SANDERSON STEWART

URBAN PLANNING STUDY

FOR

TRACTS 2, 3, 4 AND 5 OF COS 234 2ND AMENDMENT
TRACT 6-A-1 OF AMENDED TRACTS 6-7 OF COS 234 2ND AMENDMENT
UNPLATTED N2SWNE & N2SENE OF SEC. 24, T01, R25E
BILLINGS, MONTANA

PREPARED FOR:
VIKING LAND, LLC 6844
FRONTAGE ROAD
BILLINGS, MT 59101

AND

CITY OF BILLINGS
210 N. 27TH STREET
BILLINGS, MT 59102

November 20, 2014
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Updated November 13, 2015
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Project Number: 11067.05

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Executive Summary

The Viking Land Urban Planning Study addresses the property at 6844 Frontage Road, encompassing six separate properties, all owned by Viking Land, LLC. The properties are:

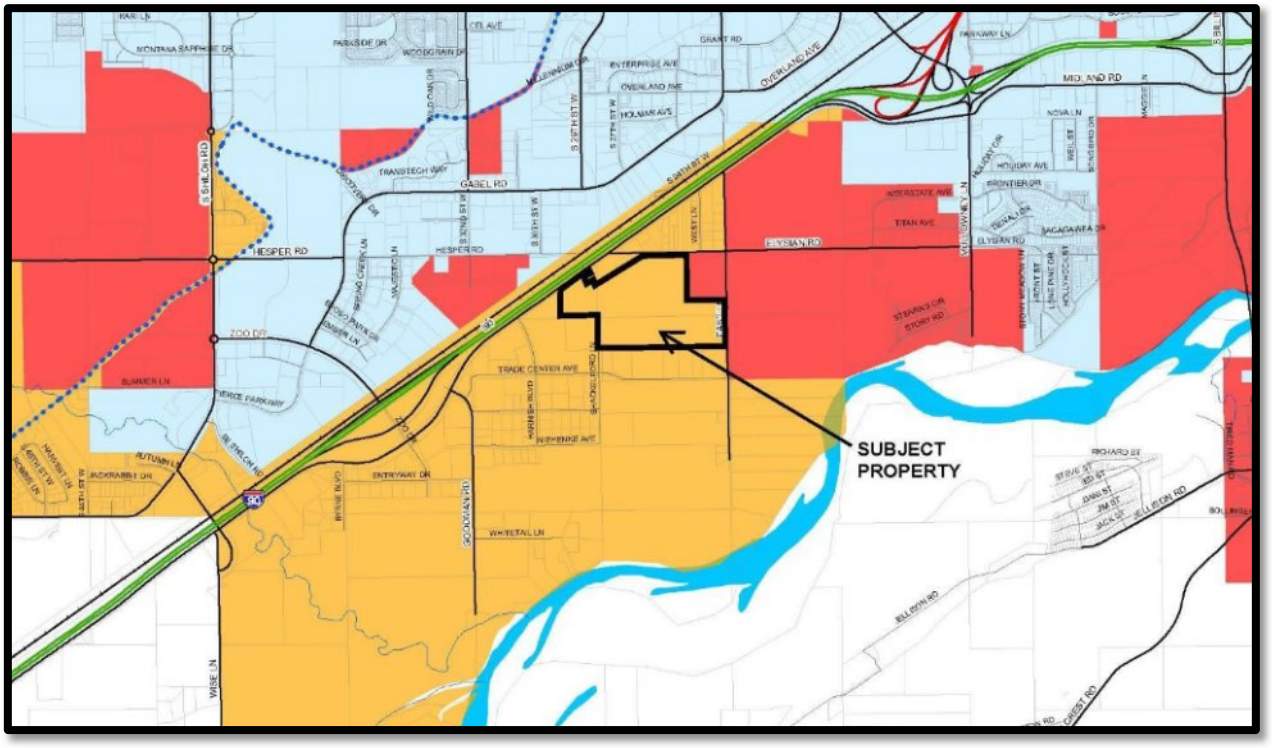
1. Tracts 2, 3, 4 and 5 of COS 234 2nd Amendment
2. Tract 6-A-1 of Amended Tracts 6-7 of COS 234 2nd Amendment
3. Unplatted N2SWNE & N2SENE of Sec. 24, T01, R25E

This study area is approximately 98 acres of land. The site is currently open agricultural land. However, changes in surrounding land uses as well as the future expansion of public water and sewer is advancing the need for planning of future land uses within this area of greater Billings.

Two Urban Planning Studies were completed in 2013 for nearby properties, the *Elysian Road/East Lane Plan* by McCall Homes and Sanderson Stewart, and the *Quarnburg Farming Corporation Study* by Morrison-Maierle. Information from those studies that are applicable to this study area will be referenced and noted.

It is requested that the City's Limits of Annexation Map be amended to locate the study area into the "Red Area", which would allow for future annexation. It would enable the property owner to begin future planning for this property.

A portion of the Limits of Annexation Map is shown with the study area indicated. It should be noted that the annexation map shown is as posted on the city's website, but is not current relative to



the area near the subject property. The Elysian school parcel as well as Harmony Meadows Subdivision to the east are now annexed.

Land Use

Existing

The study area encompasses approximately 98 acres of farmland and is zoned planned unit development (PUD) and controlled industrial (CI). In 2013, the owners of the property submitted a request to Yellowstone County and were granted a zone change to PUD for a portion of the study area. The Planned Development Agreement (PDA) between Viking Land, LLC and Yellowstone County outlines uses of the property, including a school purchase parcel, a school buffer zone surrounding the purchase parcel, and restricted uses on the remaining site. Elysian School has since purchased the property identified on the PUD site plan, and that site is not included in this urban planning study.

The use of the remaining property is agricultural for purposes of sod harvesting. Exhibit A shows an aerial exhibit of the study area.

Proposed

This area of Billings is rapidly changing, and the provision of city services and improvements will likely drive more growth to this area. The school buffer zone created as a part of the PDA will remain and would likely be a medium density residential, similar to nearby Josephine Crossing. The remaining property will be developed with permissible uses within the CI zone district and the PDA.

Projected and Estimated Population

In estimating the projected population, the PDA site plan was referenced for potential densities of residential uses and commercial activities. Exhibit C shows a proposed generalized land use plan. Approximately 15 acres is shown as residential, with the remaining 83 acres as commercial/industrial land use. It is anticipated that the residential portion of the subject property will develop with similar residential densities as Josephine Crossing, which is a mixed-use traditional neighborhood design with single family residential, some multi-family units, and a small component of neighborhood type commercial. The density for that development is approximately five units per gross acre. The Water and Wastewater Facilities Master Plan 2006 (Master Plan), prepared for the City of Billings by HDR, Inc., HKM, Inc., and JGA, Inc., assumes 2.3 persons per dwelling unit. Using this estimation, the buildout of the residential portion of the subject property would support and estimated population of about 172 residents (15 acres x 5 unit/ac. x 2.3 persons per dwelling unit).

The remaining property may be developed as allowed in the controlled industrial zone district.

Development Timelines

Development of the subject property would be a long term endeavor. Should the City move this property into the red area, the owners would begin to master plan the property for future use. Development would be phased as city services become available.

Land Characteristics

Topography and Geology

The study area covers approximately 98 acres of relatively level property just north of the Yellowstone River. It is not within the 100-year flood plain of the river. Elysian Road forms the study area's northern boundary, and Elysian School and East Lane lie along the easterly boundary.

Geologically, this area is part of the Qat2 unit, or alluvium of the second youngest alluvial terrace level. Generally speaking, this geologic unit is made up of gravel underlying terraces about 20 to 40 feet above present elevation of Yellowstone River. Mostly cobbles and pebbles with minor amounts of sand and silt are found, as well as clasts predominantly of granitic igneous rocks, granitic gneiss, schist, and quartzite with much less limestone and sandstone. This terrace is approximately forty to sixty feet thick.

Soils

According to the National Cooperative Soil Survey, there are two soil types in this study area. The predominant soil map unit in the area is Lohmiller (Lr). This soil unit presents good to fair topsoil with clayey material and is characterized by medium compressibility and expansion, low bearing capacity, moderate to high frost-action potential, moderately slow permeability, and a seasonally high water table if irrigated.

The second map unit found in a small area of the subject property is Keiser (Kh). It has similar characteristics as the Lohmiller soils; it provides a good source of topsoil to a depth of ten inches, and overall medium compressibility, low bearing capacity, high frost-action potential, moderately slow permeability, and high erodibility of embankments.

These soils are suitable for residential home construction and it is anticipated that conventional spread footings can be utilized for foundations. A detailed geotechnical investigation and report is typically required by the City of Billings at the time of subdivision of the property.

A copy of the Soils Resource Report is included in the appendix.

Effects on Agriculture

The study area is currently used for sod production. Based on the NRCS Soil Data Farmland Classification Map, this land is suitable for agriculture as classified by the NRCS soil data. Lands within the study area are considered prime farmland under certain circumstances if irrigated. Given the limited agricultural production and other commercial and residential uses nearby, the development of the study area at urban densities should have limited effects on agriculture. It is expected that development of this site would occur in phases, allowing for continuation of the agricultural use on some portion of the study area for the foreseeable future.

Historic Sites

The National Historic Preservation Act declared that the preservation of our irreplaceable heritage was in the nation's interest, and called upon federal agencies to partner with states, Indian tribes, local governments, and the public in a spirit of stewardship. Montana's State Antiquities Act also makes provision for the safeguarding of our collective heritage. The Montana State Historic

Preservation Office (SHPO) was created to ensure the State's cultural and historic resources are protected for future generations.

SHPO maintains a cultural resource annotated bibliography system. Some historic irrigation and farmstead facilities have been found in this area, although none particular to this study area. A historic/cultural study will be completed at the time of development of the study area.

Effects on Urbanization on the Existing Environment

Land adjacent to the study area has property that has already been developed or that is in a prime location for urban development. The expansion of city services to the area makes development viable and environmentally responsible. Elysian School recently expanded and remodeled their facility. Given the recent Elysian School expansion, it could be expected that the overall area will experience additional interest for development.

As urbanization occurs and city services become available, the existing environment can benefit. Use of a public sewer system and a public water system can mean increased water quality and quantity as fewer individual wells and drainfields are developed.

The surrounding properties, particularly those along the Frontage Road, have developed in a low density, haphazard way, because of the lack of public utilities. This area would benefit from availability of public water and sewer, which would allow for and encourage a higher density of development. Development of this site, as well as the sites to the east that were added to the red area earlier this year, can take development pressure off farther, more remote sections the County.

Public Service Evaluation

Water/Sewer Assumptions

If annexed, the subject area would receive public sanitary sewer and water services from the City.

In estimating the impacts on city services, the existing Josephine Crossing development was utilized to estimate the post development density. It is anticipated that the residential portion of this property will develop with similar density characteristics. The density is about five units per gross acre. The *Water and Wastewater Facilities Master Plan 2006* (Master Plan), prepared for the City of Billings by HDR, Inc., HKM, Inc., and JGA, Inc., assumes 2.3 persons per dwelling unit. Utilizing this estimation, the full build-out for the subject property would support an estimated population of about 173 residents. (15 acres x 5 units/acre x 2.3 persons per dwelling unit)
The Master Plan referenced the following information or assumptions, which were utilized in estimating the sewer and water impacts relating to the subject property.

1.	Average day per capita water use (gallons per day - gpd):	219.00
2.	Billings 2005 max. day water demand (million gallons per day - MGD):	43.20
3.	Average day to maximum day water use ratio:	2.20
4.	Max. day to peak day water use ratio:	1.50
5.	Average day per capita wastewater (WW) flow (gpd):	100.00
6.	Ave. maximum month to ave. month WW flow ratio:	1.17
7.	Billings 2000 max. month ave. day WW flow (MGD):	7.33
8.	Persons per dwelling unit:	2.30

From this information, the population density equals:

*Residential traditional neighborhood design: (5 du/ac) * (2.3 persons/du) = 11.5 persons/acre*

Water Service

Water service to the subject property can be provided by an extension from the 24-inch diameter main installed by City Work Order 14-13 in the summer of 2015. The 24-inch water main currently terminates just east of the West Lane, Elysian Road intersection and serves the Elysian School. The *Water and Wastewater Facilities Master Plan 2006* contemplates, the looping of the Zone 2 water distribution system by extension of one or possibly two trunk mains across Interstate 90. Options for the Interstate 90 crossings include 24th Street West, 32nd Street West, and associated with a potential satellite WTP, 48th Street West. Sanderson Stewart is under contract to the City of Billings for the design of the water main connecting loop in 24th Street West and East lane. This connection is included in the City's CIP for FY 2016.

The domestic water demand for the proposed residential portion of subject property is estimated based on the per capita water use times the population density for the anticipated nature of the development, similar to the existing Josephine Crossing.

For the commercial/industrial portion of the development, it is assumed that average daily demand will be 2,000 gpd/acre of developed property. Water demands from the subject property are summarized below:

Estimated Land Use	Area (acres)	Pop. Density (persons/ac)	Total Pop.	Ave. Day Demand (gpd)	Ave. Day Water Demand (gpd)	Max. Day/Ave. Day Water Demand Ratio	Max. Day Water Demand (MGD)
Residential	15	11.5	173	219/capita	37,887	2.20	0.080
Commercial/ Industrial	83	NA		2000/acre	166,000	2.20	0.370
Total	**98**				**203,881**	**2.20**	**0.45**

Treatment Capacity

Based on information within the Master Plan, the capacity of the Billings water treatment plant is 60 MGD. The year 2005 maximum day water day for the City of Billings was 43.2 MGD. Therefore, the maximum day water demand from the subject property (0.45 MGD) would represent 2.6 percent of the remaining (16.8 MGD) capacity of the water treatment plant: (based on the 2006 Master Plan)

*[0.45 MGD/(60 MGD – 43.2 MGD)] * 100% = 2.6%*

Storage Capacity

The subject property lies within the Pressure Zone 2 of the Billings water system. Water pumped to this zone is stored in elevated storage tanks and distributed to the users by gravity as water demand occurs. Based on the existing total storage capacity for Zone 2 is 9.0 million gallons (MG). The

amount of storage required is the sum of operational or equalizing storage (equal to 15-percent of peak day demand), emergency storage (equal to 1/2 of maximum day demand), and fire storage, which is per the Uniform Fire Code (UFC). Consistent with Table 3-7 of the Master Plan, the fire flow requirement for Zone 2 is assumed equal to 675,000 gallons. Therefore, the total volume of storage needed for the subject development would equal:

*[(0.45 MG *1.50)* 0.15] + (0.45 MG/2) + (0.675 MG) = 1.00 MG or 1,000,000 gallons*

The Master Plan states that the current Zone 2 storage volume requirement is 6.86 MG. Therefore, Zone 2 currently has a 2.64 MG storage surplus. Since 675,000 gallons of the required fire flow storage is already being provided by Zone 2 storage, the actual additional storage needed for the subject property would be equal to the operational storage plus the emergency storage, or approximately 0.326 MG. A storage volume of 326,000 gallons represents 12.3 percent of the Zone 2 surplus storage.

*(0.326 MG/2.64 MG) * 100% =12.3%*

From Table 3-13 of the Master Plan, the firm surplus pumping capacity of the pump stations feeding Zone 2 is 6.3 MGD. Therefore, all water demand requirements for the subject property can also be satisfied through pumping.

Pumping

Water to Zone 2 is pumped from high service pumps at the water treatment plant and from Willet pump station. As mentioned above, the firm surplus Zone 2 pumping capacity is 6.3 MGD. Therefore, the maximum day demand from the subject property (0.81 MGD) represents roughly 12.9-percent of the available Zone 2 firm surplus pumping capacity:

*(0.326 MGD / 6.3 MGD) * 100% = 5.2%*

Distribution

Adequate water pressure and the ability to convey required fire flows are dependent upon having adequately sized transmission and distribution mains. The Master Plan states that the transmission mains to this area in Zone 2 are adequate for future development, with water into the subdivision coming initially from the 16 and 24-inch main in Mullowney Lane and the planned 24-inch looping tie in East Lane and under Interstate 90.

Sanitary Sewer

Wastewater collection from the subject property can be provided by tying to the existing 8-inch lateral recently installed by City Work Order 14-13 in East Lane, adjacent to the property. The 8-inch lateral ties to the 24-inch trunk main also installed with Work Order 14-13.

Consistent with the determination of the water demand, sanitary sewer flows are estimated based on the per capita wastewater flow times the population density for the likely nature of the development. Wastewater flows from the subject property are summarized below:

Land Use	Acres	Pop. Density /acre	Total Pop.	Ave. Day Flow (gpd)	Ave. Day Flow (gpd)	Max. Demand Ratio	Max. Day Demand (gpd)
Residential	15	11.5	173	100/capita	17,300	1.17	20,241
Commercial/ Industrial	83			2,000/acre	166,000	1.17	194,220.00
Total	**98**				**183,300**	**1.17**	**214,461**
					(127 gpm)		

Treatment Capacity

The capacity of the Billings wastewater treatment plant is 26 MGD. The year 2000 maximum month average day City wastewater flow is 7.33 MGD. Therefore, maximum month average day wastewater flows from the subject property (0.21 MGD) would represent 1.1 percent of the available wastewater treatment plant capacity: (based on 2006 Master Plan)

*[(0.21 MGD)/(26 MGD – 7.33 MGD)] * 100% = 1.1%*

Upgrades to the treatment plant are currently in the design phase, with initial improvements anticipated in FY 2016. These improvements, when completed, will boost the plant capacity to 70MGD.

Collection

The City of Billings generally requires sewer mains to be sized with adequate capacity to convey design flows when flowing two-thirds full. A 24-inch sewer main constructed at minimum DEQ allowable slopes has a carrying capacity of approximately 2,269 gpm when flowing two-thirds full. Sanitary sewer design flows are typically equal to peak hourly flow conditions. Peak hour flows are estimated using an equation relating to the average flows and estimated population as outlined in DEQ design Circular DEQ-2. Based on an estimated population of 173 persons, this ratio equals approximately 1.81. Therefore, the peak hourly flow from the subject area equals:

*(127 gpm * 1.81) = 230 gpm*

Therefore, the design wastewater flow from the subject property would use approximately 10.1 percent of the carrying capacity of the 24-inch sewer constructed at minimum allowable slopes:

*(230 gpm / 2,269 gpm) * 100% = 10.1%*

DEQ requires that the internal collection system of a subject property be comprised of minimum 8-inch diameter collection mains. 8-inch diameter collection mains flowing two-thirds full at minimum allowable slopes have a capacity of approximately 270 gpm. The per capita peak hour wastewater flowrate based on 100 gpcd equals:

*[(100 gpcd / (1,440 minutes/day)] * 3.8 = 0.26 gpm per person*

Therefore, the population tributary to any 8-inch sewer cannot exceed the capacity of an 8-inch sewer flowing two-thirds or a larger sewer must be used. The design population for an 8-inch sewer equals:

270 gpm/0.26 gpm/person = 1038 persons

Stormwater Management

The subject property is currently farmland and slopes to the southeast where the runoff flows into the Yellowstone River. The design standards governing any future development within this study area are found in the City of Billings *Stormwater Management Manual (SWMM).*

The primary design requirements that would apply to any future subdivision development include:

- All subdivisions must evaluate the 100-year, 24 hour storm and ensure stormwater does not runoff the subdivision at a rate greater than the historic natural conditions runoff prior to development.
- Subdivisions must implement low impact development (LID) practices that infiltrate, evaporate, or capture for reuse the first 0.5-inch of rainfall from the 24 hour storm. The runoff from this storm must be entirely retained on site.

The storm drainage system for the subject property will comply with applicable standards at the time of subdivision review. Any project will require a detailed comprehensive drainage plan to be prepared at the time of development.

Solid Waste

Solid waste disposal facilities for the study area and the greater region are already provided by the City of Billings landfill located just south of the study area across the Yellowstone River off of Jellison Road. The City collection and disposal facility has the necessary capacity to continue to accept solid waste from this area upon further development. The landfill superintendent, Vester Wilson reports that the landfill currently has an estimated life expectancy of at least 40 years. According to Wilson, operational improvements continue to improve the efficiency of the landfill, which ultimately adds to the life expectancy.

A private hauler is currently serving portions of the study area. Consequently, the City of Billings might not assume responsibility for the solid waste collection to those areas for up to 5 years after annexation, under the provisions of 7-2-4736, MCA, which specifically states:

Preservation of existing garbage or solid waste service in the event of annexation. (1) A municipality that annexes or incorporates additional area receiving garbage and solid waste disposal service by a motor carrier authorized by the public service commission to conduct such service may not provide competitive or similar garbage and solid waste disposal service to any person or business located in the area for 5 years following annexation except: (a) upon a proper showing to the public service commission that the existing carrier is unable or refuses to provide adequate service to the annexed or incorporated area; or (b) after the expiration of 5 years, if a majority of the residents of the annexed or incorporated area sign a petition requesting the municipality to provide the service. (2) If a proper showing is made that the existing carrier is unable or refuses to provide adequate service to the annexed or incorporated area or, after the expiration of 5 years, if a majority of the residents sign a petition requesting service from the municipality, the municipality may provide garbage and solid waste disposal service to the entire annexed or incorporated area. (3) For the purposes of determining whether an existing motor carrier provides adequate service, those services provided by the carrier prior to annexation are considered adequate service.

If after five years the residents of the area were to petition for solid waste collection service from the City, the City would assume the responsibility and provide weekly service. Depending on the number of clients in the new service areas the Solid Waste Division may need to add additional staff and equipment.

Parks, Recreation, and Public Lands

Parks 2020: The Billings Parks, Recreations, and Open Space Plan (Parks2020) was adopted in 1997 by the City Council to establish a 20-year plan to guide future decision making regarding the community's parks, open spaces, and recreational opportunities. Parks2020 acknowledges that change in the community is inevitable and managing the change in order to provide parkland opportunities for current and future generations is the challenge. The goal of the park plan is to deal with the continual battle of doing more with less, and creating a sustainable park system that would "balance the diverse and sometimes competing objectives of social equality, the environment, and economics." Ultimately, it acknowledges that failure to actively pursue a plan would result in overall decline in recreational opportunity and quality of life for the Billings community.

A master plan map was created to illustrate the service areas for existing and recommended parks, and to create a spatial framework for planning. Service areas differ for different types of parks, including regional, community, neighborhood, and subdivision parks. All of the service areas overlap to create the park system which contains park lands with multiple user functions, including recreation, conservation, special uses, and multi-functional.

Nearby Parks

This study area has a few developed regional parks within the recommended 2.5-mile radius. Riverfront Park is the largest of them; it provides a wide range of recreational opportunities, including walking and jogging trails, picnic areas, water sports, volleyball, and horseshoes; and enjoyment of the Yellowstone River and natural surroundings. Riverfront Park is found north of the river and covers 600 acres of city-owned and state-leased property. Amend Park is also located nearby at the intersection of King Avenue East and South Billings Boulevard. It is 57 acres in size and provides a space for programmed sports events like soccer and other ball games.

Josephine Crossing, one and a half miles east of the subject properties, has a mix of small local pocket parks; a larger neighborhood park with swings, basketball, volleyball, an open programmable space for youth soccer or football, and a three season amphitheater and picnic shelter; as well as a gravel walking and biking trail that connects users to the Riverfront Park trail system.

Park and Recreation Needs

In the areas proposed for residential development, the subject property will develop recreational spaces that are integrated into the fabric and function of an urban neighborhood design. The Yellowstone Greenway Master Plan and the more recent Billings Area Bikeway and Trail Master Plan would also be used to incorporate a multiuse trail corridor, promoting connectivity of our Heritage Trail system, and building on the importance of citywide goals to improve multimodal transportation. Additionally, the *ZooMontana to Riverfronte Park Trail Feasibility Study (2014)* would be

used in evaluating trail planning. An overall master plan, showing proposed recreational and park areas, will be completed at the time of development of study area.

Public Safety

Police

If annexed, the study area would receive police protection from the City of Billings Police Department. The City of Billings Police Department is located at City Hall in the Billings Central Business District (approximately 5.5 miles from the study area). The Billings Operation Center located 2.5 miles east on Midland Road also functions as a police outpost.

Response time to the area would vary depending on the location of the mobile patrol unit in the general area at the time of need. If annexed, the study area would be included in an assigned area, or beat, for police officers. Police protection is already provided to the Holiday Business Park, Riverfront Pointe, Josephine Crossing Subdivisions, which are on the east side of Mullowney Lane from Midland Road south to the river. Recent annexation of the Elysian School also extends the service area west of Mullowney Lane. If annexed, this area would be adjacent to the recently annexed Elysian School.

The City of Billings Police Department 911 dispatch center currently receives between 4,500 and 10,000 calls per month, not including non-emergency calls, which are generally two to three times that amount. The 2014 Department Annual Report indicates the department received 84,011 calls for service, which was up 5.6 percent from the previous year. The City of Billings Police Department has indicated that expansion of the City limits would have an impact on its manpower and budget. In 2014, voters rejected a public safety mill levy that would have provided funding for additional police, firefighters, and dispatchers. Recently the City Council approved the hiring of additional police officers, funding the additional employees from city reserves. Also included as part of this discussion is possibly adding additional fire department personnel as well as an emergency services dispatcher.

Fire

The Billings Fire Department currently serves the study area as part of the Billings Urban Fire Service Area (BUFSA). Services provided include: fire suppression; emergency medical to residential subdivisions (Riverfront Pointe and Josephine Crossing) dispatch; communication services for local fire, police, and ambulance services; hazardous materials response, high angle and confined space rescue; vehicle accident extrication; fire investigations; building inspections; and fire education.

Fire Station No. 5 at 604 South 24th Street West is the closest station to the subject area at three miles from the subject area. Station No. 5 covers the southwest end of Billings and the BUFSA. The emergency vehicles at this station include Engine 5, Brush 5, Tender 5, and Reserve Engine 5. The maintenance shop is also located at Station 5.

According to the 2003 City of Billings Fire Department *Fire Station Location and Staffing Study,* in 2002 there was a response rate (inclusive of fire calls, emergency medical responses, and all other instances of dispatch) of approximately 85 incidents per 1,000 people (8,882 responses for the

104,000 population base including the BUFSA). Based on these statistics, the fire department could anticipate approximately six residential incidents per year within the study area, if residential development occurs, as estimated in the previous section.

As reported within the 2014 Annual Report, Station 5 had 1,846 incident responses in 2014, up by about 16 percent from the previous year. City Council has also recently taken action to add personnel to the fire department, including an additional full time training officer.

Emergency Medical Service

Billings Clinic at 2813 Ninth Avenue North and St. Vincent's Hospital at 1233 North 30th Street would provide routine and emergency medical services in the area. The hospitals are approximately 5.5 and 6 miles, respectively, from the study area. The ambulance service for the area would be provided by private industry (American Medical Response). The impact on city services, therefore, is expected to be minimal. American Medical Response indicated that the number of calls correlate with the type of development. Based upon current trends and the existing development, it is expected any increases in ambulance needs would be absorbed under the incremental growth processes that have been previously discussed. It is expected that most of the calls would be related to traffic issues as the area becomes more crowded, with more calls during the early morning and late afternoon. The impact to the provider and their ability to provide timely service, as required by city ordinance, would become increasingly difficult with the expansion of the City limits. American Medical Response, with its existing locations, cannot meet response time requirements for the entire urban planning area. Just as has occurred with the fire department, American Medical Response will need to review new dispatch locations in order to maintain the required response times. As this service is provided through the private sector, free market enterprise will continue to dictate expansion needs.

Public Schools

Public schools have a number of purposes. They educate the children, but their role within the community goes much deeper. The 2004-2005 Twenty Year School Facilities Planning Committee acknowledged in its July 2005 report that, while public education plays an essential role in enriching the personal and inner lives of children, it is also true that the community expects public schools to prepare students for lives as future taxpayers, job holders, and positive forces in the social fabric of the community. This is probably one of the most important roles an institution can have.

This responsibility comes with a host of critical resources that are necessary for its success, including facilities, staff, curriculum, equipment, supplies, and securing funding for it all. When evaluating opportunities or challenges for accommodating community growth, a schools available student capacity is a basic indicator that can be used. Presumably, student capacity will take into account all of the necessary operational components for a school.

Existing and future school children in this area are served by School District No. 23 (Elysian) for elementary and middle school. High school students are served by School District No. 2. State law requires that the district provide bussing services to students that are greater than three miles from the school they are required to attend.

Elementary and Middle School

Elysian School serves kindergarten through 8th grade students, and is located immediately to the west of the study area at 6416 Elysian Road. Current enrollment at Elysian School is approximately 295 students. The school recently completed an expansion that increases the capacity to approximately 500 students. The school superintendent indicated that attendance has been growing at a rate of about 30 to 40 students per year, due in part to growth within the district from new residential neighborhoods, such as Josephine Crossing and Riverfront Pointe.

High School

There are three high schools in the Billings Public School District: Billings Senior High, Billings West, and Skyview. According to the Billings Public School Demography Study, enrollment at the three high schools has been declining since 2007 and is expected to continue to decline until 2017. Even with declining enrollment, Billings West and Billings Senior High are enrollment above school capacity. The school district is currently undergoing a comprehensive redistricting process to consider boundary changes for the high schools in order to align attendance with school capacity. This would allow the existing facilities to serve the student population without requiring additional high school construction in the near future.

Billings Senior High at 425 Grand Avenue would serve high school students in this area. It is the oldest of the high schools in the district, with the most diverse student bodies. It presently serves 1,689 students in grades 9 through 12 and has over 120 staff members. Maximum capacity for Senior High is 1,600.

Student Population Impacts of Proposed Development:

During the planning stages for Elysian School's expansion, a demographic study was conducted by K-12 Consultants for the district. That study was published in February 2012, when the school's enrollment was 164 students. The study concluded that Josephine Crossing and Riverfront Pointe would contribute an additional 132 school age children upon their collective buildout (2016-2018). With this addition, Elysian could expect an enrollment of 300 students, with a new capacity of 500 students. The previous urban planning studies for Quarnburg Farming Corp. and Elysian/East Lane estimated an additional 53 and 180 students, respectively, at final buildout. Completion of these two projects would exceed the building capacity by 29 students.

Using an average of .50 children (under age 18) per dwelling unit in general (common number used nationally in housing studies) and the earlier estimates of 5 dwelling units/acre, the 15 acres of residential development yields 75 dwelling units. Therefore:

• 75 dwelling units x .50 children/dwelling unit = 39 children under age 18 in total

• The number of these children that would be students in the nine grades (K-8) at Elysian could be calculated by taking 9 grades/18 years of childhood = 50 percent, therefore 19 new students.

• The number of these children that would be students in the four grades (9-12) in SD2 High Schools could be calculated by taking 4 grades/18 years of childhood = 22 percent, therefore 9 new students.

Elysian School will likely exceed its newly expanded capacity of 500 students with full buildout of this and other developments in the area at 548 students.

Transportation Systems Impacts

Streets and Intersections

The proposed development is comprised of approximately 98 acres located directly south of Elysian Road, between South Frontage Road and East Lane on the southwest side of Billings. Elysian Road and East Lane are both classified as collector roadways in the Billings functional classification system. South Frontage Road is classified as a minor arterial and provides access to the I-90/Zoo Drive Interchange and the King Ave West/Mullowney Lane Interchange.

Elysian Road extends east from South Frontage Road to Mullowney Lane where it then becomes a local street providing access exclusively to Josephine Crossing Subdivision. Elysian Road is a two-lane highway that does not have a posted speed limit, with the exception of the school zone adjacent to Elysian School where speeds are restricted to 15 mph during school hours (8 AM to 5 PM, Monday through Friday). East Lane is a two-lane county highway that extends south from South Frontage Road to its terminus just north of the Yellowstone River, providing access to Elysian School and several rural homes and farms or ranches. East Lane also has a 15 mph school speed zone in the area of the school. The intersection of Elysian Road and East Lane is currently two-way stop-controlled with stop signs located on the north and south East Lane approaches. All four intersection approaches consist of a single lane for all turning movements.

Other area roadways that could potentially be impacted by traffic generated by the proposed development include South Frontage Road and Mullowney Lane. South Frontage Road is a two-lane urban minor arterial that extends northeast from the East Laurel/I-90 Interchange to Mullowney Lane. The speed limit along South Frontage Road varies depending by location. At the intersection of South Frontage Road and Elysian Road, the speed limit is 65 mph. At the intersection with Mullowney Lane, the speed limit is 45 mph. The alignment of South Frontage Road continues east from Mullowney Lane as Midland Road, then picks up again as South Frontage Road on the east side of South Billings Boulevard.

Mullowney Lane is a collector roadway that extends south from its intersection with South Frontage Road/Midland Road to its terminus south of Story Road near the Yellowstone River. Mullowney Lane carries two southbound lanes from South Frontage Road to Interstate Avenue. From that point south, Mullowney Lane is a two lane road. The speed limit along Mullowney Lane is posted at 25 mph near the south approach to the South Frontage Road intersection. Farther south, however, no speed limit is posted in either direction.

The intersection of South Frontage Road/Midland Road with Mullowney Lane is currently signalized and operates under an actuated southbound-lead phasing plan. The north intersection approach provides individual left-turn, through and shared through/right-turn lanes. The west approach provides a left-turn lane and a shared through/right-turn lane. The east approach provides a shared left-turn/through lane, along with an auxiliary right-turn lane. The south approach currently provides a single approach lane for all movements.

The intersection of South Frontage Road with Elysian Road is two-way stop-controlled with a stop sign posted on the Elysian Road approach. The westbound approach of Elysian Road to South Frontage Road is aligned at an acute angle of approximately 35 degrees from the southwest bound South Frontage Road approach.

The intersection of Mullowney Lane with Elysian Road is two-way stop-controlled with stop signs located on the east and west Elysian Road approaches. The north approach provides a dedicated left-turn lane with a shared through/right-turn lane, but all other approaches consist of a single lane for all turning movements. The intersection of East Lane with Trade Center Avenue is currently two-way stop-controlled with a single lane for all turning movements on each approach.

Nearby Developments

Traffic impact studies (TIS) have been completed for various nearby developments located within the study area over the past several years. The subject subdivisions include:

- Titan Subdivision
- Riverfront Pointe Subdivision
- Josephine Crossing Subdivision
- Harmony Meadows Subdivision

The most recent of these studies was completed in July 2015 for the Fifth Filing of Josephine Crossing Subdivision. That study was an update to the original TIS for Josephine Crossing. The update simply identified the additional trip generation component for the Fifth Filing and projected contribution percentages for the study area intersections. Prior to that, a more comprehensive overall analysis of traffic impacts was completed for Harmony Meadows Subdivision in 2007. The recommendations that came out of that study were based on full build-out volumes for the other three developments referenced above, but the study did not include traffic projections for the most recent filings in Harmony Meadows Subdivision. The recommendations from the Harmony Meadows study included the conversion to four-way stop-control at the intersection of Mullowney Lane and Elysian Road, and the eventual construction of a northbound dedicated left-turn lane and an additional through lane at the signalized intersection of Mullowney Lane and South Frontage Road/Midland Road. As part of those improvements, it was also recommended that the signal phasing plan be modified to include left-turn lead phasing on both the southbound and northbound approaches. Results of the capacity analysis completed with those improvements in place showed a significant amount of reserve capacity available to handle additional background traffic growth.

Anticipated Trip Generation

Current plans for proposed development of the Viking Land property consist of a mixed use subdivision with the majority of the property to be zoned as controlled industrial and the remainder to be zoned as highway commercial, but developed with single-family homes. For the purposes of this analysis, it was assumed that the residential component would consist of 75 single-family dwelling units. The industrial component of the proposed development would likely consist of mix of uses allowed within the controlled industrial zone district. Based on an assumption of a 15 percent building coverage at full buildout, this would result in approximately 650,000 SF of gross floor area within the industrial sector.

A reasonable projection of site-generated traffic can be estimated using *Trip Generation, 8th Edition*, published by the Institute of Transportation Engineers (ITE), the most widely accepted source for trip generation rates. Based on the assumption of 75 single-family dwelling units, it can be estimated that the development would generate on the order of 718 new trips on the average weekday. This translates to approximately 56 new trips during the weekday AM peak hour and 75 new trips during the weekday PM peak hour.

For the industrial area, the application of average rates from the general light industrial land use category results in a projected average daily trip generation total of 4,531 trips, with 598 trips during the AM peak hour and 631 trips during the PM peak hour.

It is anticipated that access to the 98-acre subdivision would be provided via multiple approaches along Elysian Road and East Lane. Based on trip distribution estimates from other nearby developments, it can be assumed that approximately 70 percent of the total trips would access the site via Elysian Road and the other 30 percent would use East Lane to come and go from the site.

As noted previously, the analysis completed for the Harmony Meadows TIS showed a fairly significant amount of reserve capacity available to handle additional nearby developments with the recommended improvements in place. However, additional area development has occurred since the Harmony Meadows study was completed in 2007 and there are other large, vacant properties in the area that are also being considered for development. A comprehensive traffic impact study should be completed for this general area to ensure that planning is ongoing relative to roadway, intersection and safety improvements. Such a study should not be the sole responsibility of the ownership group for this project, but should be funded in collaboration by all of the area parties that are proposing development.

Method of Funding Public Improvements

There are a number of public improvements that would be necessary if the study area were eventually annexed into the City of Billings. The improvements and public services come with costs. There are several mechanisms to pay for these costs.

System Development Fees

System Development Fees, or SDFs, are charged for the impact of new development on the water and sewer infrastructure. The City of Billings 2016 SDF charges are $4,035/home for residential development. Commercial development fees vary with water meter sizing and range from $8,440/ 3/4-inch to $277,980/4-inch.

Using the previous assumptions of 75 dwelling units, this would equate to $302,625 in SDFs for the residential development. Because there has been no master planning completed within the study area, it is difficult to predict the commercial area SDFs. For generalized purposes, an average lot size of 3 acres would result in 28 commercial/industrial lots. Assuming each with a 3/4-inch size meter, that would result in SDFs of $236,320.

Upon full build-out, it is anticipated that approximately $540,000 of SDFs would be generated by development within the study area.

Special Improvement District

Special Improvement Districts (SID) are formed to allow property owners to share in costs related to infrastructure improvements, for which they all receive benefit from use of that infrastructure. An SID is a taxing district that is created to finance public improvements such as transportation infrastructures, water main, sewer main, and storm drainage. Assessment can also contribute to long-term maintenance of the improvements.

Property Tax Revenues

Funding for services, such as police and fire protection, is usually provided by property tax revenue. Future tax revenues will ultimately depend on the use and density of the property. Both the *Quarnburg* and *Elysian/East Lan*e urban planning studies, assumed residential densities similar to the existing Josephine Crossing. Assuming the same for this development, the analysis provided in the *Elysian/East Lane UPS* can provide some guidance for anticipated property tax revenues.

For residential development similar Josephine Crossing, city revenue/acre is approximately $4,200. Based on the 15 acres of residential proposed within this study area, city revenues could be expected to be approximately $63,000.

Using the nearby Weil and Holiday Subdivisions as comparisons, commercial and industrial uses would yield approximately $1,244/acre, or $103,250 for the 83 acres within the study area.

Upon full build-out, annual property tax revenues to support city services within this study area would be approximately $166,000.

Conclusion

The properties within the study area are geographically, environmentally and economically suitable for urban development. Properties to the east are currently in the red area, the Elysian School property has been annexed, as well as Harmony Meadows, 1/2 mile to the East. Trunk sewer and water extensions in the area have been constructed. This area has seen development growth in

recent years, and that is expected to continue, especially as city services become available. The study area is adjacent to development on the north, west, and south, with future development to the east. Bringing this area into the red area will allow for planning for City services, transportation infrastructure, and capacity at Elysian School.

The provision for emergency services is always a concern as communities expand and grow. Adding this property to the red area provides time for the service analysis and will help identify demands for those services.

The property within the study area does not have a specific timeframe for development. Placing it within the red area allows the property owner to begin the master planning process and work with nearby property owners and the City to develop long term planning for this area of Billings.

EXHIBITS

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PREPARED FOR : VIKING LAND, LLC

PREPARED BY : SANDERSONSTEWART

EXH

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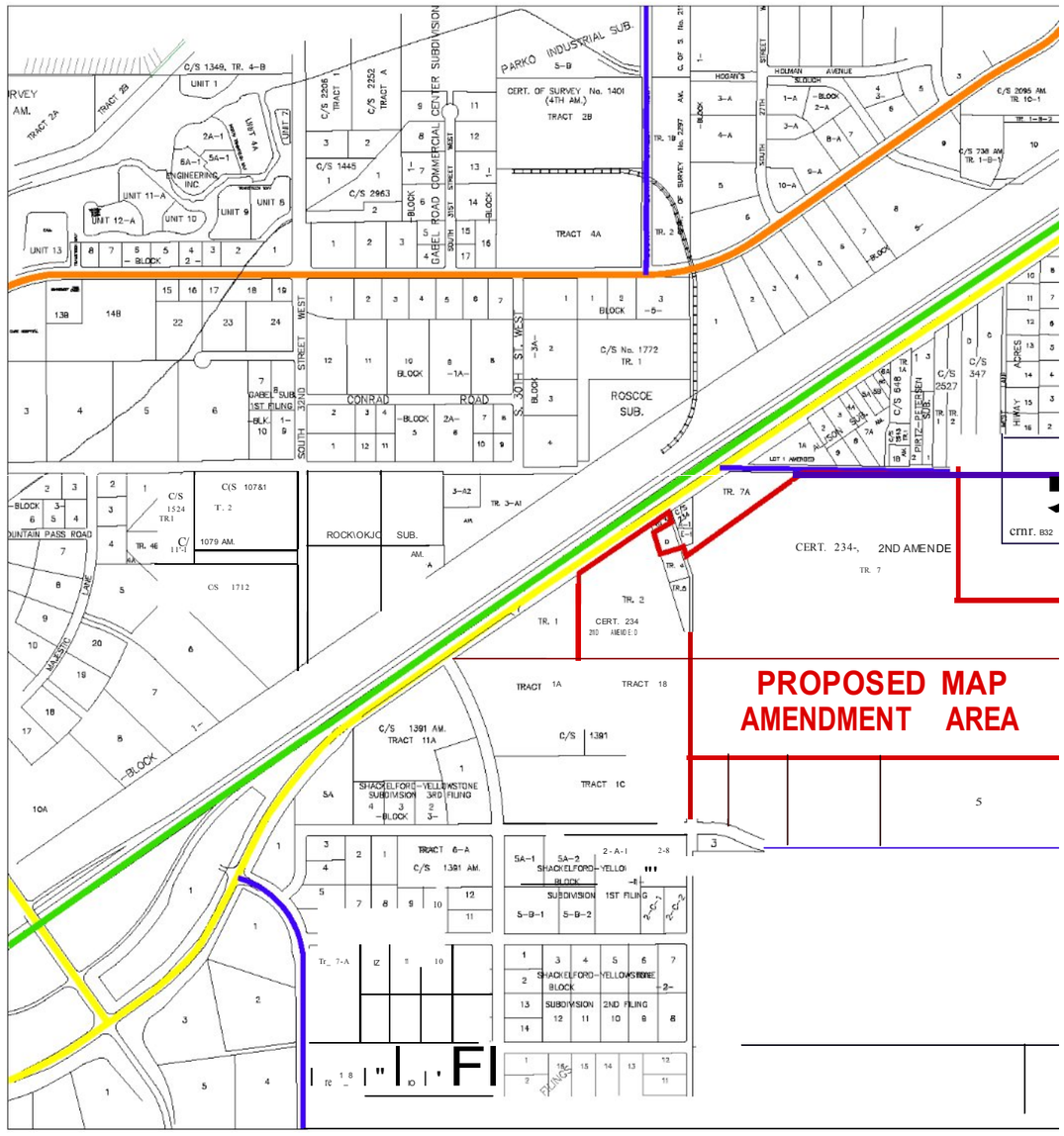
PREPARED FOR VIKING LAND, LLC

PR EPARED BY : **SANDERSONSTEWART**



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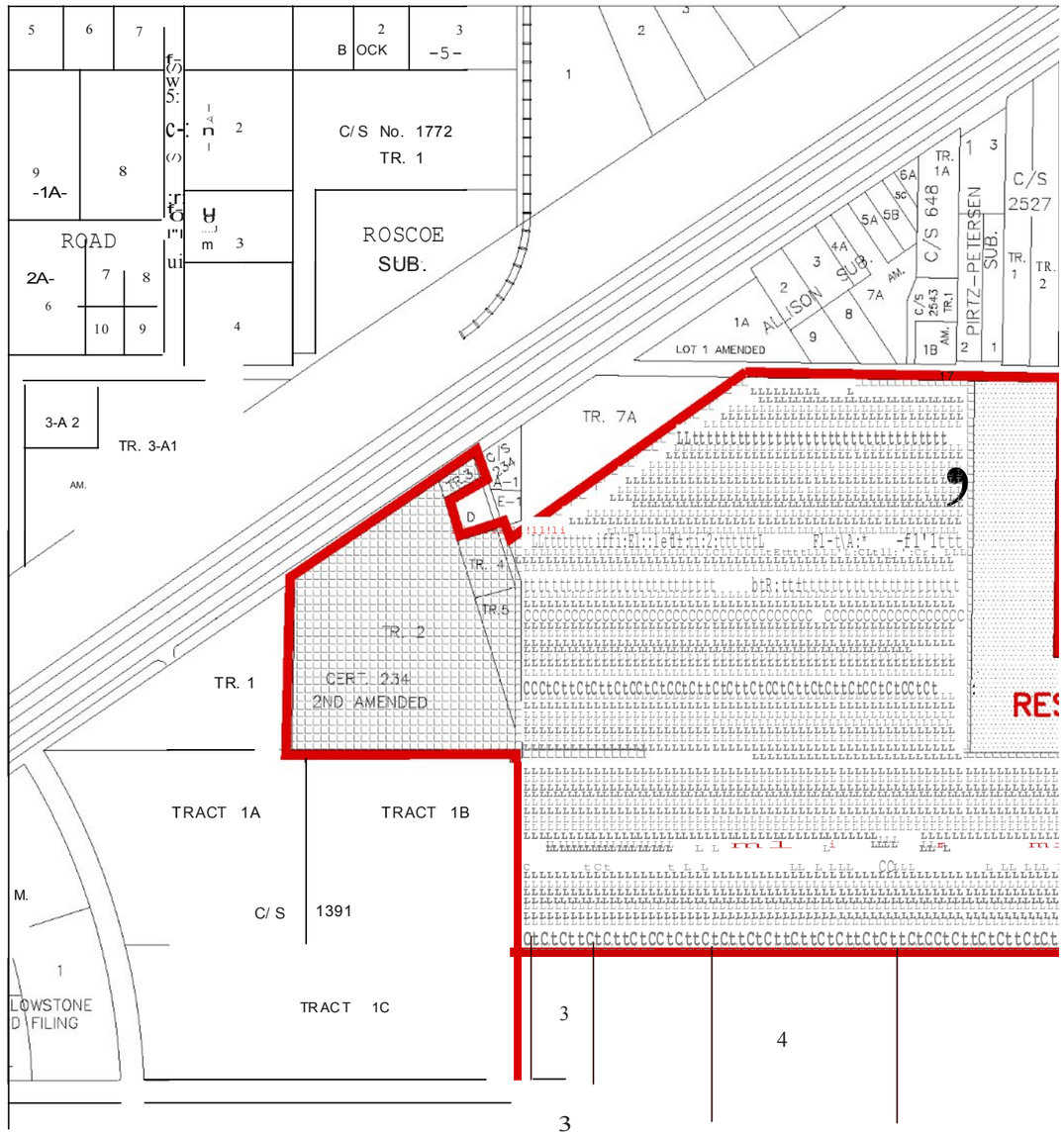
PREPARED FOR VIKING LAND, LLC

PREPARED BY : **SANDERSONSTEWART**



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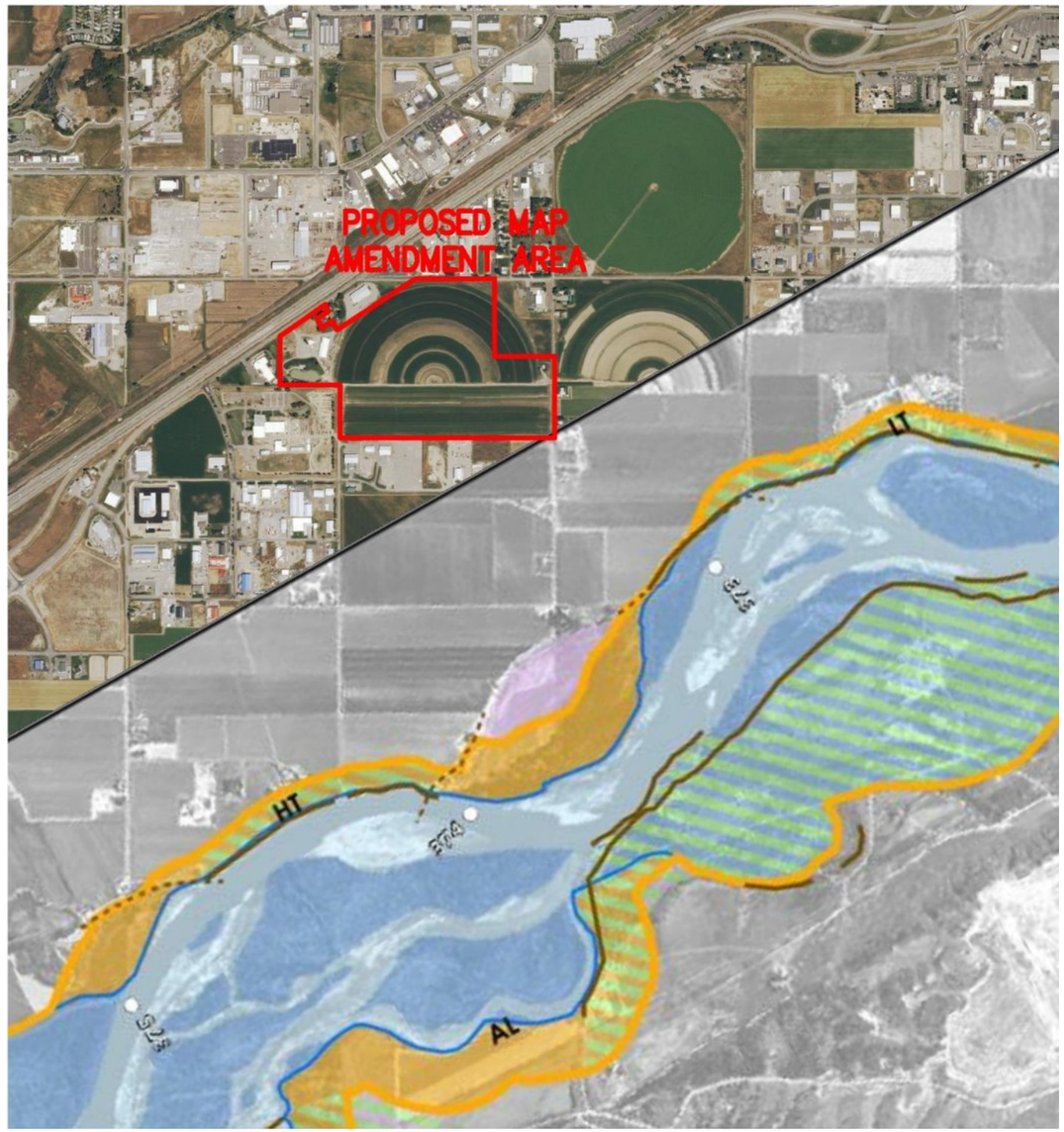
PREPARED FOR : VIKING LAND, LLC

PREPARED BY : SANDERSON STEWART



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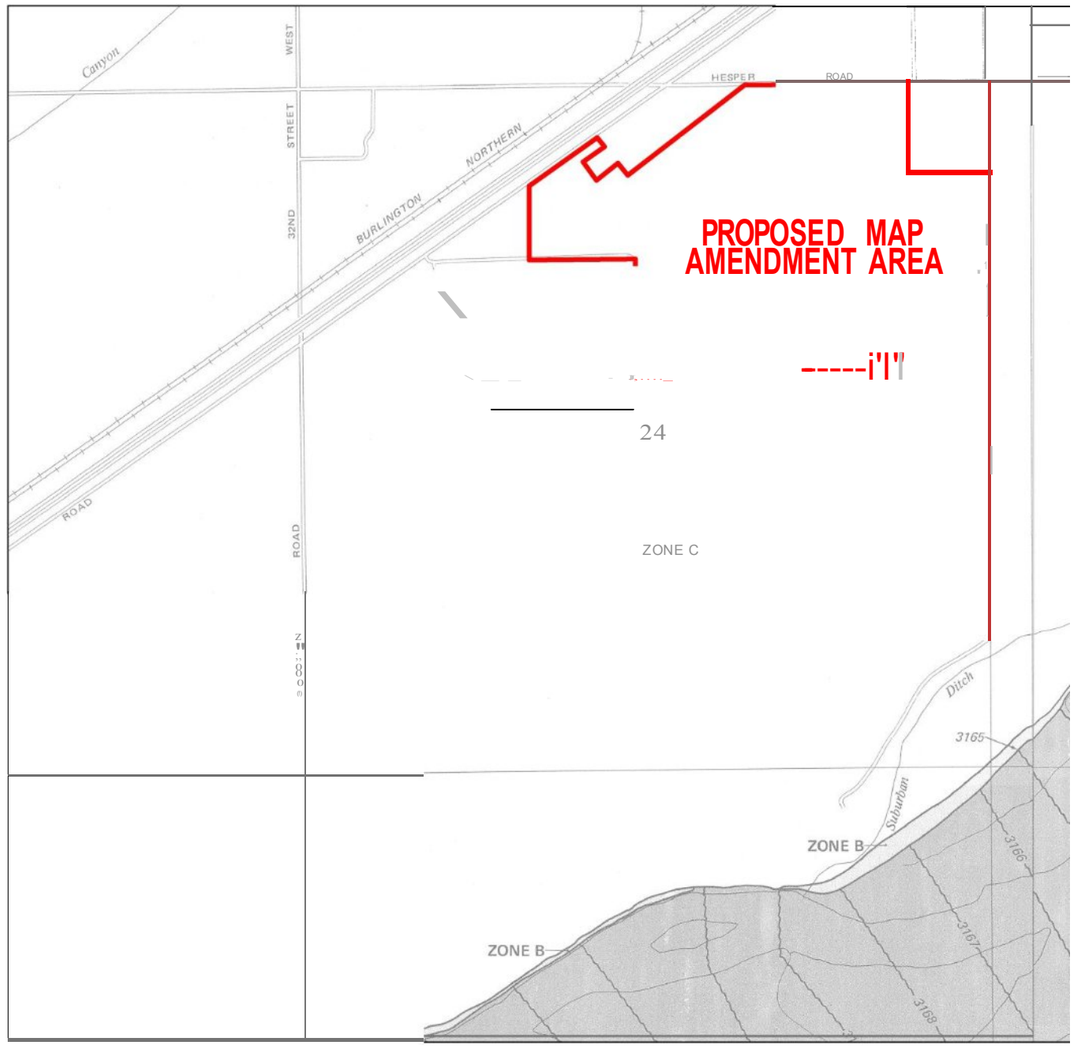
PREPARED FOR : VIKING LAND, LLC

PREPARED BY : sANDERsONsTEWART —



APPENDIX

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Yellowstone County, Montana

Viking Land, LLC

November 13, 2014

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

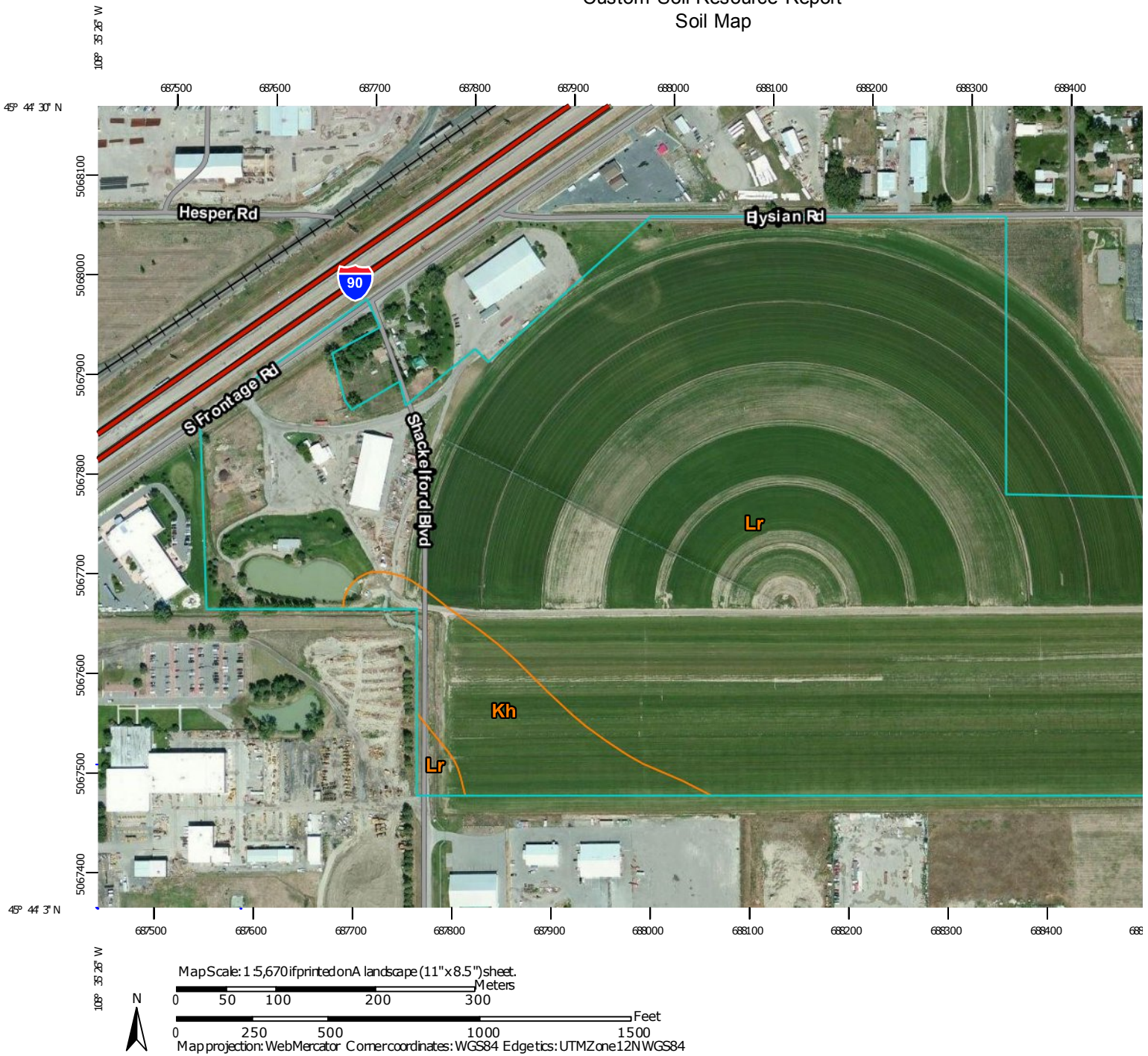
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMA

The soil surveys that comprise your AOI

Warning: Soil Map may not be valid at th

Enlargement of maps beyond the scale c misunderstanding of the detail of mappin placement. The maps do not show the s soils that could have been shown at a mo

Please rely on the bar scale on each map measurements.

Source of Map: Natural Resources Co
Web Soil Survey URL: http://websoils
Coordinate System: Web Mercator (EP

Maps from the Web Soil Survey are base projection, which preserves direction and distance and area. A projection that pres Albers equal-area conic projection, shoul calculations of distance or area are requi

This product is generated from the USDA of

Soil Survey Area: Yellowstone County
Survey Area Data: Version 13, Sep 3,

Soil map units are labeled (as space allow or larger.

Date(s) aerial images were photographe 2011

The orthophoto or other base map on w compiled and digitized probably differs f imagery displayed on these maps. As a r of map unit boundaries may be evident.

Map Unit Legend

Yellowstone County, Montana (MT111)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
Kh	Keiser and Hesper silty clay loams, 0 to 1 percent slopes	7.1	6.5%
Lr	Lohmiller silty clay, 0 to 1 percent slopes	101.5	93.5%
Totals for Area of Interest		**108.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If

intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Yellowstone County, Montana

Kh—Keiser and Hesper silty clay loams, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: cls5
Elevation: 1,900 to 4,500 feet
Mean annual precipitation: 11 to 14 inches
Mean annual air temperature: 39 to 48 degrees F
Frost-free period: 120 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Hesper and similar soils: 45 percent
Keiser and similar soils: 45 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Keiser

Setting

Landform: Low hills, terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 3 inches: silt loam
Bt - 3 to 9 inches: silty clay
Bk - 9 to 23 inches: silty clay loam
C - 23 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 8.0 mmhos/cm)
Available water storage in profile: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: Clayey (cy) rru 58a-c 11-14" p.z. (R058AC041MT)

Description of Hesper

Setting

Landform: Fans, terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 2 inches: silt loam
Bt - 2 to 17 inches: silty clay loam
Bk - 17 to 44 inches: clay loam
Ck - 44 to 60 inches: very fine sandy loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: Clayey (cy) rru 58a-c 11-14" p.z. (R058AC041MT)

Minor Components

Lambert

Percent of map unit: 4 percent
Landform: Fans, terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Silty (si) rru 58a-c 11-14" p.z. (R058AC040MT)

Clapper

Percent of map unit: 4 percent
Landform: Terraces, fans
Landform position (three-dimensional): Riser
Down-slope shape: Convex, linear
Across-slope shape: Linear
Ecological site: Saline upland (su) rru 58a-c 11-14" p.z. (R058AC050MT)

Wanetta

Percent of map unit: 2 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear

Across-slope shape: Linear
Ecological site: Silty (si) rru 58a-c 11-14" p.z. (R058AC040MT)

Lr—Lohmiller silty clay, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: clsn
Elevation: 1,900 to 6,000 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 37 to 45 degrees F
Frost-free period: 120 to 135 days
Farmland classification: Prime farmland if irrigated and the product of I (soil erodibility) x C (climate factor) does not exceed 60

Map Unit Composition

Lohmiller and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lohmiller

Setting

Landform: Flood plains, terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave, linear
Parent material: Alluvium

Typical profile

A - 0 to 9 inches: silty clay
C1 - 9 to 42 inches: stratified clay to silty clay loam
C2 - 42 to 60 inches: stratified silty clay loam to fine sandy loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 10 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 10.0
Available water storage in profile: High (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 4s

Hydrologic Soil Group: C
Ecological site: Clayey (cy) rru 58a-c 11-14" p.z. (R058AC041MT)

Minor Components

Haverson
Percent of map unit: 6 percent
Landform: Terraces, flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear, concave
Ecological site: Clayey (cy) rru 58a-c 11-14" p.z. (R058AC041MT)

Hysham
Percent of map unit: 5 percent
Landform: Flood plains, terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave, linear

Glenberg
Percent of map unit: 4 percent
Landform: Terraces, flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear, concave
Ecological site: Silty (si) rru 58a-c 11-14" p.z. (R058AC040MT)

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