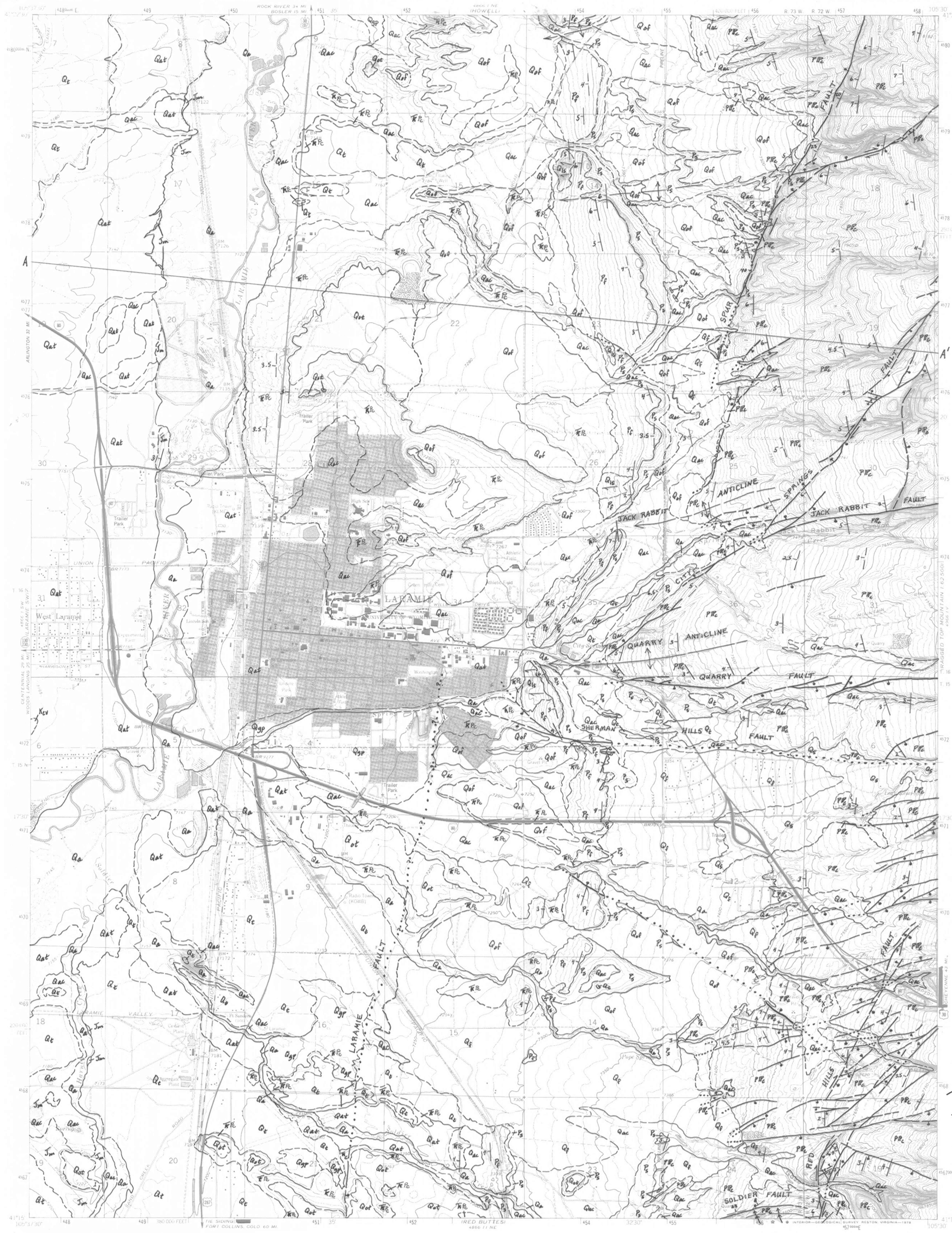
WYOMING STATE GEOLOGICAL SURVEY
Gary B. Glass, State Geologist

PRELIMINARY GEOLOGIC MAP 95-1
Laramie Quadrangle
Albany County, Wyoming

PGM-95-1



EXPLANATION

SEDIMENTARY ROCKS AND SURFICIAL DEPOSITS

QUATERNARY

Qa **Alluvial deposits**
Unconsolidated and poorly consolidated clay, silt, sand, and gravel, mainly in floodplains and lowest stream terraces. Thickness 0 to 25 feet.

Qac **Mixed alluvium and colluvium**
Sand, silt, clay, and gravel deposited mainly along intermittent streams; includes slope wash and smaller alluvial fan deposits that coalesce with alluvium. Thickness approximately 0 to 20 feet.

Qat **Mixed alluvium and terrace deposits**
Unconsolidated and poorly consolidated clay, silt, sand, and gravel, representing a transition zone between alluvium and terrace deposits, mainly adjacent to the Laramie River. Thickness approximately 0 to 30 feet.

Qs **Windblown sand deposits**
Active and stabilized dunes, made up of very fine- to fine-grained sand. Although numerous unmapped small-scale examples occur within the map area, the only mapped example occurs in the south portion of the Sherman Hills development east of Laramie. Thickness approximately 0 to 15 feet.

Qf **Alluvial fan deposits**
Poorly sorted clay, silt, and gravel; crudely bedded to nonbedded. Appear to be active receiving sediments from intermittent streams flowing off of the Laramie Range. May have some debris flow component. Grade into terrace deposits toward west, approaching the Laramie River. Locally, grade into alluvium and colluvium. Thickness approximately 0 to 25 feet.

Qt **Terrace deposits**
Beds of coarse sand and gravel with occasional boulders and lenses of silt and clay. Includes fragments of weathered granite and limestone cobbles, predominance varies depending on source of feeding stream. Occur along present drainages, a few feet to over 35 feet above modern flood plains. Thickness approximately 0 to 10 feet.

Qls **Landslide deposits**
Blocks of bedrock or loose slope debris; arrows point in the inferred direction of movement. Occur in the Forelle Limestone, detaching at the contact with the underlying Satanka Shale.

Qgp **Gypsite deposits**
Unconsolidated clay-sized gypsum interbedded with red clay, sand, gravel, and limestone cobbles. Located in stream valleys immediately west of the Laramie Fault, probably related to erosion of gypsum beds of the lower Chugwater Formation which were brought to the surface or near surface by the Laramie Fault. These deposits were mined for cement plaster near the turn of the century. Thickness 0 to 10 feet.

Qof **Older alluvial fan deposits**
Poorly sorted clay, silt, sand and gravel; crudely bedded to nonbedded with some debris flow component. Limestone cobbles are common. Currently inactive and dissected, often occurring as erosional remnants. Grade into older terrace deposits toward the west, in the northern part of the map area. Thickness 0 to 30 feet.

Qot **Older terrace deposits**
Beds of coarse sand and gravel with occasional boulders and lenses of silt and clay. Limestone cobbles are common. Often occur as erosional remnants ranging from 20 to 100 feet above present stream floodplains. Some remnants may actually be older alluvial fan remnants. Thickness 0 to 10 feet.

UNCONFORMITY

LOWER CRETACEOUS

Kcv **Cloverly Formation (Lower Cretaceous)**
Basal tan to white coarse-grained sandstone and chert pebble conglomerate, locally crossbedded and overlain by varigated buff and purple claystones interbedded with thin black shale beds, and an upper gray to buff to brown, fine- to coarse-grained sandstone, crossbedded in lower portion. Thickness 100 to 120 feet.

UNCONFORMITY

JURASSIC

Jm **Morrison Formation (Upper and Middle Jurassic)**
Pale-green, olive-green, blue-green to maroon and chalky white variegated calcareous and bentonitic claystones interbedded with thin drab limestones and buff, non-resistant sandstones. Limestone, locally, contains orange to brown chert inclusions. A thin section of Sundance Formation may exist in the area, but due to few and poor exposures, it is mapped with the Morrison. Thickness 300 to 375 feet.

UNCONFORMITY

TRIASSIC

TRPc **Chugwater Formation (Triassic and Permian)**
Red shale and siltstone with interbedded red to salmon to buff, fine-grained sandstone. Lower portion of section contains red shale interbedded with thin to thick gypsum beds and banded wavy gypsiferous thin limestone, sometimes mistaken for part of the Forelle Limestone. This portion of the Chugwater along with the underlying Forelle Limestone and Sanianka Shale would be mapped as Goose Egg Formation, west of the Laramie Basin. Locally, some possible Jelm Formation sandstone erosional outliers may occur, but due to their lack of persistence they are mapped with the Chugwater. Thickness 650 to 800 feet.

PERMIAN

Pf **Forelle Limestone (Permian)**
Gray to purple, thin bedded, sparsely fossiliferous limestone locally interbedded with red siltstone and thin gypsum laminations. Wavy outcrops resembling algal structures common. Landslides are common on Forelle dip slopes with the unit detaching from the underlying Satanka Shale. Thickness 10 to 30 feet.

Ps **Satanka Shale (Permian)**
Red siltstone and shale (often banded with white and ocher color zones), soft sandstone, thin limestones, and local gypsum beds, especially near the top. Buff to orange to red, fine-grained sandstone with ripple marks common near base of unit. Gypsum beds in the Satanka are currently being mined near Red Buttes south of this map. Thickness 250 to 300 feet.

UNCONFORMITY

PENNSYLVANIAN

PPc **Casper Formation (Permian and Pennsylvanian)**
Buff to reddish, calcareous to quartzitic, very fine- to coarse-grained, well cemented subakosic sandstone interbedded with buff to purplish-gray limestone and dolomite beds, usually micritic and locally fossiliferous. Sandstone often exhibits large-scale festoon cross-bedding, increasing toward the south. As many as 10 different limestone or dolomite beds, which are locally quarried for cement or gravel uses, have been identified in the Laramie area. The Casper Formation serves as the prime aquifer in the Laramie area. Intertongues with underlying Fountain Formation, which is less than 50 feet thick and does not crop out in the map area. Thickness 600 to 700 feet.

MAP SYMBOLS

Formation contact
Dashed where approximately located.

Fault
Dashed where approximately located, dotted where concealed. Bar and ball on downthrown block; arrows indicate relative direction of oblique-slip movement.

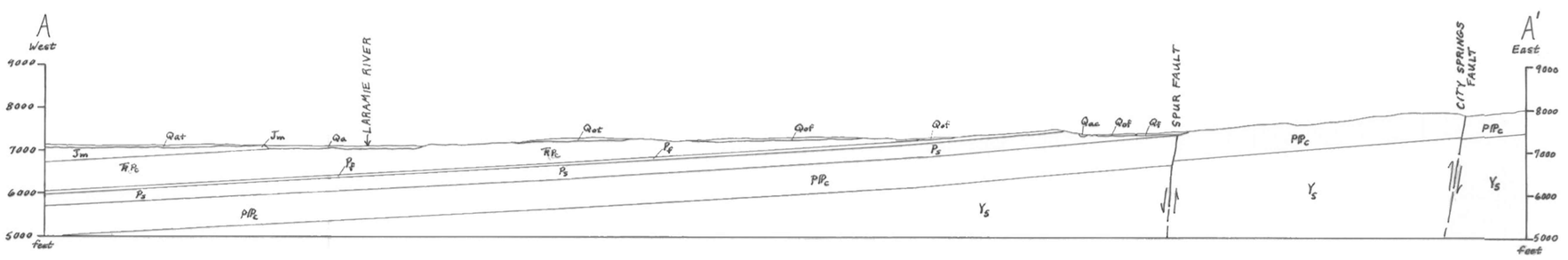
Anticline
Trace of axial plane and direction of plunge determined by field dip measurements and by photo interpretation. Dashed where approximately located.

Monocline
Trace of axial plane as determined by field measurements and by photo interpretation. Dashed where approximately located. Short arrow denotes steeper dipping limb.

Strike and dip of beds, showing angle of dip.

Strike and dip measurements from Lundy (1978).

Cross section location
Line of section. Sherman Granite (Middle Proterozoic)-**Ys**-is shown on the cross section only as it does not crop out in map area. Coarsely crystalline pink granite ranging in age from 1,414 to 1,435 Ma.



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PRELIMINARY GEOLOGIC MAP OF THE LARAMIE QUADRANGLE, ALBANY COUNTY, WYOMING

by
Alan J. Ver Ploeg

1995

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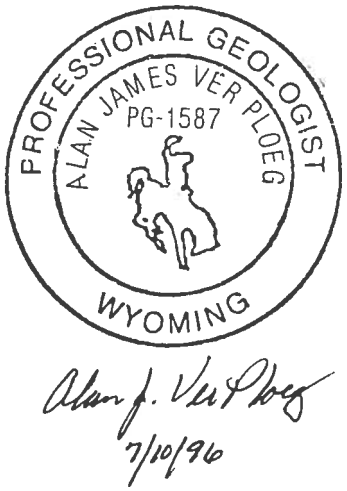

PRELIMINARY GEOLOGIC MAP
95-1

Laramie, Wyoming
1995

Overview of the Preliminary Geologic Map of the Laramie Quadrangle, Albany County, Wyoming

Introduction

The Preliminary Geologic Map of the Laramie Quadrangle represents the first in a series of 1:24,000-scale geologic maps developed to aid citizens, county and city planners, and local industry in incorporating basic geologic information into their planning and development efforts. This project emphasizes creating geologic maps at a detailed scale of the more populated areas within the State of Wyoming. The map provides information relating to mineral resources, groundwater resources, potential geologic hazards within the map area, and structural geology as it may relate to development and planning within the mapped area.

Mineral Resources

Mineral development within the Laramie Quadrangle centers primarily around sand and gravel production, limestone production, and, historically, gypsum and building stone production. Sand and gravel mining is typically associated with the Quaternary units mapped on the quadrangle, including but not restricted to alluvial deposits, mixed alluvial and colluvial deposits, mixed alluvial and terrace deposits, terrace deposits, and older terrace and alluvial fan deposits. Currently and recently active operations occur in older alluvial fan and terrace deposits northeast of Laramie, on the southwest edge of Laramie, and immediately south of Laramie. Additional mined areas occur in mixed alluvial and colluvial deposits north of Laramie, on the east side of the Laramie River.

Limestone production is restricted to the limestone units in the Casper Formation which crop out on the east side of the mapped area, on the flanks of the Laramie Mountains. The limestone is mined for concrete production needs, road gravel, and other types of construction aggregate. Historically, quarries have existed in numerous locations along the Laramie Mountains, east of the city of Laramie. Current and recently active quarries exist east of Laramie, on Quarry anticline, and southeast of the city.

Near the turn of the of the century, gypsum was mined from the gypsite deposit in south Laramie, immediately north of present-day I-80. The gypsum was used in plaster production. The sources for the gypsite deposit were the gypsum beds in the lower Chugwater Formation which were brought to a near surface position by the Laramie fault and subjected to Quaternary erosion. Local mining of the limestone in the Forelle Formation in east Laramie provided building stone for some of the buildings at Fort Sanders and in early Laramie City. Sandstone from the Casper Formation was quarried for the same purpose. "Old Main", along with several other buildings on the University of Wyoming campus, was built with sandstone quarried from the Casper Formation.

Groundwater Resources

The Casper Formation is the principal aquifer supplying water for municipal and private/domestic needs within the quadrangle. The formation consists of alternating sandstone and limestone, with the permeable sandstone serving as the aquifer and the limestones, unless highly fractured, serving as impermeable confining units. The Casper produces excellent water with low dissolved solids and excellent flows. The important recharge area for the Casper Formation is in the eastern part of the quadrangle on the flanks of the Laramie Mountains. In addition, some shallow wells produce from alluvial deposits and mixed alluvial and terrace deposits adjacent to the Laramie River. Other local aquifers of lesser importance include thin basal sands in the Satanka Shale, fractured limestone in the Forelle Limestone, and sands in the upper Chugwater Formation. These aquifers produce poor quality water, high in total dissolved solids with very limited flow potential. Wells producing from these aquifers are used primarily for livestock watering.

Potential Geologic Hazards

Potential geologic hazards within the Laramie Quadrangle are related to the Quaternary gypsite deposits, wind blown deposits, and possible landslides in the Forelle Limestone. The gypsite deposits occur west of the Laramie Fault in the Spring Creek and Soldier Creek drainages, south of Laramie. The deposits occur as a result of lower Chugwater Gypsum beds being brought near surface by the Laramie fault, coupled with Quaternary erosion of the beds and concurrent mixing with sediments from the east. Gypsite deposits may also exist near surface in the area including and adjacent to the Laramie Senior High School, as the Laramie fault may continue to the north through the city and beyond. However, poor outcrop exposures and human activity in the city make it difficult to determine the extent of the fault. The high solubility of the gypsum in these deposits make them quite susceptible to the formation of cavities and local resultant collapse features. High amounts of gypsum in the soil can inhibit plant growth and can react with untreated concrete causing disintegration. The location of these gypsite occurrences definitely needs to be considered in any plans for development within affected areas.

Windblown deposits occur locally, on a small-scale, throughout the eastern half of the quadrangle. The occurrence in the Sherman Hills development southeast of Laramie is the largest occurrence on the quadrangle. The deposits are made up of sand dunes which are for the most part stabilized by vegetation in the area. Care needs to be taken in development of these types of areas to prevent removal of too much vegetation, thereby de-stabilized the sand dunes and re-initiating migration of the dunes.

Landslides have been mapped in various parts of the quadrangle in the Forelle Limestone. The slides occur at the contact between the Forelle Limestone and the underlying Satanka Shale, where dip angles exceed 5 degrees. The slides noted on the map appear to be quite old and the potential for new slides is

probably rather remote. However, the Forelle could detach given the right combination of conditions including unusually wet weather, a steep dip slope, and, for example, removal of the toe of a slope. Consideration of this potential should be included in planning for development on or near Forelle outcrops with these characteristics.

Debris flow potential exists along the margins of mapped older alluvial fan and alluvial fan deposits. These areas become especially vulnerable during periods of abnormally high precipitation. This potential hazard should be considered in planning for development near these types of deposits.

Structural Geology

Rock units on the Laramie Quadrangle have a regional dip to the west off of the Laramie Mountains, of approximately 3-5 degrees, striking nearly north to south. This regional trend is interrupted locally by faulting and folding. Folding is in the form of mostly east-west trending anticlines and monoclines which plunge toward the west. The Quarry and Jack Rabbit anticlines and the lower hinge portion of Soldier monocline, in the southeast portion of the quadrangle, are typical examples of these folds.

Faults are quite common on the quadrangle and appear to have occurred in two episodes. The first episode, which probably occurred concurrent to the formation of the above folds, is represented by the predominantly north to northeast trending faults. Compressional stresses directed in a northeasterly direction probably created these features with the faults exhibiting strike-slip or horizontal motion in a right lateral sense, i.e., the west block of the fault moving toward the northeast relative to the east block, coupled with minor vertical motion. The northern segment of the Red Hills fault, which occurs in the southeast corner of the map, and the City Springs fault are examples of these types of faults.

A second, later episode of faulting is indicated by the east to west trending faults on the map. These faults occurred as a result of relaxation of the earlier compressional stresses, creating the east-west trending normal faults which are for the most part downthrown to the south. These faults commonly offset the earlier strike-slip faults or occur on the south flanks of east-west trending folds. The Sherman Hills and Jack Rabbit faults are examples.

The Laramie fault trends primarily north-south in the south and central portion of the map, continuing toward Red Buttes on the Red Buttes Quadrangle. This fault is not well exposed on the map but appears to be upthrown on the west side based on well data from water wells drilled adjacent to each other on opposing sides of the fault. In addition, the location of gypsum beds which led to the gypsite deposits noted on the west side of the fault can only be explained by reverse movement on the fault. Although no evidence was noted due to poor exposure, strike-slip motion is also a possibility on the Laramie fault as it is parallel to the Red Hills fault and may have been created by the same north-northeast directed stresses. The occurrence of gypsite deposits in the area

around Laramie Senior High School and immediately north of Laramie on trend with the Laramie fault indicates that it may continue toward the north through Laramie and beyond. The occurrence of numerous springs along the Laramie fault has made it a prime target for water well tests, along with the anticlinal folds which occur on the quadrangle, as they project basinward toward the west. The location and character of the structural features on the quadrangle can be instrumental in predicting the occurrence of water resources and potential geologic hazards in the Laramie area.