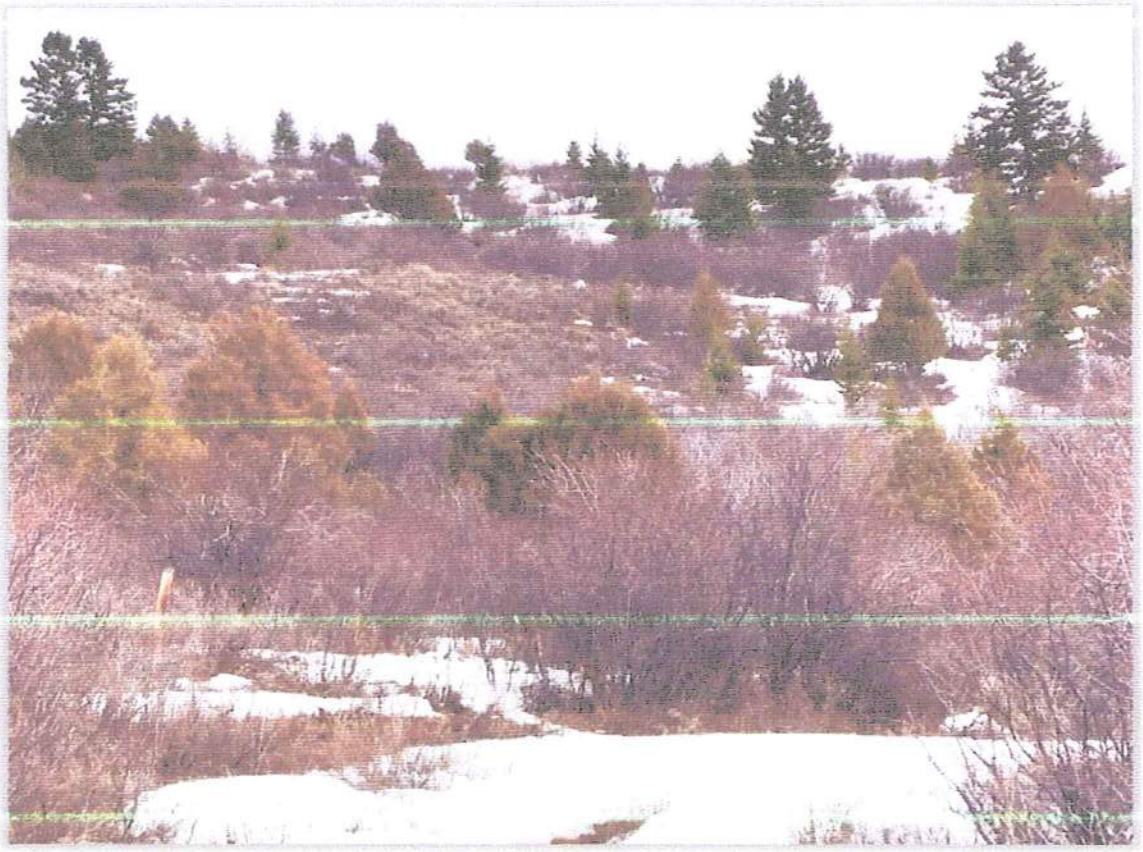
NATURAL RESOURCES ANALYSIS
PROPOSED TAYLOR SHADOWS SUBDIVISION, TETON COUNTY, IDAHO



Prepared For

David Bender
140 Alpine Trl
Victor, ID 83455

Prepared By

research & consulting inc
Biota

PO Box 8578, 140 E. Broadway, Suite 23, Jackson, Wyoming 83002

May 8, 2014

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NATURAL RESOURCES ANALYSIS
PROPOSED TAYLOR SHADOWS SUBDIVISION,
TETON COUNTY, IDAHO

INTRODUCTION AND BACKGROUND

Biota Research and Consulting, Inc. prepared a Natural Resources Analysis (NRA) for the proposed Taylor Shadows Subdivision in Teton County, Idaho in 2014. Information provided in this NRA is necessary to assess the possible adverse effects of proposed development on natural resources, and to ensure compliance with Title 9 of the Teton County Code. This analysis was required by Teton County because the property is located within the Wildlife Habitat (WH) Overlay for big game migration corridors and seasonal range.

The project area is comprised of a 13.9-acre tract owned by Daniel Bender (RP03N45E128850), within which Taylor Shadows Subdivision has been proposed. Existing development within the project area is minimal, consisting of an old access road and several old barbed wire fences. Proposed development plans currently include upgrading the existing driveway to meet county specifications, and splitting the property into 2 parcels and a 0.5-acre common area. The northern lot (Lot 1) is slated to be 9.68 acres, and the southern lot (Lot 2) will be 3.75 acres. A development area (building envelope) has been proposed for each parcel; the Lot 1 building envelope is 0.92 acres in size, and the Lot 2 envelope is 0.37 acres.

Fieldwork associated with the NRA was conducted in April of 2014, with efforts focused on determining vegetative covertypes and identifying indicator habitat and wildlife use patterns.

LOCATION AND PHYSIOGRAPHY

The project area is located east of the town of Victor in Teton County, Idaho (T3N, R45E, Section 12; Appendix 1-Exhibits 1 and 2). The project area is bordered by the Victor Cemetery on the west, BLM land on the east, and private land to the south and north. Access to the property is gained by traveling east from Victor on Cemetery Road to an existing driveway that accesses the project area. Although the property is elevated above the valley floor, it does not lie within the Hillside (HS) Overlay.

EXISTING CONDITIONS INVENTORY

Per Title 9 of the Teton County Code, the NRA shall include a description of existing conditions on the application parcel.

Floodplains, Wetlands, and Riparian Areas

No floodplains, wetlands, or riparian areas are present within the project area.

Geologic or Seismic Hazards

Seismic maps produced by the Idaho Geological Survey in 2011 depict National Earthquake Hazards Reduction Program (NEHRP) seismic classes for Teton County. According to this mapping, the southwestern portion of the project area is classified as Class 2, and the remainder of the project area is classified as Class 3 (Appendix 1-Exhibit 3). This means that the project area is located in an area of relatively high shear-wave velocity, which would likely result in lower shaking intensity during a seismic event, and indicates it is a fairly low risk area.

Wildfire Danger

The Title 9 Code refers to the "latest adopted plan of the Teton County Fire Protection District" for a determination of whether there are areas of the project area that are in designated "high" or "extreme" wildfire danger. The scale (county-wide) of the fire hazard map included in the most recent (2009) Wildfire Protection Plan (CWPP) makes it difficult to discern individual parcels, but it appears that the project area is in a Level 1 fire behavior zone (on a scale of 0 to 3, with Level 3 being the highest potential fire hazard). No CWPP GIS data for the county are available, nor is a higher resolution zoomed-in view of the parcel in relation to the CWPP mapping.

In addition to the CWPP information, Wildland Urban Interface (WUI) mapping was acquired from the Teton County GIS Department. The WUI is generally defined as those areas where homes are built near or among lands prone to wildland fire. The local WUI mapping was developed by the Caribou-Targhee National Forest and depicts the project area as within the WUI zone (Appendix 1-Exhibit 4).

Although the CWPP mapping depicts relatively low fire hazard in the vicinity of the project area, the vegetation communities within the project area are dominated by flammable shrubs and trees. It is advisable that the property owners create defensible space around all structures to limit the amount of flammable vegetation and materials surrounding the structures and implement other best management practices for development in fire-prone areas. The National Fire Protection Association provides a number of resources (http://www.firewise.org/wildfire-preparedness/be-firewise/home-and-landscape.aspx). Areas included in the defensible space are accounted for in the development impact analysis.

Vegetation Communities

The majority of the project area is comprised of undisturbed, native vegetation communities (Appendix 1-Exhibit 5). Tall Shrub (a.k.a. mountain shrubland) is the dominant community type. Specifically, Serviceberry-big sagebrush/Kentucky bluegrass (*Amelanchier alnifolia-Artemisia tridentata/Poa pratensis*) is the dominant plant association. This association comprises 12.8 acres (92%) of the project area, and the remainder is comprised of a Douglas-fir/chokecherry (*Pseudotsuga menziesii/Prunus virginiana*) association and a previously disturbed area (Table 1).

Table 1. Acreages, percent occurrence, and indicator habitat status of vegetation associations within the Bender project area, Teton County, Idaho.

Vegetation Associations	Area (Acres)	% of Parcel	Big Game Indicator Habitat (Y/N)
Tall Shrub – Serviceberry-big sagebrush/Kentucky bluegrass	12.8	92	Y
Evergreen Woodland – Douglas fir/chokecherry	0.9	7	N
Disturbed (Driveway)	0.2	1	N
Totals	**13.9**	**100**	**NA**

The serviceberry-big sagebrush/Kentucky bluegrass association within the project area is dominated by Saskatoon serviceberry, mountain big sagebrush, antelope bitterbrush, and mountain snowberry in the shrub layer, with an understory dominated by bluegrass, slender wheatgrass, Oregon grape, sulfur buckwheat, common yarrow, and other herbaceous species. Moderate to heavy ungulate browsing was evident on the serviceberry and bitterbrush shrubs Mature Rocky Mountain juniper and Douglas-fir are scattered throughout this community but do not dominate the overstory.

The Douglas-fir/chokecherry association is dominated by Douglas fir and quaking aspen trees in the overstory, with an understory of serviceberry, Douglas hawthorn, mountain snowberry, and woods rose. This association is located high on the hillside in the northeastern portion, and appears to be an ecotone

between the tall shrub community within the project area and the dense Douglas-fir/quaking aspen forest located higher on the hill east of the project area.

Ridges and Rock Outcroppings

No significant ridges or rock outcroppings exist within the project area.

Proximity to State Highways or Ski Hill Road

The project area is located within one mile of Highway 33, and a portion of the parcel is visible from Highway 33 (Appendix 1-Exhibit 6). The project area is not located within one mile of, or visible from, Ski Hill Road.

WILDLIFE HABITAT ASSESSMENT

The project area lies entirely within the WH Overlay for big game migration corridors and seasonal range (Appendix 1-Exhibit 7) and, therefore, is subject to the Teton County WH Overlay regulations as outlined in Title 9. The WH Overlay regulations require that the Natural Resources Analysis include the following documentation:

- Wildlife Habitat Assessment;
- Impact Analysis;
- Mitigation Plan; and
- Land Management Plan.

In addition, the following maps are also required:

- Big game winter range on or within 1 mile of the proposed subdivision;
- Information pertinent to the Wildlife Habitat Assessment;
- Proposed impacts to wildlife or indicator habitat; and
- Proposed mitigation treatment areas and treatment measures.

The indicator species for big game habitat, as defined in Title 9, are elk and mule deer, and the indicator habitat for these species is mountain shrublands. More than 90% of the project area is comprised of a tall shrub (mountain shrubland) plant association (Appendix 1-Exhibit 8). Most of the vegetation within the project area is indicator habitat for big game. The only areas of the project area that are not indicator habitat are the existing driveway and the northeastern corner, which is comprised of a Douglas-fir/chokecherry plant association.

Abundant elk, mule deer, and moose sign observed throughout the project area during field investigations confirms that the area is important habitat for these species. Because elk and mule deer have been identified as indicator species for the WH Overlay, these species will be the focus of the wildlife habitat assessment. Numerous elk and mule deer pellet groups, bedding sites, tracks, rubs, evidence of browsing, and game trails are present throughout the project area (see Appendix 2-Photos 1-4). Elk and mule deer trails are numerous, and it appears some of the more significant trails have been used by horses, or vice versa.

Mule deer pellet groups outnumbered those of elk by a 20:1 ratio, and several mule deer were observed in central portion of the project area during field investigations. Bedding sites and rubs were scattered around the project area. It appears that the project area serves as year-round habitat for elk and mule deer; however, deep snow likely limits winter use in most years. Any mule deer or elk use of the project area in

the winter is likely incidental. Concentrated use of the project area by mule deer and elk likely occurs during spring, summer, and fall. The value of the project area as mule deer and elk habitat is elevated by minimal development located on and around the parcel, a lack of human activity, low hunting pressure, and natural environmental features that prove attractive to these species.

IMPACT ANALYSIS

Due to the extent of indicator habitat in the project area and minimal existing development, new development at any scale is likely to have adverse impacts on indicator habitat and indicator species. The only portion of the project area that is not comprised of indicator habitat is the existing driveway and a small area of Douglas-fir/chokecherry covertype in the northeastern portion. The eastern portion of the project area is dominated by steep slopes that exceed 20% and is not conducive for development.

Proposed development areas have been located in the only portion of the project area that has slopes less than 20% and is the only feasible area upon which to build. The development areas (per plans provided by AW Engineering) will impact approximately 16.8% (2.15 acres) of the mountain shrubland habitat (Appendix 1-Exhibit 9). Proposed development consists of driveway enlargement, construction of 2 single-family residences and appurtenant structures, and a common area for gardens, animal pens, etc. Wildland fire protection measures will include the creation of fire breaks around all structures. The development will result in increased human presence on the property, but human activity will be concentrated in areas proximate to residences.

An assessment of consequences of the proposed development on big game indicator species is provided below. The assessment uses the following impact measure, duration, and intensity definitions.

Impact Measures - Four impact measures are examined including habitat loss, mortality, habitat fragmentation, and human-caused disturbance.

- Habitat Loss - Implementation and perpetuation of all or part of the project would result in a direct loss of habitat.
- Mortality - Implementation and perpetuation of all or part of the project would result in the death(s) of individuals.
- Habitat Fragmentation - Implementation and perpetuation of all or part of the project would result in the fragmentation of habitat.
- Human-caused Disturbance - Implementation and perpetuation of all or part of the project would result in the displacement of individual animals.

Duration of Impact - A short-term impact would have a duration less than or equal to 3 years and a long-term impact would have a duration greater than 3 years following implementation.

Intensity of Impact - Impact thresholds are defined in Table 2.

Table 2. Impact threshold definitions for the development impact analysis.

Impact Threshold Definitions				
Measures	**Negligible**	**Minor**	**Moderate**	**Major**
Habitat Loss **Mortality** **Habitat Fragmentation** **Human-caused Disturbance**	A small number of individual animals and/or a small amount of their respective habitat may be adversely affected via direct or indirect impacts associated with a given alternative. Populations would not be affected or the effects would be below a measurable level of detection. Mitigation measures are typically not warranted.	Adverse impacts to individual animals and/or their respective habitats would be more numerous and detectable. Populations would not be affected or the effects would be below a measurable level of detection. Mitigation measures may be needed and would be successful in reducing adverse effects.	Effects to individual animals and their habitat would be readily detectable, with consequences occurring at a local population level. Mitigation measures would likely be needed to reduce adverse effects and would likely be successful.	Effects to individual animals and their habitat would be obvious and would have substantive consequences on a regional population level. Extensive mitigation measures would be needed to reduce any adverse effects and their success would not be guaranteed.

The proposed development will result in a direct loss of high quality habitat for elk and mule deer.

Mule Deer

The proposed development will likely negatively affect an unknown number of mule deer by reducing the availability of spring-summer-fall foraging and cover habitat and increasing human activity in the area, but it is not expected to have a measurable effect on the Teton Valley mule deer population. Deer movements to and from the surrounding parcels and the mountains east of the project area will not be disrupted. The proposed development is expected to have minor adverse, long-term impacts on mule deer.

Elk

Elk use the forested areas and mature Douglas-fir trees for cover and, to a lesser degree, the mountain shrubland community for foraging. Proposed development will reduce the availability of spring-summer-fall elk foraging habitat, and increased human activity on the project area may alter elk use patterns. Proposed development will likely negatively affect a few individual elk, but it is not expected to have a measurable effect on the Teton Valley elk population. Elk movements to and from the surrounding parcels and the mountains east of the project area will not be disrupted. The proposed development is expected to have negligible adverse, long-term impacts on elk.

MITIGATION PLAN

Per guidance provided in Title 9, avoidance and minimization of impacts are preferable to offsetting mitigation measures. In this case, complete avoidance of impacts to indicator habitat was not possible; however, project proponents have developed a subdivision plan that minimizes development-related impacts. By splitting a property that is zoned A-2.5 into only 2 lots, the area of disturbance has been minimized. The proposed building envelopes and associated disturbance areas total 2.41 acres. The existing driveway, which will be used for access to the neighborhood, comprises 0.26 acres of the proposed disturbance area. The remaining 2.15 acres of the impact area is comprised of undisturbed tall shrub habitat. The eastern half of the property will not be developed and will remain in a relatively

undisturbed state. The current development plan allows the owner to achieve project goals and objectives while minimizing wildlife habitat disturbance.

Direct, on-site mitigation based on replacement of indicator habitat is not feasible because there are no suitable (i.e., previously-disturbed) areas to implement this type of mitigation on the project area. Instead, mitigation for impacts to indicator species will be accomplished through habitat preservation and land management practices (Appendix 1-Exhibit 10). Use restrictions and habitat protection mechanisms have been incorporated into the covenants, conditions, and restrictions (CCRs) for the neighborhood to ensure that undeveloped portions of the neighborhood are preserved as wildlife habitat. Section 2.14 of the CCRs for Taylor Shadows Subdivision is the Wildlife Habitat Provision, which states that "all areas outside of the approved building envelops will be managed and preserved for wildlife habitat. There will be no development or motorized vehicle access within areas outside of the approved building envelopes."

In addition the owner will remove several old, dilapidated, barbed wire fences within and surrounding the property that are no longer used. Fence will remain along the northern boundary of the property because this fence keeps g horses on the neighboring property. Any new perimeter fencing will follow the wildlife-friendly fencing guidelines provided in Appendix 2. In addition, the landowner will initiate weed management efforts to control spotted knapweed and other noxious weeds that currently exist in the project area.

These mitigation measures are appropriate and likely to succeed in mitigating impacts to indicator species. Elk and mule deer will continue to use the project area after the development is completed.

LAND MANAGEMENT PLAN

All land outside of the proposed development areas will be managed and maintained to enhance and preserve wildlife habitat. Weed management efforts will be carried out on an as-needed basis and will ensure that noxious weeds are controlled and prevent weed encroachment into native plant communities. As mentioned in the mitigation plan, several of the old barbed wire fences in the project area will be removed. Fence removal will facilitate wildlife movement through the project area and reduce the potential for entanglement and injury. Domestic pets will be restrained within yard fences to ensure that wildlife are not chased or harassed.

All monitoring, management, and maintenance of open areas within the subdivision will be performed and funded by the owners. No public access will be allowed, and human use of the open areas will be minimized. Vegetation communities within the project area are in good condition and will require minimal management. Many of the plant species in these communities are fire-dependent, and in the absence of fire, may require some manual thinning to maintain healthy vigorous growth and optimal habitat characteristics. Land management activities such as thinning and weed control will be carried out on an as-needed basis and will be performed in a manner that minimizes negative impacts to big game habitat and avoids harm to natural resources.

SUMMARY AND CONCLUSION

The proposed Taylor Shadows Subdivision will result in the development of two parcels within the 13.9-acre project area. Development plans provided by AW Engineering include driveway enlargement; construction of 2 single-family residences and appurtenant structures; and development of a neighborhood common area. This NRA report has been prepared because the project area falls entirely within the WH Overlay for big game migration corridors and seasonal habitat. The proposed development will result in 2.15 acres of impact to the tall shrub (mountain shrubland) plant association, which is indicator habitat for

big game. Development-related impacts to mule deer are expected to be adverse, minor, and long-term, and impacts to elk are expected to be adverse, negligible, and long-term.

It is concluded that the proposed development is compliant with Title 9 of the Teton County Code as it pertains to development occurring within the WH Overlay. Proposed development has been located so that direct impacts to big game habitat and indicator species are minimized. Impacts to big game habitat and indicator species will be mitigated through minimization of impacts; the incorporation of a wildlife habitat protection mechanism into the neighborhood CCRs; and implementing wildlife-friendly land management practices.

LITERATURE CITED

Teton County. 2012. Title 9 Teton County Subdivision Regulations. Revised 11/05/2012. http://www.tetoncountyidaho.gov/pdf/codePolicy/Title9_apdxA_Amdended_20121115.pdf

APPENDIX 1 – LIST OF EXHIBITS

NATURAL RESOURCES ANALYSIS

PROPOSED TAYLOR SHADOWS SUBDIVISION

TETON COUNTY, IDAHO

1) Location and topography of the proposed Taylor Shadows Subdivision, Teton County, Idaho.

2) Aerial photograph depicting the location and site conditions of the proposed Taylor Shadows Subdivision, Teton County, Idaho.

3) Aerial photograph depicting National Earthquake Hazards Reduction Program seismic hazard classes in the vicinity of the Taylor Shadows Subdivision project area, Teton County, Idaho.

4) Aerial photograph depicting wildland urban interface (WUI) mapping in the vicinity of the Taylor Shadows Subdivision project area, Teton County, Idaho.

5) Aerial photograph depicting vegetation covertypes within the Taylor Shadows Subdivision project area, Teton County, Idaho.

6) Aerial photograph depicting state highways within a one-mile radius around the Taylor Shadows Subdivision project area, Teton County, Idaho.

7) Aerial photograph depicting the Teton County Wildlife Habitat Overlay in the vicinity of the Taylor Shadows Subdivision project area, Teton County, Idaho.

8) Aerial photograph depicting the results of the wildlife habitat assessment within the Taylor Shadows Subdivision project area, Teton County, Idaho.

9) Aerial photograph depicting vegetative impacts resulting from proposed development within the Taylor Shadows Subdivision project area, Teton County, Idaho.

10) Aerial photograph depicting proposed mitigation measures for the Taylor Shadows Subdivision, Teton County, Idaho.

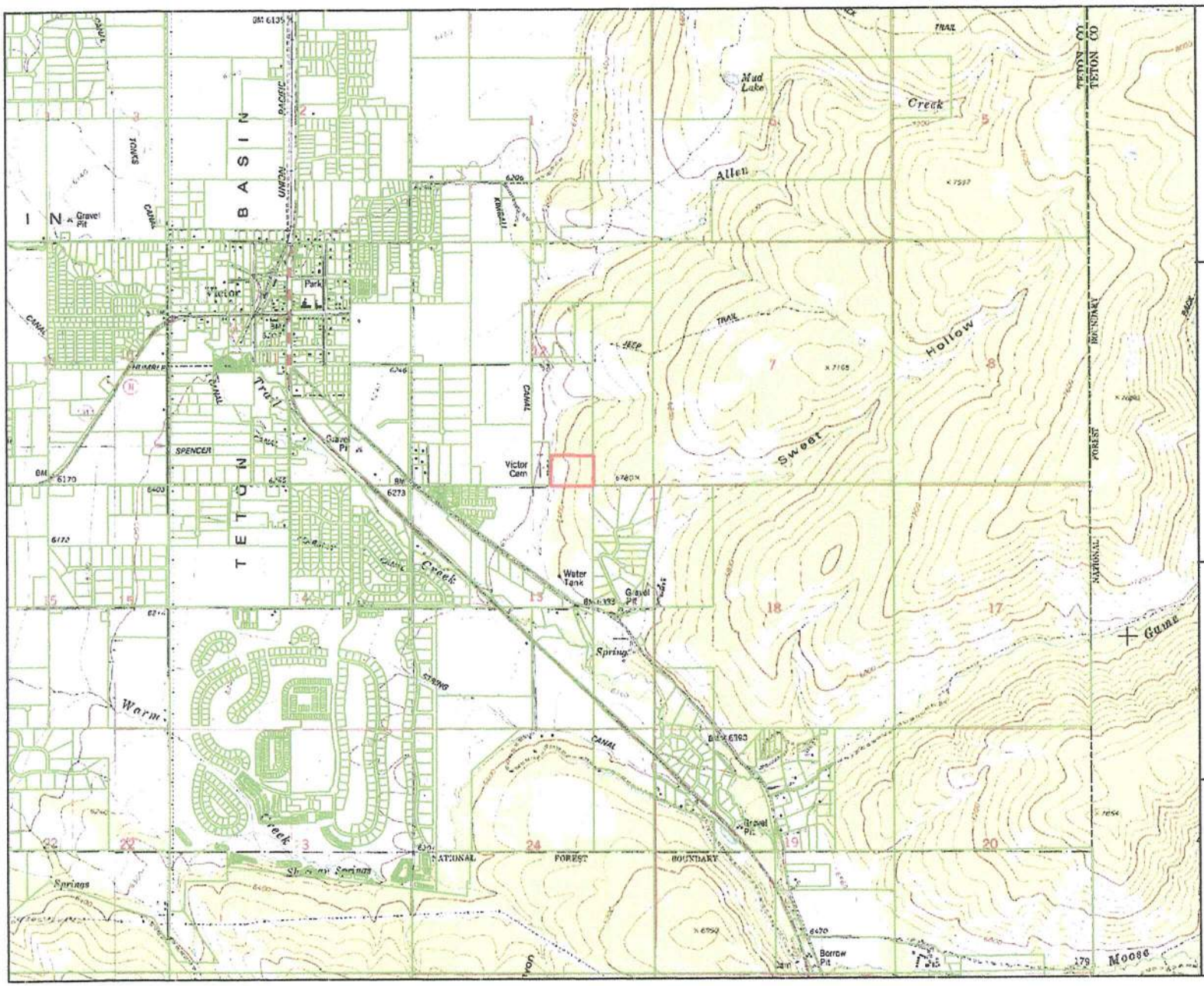

Exhibit 1
Location and topography of the proposed
Taylor Shadows Subdivision,
Teton County, Idaho.

May 8, 2014

Approximate Scale: 1 inch = 2,000 feet

LEGEND

Project Area

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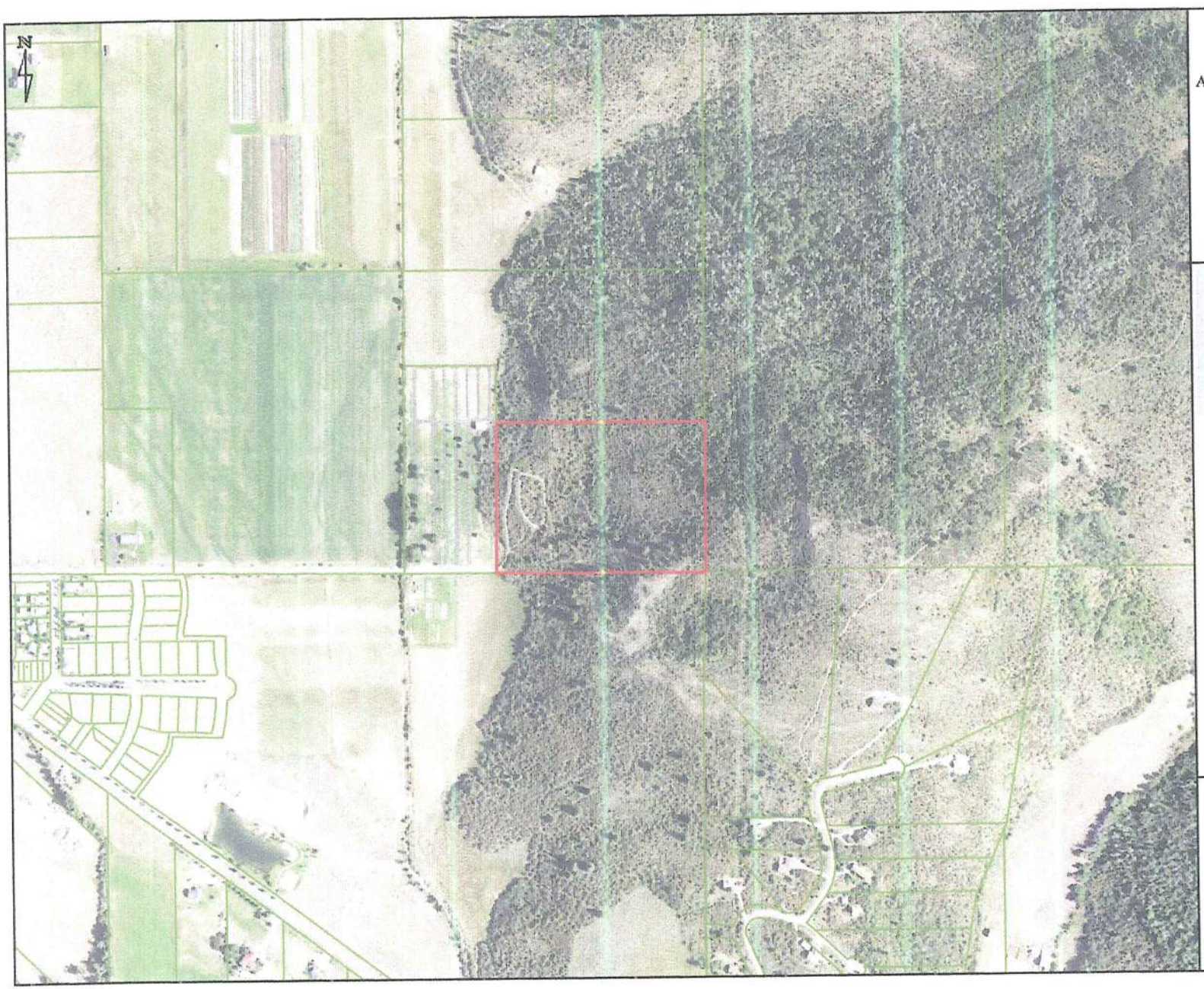

Exhibit 2
Aerial photograph depicting the location and site conditions of the proposed Taylor Shadows Subdivison, Teton County, Idaho.

May 8, 2014

Approximate Scale: 1 inch = 400 feet

LEGEND

Project Area

Platted Parcels

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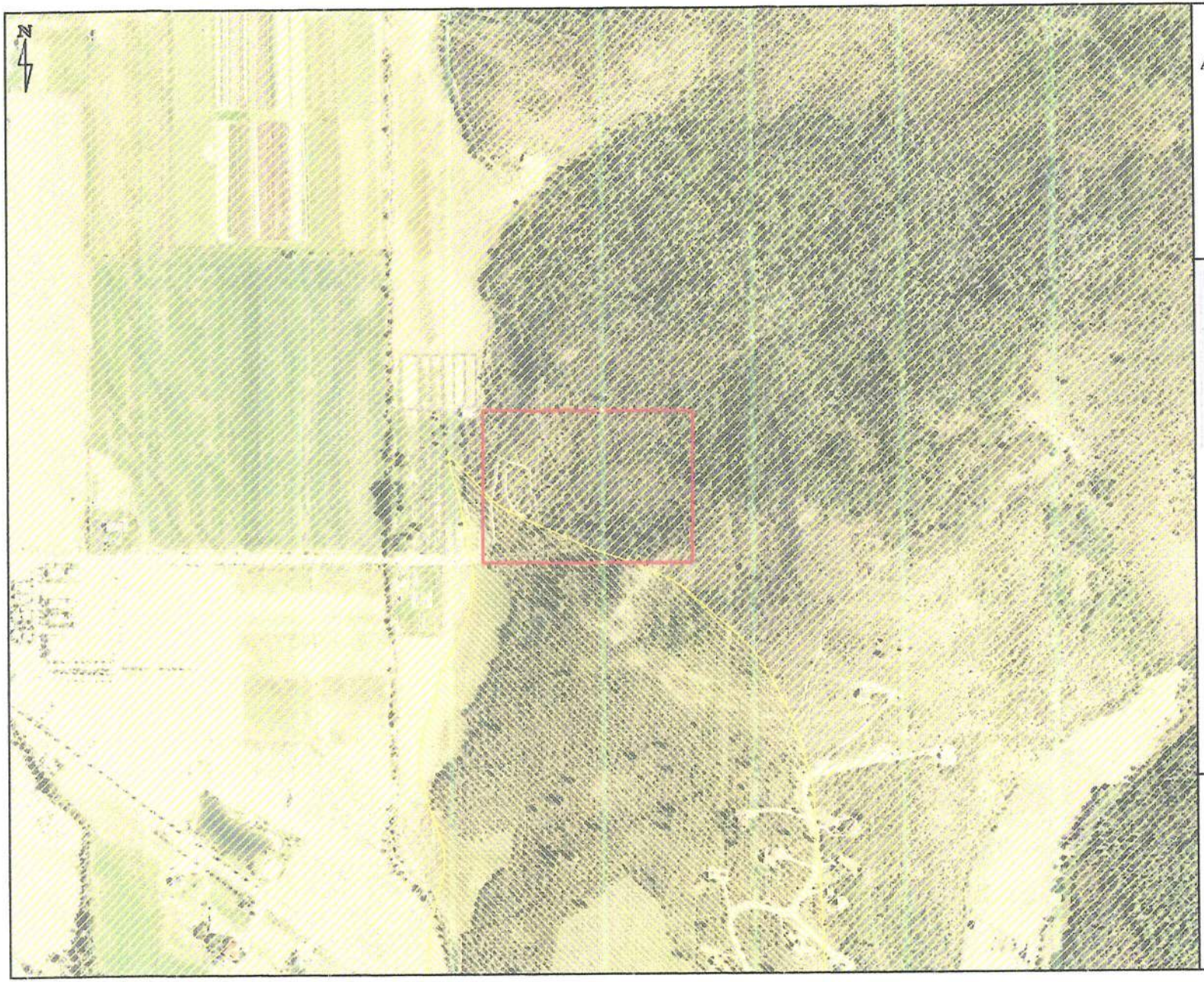

Exhibit 3
Aerial photograph depicting National Earthquake Hazards Reduction Program seismic hazard classes in the vicinity of the Taylor Shadows Subdivision project area, Teton County, Idaho.

May 8, 2014

Approximate Scale: 1 inch = 400 feet

LEGEND

- Project Area
- NEHRP Class 2
- NEHRP Class 3

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Exhibit 4
Aerial photograph depicting Wildland Urban Interface (WUI) mapping in the vicinity of the Taylor Shadows Subdivision project area, Teton County, Idaho.

May 8, 2014

Approximate Scale: 1 inch = 400 feet

LEGEND

- Project Area
- Wildland Urban Interface Mapping
- Platted Parcels

research & restoration inc
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Exhibit 5
Aerial photograph depicting vegetation covertypes within the Taylor Shadows Subdivision project area, Teton County, Idaho.

May 8, 2014

Approximate Scale: 1 inch = 100 feet

LEGEND

- Project Area
- Douglas-fir/Chokecherry Association (Evergreen Woodland)
- Serviceberry-Big Sagebrush/Kentucky bluegrass Association (Mountain Shrub)
- Previously Disturbed (Driveway)

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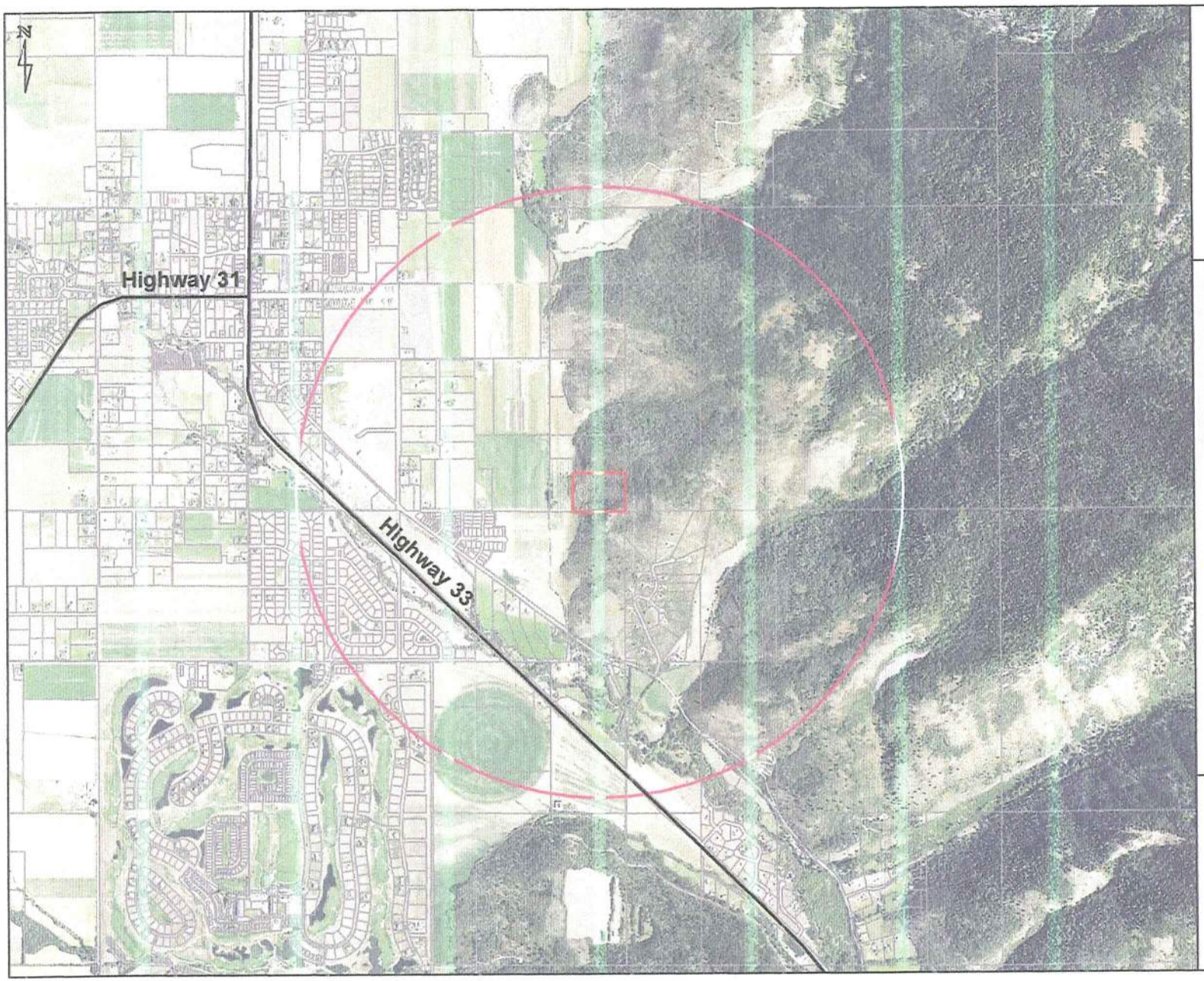

Exhibit 6
Aerial photograph depicting state highways within a one-mile radius around the Taylor Shadows Subdivision project area, Teton County, Idaho.

May 8, 2014

Approximate Scale: 1 inch = 1,600 feet

LEGEND

- Project Area
- State Highways
- Platted Parcels
- 1-Mile Buffer Around the Project Area

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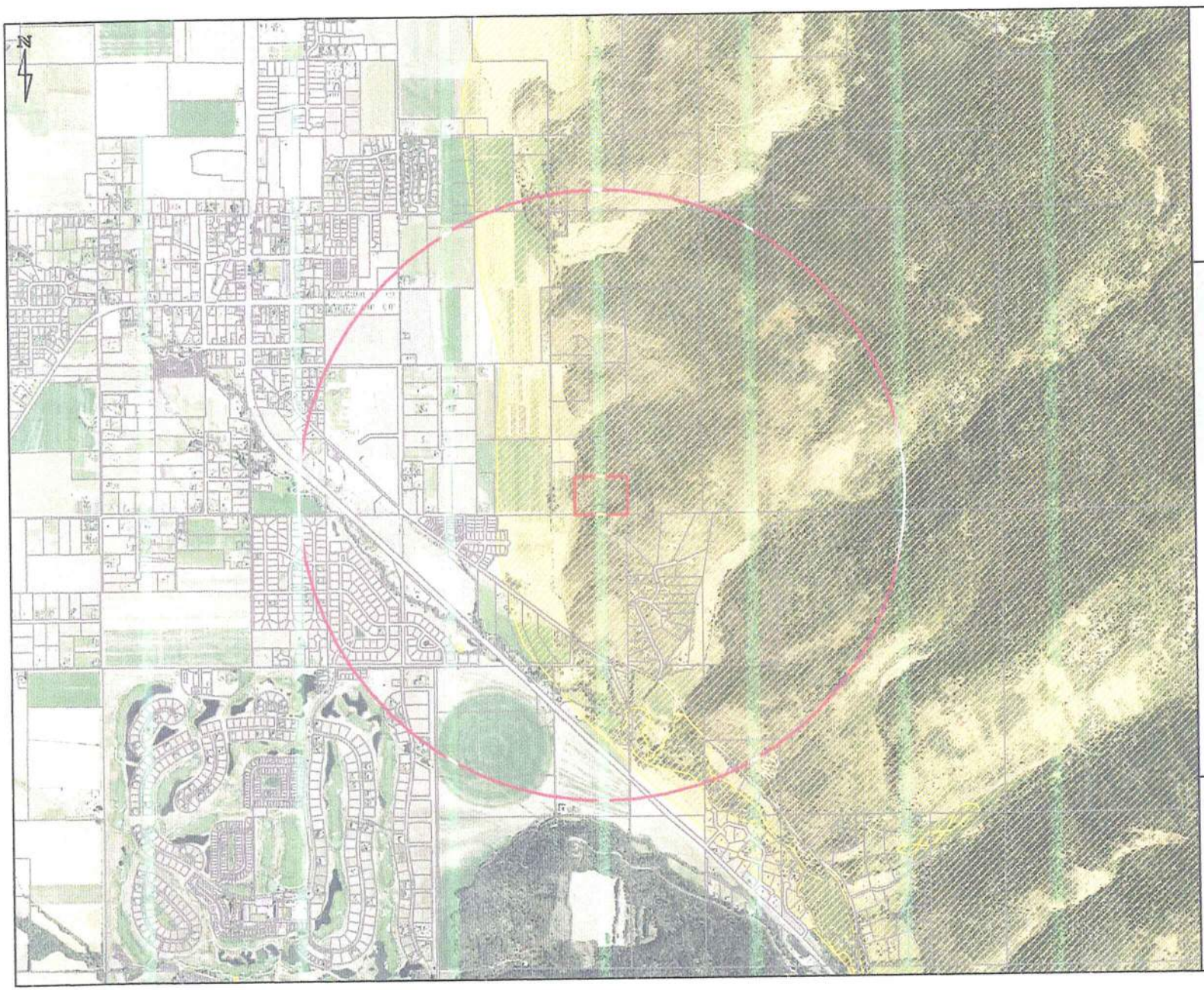

Exhibit 7
Aerial photograph depicting the Teton County Wildlife Habitat Overlay in the vicinity of the Taylor Shadows Subdivision project area, Teton County, Idaho.

May 8, 2014

Approximate Scale: 1 inch = 1,600 feet

LEGEND

- Project Area
- Wildlife Habitat Overlay
- Platted Parcels
- 1-Mile Buffer Around the Project Area

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Exhibit 8
Aerial photograph depicting the results of the wildlife habitat assessment within the Taylor Shadows Subdivision project area, Teton County, Idaho.

May 8, 2014

Approximate Scale: 1 inch = 100 feet

LEGEND

Project Area

Big Game Indicator Habitat (Mountain Shrubland)

* Moderate elk use and heavy mule deer use was evident throughout the big game indicator (mountain shrubland) habitat within the project area.

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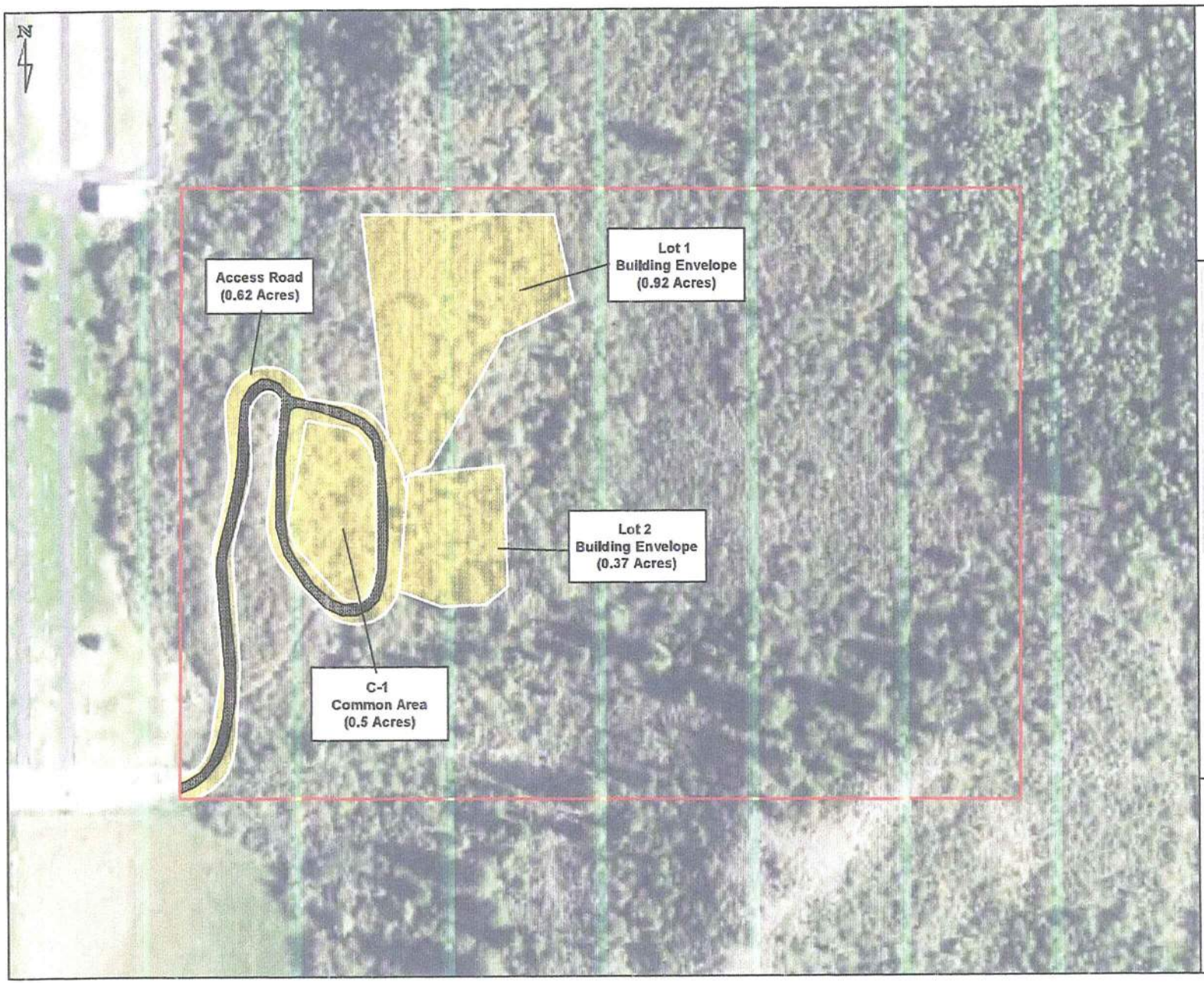

Exhibit 9
Aerial photograph depicting vegetative impacts resulting from proposed development within the Taylor Shadows Subdivision project area, Teton County, Idaho.

May 8, 2014

Approximate Scale: 1 inch = 100 feet

LEGEND

- Project Area
- Platted Parcels
- Proposed Development Area

Covertype Impacts

- Mountain Shrubland (2.15 Acres)
- Disturbed Area (0.26 Acres)

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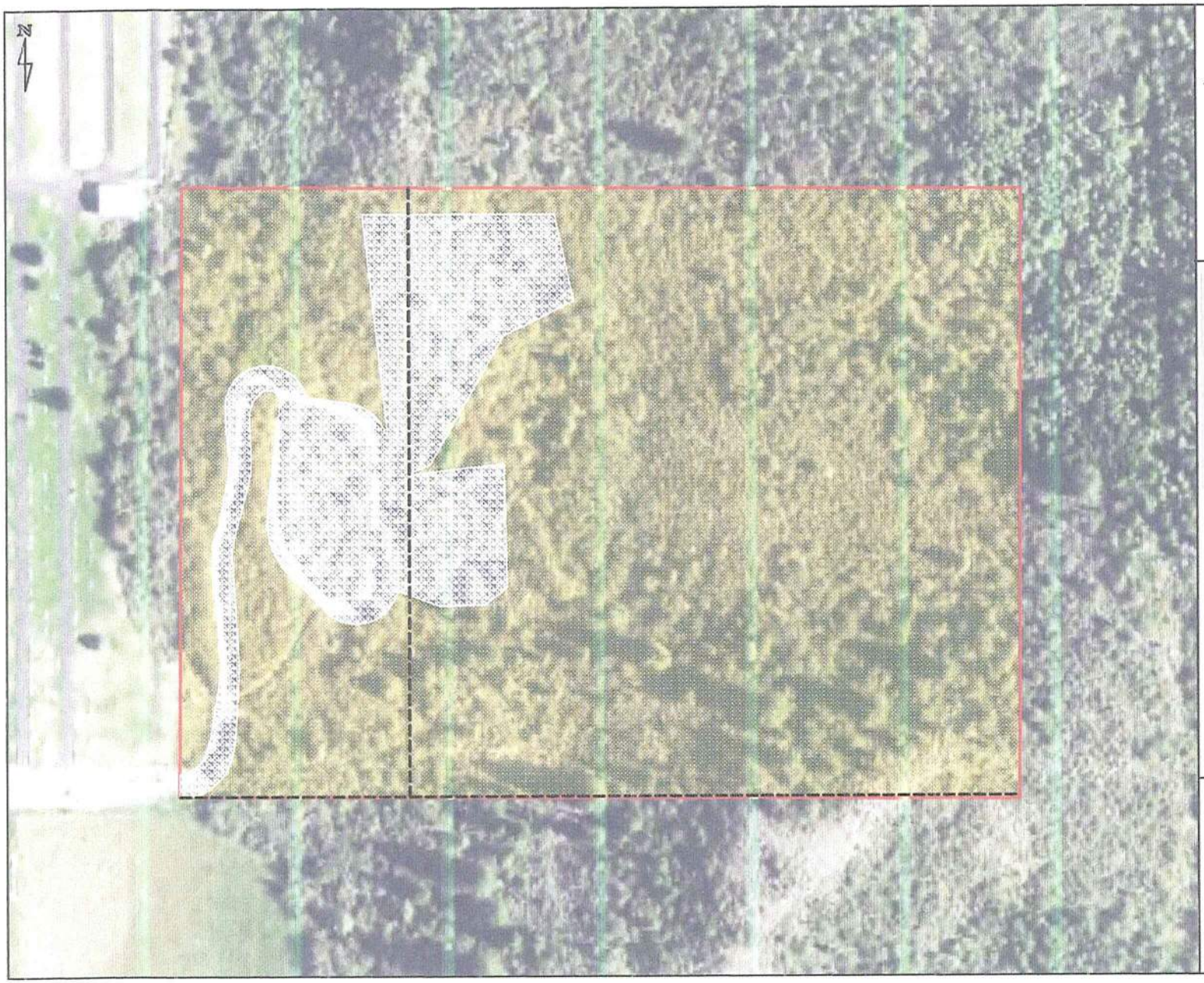

Exhibit 10
Aerial photograph depicting proposed mitigation measures for Taylor Shadows Subdivision, Teton County, Idaho.

May 8, 2014

Approximate Scale: 1 inch = 100 feet

LEGEND

- Project Area
- Proposed Habitat Protection Area
- Proposed Development Area
- Fence To Be Removed

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APPENDIX 2 – PHOTOGRAPHIC DOCUMENTATION

NATURAL RESOURCES ANALYSIS
PROPOSED TAYLOR SHADOWS SUBDIVISION
TETON COUNTY, IDAHO

Photo 1. One of many mule deer pellet groups observed in the project area.

Photo 2. Heavily browsed serviceberry branches in the central portion of the project area.

Photo 3. A game trail in the central portion of the project area.

Photo 4. A recent elk rub on an aspen tree in the northern portion of the project area.

Photo 5. Spotted knapweed along the driveway in the southwestern portion of the project area.

Photo 6. An old barbed wire fence near the proposed development area scheduled for removal.

APPENDIX 3 – GENERAL LAND USE RECOMMENDATIONS

Proposed Taylor Shadows Subdivision, Teton County, Idaho

The following recommendations, if implemented, would aid in protecting, preserving, and improving the wildlife and habitat values associated with the property.

1. **Agriculture.** The pasturing of livestock on the parcel is not recommended since the vegetation communities have little forage value for domestic livestock and these communities represent very important wildlife habitat and are used by elk, mule deer, and moose. Wintering livestock on the property is also not recommended; to do so would require the storage of hay or other alfalfa or grass product on-site. Careless hay storage or feeding livestock will probably attract deer, elk, and/or moose and increase the likelihood of problems resulting from this attraction.

2. **Fences.** An assessment of site-specific fencing needs should be made for the property. Fences frequently disrupt or discourage normal movement and use patterns of wildlife or actually present hazards to wildlife and their use should be avoided or minimized. If the control of livestock is not necessary, perimeter fences around the parcel should be removed. In situations where perimeter fences are necessary, they should be constructed in such a way so as to reduce their potential negative impacts to wildlife. Unless fences are intended to exclude wildlife (e.g., for gardens) or restrain domestic pets, fence construction should closely adhere to the recommendations provided below for wildlife-compatible fences.

   Recommendations for any fences internal to or around the parcel are provided below:

   1) The preferred fence design is a combination of pressure-treated posts, wire strands, and a pressure-treated top pole. This design effectively controls livestock while promoting wildlife movements.
   2) The spacing of fence posts should be on 12-foot centers.
   3) The overall height of the fence should not exceed 42 inches; the preferred height is 38 inches in most situations and 40 inches if problems develop.
   4) Installed fence posts should have extra height to allow raising or lowering top pole 38-42 inches above the ground.
   5) The bottom wire should consist of smooth twisted wire located 16-17 inches above the ground. This will allow small and medium-sized mammals, such as moose/ elk calves and deer fawns, to crawl under the fence.
   6) The second and third wire strands can be barbed wire (if necessary) and spaced evenly over the 26-27 inches distance between the bottom strand and the top of fence (e.g., the second strand is at 25 inches and the third strand is at 34 inches). It may be that only one strand of wire is actually needed and could be placed at about 29 inches. Spacing between the top pole and the first strand of wire also varies between 6 in on 38-in high fence and 10 inches on 42-inches fence.
   7) The top pole spiked to the side of the fence posts will facilitate animals attempting to jump the fence and protect them from injuries resulting from rubbing or becoming entangled in a top strand of wire. The top pole should be set at either 38 or 42 inches due to alternating top rails.
   8) Gates should be constructed of wire with an optimal height of 38 inches. The gates should be installed at least every 450-foot of continuous fence. The spacing of the wires should be the same as that on the fence (i.e., bottom at 16-17 inches above ground, top at no more than 42 inches, and either one or two strands spaced evenly between). The top and bottom strands should be of smooth-twisted wire. The middle strand(s) can be barbed wire, if necessary. Opening gates will allow wildlife access to the property during periods when livestock control is unnecessary. Gates should be left opened whenever possible to facilitate ease of wildlife movement.

   These recommendations generally follow guidelines developed by the Wyoming Game and Fish Department and the Bureau of Land Management. If adhered to, the fences resulting from these recommendations will be "wildlife friendly" and promote the continued use of the important wildlife habitat found on the parcel. In particular, crucial wildlife winter habitats will be easily accessible to animals, especially if efforts are taken to lower top poles or open gates when livestock are not present.

3. **Non-native Plants.** The introduction of any non-native plants that might compete with or harm native species and result in their decline is discouraged. Exceptions to this would be the introduction of a non-native species that would improve or prevent undue damage to the natural environment (e.g., soil stabilization) or plants within the immediate confines of the building envelope.

4. **Non-native Fauna.** The introduction into the wild of any non-native or domesticated animal species that might compete with or harm native species and result in a decline in their use is strongly discouraged.

5. **Vegetation Alteration.** The destruction, removal or alteration of living or dead vegetation is discouraged except when absolutely necessary. This is particularly important for properties that have wildlife use occurring within stands of woody overstory and shrubby understory vegetation. Standing dead trees, and dead and down vegetation provide important habitat for a variety of smaller wildlife species and greatly diversifies a piece of land. Woodpeckers forage for insects in standing dead trees and create nesting cavities for themselves and numerous other bird species. Fallen, rotten plant material creates shelter used by many small mammals while simultaneously returning nutrients to the soil.

6. **Roads.** The construction of roads should be minimized.

7. **Habitat Enhancement.** Wildlife habitat enhancements are acceptable physical alterations to the property. A plan describing enhancements and delineating affected areas should be developed by a qualified, county-approved consultant. This plan should consider negative impacts to non-target species.

8. **Herbicides**. The use of chemical herbicides and pesticides are discouraged except for controlling noxious weeds. Application of state-approved herbicides should be done responsibly by persons appropriately licensed and trained, and application instructions should be strictly adhered to.

9. **Burning.** The burning of any materials or vegetation is discouraged except in accordance with government regulations, and in the case of vegetation, where burning is shown to be beneficial to wildlife.

10. **Off-road Vehicle Use.** Control the use of any off-road vehicles such as all-wheel drives, motorcycles, all-terrain vehicles, and snowmobiles, except when necessary for specified activities on existing roads. This will allow wildlife to adapt to predictable patterns of human use.

11. **Topographic Alterations.** The filling, excavating, dredging, mining, drilling, or removing of topsoil, sand, gravel, rock, minerals, or other materials, or other changes of the topography of the property is discouraged, except where absolutely necessary or associated with approved development and enhancement plans.

12. **Domestic Pets.** Free-roaming, unrestrained domestic pets disturb wildlife. Unrestrained pets can easily disrupt wildlife use on parcels and must be controlled. Dogs will readily chase, harass, and even kill both small and large mammals, as well as birds. Although less conspicuous than dogs, free-roaming cats can be as damaging to wildlife as dogs. Cats are effective predators of small birds and mammals and free-roaming cats have a high potential (both short- and long-term) for disturbing many wildlife species.

13. **Wildlife Feeding.** Intentionally feeding moose, deer, and elk anywhere in Teton County, Idaho is illegal.

14. **Wildlife Harassment.** Mule deer, elk, and moose will be present on the property at various times of the year. This is because important habitats for these ungulates are found on and in the vicinity of the parcel. The presence of these and other wildlife species should be expected and tolerated. People residing or owning property within the subdivision should be both respectful of and sensitive to wintering wildlife and not purposefully harass these animals as they struggle to survive harsh winter conditions. Moose, in particular, can be expected to browse upon landscaped vegetation and this activity can sometimes cause significant damage to this vegetation. Project proponents should make a concerted effort to educate themselves and future residents on how to minimize wildlife harassment.

15. **Trash Storage.** If the project area is located in bear habitat, bear-resistant garbage containers should be used to prevent bear-human conflicts. If non bear-resistant garbage containers are used, they should be stored inside an enclosed building or bear-resistant enclosure until the morning of waste pick-up, and promptly returned to secure storage after waste pick-up.

STORMWATER MANAGEMENT

TAYLOR SHADOWS Subdivision

East of Victor, Teton County, Idaho

Prepared for:
Dan Bender
RP 03N4RE128850
4417 Forge Rd
Perry Hill M.D. 21128

Prepared by:
A-W Engineering
Box 139
Victor, ID 83455
208-787-2952

May 5, 2014

TABLE OF CONTENTS

APPENDIX INDEX

I. GENERAL PROJECT INFORMATION

LOCATION:
SW 1/4 SE ¼ Sec 12, Twp. 3 N, Rng. 45 E.,B.M. Teton County, Idaho.
(see Map Part of *M:1 & 2 in appendix)*

OWNER / DEVELOPER:
Dan Bender
4417 Forge Road
Perry Hill, M.D. 21128

ENGINEER / SURVEYOR:
Arnold W. Woolstenhulme
A-W Engineering
255 South Main
Victor, Id. 83455
208-787-2952
aweng@ida.net

PROPOSAL: Dan Bender has recently purchased 13.93 acres in the SW 1/4 SE 1/4 of Section 12, Twp 3 N., Rng 45 E., B.M. in Teton County, Idaho. He is planning on building a house on the northern 10 acres and selling the southern 3.93 acres to his brother.

The site is outside of the City of Victor limits and within the city area of impact. It lies on the East side of the Victor Cemetery. The site has slopes over 30 % on 2/3 of the property. This is being considered in the planning process to locate the building envelopes on the flatter area on the property. There is an existing 10 foot wide roadway built on the slope of this land. This was built when the cemetery district was planning to have cemetery lots on this property. The land proved to be too rocky and steep for this to be feasible.

The two lots with building sites will have individual water and sewer services because no central system exists within 1/4 mile of the site.

The site has access onto 9000 South County / City road.

No central storm water system exists in this rural area. The land has natural runoff onto the cemetery property, which is entirely planted in lawn grass, then into the small Trail Creek canal. The runoff slope at the bottom of the property is one percent to the west and eventually drains into Teton River.
Only minor evidence of direct runoff or erosion is visible on this property. This is due to an old trail which ran up a small swale and accessed onto the steeper land. The old path did not go anywhere nor did it access the BLM land to the east.

The concerns and problems that will be addressed as this project proceeds are discussed in this report. Oversights or problems which are not apparent at this time neither negate the interest of the Engineer or the developer in addressing all concerned problems in a professional manner, nor their interest in having a quality project of which they are proud to be a part.

II. BACKGROUND AND GUIDELINES

The 13.93 acres have been used by the previous owners for natural pasture for cattle and horses. There isn't much good feed or vegetation on the property that would keep domestic live stock in this area and no water source exists on this land. The most natural and visual use has been for mule deer spring and winter use. The land is too steep and rocky for any farming operation.

Easements associated with this property are:

1. The prescriptive rights easement to access onto the City/County Road 9000 South.
2. A 100 foot wide easement along the West boundary to access a 10 acre parcel on the North side on this tract.
3. Power and telephone services allowed on the 100 foot easement via this plat.

A. PROPOSED PLANNED SITE DEVELOPMENT

Total acres in project:	13.93 acres
Roads in project County Road r-o-w:	0.00 acres
Acres improved or impervious surface:	1.50 acres

B. EXISTING CONDITIONS AT BUILDING SITES

1. Majority of soil is classified as Dra Pinocle rock.
2. Permeability of 0.80 to 2.5 inches per hour.
3. Percolation of 1.0 to 4 inches per hour estimated according to SCS Soil Survey.
4. Property vegetation and ground cover in good condition.
5. No runoff washes or erosion visible.

C. SITE AREA ISSUES

1. Existing storm water runoff conditions.
2. Calculated storm water runoff from developed site.
3. Proposed storm water runoff solution.
4. Storm water drainage swale and infiltration system design.

III. DESIGN CRITERIA AND DATA

A. CURRENT STATUS

The13.93 acres proposed development site has been used by the previous owners for horses and cattle pasture land. This property is bounded on the west by the cemetery plots with nice lawn grass, on the north by similar hill side land and on the northwest by farm pasture and hay ground.

B. STORM WATER PRESENT RUNOFF

I. Assumptions: AW Engineering made the following conditions and assumptions:

1. The tract is going to be divided into two lots. For drainage purposes it will be the North ½ and South ½, each area being about 7.0 acres in size.

2. Drainage of the two areas have the same soils and slope.

3. A small drainage pond can be constructed at the base of both areas.

4. Approximate size of drainage swale would be 10' wide x 20' long with a 2.5' dike on the low side.

5. The dike area would percolate into the ground at 1" per hour.
Using 6 hours of percolation time this would equal 100 cu. ft. of water absorbed into the ground.

II. The Hydro CADD program was run through several different scenarios.
The two submitted in this report are:

A. Type II rainfall for summer 24 hr storm with 1.52" precipitation.
B. Type I-A storm for winter rain on snow with 1.14" rain + 1.0" snow melt = 2.14".

Other scenarios run did not show runoff volume as high as the 100 year storm, which was the expected result. Therefore they were not included in this report.

The source for precipitation and the method of conducting this analysis was taken from "Williams Teton County Precipitation Report" included in Appendix page 8.

The history and visual inspection shows very little runoff from this property in its natural condition except for the driveway constructed by the Cemetery District when it was planned to be an addition to the cemetery. No significant runoff is noted from this driveway construction work that was done about 10 years ago. No farming or agricultural activity has been done on this land.

The adjacent BLM property on the East does not show any significant runoff onto this site from visual inspection of this land. Because this is a low, western facing slope, a significant amount of snow does not accumulate. The snow that is on the land in the spring melts off early and usually very slowly and is absorbed into the ground. No evidence of accumulative runoff on the lower property to the west (Victor Cemetery).

C. PERCOLATION RATE

The percolation rate from the NRCS Soils Report shows a rate from 2 to 10 inches per hour of percolation for the rocky-gravel loam soil in this area.
This soil is shown as Dra or Driggs gravelly loam. (See Soils report pages S 1-11 in appendix).

A-W Engineering dug three different soil test holes in November 2013. The top 12 inches is gravelly loam topsoil. Below this was stony gravel loam. The holes were dug 6 feet deep where it was hard for the backhoe to dig through the large rock.

D. PROPOSED DRAINAGE SWALE

The two (2) drainage swales will be dug at the western edge of the property adjacent to the Victor Cemetery plots. This area is the flattest on the property and is a natural place to have the drainage ponds. The area will be excavated one foot deep and the material used to construct the 1.5 foot dike on the lower side. The material at this one foot depth will be gravelly loam and provide the infiltration necessary for the drainage swale to work. The proposed infiltration of 1" per hour and a time of 6 hours will be used in this report to calculate the balance for the swale capacity. This calculates to 100 cfs being percolated into the ground which can be deducted from the design capacity of the swale.

Use 1" per hour percolation rate for infiltration swale.
Using 6 hours time for percolation, it is estimated that the swale will have 70 % of wetted perimeter utilized for infiltration for the 100 year Type II storm.

E. RUN-OFF HYDRO CADD CALCULATIONS

A Hydro CADD Storm water TR-20 software program was used to run the storm water runoff and calculate the data for the storm water detention pond and infiltration swale system. The peak condition from this program was then used for the 7.0 acre site, with 0.5 acres being the developed site for the design of the storm water detention and infiltration swale. The TR-20 program uses the typical NRCS curves that are applicable curves for this project.
Pages 1-8 in the Appendix show the pre-developed scenarios for the 100 year storms under different conditions.

1. Hydro CADD Program Calculations

100 Year 24 hr Storm Rainfall

	Summer Type II Storm	Page	Early Spring Type I-A	Page
Pre-developed	1.52"	1	1.14 + 1.0 = 2.14	2
Developed	1.52"	5a & 5b	1.14" + 1.0" = 2.14"	6a &6b

The 100 year scenario showed more peak runoff than other periods of 2 years and 25 years. Therefore it was the only data included in this report.

The storm water Hydro graph for the pre-development condition shows 0.32 cfs on the 7.0 acres for the 100 year summer rain storm.
There is no evidence on the ground of any water running off from this land. There is only one swale that shows some runoff from natural ground on this property.

2. State of Soils and Horology of Area

The soils in the Victor area on the east side of the valley are absorbent and will infiltrate a significant amount of water into them. The "Williams Teton County Storm Water Design Data" states that you need to consider rain or a snow winter event. This scenario does not cause runoff in the Victor area except on impervious areas where snow has been removed and therefore the ground is frozen. The ground does not freeze or stay frozen in the Victor area if there is 12" of undisturbed snow cover on it. Even if the ground freezes in the fall, it will thaw out after the snow comes and acts as insulation on the ground. Any rain on winter snow pack will freeze at night and cause a frozen lake effect on top of the snow. Therefore, unless the ground is frozen, the soil is very absorbent in the Victor area.

3. Hydro CADD Program Pre Development Condition

The storm water for the natural state on this land was calculated and it shows the runoff for a 100 year 24 hour storm at peak conditions.

I. Type I-A: Rain on snow spring 1.14" rain + 1.0" snow melt = 2.14" precipitation.
Type I-A Curve 24 hour storm event A-Page 3 shows 0.06 cfs peak flow.
A-Page 4 shows 0.099 ac. ft. storage volume.

II. Type II Storm: Summer rainfall at 1.52" precipitation on Teton Valley floor.
Type II Curve 24 hour storm event A-Page 5 shows 0.31 cfs peak flow.
A-Page 6 shows 0.39 ac. ft. storage volume.

4. Hydro CADD Program Developed Condition

The storm water for the natural state of this land was calculated and shows the runoff for a 100 year, 24 hour storm at peak conditions after development of the sites, including new houses.

I. Type I-A: Rain on spring snow: 1.14" rain + 1.0" snow melt = 2.14" precipitation.
Type I-A Curve 24 hour storm event A-Page 3 shows 0.08 cfs peak flow.
A-Page 4 shows 0.102 ac. ft. storage volume.

II. Type II Storm: Summer rain fall at 1.52" precipitation on Teton Valley floor.
Type II Curve 24 hour storm event A-Page 5 shows 0.42 cfs peak flow.
A-Page 6 shows 0.44 ac. ft. storage volume.

5. Pond size for summer condition; developed site – 1.52" Type II Storm

The condition from the above numbers and the Hydro graph date "A-3-6" in the Appendix shows a peak condition of 3.61 cfs of runoff. This number is used to calculate the volume of runoff during the one hour of peak time as follows:

Pond size 20' x 10' bottom x 2.0 ft deep; design volume = 500 cu. ft.
Percolation in drainage swale: 1"/hr at 12 hrs at 70% effective = 1680 cu. ft. water.
System runoff: 0.44 – 0.39 = .05 ac. ft. or 2180 cu. ft. water.
Runoff-pond perc: 2180 cu. ft. – 1680 cu. ft. per = 500 cu. ft. water storage in drainage swale.

Therefore 20' x 10' x 3.0' deep = 600 cu. ft.
Pond: 500/600 = 83% full for 100 year design storm.

6. Winter rain on snow 2.14" Type IA Storm

This shows a peak condition of 3.61 cfs of runoff. This number is used with calculating the volume of runoff during the one hour of peak time as follows:

Pond size 20' x 10' bottom x 3.0 ft deep from above, design volume = 500 cu. ft.
Percolation in drainage swale: 1"/hr at 12 hrs at 70% effective = 1680 cu. ft. water.
System runoff = 0.102 – 0.099 = .03 ac. ft. or 13068 cu. ft. water.
Runoff - pond perc. 1306 cu. ft. – 1680 cu. ft. per = no water storage in swale needed.
Pond acts as infiltration basin with no storage required.

7. Conclusion from the Hydrograph data and the above statements:

A storm water/infiltration pond retaining over 500 cu. ft. of water will be required to retain all of the water from running off site for the Type II 100 year 24 hour storm as shown above.
AW Engineering recommends the 20 ft x 10 ft infiltration pond at 3.0 feet depth or equivalent in size to contain over 500 cu. ft. of water in pond.

IV. DEVELOPED SITE:

The peak developed site calculation from the above Section "D" shows that a storm drain pond of over 500 cu. ft. of storage will be required to meet peak runoff demand for each half of tract. Two ponds will be required at the bottom of developed sites. It is planned that these ponds will be near the property line on the lower land to collect most of the runoff from the developed areas. The percolation rate of 1" per hour is only being used for the drainage swale. Other areas that will have construction work done on them, such as the borrow ditch area of the rebuilt road, will add an additional 2000 sq. ft. of percolation area to the overall storm water system.

The third factor not considered here is that 0.3 acres of the site improvement will be developed in some lawn and flower areas and possible garden area. All of these items will lessen the water runoff from the site and will act as an infiltration system for that land as well as for storm water drainage from sidewalks and the building, thus further reducing the runoff.

A. Storm retention pond and infiltration swale design
   Storm pond design #1:
   Pond: 18 ft x 8 ft bottom with 2:1 side slopes, 3.0 ft deep = 588 cu. ft. of storage.

B. Storm retention pond percolation
   A percolation of 1"/hour at the developed infiltration site could percolate:
   Percolation in drainage swale: 1"/hr at 12 hrs at 70% efficiency = 1680 cu. ft. water.

C. Design pond for 500 cu. ft. of storm water storage
   Storm infiltration swale to contain 500 cu. ft. of water.
   Have side slopes of 2:1 min. slopes.
   Design bottom to have percolation median at 1"/hr rate min.
   South pond area could be used for winter snow storage.

V. QUALITY OF DISCHARGED STORM WATER

The storm water infiltrating into the ground will be of good quality because of the following criteria that is being used by the developer to discharge said waters.

-The grassy swale infiltrator system that discharges or percolates into the ground is the method by which nature cleans its dirty waters. It is one of the best systems and man has not improved upon it.

-The ground water in this area is estimated to be over 50 feet deep. No creeks or springs exist within 1 mile of the property. A minor Trail Creek canal lies 300 feet to the west of this property and is only used during high water season, so some discharge into the canal would be significant. The loamy gravel in the Victor area has layers of gravel that are hard to dig through and therefore act as a slowing down barrier for the infiltrated water.

-The loamy gravel is a good medium for infiltration and straining out impurities.

-A vegetative swale is designed to provide runoff treatment of conventional pollutants. This swale will have to be of adequate size to handle the peak hydraulic 10 year and 100 year storms.

-From the BMP #38 Vegetative Swale Catalog of Best Management Practice it states:

"Natural drainage courses should be regarded as significant resources that are generally to be kept in use for storm water management, including biofiltration. Roadside ditches should be regarded as significant potential biofilttration sites; road design standards and ditch maintenance programs should be developed to maximize their usefulness in biofiltration."

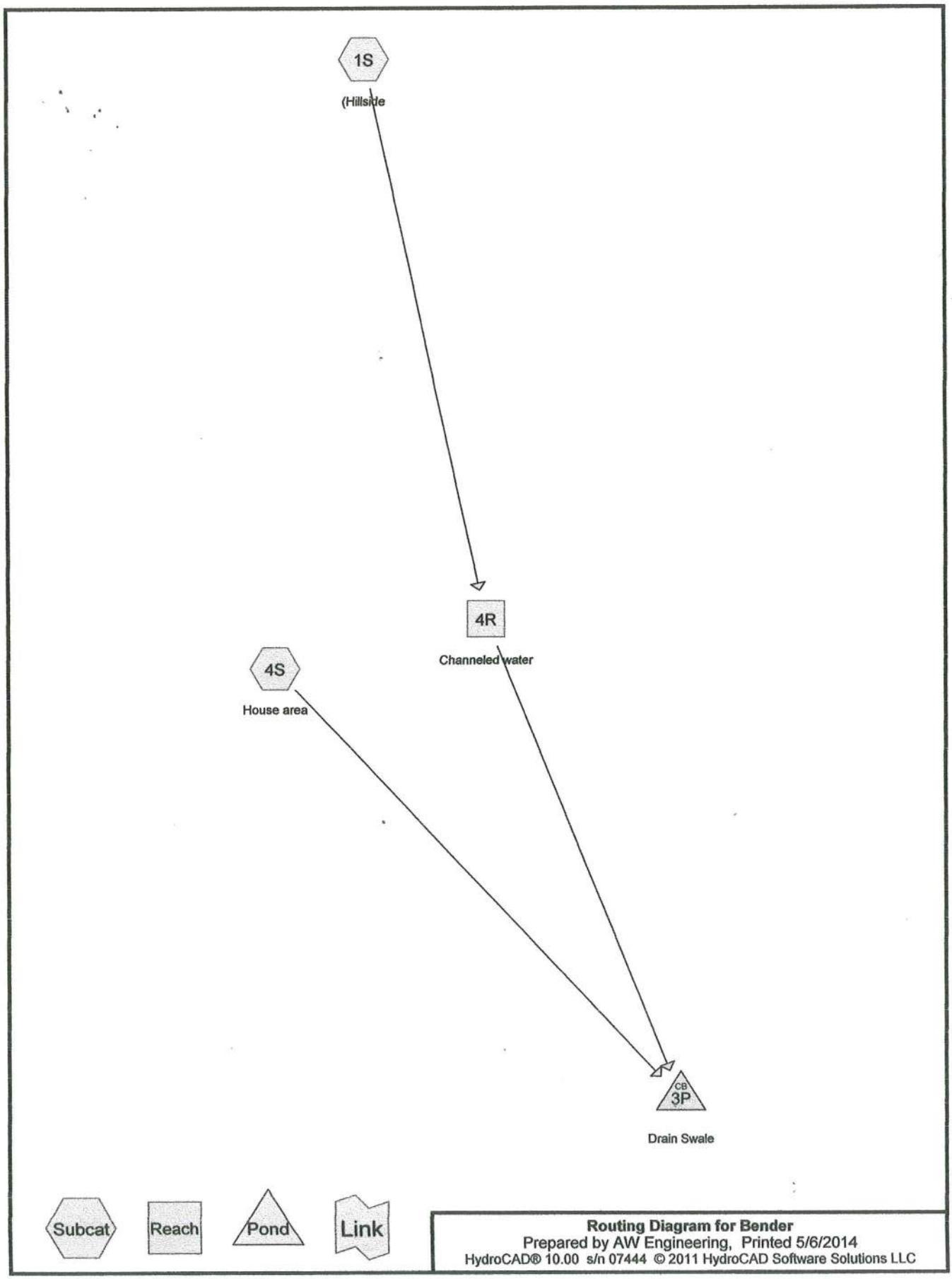
VI. IMPACTS ON ADJACENT PROPERTIES

The developed 13.93 acres with the two 500 cubic foot infiltration swales would have little, if any, impact on the adjacent properties. A percolation rate of 1"/hr. is a conservative number and would allow 3200 cu. ft. of water to percolate in the ground during rainfall and storm conditions. This would continue to replenish the ground water in the area at a similar rate and condition as it was pre-developed site. The infiltration swale would require 3 hours after a storm for the infiltration pond to percolate out before the next 100 year – 24 hour storm.
This system is designed to retain all of the storm water runoff that would be generated at this site under the stated conditions.

VII. POST CONSTRUCTION OPERATION AND MAINTENANCE PLAN

The developed site will be maintained by the Owner/Developer of the site. This is no problem since both the owner and his brother are planning to construct homes on these two lots and will live there permanently.
The biofilter swale will be checked after each major storm event. This will be done by the owners living on the site as they would be driving by the swales each trip.

The biofilter will be inspected in the spring and in the fall for any damage through the winter and for any repairs that may be needed for the filter to function through the following season.
Because a grass biofilter is self sustaining and built to last as a detention pond, there should only be light maintenance and normal grass lawn duties to sustain said basin for many years.
If the pond appears to have lost its percolation ability, then a restoration project may be needed. This would entail removal of the grass and topsoil layer down to the gravel base and then restore said surface to the original design.



Routing Diagram for Bender
Prepared by AW Engineering, Printed 5/6/2014
HydroCAD® 10.00 s/n 07444 © 2011 HydroCAD Software Solutions LLC

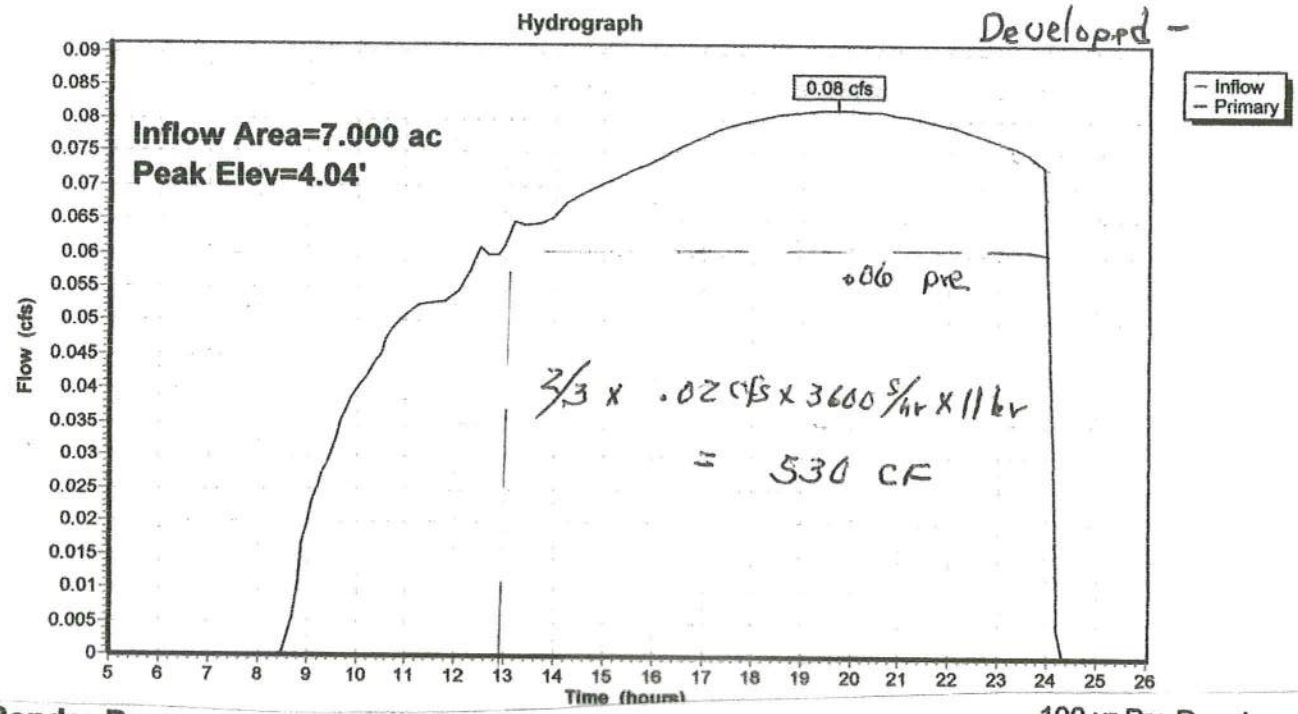
Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.500	56	Brush, Fair, HSG B (4S)
4.000	65	Brush, Good, HSG C (1S)
1.500	72	1/3 acre lots, 30% imp, HSG B (4S)
1.000	72	Woods/grass comb., Good, HSG C (1S)
7.000	**67**	**TOTAL AREA**

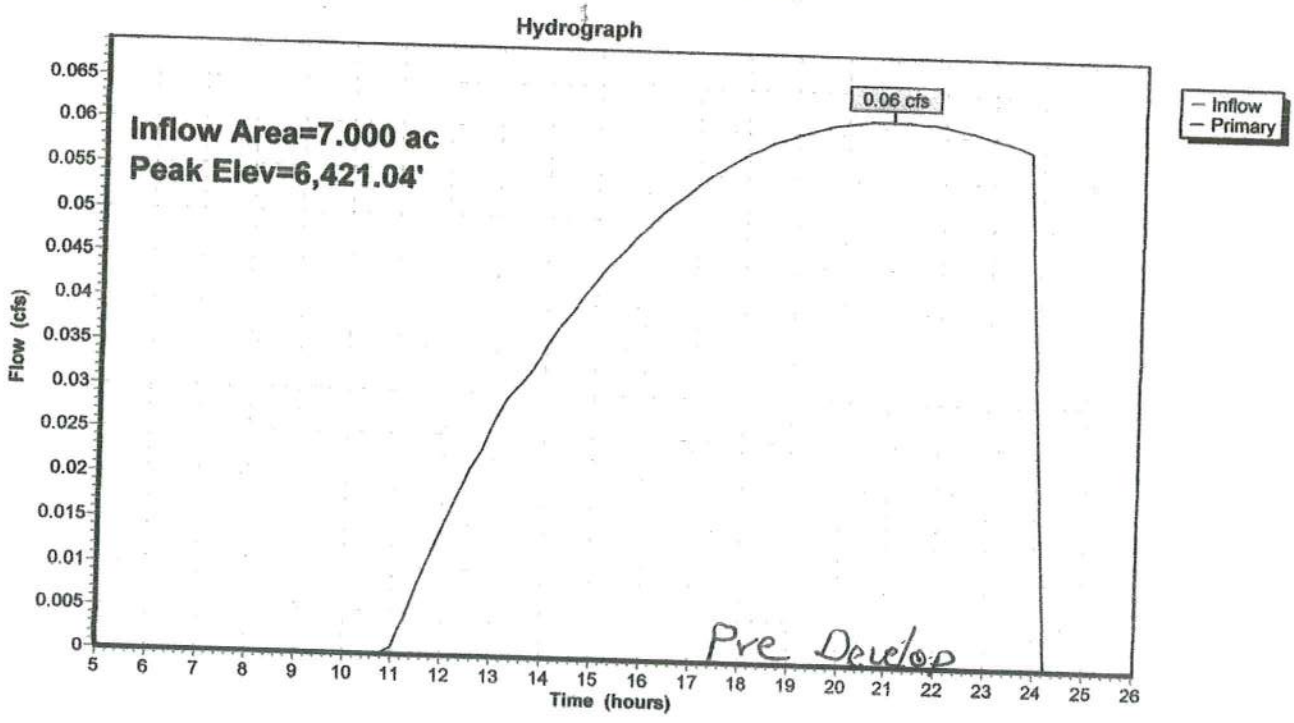
Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.600	48	Brush, Good, HSG B (4S)
0.400	56	Brush, Fair, HSG B (4S)
4.000	65	Brush, Good, HSG C (1S)
1.000	72	Woods/grass comb., Good, HSG C (1S)
7.000	**62**	**TOTAL AREA**

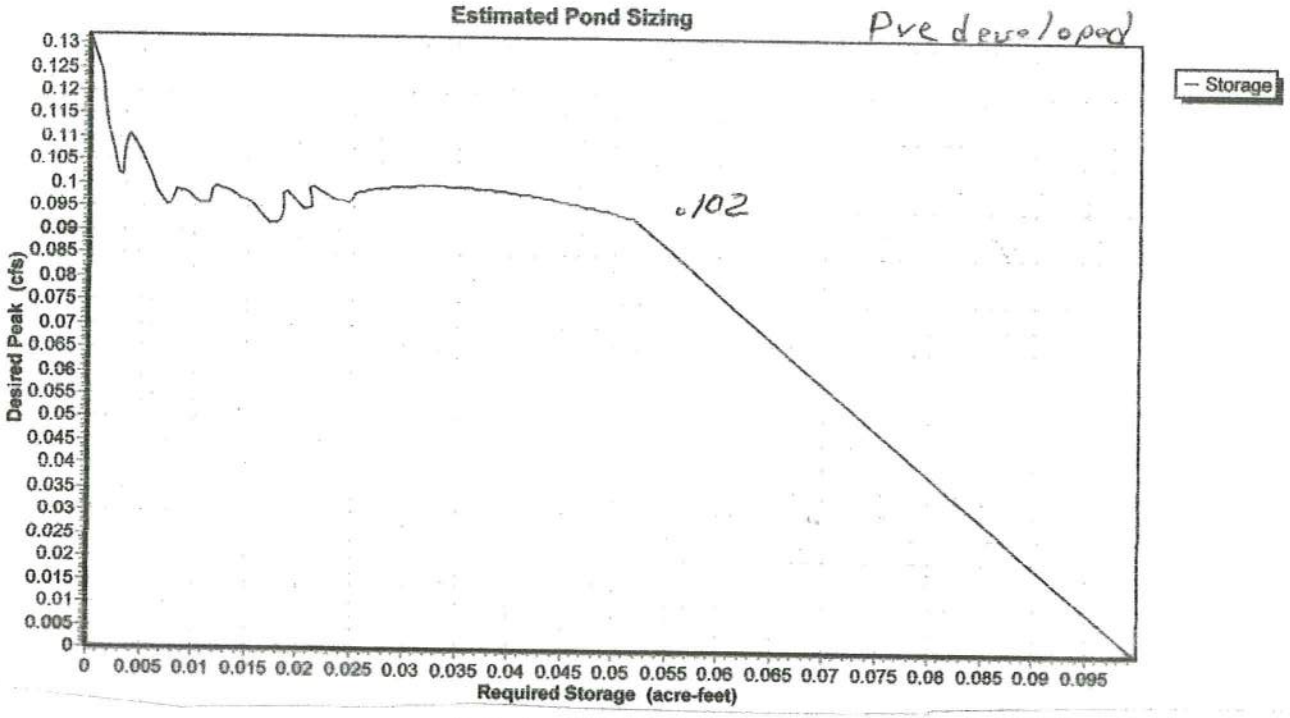
Pond 3P: Drain Swale

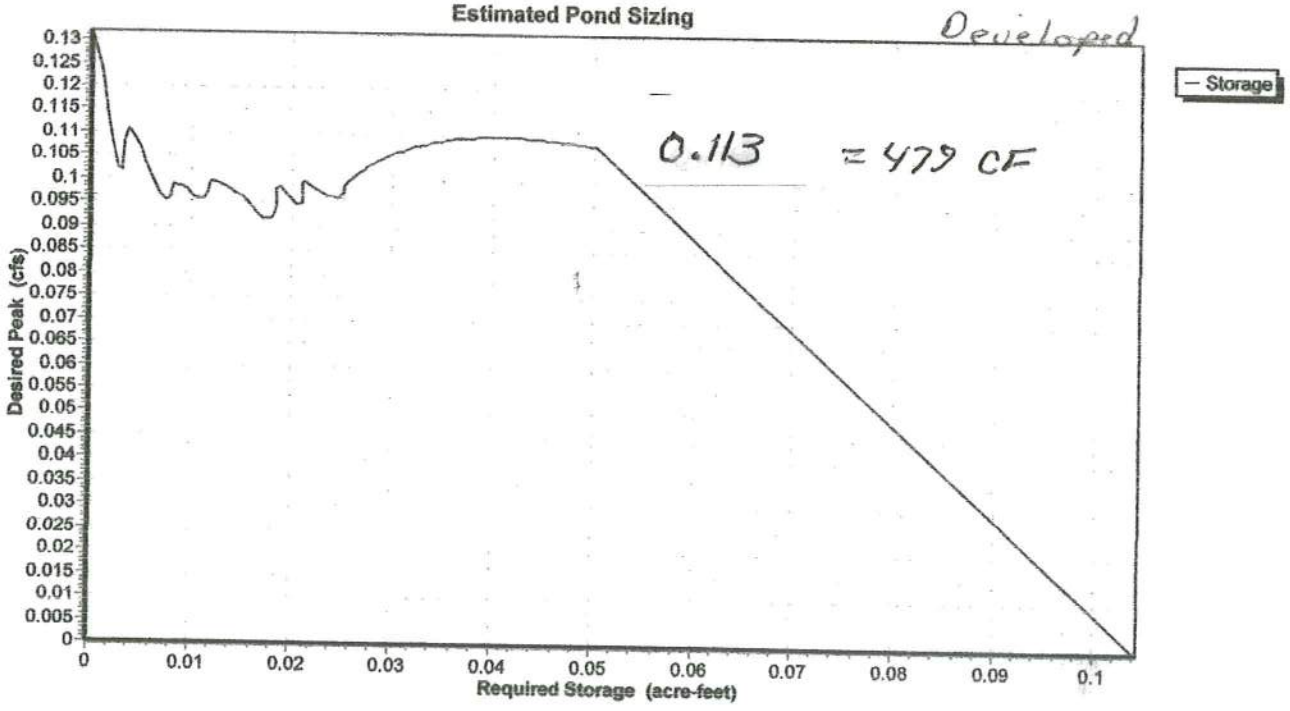


Pond 3P: Pond area

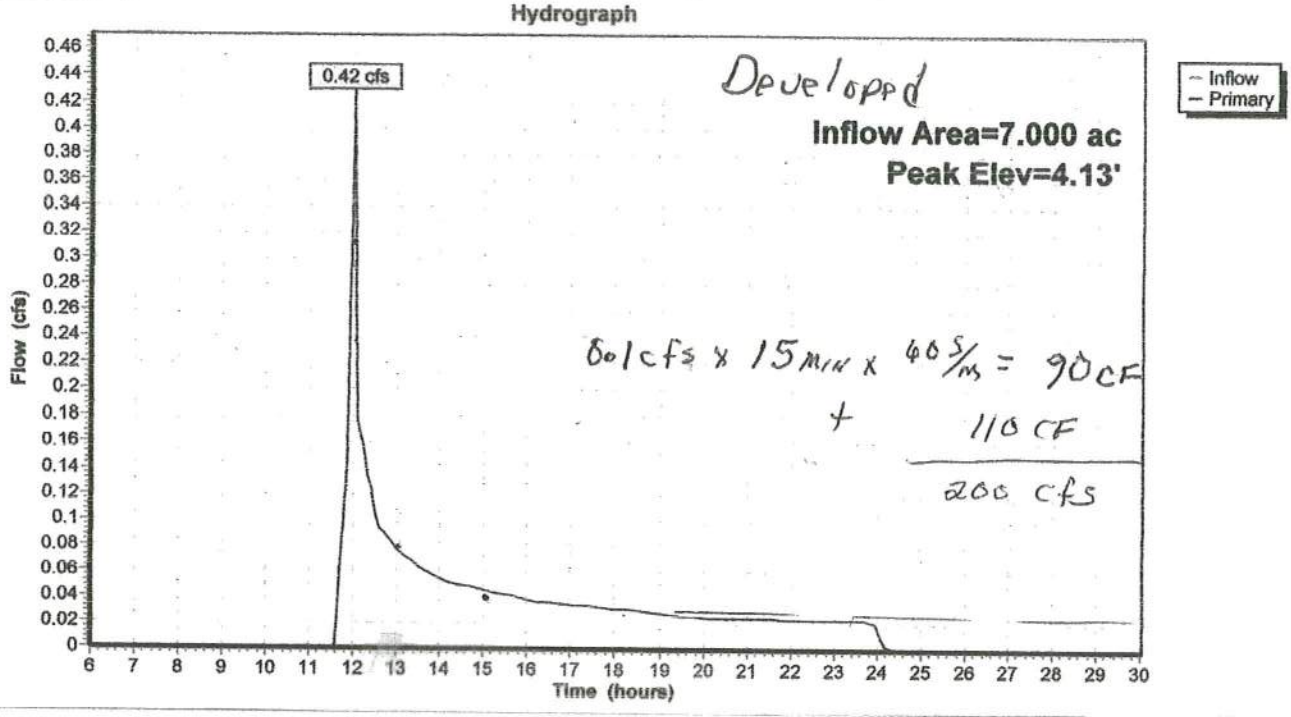


Pond 3P: Drain Swale



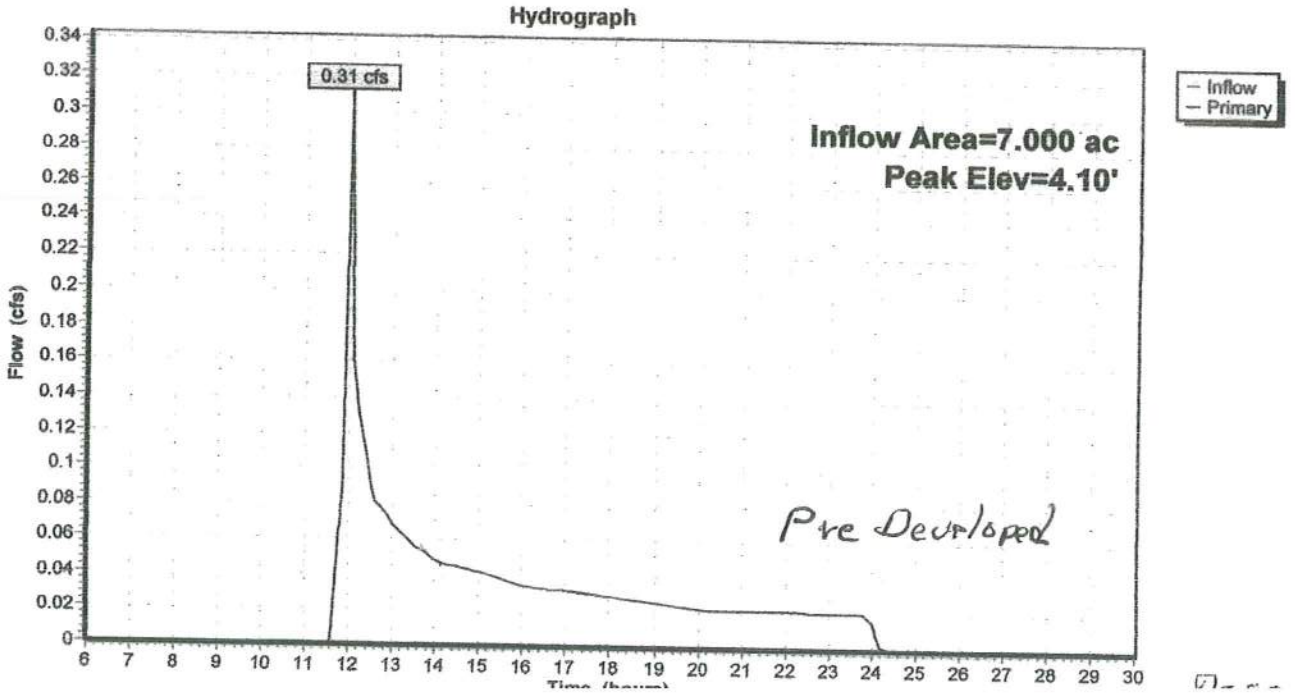


Pond 3P: Drain Swale

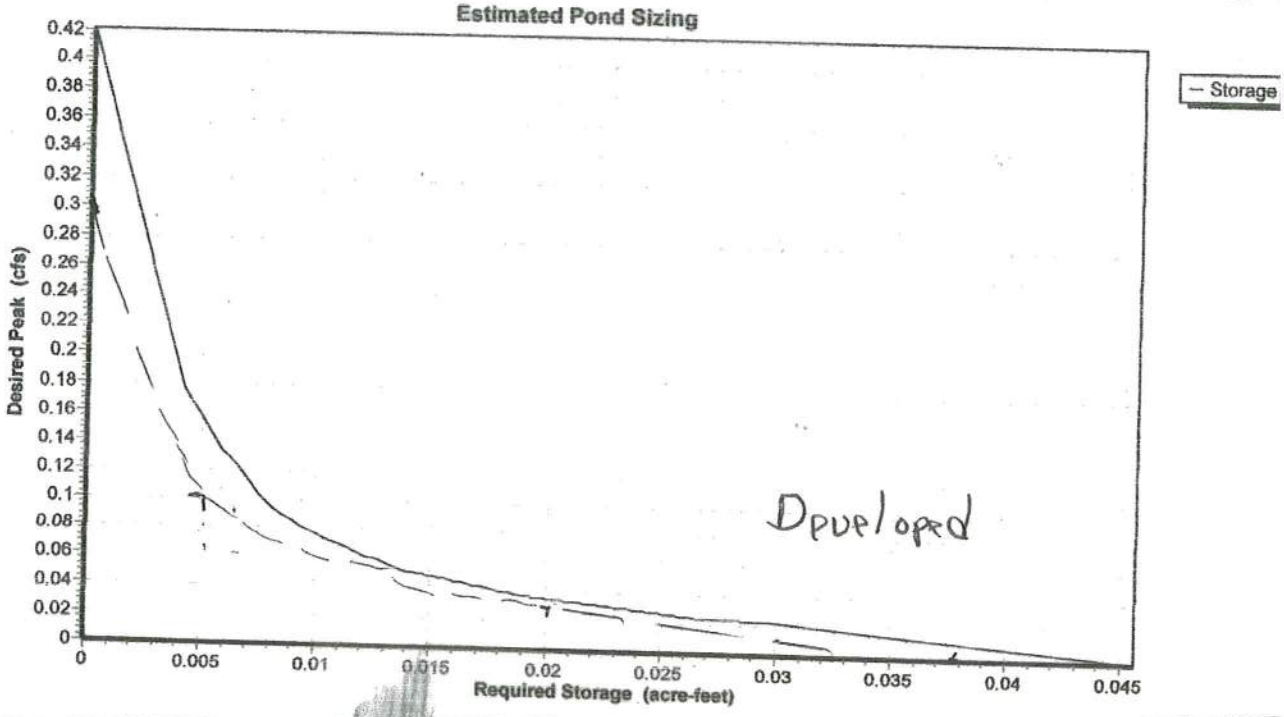


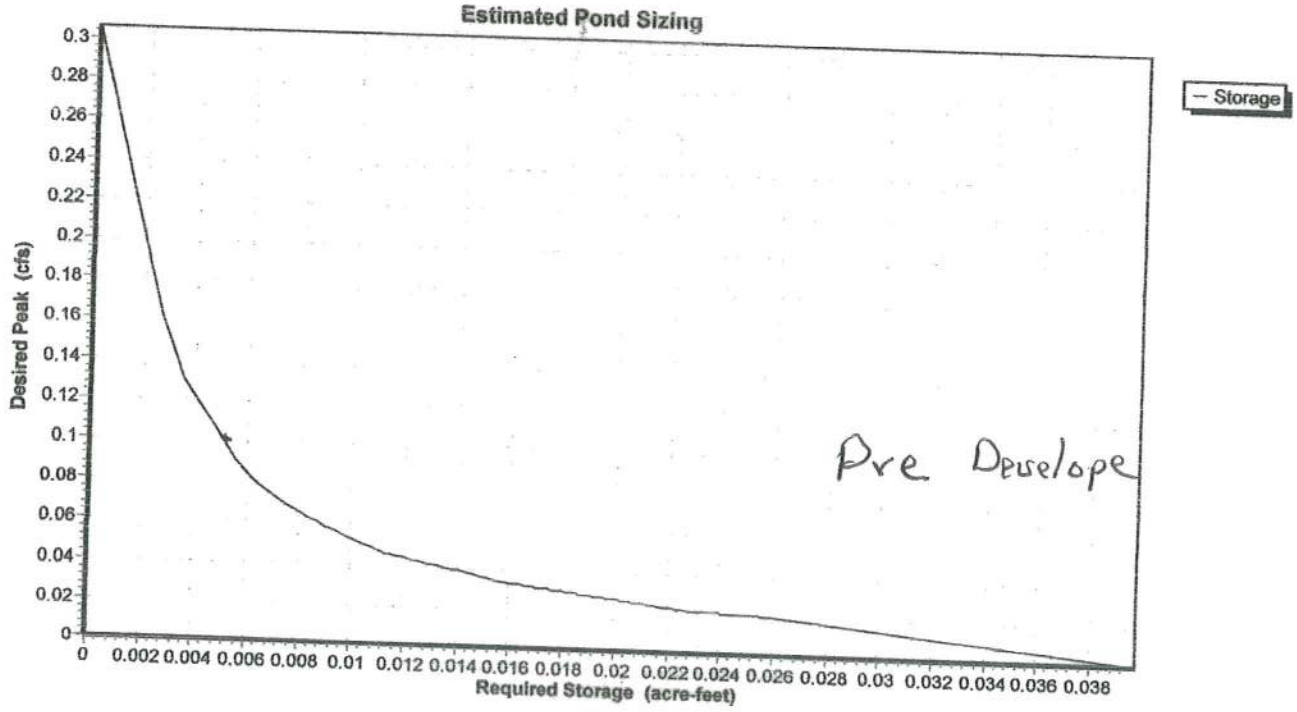
$0.1\ cfs \times 15\ min \times 40\ s/m = 90\ CF$
$+ \quad 110\ CF$
$200\ cfs$

Pond 3P: Drain Swale



Pond 3P: Drain Swale





Pond 3P: Drain Swale

Time span=6.00-30.00 hrs, dt=0.10 hrs, 241 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: (Hillside Runoff Area=4.000 ac 0.00% Impervious Runoff Depth=0.12'
Tc=0.0 min CN=72 Runoff=0.36 cfs 0.040 a

Subcatchment 4S: House area Runoff Area=3.000 ac 4.17% Impervious Runoff Depth=0.01'
Tc=0.0 min CN=60 Runoff=0.00 cfs 0.001 a

Reach 4R: Channeled water Avg. Flow Depth=0.08' Max Vel=3.90 fps Inflow=0.36 cfs 0.040 a
n=0.035 L=300.0' S=0.3000 '/' Capacity=30.17 cfs Outflow=0.31 cfs 0.040 a

Pond 3P: Drain Swale Peak Elev=4.10' Inflow=0.31 cfs 0.041 a
Outflow=0.31 cfs 0.041 a

Total Runoff Area = 7.000 ac Runoff Volume = 0.041 af Average Runoff Depth = 0.07'
98.21% Pervious = 6.875 ac 1.79% Impervious = 0.125 ac

Summary for Pond 3P: Drain Swale

[57] Hint: Peaked at 4.10' (Flood elevation advised)

Inflow Area =	7.000 ac,	1.79% Impervious,	Inflow Depth = 0.07"	for Pre Develop event
Inflow =	0.31 cfs @	12.00 hrs, Volume=	0.041 af	
Outflow =	0.31 cfs @	12.00 hrs, Volume=	0.041 af,	Atten= 0%, Lag= 0.0 min
Primary =	0.31 cfs @	12.00 hrs, Volume=	0.041 af	

Routing by Stor-Ind method, Time Span= 6.00-30.00 hrs, dt= 0.10 hrs
Peak Elev= 4.10' @ 12.00 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	4.00'	**4.0' long x 4.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66 2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=0.30 cfs @ 12.00 hrs HW=4.10' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.30 cfs @ 0.75 fps)

The total "precipitation" to use would be the sum of the rainfall and snowmelt inches. For example, if the winter rainfall was 1.20" and the snowmelt was 0.75", the winter precipitation rate would be 1.95".

TETON VALLEY FLOOR DESIGN RUNOFF SCENARIOS					
Season	Rainfall	Snowmelt	NRCS Type Hydrograph & Duration	% Impervious	
				Total	Directly Connected
Winter (December- February)	1.19"	0.75"	1A 24 hr.	90	80
Early Spring (March, April)	1.14"	1.00"	1A 24 hr.	50	25
Late Spring (May, June)	1.92"	1.00"	1A 24 hr.	0	0
Thundershower (July-November)	1.52"	0.00"	II 24 hr.	0	0
BIG HOLE MOUNTAINS AREA DESIGN RUNOFF SCENARIOS					
Winter (December- February)	1.20"	0.50"	1A 24 hr.	90	80
Early Spring (March, April)	1.28"	0.75"	1A 24 hr.	50	25
Late Spring (May, June)	1.78"	0.75"	1A 24 hr.	0	0
Thundershower (July-November)	1.96"	0.00"	II 24 hr.	0	0

10. **Abstraction Coefficients** Use values appropriate for the soil types and land uses involved. For the rational method, this would be runoff coefficient or "C" values. Using NRCS abstraction procedures, this would be curve number or "CN" values.

11. **Time of Concentration and Lag Time** Lag time must be computed using the equation for watershed lag time that is based on the same definitions and parameters as for the used unit hydrographs. The NRCS TR-55 time of concentration procedure works well, particularly urban settings. The lag time would be 0.6 times the time of concentration.

12. **Base Flow** Separate from rainfall runoff is irrigation flows, which must be added to late spring and summer thundershower flows.

13. **Modeling Method** Rational Method procedures are allowed where the total watershed is no greater than 25 acres, if detention or retention is involved, or 200 acres where only peak runoff rates are involved. Otherwise, unit hydrograph or other approved procedures are required. If flow routing through a retention or detention basin to another basin is required, the Rational Method may not be used.

C. HYDRAULICS: STREET AND INLET FLOW

1. **Design Methods** Street flow depths and spread and catch basin inlet capacities

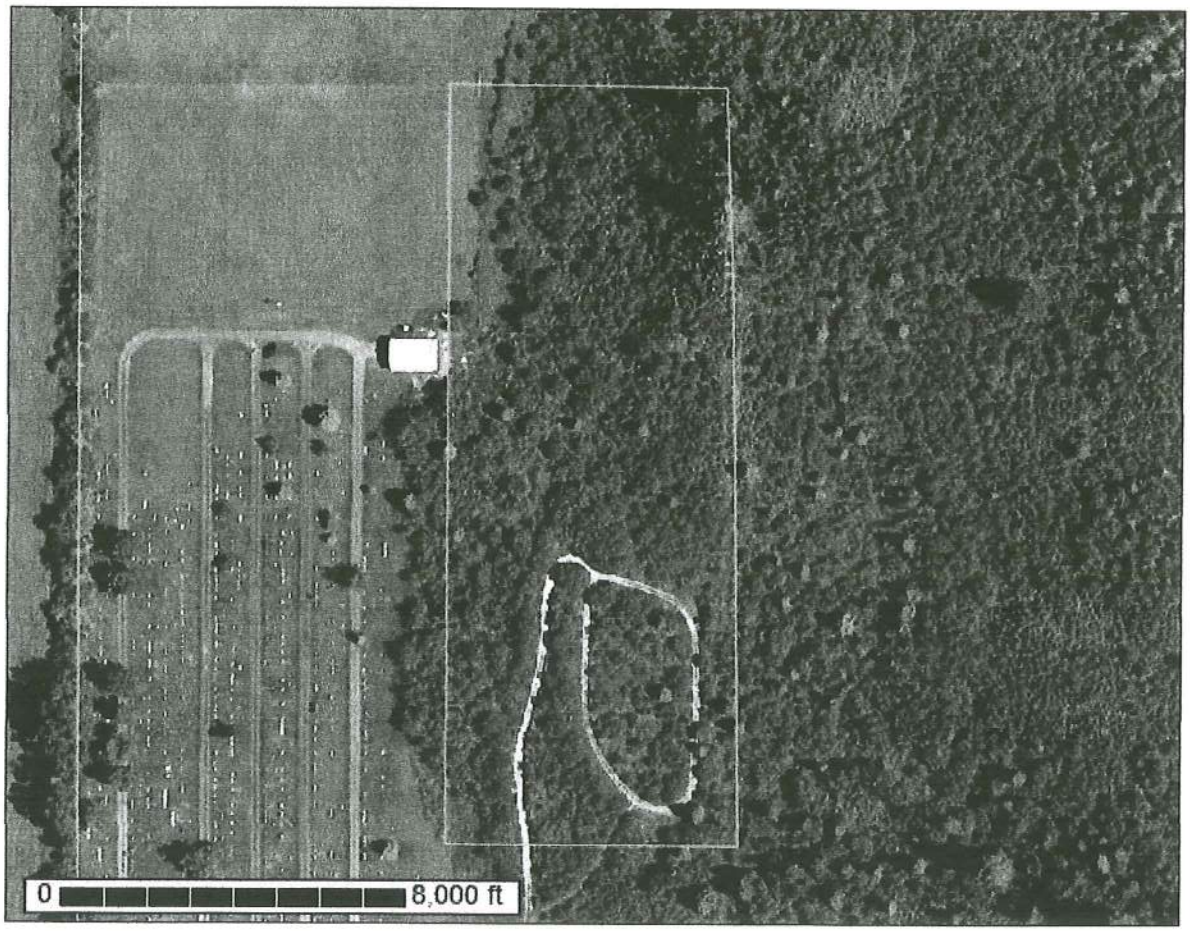
United States Department of Agriculture

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 Teton Area, Idaho and Wyoming



May 2, 2014

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- 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 Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Teton Area, Idaho and Wyoming
Survey Area Data: Version 2, Dec 9, 2013

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 20, 2011—Aug 19, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Teton Area, Idaho and Wyoming (ID650)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
43B708	Grouse-Ezbin complex, 12 to 30 percent slopes	0.0	0.1%
43B737	Dra-Pinochle-Rock outcrop complex, 25 to 55 percent slopes	3.3	69.1%
13438	Altaby-Alpine complex, 0 to 4 percent slopes	1.5	30.8%
Totals for Area of Interest		**4.8**	**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.

Teton Area, Idaho and Wyoming

43B708—Grouse-Ezbin complex, 12 to 30 percent slopes

Map Unit Setting

Elevation: 6,110 to 7,250 feet
Mean annual precipitation: 21 to 28 inches
Mean annual air temperature: 33 to 37 degrees F
Frost-free period: 30 to 50 days

Map Unit Composition

Grouse and similar soils: 65 percent
Ezbin, high effective precipitation, and similar soils: 25 percent

Description of Grouse

Setting

Landform: Mountain slopes
Landform position (two-dimensional): Backslope
Down-slope shape: Linear
Across-slope shape: Linear, convex
Parent material: Loess

Properties and qualities

Slope: 12 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water capacity: High (about 11.9 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 6e
Hydrologic Soil Group: C
Other vegetative classification: subalpine fir/common snowberry (SC607)

Typical profile

0 to 1 inches: Slightly decomposed plant material
1 to 2 inches: Silt
2 to 9 inches: Silt
9 to 16 inches: Silt
16 to 21 inches: Silt loam
21 to 24 inches: Silt loam
24 to 34 inches: Silt loam
34 to 47 inches: Silt loam
47 to 60 inches: Silty clay loam

Description of Ezbin, High Effective Precipitation

Setting

Landform: Mountain slopes
Landform position (two-dimensional): Backslope
Down-slope shape: Linear, concave
Across-slope shape: Concave
Parent material: Colluvium derived from rhyolite

Properties and qualities

Slope: 12 to 30 percent
Depth to restrictive feature: More than 80 inches
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
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water capacity: Moderate (about 6.0 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 6e
Hydrologic Soil Group: C
Other vegetative classification: subalpine fir/common snowberry (SC607)

Typical profile

0 to 1 inches: Slightly decomposed plant material
1 to 4 inches: Silt loam
4 to 14 inches: Stony clay loam
14 to 20 inches: Very stony clay loam
20 to 30 inches: Very stony clay loam
30 to 44 inches: Very gravelly clay loam
44 to 60 inches: Very gravelly clay loam

43B737—Dra-Pinochle-Rock outcrop complex, 25 to 55 percent slopes

Map Unit Setting

Elevation: 5,970 to 7,070 feet
Mean annual precipitation: 21 to 28 inches
Mean annual air temperature: 38 to 42 degrees F
Frost-free period: 50 to 90 days

Map Unit Composition

Dra and similar soils: 35 percent
Pinochle, extremely stony surface, and similar soils: 25 percent
Rock outcrop: 15 percent

Description of Dra

Setting

Landform: Mountain slopes
Landform position (two-dimensional): Backslope
Down-slope shape: Linear
Across-slope shape: Linear, convex
Parent material: Colluvium derived from quartzite and sandstone with loess influence

Properties and qualities

Slope: 25 to 55 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 55 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water capacity: Moderate (about 8.5 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: STEEP SOUTH 16-22 ARTRV/PSSPS (R013XY003ID)

Typical profile

0 to 2 inches: Moderately decomposed plant material
2 to 5 inches: Silt loam
5 to 11 inches: Silt loam
11 to 18 inches: Very cobbly silty clay loam
18 to 29 inches: Very cobbly silty clay loam
29 to 34 inches: Gravelly loam
34 to 60 inches: Gravelly loam

Description of Pinochle, Extremely Stony Surface

Setting

Landform: Mountain slopes
Landform position (two-dimensional): Backslope
Down-slope shape: Convex
Across-slope shape: Linear, convex
Parent material: Residuum weathered from rhyolite

Properties and qualities

Slope: 25 to 55 percent
Surface area covered with cobbles, stones or boulders: 5.0 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None

Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water capacity: Very low (about 2.0 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: STONY LOAM 16-22 ARTRV/PSSPS (R013XY019ID)

Typical profile

0 to 5 inches: Gravelly loam
5 to 12 inches: Very gravelly silt loam
12 to 17 inches: Extremely flaggy silt loam
17 to 22 inches: Extremely flaggy loam
22 to 31 inches: Bedrock

Description of Rock Outcrop

Properties and qualities

Slope: 25 to 55 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 8
Hydrologic Soil Group: D

Typical profile

0 to 60 inches: Bedrock

13438—Altaby-Alpine complex, 0 to 4 percent slopes

Map Unit Setting

Elevation: 5,950 to 6,550 feet
Mean annual precipitation: 16 to 18 inches
Mean annual air temperature: 38 to 44 degrees F
Frost-free period: 50 to 90 days

Map Unit Composition

Altaby and similar soils: 70 percent
Alpine, gravelly silt loam, and similar soils: 20 percent

Description of Altaby

Setting

Landform: Stream terraces, fan remnants
Down-slope shape: Convex, linear
Across-slope shape: Linear
Parent material: Mixed alluvium with loess influence

Properties and qualities

Slope: 0 to 4 percent
Depth to restrictive feature: 20 to 33 inches to strongly contrasting textural stratification
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 65 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water capacity: Low (about 4.8 inches)

Interpretive groups

Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 4c
Land capability (nonirrigated): 4c
Hydrologic Soil Group: C
Ecological site: LOAMY 12-16 ARTRV/PSSPS-FEID (R013XY001ID)

Typical profile

0 to 7 inches: Silt loam
7 to 16 inches: Silt loam
16 to 19 inches: Silt loam
19 to 24 inches: Gravelly silt loam
24 to 28 inches: Very gravelly sandy loam
28 to 60 inches: Extremely gravelly sand

Description of Alpine, Gravelly Silt Loam

Setting

Landform: Swales on fan remnants
Down-slope shape: Convex, linear
Across-slope shape: Linear, concave
Parent material: Mixed alluvium

Properties and qualities

Slope: 2 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 75 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water capacity: Very low (about 2.3 inches)

Interpretive groups

Farmland classification: Prime farmland if irrigated
Land capability classification (irrigated): 6s
Land capability (nonirrigated): 6s

Hydrologic Soil Group: B
Ecological site: SHALLOW GRAVELLY 12-16 ARTRV/PSSPS (R013XY004ID)

Typical profile

0 to 2 inches: Gravelly silt loam
2 to 11 inches: Very gravelly loam
11 to 17 inches: Extremely gravelly loam
17 to 25 inches: Extremely gravelly sandy loam
25 to 31 inches: Extremely gravelly loamy sand
31 to 35 inches: Extremely gravelly sandy loam
35 to 44 inches: Extremely gravelly loamy sand
44 to 51 inches: Extremely gravelly sandy loam
51 to 60 inches: Gravel

Table—Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Teton Area, Idaho and Wyoming (ID650)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
43B708	Grouse-Ezbin complex, 12 to 30 percent slopes	C	0.0	0.1%
43B737	Dra-Pinochle-Rock outcrop complex, 25 to 55 percent slopes	C	3.3	69.1%
13438	Altaby-Alpine complex, 0 to 4 percent slopes	C	1.5	30.8%
Totals for Area of Interest			**4.8**	**100.0%**

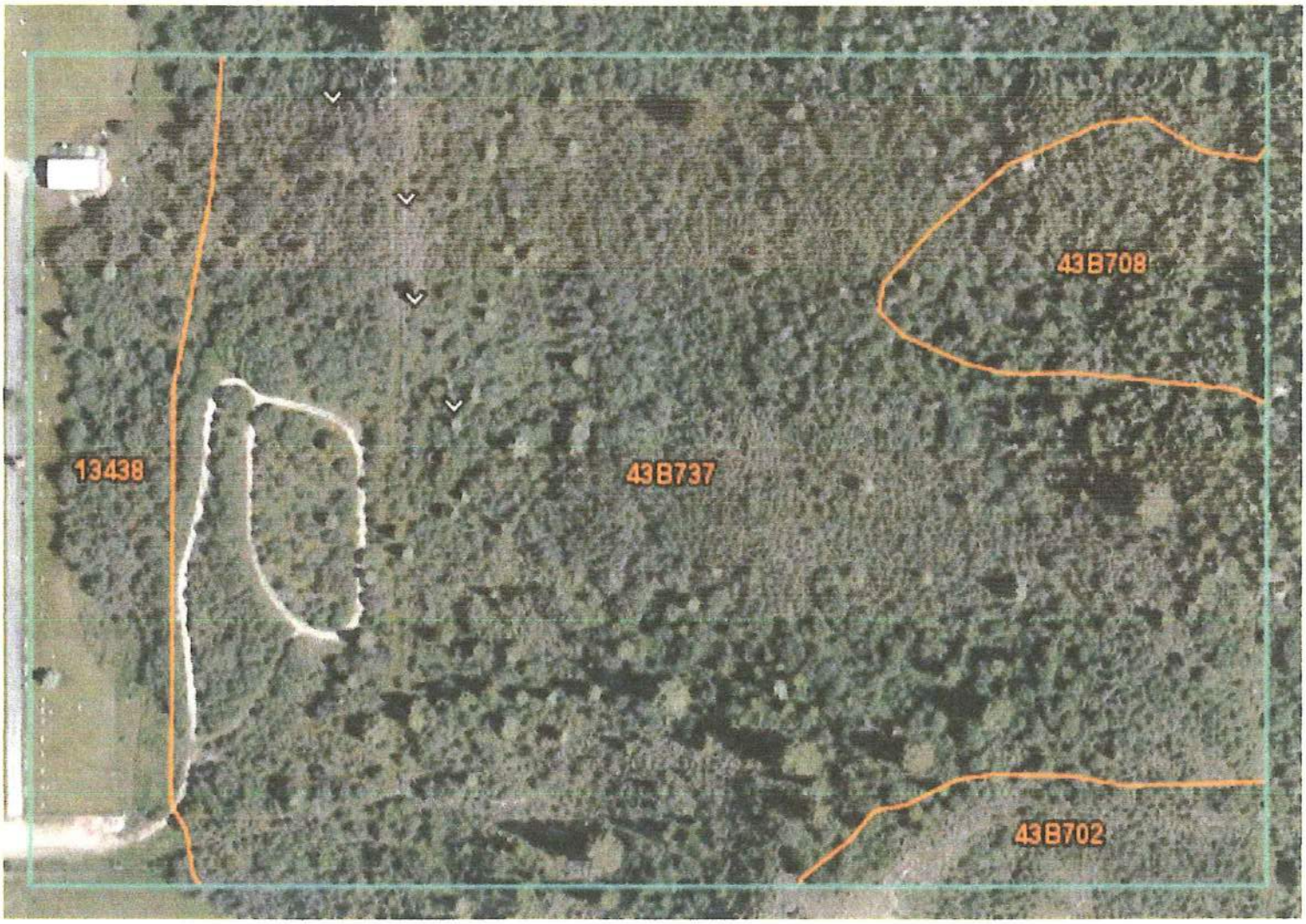
Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Soils Survey Drawing



Teton Area, Idaho and Wyoming (ID650)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
43B702	Beehunt-Conner complex, 20 to 60 percent slopes	0.9	4.1%
43B708	Grouse-Ezbin complex, 12 to 30 percent slopes	1.7	7.7%
43B737	Dra-Pinochle-Rock outcrop complex, 25 to 55 percent slopes	16.5	75.6%
13438	Altaby-Alpine complex, 0 to 4 percent slopes	2.7	12.6%
Totals for Area of Interest		**21.8**	**100.0%**