PE	LAND SURFACE ALTITUDE	3510. FT < 10
AGENCY + SAMPLER	UM W*CU	SUSTAINED YIELD	20. GPM
BOTTLE NUMBER		YIELD MEAS METHOD	REPORTED
DATE SAMPLED	22-JUN-84	TOTAL DEPTH OF WELL	60. FT (R)
TIME SAMPLED	13:00 HOURS	SWL ABOVE(-) OR BELOW GS	17.66 FT (M)
LAB + ANALYST	MBMG*GAL	CASING DIAMETER	6 IN (R)
DATE ANALYZED	19-JUL-84	CASING TYPE	STEEL
SAMPLE HANDLING	3120	COMPLETION TYPE	01*
METHOD SAMPLED	PUMPED	PERFORATION INTERVAL	
WATER USE	DOMESTIC		

SAMPLING SITE HOPINGARDNER, KREG * CORVALLIS, MT
GEOLOGIC SOURCE ALLUVIUM (QUATERNARY)

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	42.6	2.13	BICARBONATE (HCO3)	177.	2.90
MAGNESIUM (MG)	7.6	0.63	CARBONATE (CO3)	0.	
SODIUM (NA)	7.3	0.32	CHLORIDE (CL)	1.4	0.04
POTASSIUM (K)	2.5	0.06	SULFATE (SO4)	4.4	0.09
IRON (FE)	<.002		NITRATE (AS N)	.67	0.05
MANGANESE (MN)	.002	0.00	FLUORIDE (F)	.2	0.01
SILICA (SIO2)	26.5		PHOSPHATE TOT (AS P)		
TOTAL CATIONS		3.13	TOTAL ANIONS		3.09

STANDARD DEVIATION OF ANION-CATION BALANCE (SIGMA) -0.28

CALCULATED DISSOLVED SOLIDS	180.36	TOTAL HARDNESS AS CACO3	137.65
SUM OF DISS. CONSTITUENT	270.17	TOTAL ALKALINITY AS CACO3	145.17
FIELD CNDUCTVY, MICROMHOS	272.	FIELD ALKALINITY AS CACO3	
LAB CNDUCTVY, MICROMHOS	284.2	RYZNAR STABILITY INDEX	8.03
FIELD PH	7.14	LANGLIER SATURATION INDEX	-0.32
LABORATORY PH	7.39	SODIUM ADSORPTION RATIO	0.27

PARAMETER	VALUE	PARAMETER	VALUE
FIELD TEMP. AIR	23.8 C	FIELD TEMP. WATER	12. C
ALUMINUM, DISS (UG/L-AL)	<30.	NICKEL,DISS (UG/L AS NI)	20.
SILVER, DISS(UG/L AS AG)	<2.	PHOSPHATE,TOT,DIS(MG/L-P)	<.1
BORON,DISS (UG/L AS B)	<20.	STRONTIUM,DISS (UG/L-SR)	75.
CADMIUM,DISS(UG/L AS CD)	<2.	TITANIUM DIS(UG/L AS TI)	2.
CHROMIUM, DISS (UG/L-CR)	<2.	VANADIUM,DISS(UG/L AS V)	4.
COPPER,DISS (UG/L AS CU)	4.	ZINC, DISS (UG/L AS ZN)	120.
LITHIUM,DISS(UG/L AS LI)	<2.	ZIRCONIUM DIS(UG/L AS ZR	<4.
MOLYBDENUM,DISS(UG/L-MO)	<20.	BROMIDE,DISS(MG/L AS BR)	<.1
O-PHOSPHATE,DISS(MG/L-P)	<.1		

REMARKS: OWNER'S ADDRESS: 163 BLACK LANE, CORVALLIS, MT

EXPLANATION: MG/L = MILLIGRAMS PER LITER, UG/L = MICROGRAMS PER LITER, MEQ/L = MILLIEQUIVELENTS PER LITER. FT = FEET, MT = METERS. (M) = MEASURED, (E) = ESTIMATED, (R) = REPORTED. TR = TOTAL RECOVERABLE. TOT = TOTAL. BIO = BIOLOGICALLY AVAILABLE.

	QW	WA	S2	W1	OW	PW	AT	OTHER
OTHER AVAILABLE DATA		Y						

OTHER FILE NUMBERS:

PROJECT:		COST:	
LAST EDIT DATE:	09-AUG-84	BY:	TP *BCS
PROCESSING PROGRAM:	F1730P V3 (09/1/83)	PRINTED:	09-AUG-84

PERCENT MEQ/L (FOR PIPER PLOT)

CA	MG	NA	K	CL	SO4	HCO3	CO3
67.9	20.0	10.1	2.1	1.3	3.0	75.7	0.0

NOTE: IN CORRESPONDENCE, PLEASE REFER TO LAB NUMBER: 8400449

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE,MONTANA 59701 (406)496-4101

WATER QUALITY ANALYSIS
LAB NO. 8400431

STATE	MONTANA	COUNTY	RAVALLI
LATITUDE-LONGITUDE	46D18'21"N 114D08'01"W	SITE LOCATION	06N 20W 05*BCCC 01
UTM COORDINATES	Z N E	MBMG SITE	
TOPOGRAPHIC MAP	HAMILTON NORTH 7 1/2'	STATION ID	461821114080101
GEOLOGIC SOURCE	110ALVM* *	* SAMPLE SOURCE	WELL
DRAINAGE BASIN	PE	LAND SURFACE ALTITUDE	3474. FT < 10
AGENCY + SAMPLER	UM *WCU	SUSTAINED YIELD	25. GPM
BOTTLE NUMBER		YIELD MEAS METHOD	REPORTED
DATE SAMPLED	20-JUN-84	TOTAL DEPTH OF WELL	45. FT (R)
TIME SAMPLED	13:30 HOURS	SWL ABOVE(-) OR BELOW GS	5.56 FT (M)
LAB + ANALYST	MBMG3GAL	CASING DIAMETER	6 IN (R)
DATE ANALYZED	10-JUL-84	CASING TYPE	STEEL
SAMPLE HANDLING	3120	COMPLETION TYPE	01*
METHOD SAMPLED	PUMPED	PERFORATION INTERVAL	
WATER USE	DOMESTIC AND STOCK		

SAMPLING SITE DEWIT, CORNELIUS * CORVALLIS, MT
GEOLOGIC SOURCE ALLUVIUM (QUATERNARY)

		MG/L	MEQ/L			MG/L	MEQ/L
CALCIUM	(CA)	38.8	1.94	BICARBONATE	(HCO3)	167.	2.74
MAGNESIUM	(MG)	7.7	0.63	CARBONATE	(CO3)	0.	
SODIUM	(NA)	6.3	0.27	CHLORIDE	(CL)	1.2	0.03
POTASSIUM	(K)	2.8	0.07	SULFATE	(SO4)	4.2	0.09
IRON	(FE)	.23	0.01	NITRATE	(AS N)	.23	0.02
MANGANESE	(MN)	.003	0.00	FLUORIDE	(F)	.1	0.01
SILICA	(SIO2)	22.6		PHOSPHATE TOT	(AS P)		
TOTAL CATIONS			2.93	TOTAL ANIONS			2.88

STANDARD DEVIATION OF ANION-CATION BALANCE (SIGMA) -0.32

CALCULATED DISSOLVED SOLIDS	166.43	TOTAL HARDNESS AS CACO3	128.58
SUM OF DISS. CONSTITUENT	251.16	TOTAL ALKALINITY AS CACO3	136.97
FIELD CNDUCTVY, MICROMHOS	259.	FIELD ALKALINITY AS CACO3	
LAB CNDUCTVY, MICROMHOS	271.7	RYZNAR STABILITY INDEX	8.38
FIELD PH	6.69	LANGLIER SATURATION INDEX	-0.60
LABORATORY PH	7.17	SODIUM ADSORPTION RATIO	0.24

PARAMETER	VALUE	PARAMETER	VALUE
FIELD TEMP, AIR	26. C	FIELD TEMP, WATER	9.5 C
ALUMINUM, DISS (UG/L-AL)	<30.	NICKEL,DISS (UG/L AS NI)	<10.
SILVER, DISS(UG/L AS AG)	<2.	PHOSPHATE,TO,DIS(MG/L-P)	<.1
BORON,DISS (UG/L AS B)	<20.	STRONTIUM,DISS (UG/L-SR)	66.
CADMIUM,DISS(UG/L AS CD)	6.	TITANIUM DIS(UG/L AS TI)	4.
CHROMIUM, DISS (UG/L-CR)	<2.	VANADIUM,DISS(UG/L AS V)	<1.
COPPER,DISS (UG/L AS CU)	2.	ZINC, DISS (UG/L AS ZN)	90.
LITHIUM,DISS(UG/L AS LI)	2.	ZIRCONIUM DIS(UG/L AS ZR)	4.
MOLYBDENUM,DISS(UG/L-MO)	<20.	BROMIDE,DISS(MG/L AS BR)	<.1
O-PHOSPHATE,DISS(MG/L-P)	<.1		

REMARKS: OWNER'S ADDRESS: 940 OLD CORVALLIS ROAD, CORVALLIS, MT

EXPLANATION: MG/L = MILLIGRAMS PER LITER, UG/L = MICROGRAMS PER LITER, MEQ/L = MILLIEQUIVELENTS PER LITER, FT = FEET, MT = METERS, (M) = MEASURED, (E) = ESTIMATED, (R) = REPORTED, TR = TOTAL RECOVERABLE, TOT = TOTAL, BIO = BIOLOGICALLY AVAILABLE.

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OTHER AVAILABLE DATA
OTHER FILE NUMBERS:

PROJECT:		COST:	
LAST EDIT DATE:	09-AUG-84	BY:	TP *BCS
PROCESSING PROGRAM:	F1730P V3 (09/1/83)	PRINTED:	09-AUG-84

PERCENT MEQ/L (FOR PIPER PLOT)

CA	MG	NA	K	CL	SO4	HCO3	CO3
66.4	21.7	9.4	2.5	1.2	3.1	95.8	0.0

NOTE: IN CORRESPONDENCE, PLEASE REFER TO LAB NUMBER: 8400431

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE,MONTANA 59701 (406)496-4101

WATER QUALITY ANALYSIS
LAB NO. 8400432

STATE	MONTANA	COUNTY	RAVALLI
LATITUDE-LONGITUDE	46D18'44"N 114D04'50"W	SITE LOCATION	06N 20W 03 ABBB 01
UTM COORDINATES	Z N E	MBMG SITE	
TOPOGRAPHIC MAP	CORVALLIS 7 1/2'	STATION ID	461844114045001
GEOLOGIC SOURCE	110ALVM* *	* SAMPLE SOURCE	WELL
DRAINAGE BASIN	PE	LAND SURFACE ALTITUDE	3583. FT < 10
AGENCY + SAMPLER	UM *WCU	SUSTAINED YIELD	17. GPM
BOTTLE NUMBER		YIELD MEAS METHOD	REPORTED
DATE SAMPLED	20-JUN-84	TOTAL DEPTH OF WELL	59. FT (R)
TIME SAMPLED	15:30 HOURS	SWL ABOVE(-) OR BELOW GS	30.69 FT (M)
LAB + ANALYST	MBMG*GAL	CASING DIAMETER	6 IN (R)
DATE ANALYZED	10-JUL-84	CASING TYPE	STEEL
SAMPLE HANDLING	3120	COMPLETION TYPE	02*
METHOD SAMPLED	PUMPED	PERFORATION INTERVAL	39 TO 59 FT (R)
WATER USE	DOMESTIC		

SAMPLING SITE HULL, LEWIS * CORVALLIS, MT
GEOLOGIC SOURCE ALLUVIUM (QUATERNARY)

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	79.6	3.97	BICARBONATE (HCO3)	321.1	5.26
MAGNESIUM (MG)	7.8	0.64	CARBONATE (CO3)	0.	
SODIUM (NA)	29.	1.26	CHLORIDE (CL)	6.3	0.18
POTASSIUM (K)	3.1	0.08	SULFATE (SO4)	14.1	0.29
IRON (FE)	.005	0.00	NITRATE (AS N)	1.39	0.10
MANGANESE (MN)	<.001		FLUORIDE (F)	.2	0.01
SILICA (SIO2)	28.1		PHOSPHATE TOT (AS P)		
TOTAL CATIONS		5.96	TOTAL ANIONS		5.84

STANDARD DEVIATION OF ANION-CATION BALANCE (SIGMA) -0.58

CALCULATED DISSOLVED SOLIDS	327.77	TOTAL HARDNESS AS CACO3	230.87
SUM OF DISS. CONSTITUENT	490.70	TOTAL ALKALINITY AS CACO3	263.36
FIELD CNDUCTVY, MICROMHOS	496.	FIELD ALKALINITY AS CACO3	
LAB CNDUCTVY, MICROMHOS	484.7	RYZNAR STABILITY INDEX	6.81
FIELD PH	7.17	LANGLIER SATURATION INDEX	0.37
LABORATORY PH	7.55	SODIUM ADSORPTION RATIO	0.83

PARAMETER	VALUE	PARAMETER	VALUE
FIELD TEMP. AIR	21.5 C	FIELD TEMP. WATER	11. C
ALUMINUM, DISS (UG/L-AL)	<30.	NICKEL,DISS (UG/L AS NI)	<10.
SILVER, DISS(UG/L AS AG)	3.	PHOSPHATE,TO,DIS(MG/L-P)	<.1
BORON,DISS (UG/L AS B)	<20.	STRONTIUM,DISS (UG/L-SR)	110.
CADMIUM,DISS(UG/L AS CD)	4.	TITANIUM DIS(UG/L AS TI)	10.
CHROMIUM, DISS (UG/L-CR)	3.	VANADIUM,DISS(UG/L AS V)	7.
COPPER,DISS (UG/L AS CU)	10.	ZINC, DISS (UG/L AS ZN)	50.
LITHIUM,DISS(UG/L AS LI)	3.	ZIRCONIUM DIS(UG/L AS ZR	<4.
MOLYBDENUM,DISS(UG/L-MO)	<20.	BROMIDE,DISS(MG/L AS BR)	<.1
O-PHOSPHATE,DISS(MG/L-P)	<.1		

REMARKS: OWNER'S ADDRESS: 589 WILLOW CREEK ROAD, CORVALLIS, MT

EXPLANATION: MG/L = MILLIGRAMS PER LITER, UG/L = MICROGRAMS PER LITER, MEQ/L = MILLIEQUIVELENTS PER LITER, FT = FEET, MT = METERS, (M) = MEASURED, (E) = ESTIMATED, (R) = REPORTED, TR = TOTAL RECOVERABLE, TOT = TOTAL, BIO = BIOLOGICALLY AVAILABLE.

	GW	WA	SS	WI	ON	PW	AT	OTHER
OTHER AVAILABLE DATA		Y						

OTHER FILE NUMBERS:

PROJECT:
LAST EDIT DATE: 09-AUG-84 BY: TP *BCS
PROCESSING PROGRAM: F1730P V3 (09/1/83) PRINTED: 09-AUG-84

PERCENT MEQ/L (FOR PIPER PLOT)

CA	MG	NA	K	CL	SO4	HCO3	CO3
66.7	10.8	21.2	1.3	3.1	5.1	91.8	0.0

NOTE: IN CORRESPONDENCE, PLEASE REFER TO LAB NUMBER: 8400432

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE,MONTANA 59701 (406)496-4101

WATER QUALITY ANALYSIS
LAB NO. 8400438

STATE	MONTANA	COUNTY	RAVALLI
LATITUDE-LONGITUDE	46D18'45"N 114D09'21"W	SITE LOCATION	07N 21W 36*DDDC 01
UTM COORDINATES	Z N E	NBMG SITE	
TOPOGRAPHIC MAP	HAMILTON NORTH 7 1/2'	STATION ID	461845114092101
GEOLOGIC SOURCE	110ALVM* *	SAMPLE SOURCE	WELL
DRAINAGE BASIN	FE	LAND SURFACE ALTITUDE	3480. FT < 10
AGENCY + SAMPLER	UM *WCU	SUSTAINED YIELD	
BOTTLE NUMBER		YIELD MEAS METHOD	
DATE SAMPLED	20-JUN-84	TOTAL DEPTH OF WELL	31. FT (R)
TIME SAMPLED	12:15 HOURS	SWL ABOVE(-) OR BELOW GS	6.83 FT (M)
LAB + ANALYST	MBMG*GAL	CASING DIAMETER	6 IN (R)
DATE ANALYZED	18-JUL-84	CASING TYPE	STEEL
SAMPLE HANDLING	3120	COMPLETION TYPE	02*
METHOD SAMPLED	PUMPED	PERFORATION INTERVAL	23 TO 28 FT (R)
WATER USE	DOMESTIC		

SAMPLING SITE DUNBAR, TOM * HAMILTON, MT
GEOLOGIC SOURCE ALLUVIUM (QUATERNARY)

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	3.3	0.16	BICARBONATE (HCO3)	20.	0.33
MAGNESIUM (MG)	.7	0.06	CARBONATE (CO3)	0.	
SODIUM (NA)	2.4	0.10	CHLORIDE (CL)	.4	0.01
POTASSIUM (K)	1.	0.03	SULFATE (SO4)	.9	0.02
IRON (FE)	.035	0.00	NITRATE (AS N)	.10	0.01
MANGANESE (MN)	.003	0.00	FLUORIDE (F)	.1	0.01
SILICA (SIO2)	14.4		PHOSPHATE TOT (AS P)		
TOTAL CATIONS		0.35	TOTAL ANIONS		0.37

STANDARD DEVIATION OF ANION-CATION BALANCE (SIGMA) 0.14

CALCULATED DISSOLVED SOLIDS	33.19	TOTAL HARDNESS AS CACO3	11.12
SUM OF DISS. CONSTITUENT	43.34	TOTAL ALKALINITY AS CACO3	16.40
FIELD CNDUCTVY, MICROMHOS	34.	FIELD ALKALINITY AS CACO3	
LAB CNDUCTVY, MICROMHOS	37.0	RYZNAR STABILITY INDEX	12.95
FIELD PH	5.48	LANGLIER SATURATION INDEX	-2.24
LABORATORY PH	6.48	SODIUM ADSORPTION RATIO	0.31

PARAMETER	VALUE	PARAMETER	VALUE
FIELD TEMP. AIR	25. C	FIELD TEMP. WATER	10.3 C
ALUMINUM, DISS (UG/L-AL)	30.	NICKEL,DISS (UG/L AS NI)	<10.
SILVER, DISS(UG/L AS AG)	<2.	PHOSPHATE,TO,DIS(MG/L-P)	.3
BORON,DISS (UG/L AS B)	<20.	STRONTIUM,DISS (UG/L-SR)	40.
CADMIUM,DISS(UG/L AS CD)	<2.	TITANIUM DIS(UG/L AS TI)	<1.
CHROMIUM, DISS (UG/L-CR)	<2.	VANADIUM,DISS(UG/L AS V)	3.
COPPER,DISS (UG/L AS CU)	11.	ZINC, DISS (UG/L AS ZN)	26.
LITHIUM,DISS(UG/L AS LI)	<2.	ZIRCONIUM DIS(UG/L AS ZR	<4.
MOLYBDENUM,DISS(UG/L-MO)	<20.	BROMIDE,DISS(MG/L AS BR)	<.1
O-PHOSPHATE,DISS(MG/L-P)	.2		

REMARKS: OWNER'S ADDRESS: 120 DUTCH HILL ROAD, HAMILTON, MT

EXPLANATION: MG/L = MILLIGRAMS PER LITER, UG/L = MICROGRAMS PER LITER, MEQ/L = MILLIEQUIVELENTS PER LITER, FT = FEET, MT = METERS, (M) = MEASURED, (E) = ESTIMATED, (R) = REPORTED, TR = TOTAL RECOVERABLE, TOT = TOTAL, BIO = BIOLOGICALLY AVAILABLE.

	OW	WA	S2	WI	OW	PW	AT	OTHER
OTHER AVAILABLE DATA		Y						

OTHER FILE NUMBERS:

PROJECT:
COST:
LAST EDIT DATE: 09-AUG-84 BY: TP *BCS
PROCESSING PROGRAM: F1730P V3 (09/1/83) PRINTED: 09-AUG-84

PERCENT MEQ/L (FOR PIPER PLOT)

CA	MG	NA	K	CL	SO4	HCO3	CO3
46.7	16.3	29.6	7.3	3.2	5.2	91.6	0.0

NOTE: IN CORRESPONDENCE, PLEASE REFER TO LAB NUMBER: 8400438

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE,MONTANA 59701 (406)496-4101

WATER QUALITY ANALYSIS
LAB NO. 8480447

STATE	MONTANA	COUNTY	RAVALLI
LATITUDE-LONGITUDE	46D21'40"N 114D06'52"W	SITE LOCATION	07N 20W 17*DAD 01
UTM COORDINATES	Z N E	MBMG SITE	
TOPOGRAPHIC MAP	CORVALLIS 7 1/2'	STATION ID	462140114065201
GEOLOGIC SOURCE	110ALVM* *	SAMPLE SOURCE	WELL
DRAINAGE BASIN	PE	LAND SURFACE ALTITUDE	341#. FT < 10
AGENCY & SAMPLER	UN *WCU	SUSTAINED YIELD	
BOTTLE NUMBER		YIELD MEAS METHOD	
DATE SAMPLED	22-JUN-84	TOTAL DEPTH OF WELL	62. FT (R)
TIME SAMPLED	1030 HOURS	SWL ABOVE(-) OR BELOW GS	3.28 FT (M)
LAB & ANALYST	MBMG*BAL	CASING DIAMETER	6 IN (R)
DATE ANALYZED	19-JUL-84	CASING TYPE	STEEL
SAMPLE HANDLING	3120	COMPLETION TYPE	02*
METHOD SAMPLED	PUMPED	PERFORATION INTERVAL	62 TO 67 FT (R)
WATER USE	DOMESTIC AND STOCK		

SAMPLING SITE HAMILTON, JAMES * CORVALLIS, MT
GEOLOGIC SOURCE ALLUVIUM (QUATERNARY)

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	54.1	2.70	BICARBONATE (HCO3)	226.	3.70
MAGNESIUM (MG)	7.6	0.63	CARBONATE (CO3)	0.	
SODIUM (NA)	15.7	0.68	CHLORIDE (CL)	2.3	0.06
POTASSIUM (K)	3.	0.08	SULFATE (SO4)	7.	0.15
IRON (FE)	.002	0.00	NITRATE (AS N)	1.08	0.08
MANGANESE (MN)	.002	0.00	FLUORIDE (F)	.1	0.01
SILICA (SIO2)	28.4		PHOSPHATE TOT (AS P)		
TOTAL CATIONS		4.09	TOTAL ANIONS		4.00

STANDARD DEVIATION OF ANION-CATION BALANCE (SIGMA) -0.53

CALCULATED DISSOLVED SOLIDS	230.61	TOTAL HARDNESS AS CACO3	166.37
SUM OF DISS. CONSTITUENT	345.28	TOTAL ALKALINITY AS CACO3	185.36
FIELD CNDUCTVY, MICROMHOS	362.	FIELD ALKALINITY AS CACO3	
LAB CNDUCTVY, MICROMHOS	367.6	RYZNAR STABILITY INDEX	7.76
FIELD PH	6.84	LANGLIER SATURATION INDEX	-0.26
LABORATORY PH	7.24	SODIUM ADSORPTION RATIO	0.53

PARAMETER	VALUE	PARAMETER	VALUE
FIELD TEMP, AIR	17. C	FIELD TEMP, WATER	11. C
ALUMINUM, DISS (UG/L-AL)	<30.	NICKEL,DISS (UG/L AS NI)	<10.
SILVER, DISS(UG/L AS AG)	<2.	PHOSPHATE,TO,DIS(MG/L-P)	.1
BORON,DISS (UG/L AS B)	<20.	STRONTIUM,DISS (UG/L-SR)	93.
CADMIUM,DISS(UG/L AS CD)	<2.	TITANIUM DIS(UG/L AS TI)	4.
CHROMIUM, DISS (UG/L-CR)	<2.	VANADIUM,DISS(UG/L AS V)	3.
COPPER,DISS (UG/L AS CU)	28.	ZINC, DISS (UG/L AS ZN)	49.
LITHIUM,DISS(UG/L AS LI)	<2.	ZIRCONIUM DIS(UG/L AS ZR	<4.
MOLYBDENUM,DISS(UG/L-MO)	<20.	BROMIDE,DISS(MG/L AS BR)	<.1
O-PHOSPHATE,DISS(MG/L-P)	<.1		

REMARKS: OWNER'S ADDRESS: 1745 CHAFFIN LANE, CORVALLIS, MT

EXPLANATION: MG/L = MILLIGRAMS PER LITER, UG/L = MICROGRAMS PER LITER, MEQ/L = MILLIEQUIVELENTS PER LITER. FT = FEET, MT = METERS. (M) = MEASURED, (E) = ESTIMATED, (R) = REPORTED. TR = TOTAL RECOVERABLE. TOT = TOTAL. BIO = BIOLOGICALLY AVAILABLE.

	OW	WA	S2	WI	OW	PW	AT	OTHER
OTHER AVAILABLE DATA		Y						

OTHER FILE NUMBERS:

PROJECT:
LAST EDIT DATE: 09-AUG-84 COST: BY: TP *BCS
PROCESSING PROGRAM: F1730P V3 (09/1/83) PRINTED: 09-AUG-84

PERCENT MEQ/L (FOR PIPER PLOT)

CA	MG	NA	K	CL	SO4	HCO3	CO3
66.1	15.3	16.7	1.9	1.7	3.7	94.6	0.0

NOTE: IN CORRESPONDENCE, PLEASE REFER TO LAB NUMBER: 8480447

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE,MONTANA 59701 (406)496-4101

WATER QUALITY ANALYSIS
LAB NO. 84Q0451

STATE	MONTANA	COUNTY	RAVALLI
LATITUDE-LONGITUDE	46D17'58"N 114D02'30"W	SITE LOCATION	06N 20W 01*CDCD 01
UTM COORDINATES	Z N E	NBNG SITE	
TOPOGRAPHIC MAP	CORVALLIS 7 1/2'	STATION ID	461758114023001
GEOLOGIC SOURCE	211DBTL* *	SAMPLE SOURCE	WELL
DRAINAGE BASIN	PE	LAND SURFACE ALTITUDE	3833. FT < 10
AGENCY + SAMPLER	UN *WCU	SUSTAINED YIELD	15. GPM
BOTTLE NUMBER		YIELD MEAS METHOD	REPORTED
DATE SAMPLED	20-JUN-84	TOTAL DEPTH OF WELL	120. FT (R)
TIME SAMPLED	18:00 HOURS	SWL ABOVE(-) OR BELOW GS	4.92 FT (M)
LAB + ANALYST	MBNG*GAL	CASING DIAMETER	8 IN (R)
DATE ANALYZED	20-JUL-84	CASING TYPE	STEEL
SAMPLE HANDLING	3120	COMPLETION TYPE	02*02
METHOD SAMPLED	PUMPED	PERFORATION INTERVAL	20 TO 40 FT (R)
WATER USE	DOMESTIC AND STOCK		60 TO 100 FT (R)

SAMPLING SITE STEUER, GUY * CORVALLIS, MT
GEOLOGIC SOURCE IDAHO BATHOLITH

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	55.7	2.78	BICARBONATE (HCO3)	260.	4.26
MAGNESIUM (MG)	13.1	1.08	CARBONATE (CO3)	0.	
SODIUM (NA)	18.6	0.81	CHLORIDE (CL)	2.7	0.08
POTASSIUM (K)	2.2	0.06	SULFATE (SO4)	7.2	0.15
IRON (FE)	.010	0.00	NITRATE (AS N)	1.81	0.13
MANGANESE (MN)	.001	0.00	FLUORIDE (F)	.6	0.03
SILICA (SIO2)	38.9		PHOSPHATE TOT (AS P)		
TOTAL CATIONS		4.72	TOTAL ANIONS		4.65

STANDARD DEVIATION OF ANION-CATION BALANCE (SIGNA) -0.43

CALCULATED DISSOLVED SOLIDS	268.90	TOTAL HARDNESS AS CACO3	193.00
SUM OF DISS. CONSTITUENT	400.82	TOTAL ALKALINITY AS CACO3	213.24
FIELD CNDUCTVY, MICROMHOS	413.	FIELD ALKALINITY AS CACO3	
LAB CNDUCTVY, MICROMHOS	425.	RYZNAR STABILITY INDEX	7.45
FIELD PH	7.21	LANGLIER SATURATION INDEX	-0.03
LABORATORY PH	7.40	SODIUM ADSORPTION RATIO	0.58

PARAMETER	VALUE	PARAMETER	VALUE
FIELD TEMP, AIR	24. C	FIELD TEMP, WATER	9.5 C
ALUMINUM, DISS (UG/L-AL)	<30.	NICKEL,DISS (UG/L AS NI)	20.
SILVER, DISS(UG/L AS AG)	<2.	PHOSPHATE,TO,DIS(MG/L-P)	<.1
BORON,DISS (UG/L AS B)	<20.	STRONTIUM,DISS (UG/L-SR)	330.
CADMIUM,DISS(UG/L AS CD)	<2.	TITANIUM DIS(UG/L AS TI)	7.
CHROMIUM, DISS (UG/L-CR)	2.	VANADIUM,DISS(UG/L AS V)	26.
COPPER,DISS (UG/L AS CU)	21.	ZINC, DISS (UG/L AS ZN)	210.
LITHIUM,DISS(UG/L AS LI)	10.	ZIRCONIUM DIS(UG/L AS ZR	<4.
MOLYBDENUM,DISS(UG/L-MO)	<20.	BROMIDE,DISS(MG/L AS BR)	<.1
O-PHOSPHATE,DISS(MG/L-P)	.1		

REMARKS: OWNER'S ADDRESS: 1145 WILLOW CREEK ROAD, CORVALLIS, MT

EXPLANATION: MG/L = MILLIGRAMS PER LITER, UG/L = MICROGRAMS PER LITER, MEQ/L = MILLIEQUIVELENTS PER LITER, FT = FEET, MT = METERS, (M) = MEASURED, (E) = ESTIMATED, (R) = REPORTED, TR = TOTAL RECOVERABLE, TOT = TOTAL, BIO = BIOLOGICALLY AVAILABLE.

	QW	WA	S2	WI	OW	PW	AT	OTHER
OTHER AVAILABLE DATA		Y						

OTHER FILE NUMBERS:

PROJECT:
COST:
LAST EDIT DATE: 15-AUG-84 BY: TP *BCS
PROCESSING PROGRAM: F1730P V3 (09/1/83) PRINTED: 15-AUG-84

PERCENT MEQ/L (FOR PIPER PLOT)

CA	MG	NA	K	CL	SO4	HCO3	CO3
58.9	22.8	17.1	1.2	1.7	3.3	95.0	0.0

NOTE: IN CORRESPONDENCE, PLEASE REFER TO LAB NUMBER: 84Q0451

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE,MONTANA 59701 (406)496-4101

WATER QUALITY ANALYSIS
LAB NO. 8400444

STATE	MONTANA	COUNTY	RAVALLI
LATITUDE-LONGITUDE	46D18'18"N 114D05'42"W	SITE LOCATION	06N 20W 04*ADCC 01
UTM COORDINATES	Z N E	MBMG SITE	
TOPOGRAPHIC MAP	CORVALLIS 7 1/2'	STATION ID	461818114054201
GEOLOGIC SOURCE	120SDMS* *	* SAMPLE SOURCE	WELL
DRAINAGE BASIN	PE	LAND SURFACE ALTITUDE	3562. FT < 10
AGENCY + SAMPLER	UN *WCU	SUSTAINED YIELD	8. GPM
BOTTLE NUMBER		YIELD MEAS METHOD	REPORTED
DATE SAMPLED	22-JUN-84	TOTAL DEPTH OF WELL	100. FT (R)
TIME SAMPLED	12:00 HOURS	SWL ABOVE(-) OR BELOW GS	41.25 FT (M)
LAB + ANALYST	MBMG*GAL	CASING DIAMETER	6 IN (R)
DATE ANALYZED	19-JUL-84	CASING TYPE	STEEL
SAMPLE HANDLING	3120	COMPLETION TYPE	01*
METHOD SAMPLED	PUMPED	PERFORATION INTERVAL	
WATER USE	DOMESTIC AND STOCK		

SAMPLING SITE MCMILLAN, BOB * CORVALLIS, MT
GEOLOGIC SOURCE SEDIMENTS (TERTIARY)

		MG/L	MEQ/L			MG/L	MEQ/L
CALCIUM	(CA)	56.8	2.83	BICARBONATE	(HCO3)	194.	3.18
MAGNESIUM	(MG)	5.7	0.47	CARBONATE	(CO3)	0.	
SODIUM	(NA)	7.7	0.33	CHLORIDE	(CL)	6.5	0.18
POTASSIUM	(K)	2.8	0.07	SULFATE	(SO4)	11.1	0.23
IRON	(FE)	.004	0.00	NITRATE	(AS N)	.94	0.07
MANGANESE	(MN)	.002	0.00	FLUORIDE	(F)	.3	0.02
SILICA	(SIO2)	29.5		PHOSPHATE TOT	(AS P)		
TOTAL CATIONS			3.71	TOTAL ANIONS			3.68

STANDARD DEVIATION OF ANION-CATION BALANCE (SIGMA) -0.21

CALCULATED DISSOLVED SOLIDS	216.91	TOTAL HARDNESS AS CACO3	165.29
SUM OF DISS. CONSTITUENT	315.35	TOTAL ALKALINITY AS CACO3	159.11
FIELD CNDUCTVY, MICROMHOS	322.	FIELD ALKALINITY AS CACO3	
LAB CNDUCTVY, MICROMHOS	538.3	RYZNAR STABILITY INDEX	7.63
FIELD PH	7.46	LANGLIER SATURATION INDEX	-0.08
LABORATORY PH	7.46	SODIUM ADSORPTION RATIO	0.26

PARAMETER	VALUE	PARAMETER	VALUE
FIELD TEMP, AIR	19. C	FIELD TEMP, WATER	11.8 C
ALUMINUM, DISS (UG/L-AL)	30.	NICKEL,DISS (UG/L AS NI)	<10.
SILVER, DISS(UG/L AS AG)	<2.	PHOSPHATE,TO,DIS(MG/L-P)	.4
BORON,DISS (UG/L AS B)	<20.	STRONTIUM,DISS (UG/L-SR)	100.
CADMIUM,DISS(UG/L AS CD)	<2.	TITANIUM DIS(UG/L AS TI)	6.
CHROMIUM, DISS (UG/L-CR)	3.	VANADIUM,DISS(UG/L AS V)	6.
COPPER,DISS (UG/L AS CU)	14.	ZINC, DISS (UG/L AS ZN)	100.
LITHIUM,DISS(UG/L AS LI)	<2.	ZIRCONIUM DIS(UG/L AS ZR	<4.
MOLYBDENUM,DISS(UG/L-MO)	<20.	BROMIDE,DISS(MG/L AS BR)	<.1
O-PHOSPHATE,DISS(MG/L-P)	<.1		

REMARKS: OWNER'S ADDRESS: 876 NE HONEY HOUSE ROAD, CORVALLIS, MT

EXPLANATION: MG/L = MILLIGRAMS PER LITER, UG/L = MICROGRAMS PER LITER, MEQ/L = MILLIEQUIVELENTS PER LITER, FT = FEET, MT = METERS, (M) = MEASURED, (E) = ESTIMATED, (R) = REPORTED, TR = TOTAL RECOVERABLE, TOT = TOTAL, BIO = BIOLOGICALLY AVAILABLE.

	QW	WA	S2	WI	OW	PW	AT	OTHER
OTHER AVAILABLE DATA		Y						

OTHER FILE NUMBERS:

PROJECT:		COST:	
LAST EDIT DATE:	09-AUG-84	BY:	TP *BCS
PROCESSING PROGRAM:	F1730P V3 (09/1/83)	PRINTED:	09-AUG-84

PERCENT MEQ/L (FOR PIPER PLOT)

CA	MG	NA	K	CL	SO4	HCO3	CO3
76.4	12.6	9.0	1.9	5.1	5.4	38.5	0.0

NOTE: IN CORRESPONDENCE, PLEASE REFER TO LAB NUMBER: 8400444

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE,MONTANA 59701 (406)496-4101

WATER QUALITY ANALYSIS
LAB NO. 8400445

STATE	MONTANA	COUNTY	RAVALLI
LATITUDE-LONGITUDE	46D16'55"N 114D03'37"W	SITE LOCATION	06N 20W 14*BAAD 01
UTM COORDINATES	Z N E	MBMG SITE STATION ID	461655114033701
TOPOGRAPHIC MAP	CORVALLIS 7 1/2'	* SAMPLE SOURCE	WELL
GEOLOGIC SOURCE	120SDMS* *	LAND SURFACE ALTITUDE	3845. FT < 10
DRAINAGE BASIN	PE	SUSTAINED YIELD	20. GPM
AGENCY + SAMPLER	UM *WCU	YIELD MEAS METHOD	REPORTED
BOTTLE NUMBER		TOTAL DEPTH OF WELL	85. FT (R)
DATE SAMPLED	20-JUN-84	SWL ABOVE(-) OR BELOW GS	34.51 FT (M)
TIME SAMPLED	16:30 HOURS	CASING DIAMETER	6 IN (R)
LAB + ANALYST	MBMG*GAL	CASING TYPE	STEEL
DATE ANALYZED	19-JUL-84	COMPLETION TYPE	02*
SAMPLE HANDLING	3120	PERFORATION INTERVAL	40 TO 80 FT (R)
METHOD SAMPLED	PUMPED		
WATER USE	DOMESTIC AND STOCK		

SAMPLING SITE ANDERSON, TOM * CORVALLIS, MT
GEOLOGIC SOURCE SEDIMENTS (TERTIARY)

		MG/L	MEQ/L			MG/L	MEQ/L
CALCIUM	(CA)	69.3	3.46	BICARBONATE	(HCO3)	401.	6.57
MAGNESIUM	(MG)	25.1	2.06	CARBONATE	(CO3)	0.	
SODIUM	(NA)	39.4	1.71	CHLORIDE	(CL)	1.9	0.05
POTASSIUM	(K)	5.5	0.14	SULFATE	(SO4)	29.4	0.61
IRON	(FE)	.002	0.00	NITRATE	(AS N)	.97	0.07
MANGANESE	(MN)	.001	0.00	FLUORIDE	(F)	1.1	0.06
SILICA	(SIO2)	26.2		PHOSPHATE TOT	(AS P)		
TOTAL CATIONS			7.38	TOTAL ANIONS			7.36

STANDARD DEVIATION OF ANION-CATION BALANCE (SIGMA) -0.06

CALCULATED DISSOLVED SOLIDS	396.41	TOTAL HARDNESS AS CACO3	276.35
SUM OF DISS. CONSTITUENT	599.87	TOTAL ALKALINITY AS CACO3	328.89
FIELD CNDUCTVY, MICROMHOS	650.	FIELD ALKALINITY AS CACO3	
LAB CNDUCTVY, MICROMHOS	645.6	RYZNAR STABILITY INDEX	6.55
FIELD PH	7.65	LANGLIER SATURATION INDEX	0.59
LABORATORY PH	7.73	SODIUM ADSORPTION RATIO	1.03

PARAMETER	VALUE	PARAMETER	VALUE
FIELD TEMP. AIR	20.5 C	FIELD TEMP. WATER	9.8 C
ALUMINUM, DISS (UG/L-AL)	<30.	NICKEL,DISS (UG/L AS NI)	<10.
SILVER, DISS(UG/L AS AG)	<2.	PHOSPHATE,TO,DIS(MG/L-P)	<.1
BORON,DISS (UG/L AS B)	150.	STRONTIUM,DISS (UG/L-SR)	430.
CADMIUM,DISS(UG/L AS CD)	<2.	TITANIUM DIS(UG/L AS TI)	8.
CHROMIUM, DISS (UG/L-CR)	<2.	VANADIUM,DISS(UG/L AS V)	11.
COPPER,DISS (UG/L AS CU)	6.	ZINC, DISS (UG/L AS ZN)	150.
LITHIUM,DISS(UG/L AS LI)	9.	ZIRCONIUM DIS(UG/L AS ZR	<4.
MOLYBDENUM,DISS(UG/L-MO)	<20.	BROMIDE,DISS(MG/L AS BR)	<.1
O-PHOSPHATE,DISS(MG/L-P)	<.1		

REMARKS: OWNER'S ADDRESS: 501 WILLOW CREEK CROSS ROAD, CORVALLIS, MT

EXPLANATION: MG/L = MILLIGRAMS PER LITER, UG/L = MICROGRAMS PER LITER, MEQ/L = MILLIEQUIVELENTS PER LITER, FT = FEET, MT = METERS, (M) = MEASURED, (E) = ESTIMATED, (R) = REPORTED, TR = TOTAL RECOVERABLE, TOT = TOTAL, BIO = BIOLOGICALLY AVAILABLE.

	QW	WA	S2	WI	OW	PW	AT	OTHER
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PERCENT MEQ/L (FOR PIPER PLOT)

CA	MG	NA	K	CL	SO4	HCO3	CO3
46.9	28.0	23.2	1.9	0.7	8.5	90.8	0.0

NOTE: IN CORRESPONDENCE, PLEASE REFER TO LAB NUMBER: 8400445

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE,MONTANA 59701 (406)496-4101

WATER QUALITY ANALYSIS
LAB NO. 8400442

STATE	MONTANA	COUNTY	RAVALLI
LATITUDE-LONGITUDE	46D19'42"N 114D03'38"W	SITE LOCATION	07N 20W 26*CDD 01
UTM COORDINATES	Z N E	MBMG SITE	
TOPOGRAPHIC MAP	CORVALLIS 7 1/2'	STATION ID	461942114033801
GEOLOGIC SOURCE	1208DMS* *	* SAMPLE SOURCE	WELL
DRAINAGE BASIN	PE	LAND SURFACE ALTITUDE	3740 FT < 10
AGENCY + SAMPLER	UM *WCU	SUSTAINED YIELD	15. GPM
BOTTLE NUMBER		YIELD MEAS METHOD	REPORTED
DATE SAMPLED	22-JUN-84	TOTAL DEPTH OF WELL	105. FT (R)
TIME SAMPLED	16:30 HOURS	SWL ABOVE(-) OR BELOW GS	55.79 FT (M)
LAB + ANALYST	MBMG*GAL	CASING DIAMETER	6 IN (R)
DATE ANALYZED	19-JUL-84	CASING TYPE	STEEL
SAMPLE HANDLING	3120	COMPLETION TYPE	02*
METHOD SAMPLED	PUMPED	PERFORATION INTERVAL	97 TO 102 FT (R)
WATER USE	DOMESTIC		

SAMPLING SITE COURTNEY, BILL * CORVALLIS, MT
GEOLOGIC SOURCE SEDIMENTS (TERTIARY)

		MG/L	MEQ/L			MG/L	MEQ/L
CALCIUM	(CA)	46.2	2.31	BICARBONATE	(HCO3)	228.	3.74
MAGNESIUM	(MG)	13.5	1.11	CARBONATE	(CO3)	0.	
SODIUM	(NA)	16.5	0.72	CHLORIDE	(CL)	3.	0.08
POTASSIUM	(K)	4.	0.10	SULFATE	(SO4)	8.5	0.18
IRON	(FE)	.003	0.00	NITRATE	(AS N)	.51	0.04
MANGANESE	(MN)	.010	0.00	FLUORIDE	(F)	.8	0.04
SILICA	(SIO2)	44.8		PHOSPHATE TOT	(AS P)		
TOTAL CATIONS			4.24	TOTAL ANIONS			4.08

STANDARD DEVIATION OF ANION-CATION BALANCE (SIGMA) -0.96

CALCULATED DISSOLVED SOLIDS	250.14	TOTAL HARDNESS AS CACO3	170.93
SUM OF DISS. CONSTITUENT	365.82	TOTAL ALKALINITY AS CACO3	187.00
FIELD CNDUCTVY, MICROMHOS	380.	FIELD ALKALINITY AS CACO3	
LAB CNDUCTVY, MICROMHOS	371.5	RYZNAR STABILITY INDEX	7.52
FIELD PH	7.53	LANGLIER SATURATION INDEX	0.05
LABORATORY PH	7.61	SODIUM ADSORPTION RATIO	0.55

PARAMETER	VALUE	PARAMETER	VALUE
FIELD TEMP, AIR	19.8 C	FIELD TEMP, WATER	10.8 C
ALUMINUM, DISS (UG/L-AL)	<30.	NICKEL,DISS (UG/L AS NI)	10.
SILVER, DISS(UG/L AS AG)	2.	PHOSPHATE,TO,DIS(MG/L-P)	1.5
BORON,DISS (UG/L AS B)	30.	STRONTIUM,DISS (UG/L-SR)	110.
CADMIUM,DISS(UG/L AS CD)	<2.	TITANIUM DIS(UG/L AS TI)	6.
CHROMIUM, DISS (UG/L-CR)	<2.	VANADIUM,DISS(UG/L AS V)	23.
COPPER,DISS (UG/L AS CU)	5.	ZINC, DISS (UG/L AS ZN)	90.
LITHIUM,DISS(UG/L AS LI)	12.	ZIRCONIUM DIS(UG/L AS ZR)	<4.
MOLYBDENUM,DISS(UG/L-MO)	<20.	BROMIDE,DISS(MG/L AS BR)	<.1
O-PHOSPHATE,DISS(MG/L-P)	<.1		

REMARKS: OWNER'S ADDRESS: 792 QUAST LANE, CORVALLIS, MT
LAB: FU CA 44.6 MG/L GIVES 4.16 MEQ/L CATIONS FOR -.48 SIGMA *

EXPLANATION: MG/L = MILLIGRAMS PER LITER, UG/L = MICROGRAMS PER LITER, MEQ/L = MILLIEQUIVELENTS PER LITER. FT = FEET, MT = METERS. (M) = MEASURED, (E) = ESTIMATED, (R) = REPORTED. TR = TOTAL RECOVERABLE. TOT = TOTAL. BIO = BIOLOGICALLY AVAILABLE.

	QW	WA	S2	WI	OW	PW	AT	OTHER
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PERCENT MEQ/L (FOR PIPER PLOT)

CA	MG	NA	K	CL	SO4	HCO3	CO3
54.4	26.2	16.9	2.4	2.1	4.4	93.5	0.0

NOTE: IN CORRESPONDENCE, PLEASE REFER TO LAB NUMBER: 8400442

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE,MONTANA 59701 (406)496-4101

WATER QUALITY ANALYSIS
LAB NO. 8400446

STATE	MONTANA	COUNTY	RAVALLI
LATITUDE-LONGITUDE	46D20'38"N 114D03'35"W	SITE LOCATION	07N 20W 23*DCBB 01
UTM COORDINATES	Z N E	MBMG SITE	
TOPOGRAPHIC MAP	CORVALLIS 7 1/2'	STATION ID	462038114032501
GEOLOGIC SOURCE	110ALVM*120SDMS*	* SAMPLE SOURCE	WELL
DRAINAGE BASIN	PE	LAND SURFACE ALTITUDE	372D. FT < 10
AGENCY + SAMPLER	UM *WCU	SUSTAINED YIELD	12. GPM
BOTTLE NUMBER		YIELD MEAS METHOD	REPORTED
DATE SAMPLED	22-JUN-84	TOTAL DEPTH OF WELL	78. FT (R)
TIME SAMPLED	15:30 HOURS	SWL ABOVE(-) OR BELOW GS	34.75 FT (M)
LAB + ANALYST	MBMG*GAL	CASING DIAMETER	6 IN (R)
DATE ANALYZED	19-JUL-84	CASING TYPE	STEEL
SAMPLE HANDLING	3120	COMPLETION TYPE	02*
METHOD SAMPLED	PUMPED	PERFORATION INTERVAL	68 TO 73 FT (R)
WATER USE	DOMESTIC		

SAMPLING SITE CALDWELL, TONY * CORVALLIS, MT
GEOLOGIC SOURCE ALLUVIUM (QUATERNARY)

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	61.6	3.07	BICARBONATE (HCO3)	342.	5.61
MAGNESIUM (MG)	18.	1.48	CARBONATE (CO3)	0.	
SODIUM (NA)	28.2	1.23	CHLORIDE (CL)	1.5	0.04
POTASSIUM (K)	5.2	0.13	SULFATE (SO4)	7.	0.15
IRON (FE)	.008	0.00	NITRATE (AS N)	.67	0.05
MANGANESE (MN)	.001	0.00	FLUORIDE (F)	1.1	0.06
SILICA (SIO2)	47.6		PHOSPHATE TOT (AS P)		
TOTAL CATIONS		5.92	TOTAL ANIONS		5.90

STANDARD DEVIATION OF ANION-CATION BALANCE (SIGMA) -0.09

CALCULATED DISSOLVED SOLIDS	339.35	TOTAL HARDNESS AS CACO3	227.90
SUM OF DISS. CONSTITUENT	512.80	TOTAL ALKALINITY AS CACO3	280.50
FIELD CNDUCTVY, MICROMHOS	502.	FIELD ALKALINITY AS CACO3	
LAB CNDUCTVY, MICROMHOS	513.6	RYZNAR STABILITY INDEX	6.82
FIELD PH	7.72	LANGLIER SATURATION INDEX	0.44
LABORATORY PH	7.70	SODIUM ADSORPTION RATIO	0.81

PARAMETER	VALUE	PARAMETER	VALUE
FIELD TEMP, AIR	21.5 C	FIELD TEMP, WATER	11.5 C
ALUMINUM, DISS (UG/L-AL)	<30.	NICKEL,DISS (UG/L AS NI)	<10.
SILVER, DISS(UG/L AS AG)	<2.	PHOSPHATE,TO,DIS(MG/L-P)	.2
BORON,DISS (UG/L AS B)	70.	STRONTIUM,DISS (UG/L-SR)	170.
CADMIUM,DISS(UG/L AS CD)	<2.	TITANIUM DIS(UG/L AS TI)	7.
CHROMIUM, DISS (UG/L-CR)	3.	VANADIUM,DISS(UG/L AS V)	41.
COPPER,DISS (UG/L AS CU)	6.	ZINC, DISS (UG/L AS ZN)	70.
LITHIUM,DISS(UG/L AS LI)	15.	ZIRCONIUM DIS(UG/L AS ZR	<4.
MOLYBDENUM,DISS(UG/L-MO)	<20.	BROMIDE,DISS(MG/L AS BR)	<.1
O-PHOSPHATE,DISS(MG/L-P)	<.1		

REMARKS: THICK MINERAL DEPOSIT IN TEA KETTLE
OWNER'S ADDRESS: 1420 SUMMERDALE ORCHARD LANE, CORVALLIS, MT

EXPLANATION: MG/L = MILLIGRAMS PER LITER, UG/L = MICROGRAMS PER LITER, MEQ/L = MILLIEQUIVELENTS PER LITER. FT = FEET, MT = METERS. (M) = MEASURED, (E) = ESTIMATED, (R) = REPORTED. TR = TOTAL RECOVERABLE. TOT = TOTAL. BIO = BIOLOGICALLY AVAILABLE.

	QW	WA	S2	WI	OW	PW	AT	OTHER
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PERCENT MEQ/L (FOR PIPER PLOT)

CA	MG	NA	K	CL	SO4	HCO3	CO3
52.0	25.0	20.7	2.3	0.7	2.5	96.8	0.0

NOTE: IN CORRESPONDENCE, PLEASE REFER TO LAB NUMBER: 8400446

MONTANA BUREAU OF MINES AND GEOLOGY
BUTTE,MONTANA 59701 (406)496-4101

WATER QUALITY ANALYSIS
LAB NO. 8400450

STATE	MONTANA	COUNTY	RAVALLI
LATITUDE-LONGITUDE	46D19'24"N 114D02'55"W	SITE LOCATION	07N 20W 36*BBCC 01
UTM COORDINATES	Z N E	MBMG SITE	
TOPOGRAPHIC MAP	CORVALLIS 7 1/2'	STATION ID	461924114025501
GEOLOGIC SOURCE	* *	* SAMPLE SOURCE	DITCH OR CANAL
DRAINAGE BASIN	PE	LAND SURFACE ALTITUDE	3880. FT < 10
AGENCY + SAMPLER	UM *WCU	WATER FLOW RATE	
BOTTLE NUMBER		FLOW MEAS METHOD	
DATE SAMPLED	22-JUN-84	STAFF GAGE	
TIME SAMPLED	17:30 HOURS	STREAM STAGE	
LAB + ANALYST	MBMG*GAL	DEPTH TO SAMPLE	.8 FT (E)
DATE ANALYZED	19-JUL-84	TOTAL DEPTH OF WATER	5. FT (E)
SAMPLE HANDLING	3120	STREAM WIDTH	
METHOD SAMPLED	GRAB		
WATER USE	IRRIGATION		

SAMPLING SITE BITTERROOT IRRIGATION COMPANY
DRAINAGE BASIN BITTERROOT RIVER

	MG/L	MEQ/L		MG/L	MEQ/L
CALCIUM (CA)	5.2	0.26	BICARBONATE (HCO3)	24.4	0.40
MAGNESIUM (MG)	.8	0.07	CARBONATE (CO3)	0.	
SODIUM (NA)	1.3	0.06	CHLORIDE (CL)	.3	0.01
POTASSIUM (K)	.5	0.01	SULFATE (SO4)	.8	0.02
IRON (FE)	.004	0.00	NITRATE (AS N)	.02	0.00
MANGANESE (MN)	.001	0.00	FLUORIDE (F)	<.1	
SILICA (SIO2)	6.0		PHOSPHATE TOT (AS P)		
TOTAL CATIONS		0.39	TOTAL ANIONS		0.43

STANDARD DEVIATION OF ANION-CATION BALANCE (SIGMA) 0.28

CALCULATED DISSOLVED SOLIDS	26.94	TOTAL HARDNESS AS CACO3	16.28
SUM OF DISS. CONSTITUENT	39.33	TOTAL ALKALINITY AS CACO3	20.01
FIELD CNDUCTVY, MICROMHOS	37.	FIELD ALKALINITY AS CACO3	
LAB CNDUCTVY, MICROMHOS	40.5	RYZNAR STABILITY INDEX	11.89
FIELD PH	7.91	LANGLIER SATURATION INDEX	-2.40
LABORATORY PH	7.08	SODIUM ADSORPTION RATIO	0.14

PARAMETER	VALUE	PARAMETER	VALUE
FIELD TEMP. AIR	19. C	FIELD TEMP. WATER	14.5 C
ALUMINUM, DISS (UG/L-AL)	<30.	NICKEL,DISS (UG/L AS NI)	<10.
SILVER, DISS(UG/L AS AG)	<2.	PHOSPHATE,TO,DIS(MG/L-P)	<.1
BORON,DISS (UG/L AS B)	20.	STRONTIUM,DISS (UG/L-SR)	22.
CADMIUM,DISS(UG/L AS CD)	<2.	TITANIUM DIS(UG/L AS TI)	<1.
CHROMIUM, DISS (UG/L-CR)	<2.	VANADIUM,DISS(UG/L AS V)	4.
COPPER,DISS (UG/L AS CU)	<2.	ZINC, DISS (UG/L AS ZN)	<3.
LITHIUM,DISS(UG/L AS LI)	<2.	ZIRCONIUM DIS(UG/L AS ZR	<4.
MOLYBDENUM,DISS(UG/L-MO)	<20.	BROMIDE,DISS(MG/L AS BR)	<.1
O-PHOSPHATE,DISS(MG/L-P)	<.1		

REMARKS: BIG DITCH IS MAJOR CONTRIBUTOR TO GROUND WATER SUPPLIES * SAMPLED NEAR SOFT ROCK CANYON DITCH OVERPASS *

EXPLANATION: MG/L = MILLIGRAMS PER LITER, UG/L = MICROGRAMS PER LITER, MEQ/L = MILLIEQUIVELENTS PER LITER. FT = FEET, MT = METERS. (M) = MEASURED, (E) = ESTIMATED, (R) = REPORTED. TR = TOTAL RECOVERABLE. TOT = TOTAL. BIO = BIOLOGICALLY AVAILABLE.

OW WA S2 WI OW PW AT OTHER

OTHER AVAILABLE DATA
OTHER FILE NUMBERS:

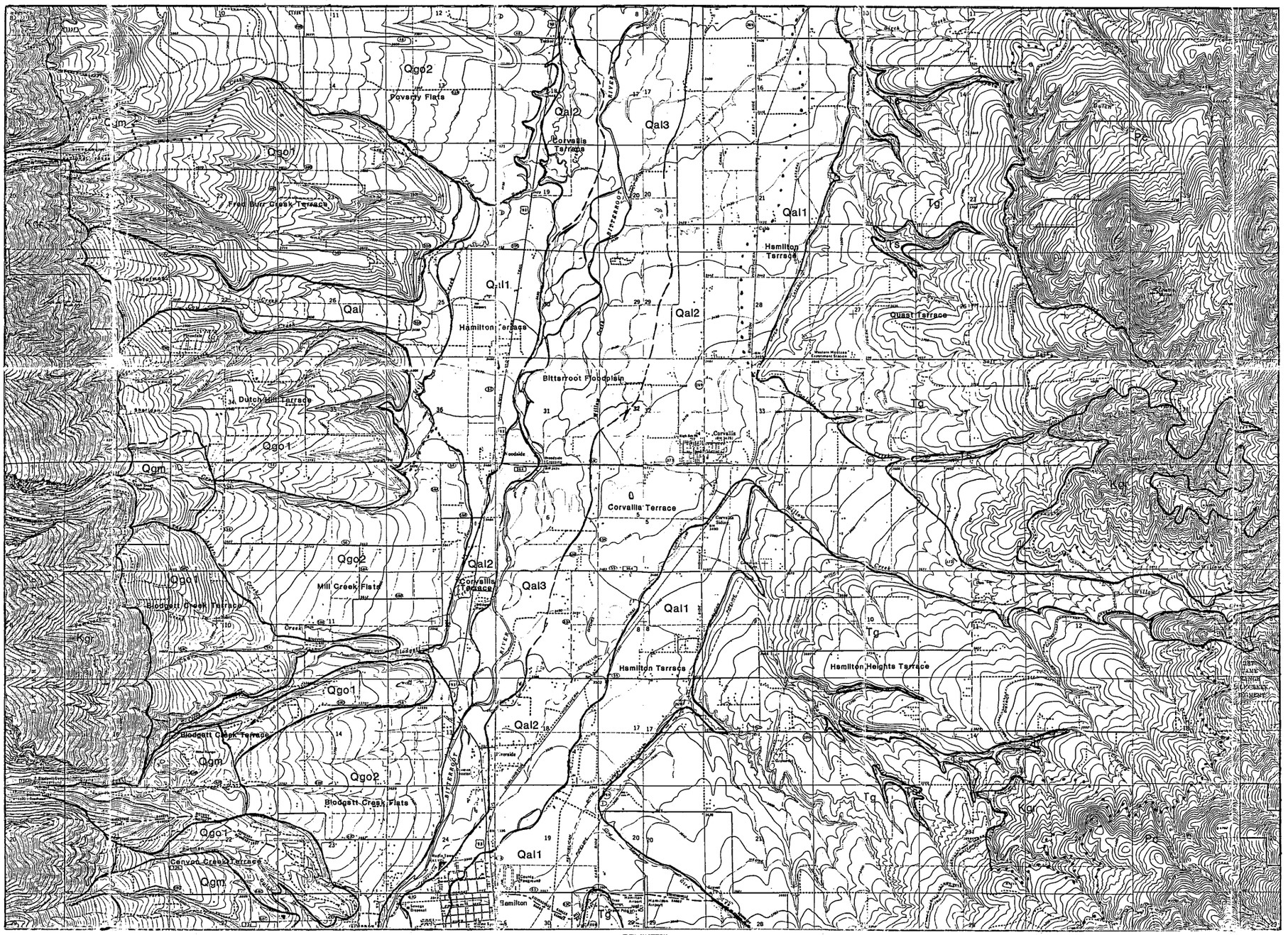
PROJECT: COST:
LAST EDIT DATE: 09-AUG-84 BY: TP *BCS
PROCESSING PROGRAM: F1730P V3 (09/1/83) PRINTED: 09-AUG-84

PERCENT MEQ/L (FOR PIPER PLOT)

CA	MG	NA	K	CL	SO4	HCO3	CO3
65.7	16.7	14.3	3.3	2.0	3.9	94.1	0.0

NOTE: IN CORRESPONDENCE, PLEASE REFER TO LAB NUMBER: 8400450

PLATE 1: SURFICIAL GEOLOGY OF HAMILTON NORTH AND CORVALLIS QUADRANGLES, BITTERROOT VALLEY



EXPLANATION

Qal1 Quaternary river terrace alluvium, older; pebble gravel; well-rounded; poorly-sorted; interbedded silt and clays.

Qal2 Quaternary river terrace alluvium, younger; pebble-cobble gravel; well-rounded; poorly-sorted; interbedded silt and clays.

Qal3 Quaternary-Recent floodplain; well-rounded cobble gravel and sand mixes, locally contains lenses of silt.

Qgm Quaternary glacial moraine, heterogeneous mixture of rock fragments as large boulders in a clay and silt matrix.

Qgo1 Quaternary glacial outwash, older; poorly-sorted, rounded to sub-rounded gravels in matrix of grus and clay.

Qgo2 Quaternary glacial outwash, younger; moderately well-sorted; well-rounded cobbles and boulders in a coarse sandy matrix; some clay lenses.

Tg Tertiary Sixmile Creek Formation equivalents; alluvial fan deposits; heterogeneous mixture of interbedded lenses of pebble- to cobble fragments in sandy matrix; contains local lenses of clay and silt.

Ts Tertiary Renova Formation equivalents; lacustrine and fluvial deposits; clays and silts containing much volcanic ash; massive, light-brown; occasional thin-thick pebble lenses.

Kgr Cretaceous granite, undifferentiated.

Pc Precambrian bedrock, undifferentiated.

SCALE: 1:24,000

1 mile

N