BearWest

CLARION

BEAR WEST CONSULTING TEAM

DIAGNOSIS: SALT LAKE CITY ZONING AND DEVELOPMENT STANDARDS FOR FOOTHILL, HILLSIDE, AND SLOPE AREAS

MARCH 2008

SALT LAKE CITY FOOTHILLS DIAGNOSIS PROJECT
PUBLIC HEARING DRAFT
March 2008

Introduction

Salt Lake City has a decades-long tradition of protecting its foothills from unsafe and unappealing development through protective regulation of land uses. With increasing pressure for development from increasing property values, the Salt Lake City Council hired the Bear West Consulting Team (consisting of Bear West, Clarion Associates, and Western GeoLogic) to comprehensively review existing standards, policies, and procedures and recommend changes.

The Consulting Team has:

- Analyzed the relevant ordinances, regulations, and plans related to foothills protection and associated topics such as riparian habitat protection and open space conservation.
- Interviewed city, county, and other governmental employees, members of the Salt Lake City Council, Planning Commission, Historic Landmarks Commission, Board of Adjustment, community council representatives, non-profit open space organizations, property owners, developers, and interested residents.
- Evaluated city ordinances against the best practices used by communities across the Western United States and across the country.
- Mapped areas of application of the foothills protection ordinances and other areas of the city with sensitive lands that may be applicable to new ordinances.
- Analyzed the basis and percentage for selecting an appropriate slope above which development should not occur.
- Considered the options for open space protection through acquisition in Salt Lake City.
- Prepared a draft set of recommendations for ordinance changes and open space protection, which is the foundation of this report.

Existing Foothills/Hillside/Slope Regulatory System

Salt Lake City has protected its foothills from development that violates the community's basic notions of safety, health, and welfare through regulation.

The city foothills are generally barren of larger vegetation and are highly visible to residents throughout the city and valley. Development can adversely affect the quality of Salt Lake City's scenic setting. Salt Lake City has also become more attuned to the effects of foothill development on wildlife. Big game species use the foothills for winter range, and the manner of development affects their survivability during these stress times.

Salt Lake City foothills protection ordinances are found in several locations of the Salt Lake City Code: Foothills Protection District, Open Space District, Foothills Residential Districts, Subdivision Regulations, and the Site Development Ordinance, among others. Because the regulations are in different sections of the city code and are not cross-referenced, it is sometimes difficult for those developing in or seeking information about foothills or steep slope development to find the full range of standards and processes applicable to development.

Initial regulations were adopted in 1977 after storms led to slides and washouts in the foothills and the city placed a moratorium on foothill subdivision development. Two new zoning districts were established: above the 5200' level (approximating the Bonneville Bench) a Foothill Protection (FP) zone limited density to 16-acre lots size, and a F-1 Overlay required site specific studies for geotechnical and natural hazards and special engineering standards.[1]

In 1983, Salt Lake City established prohibitions on new subdivision development, classifying slopes of 40 percent or steeper as "undevelopable." At that time, the city also established street geometric requirements to address slope issues (e.g., centerlines and curve lines at intersections), and placed limits on cuts and fills.

After the floods of 1983-1984, geologists analyzed slope failures within several Utah jurisdictions and determined that 30 percent slopes were a point above which many slopes failed in wet conditions and that a safer standard for development would prohibit development above that slope gradient.

In 1994 and 1995, Salt Lake City adopted 30 percent as the maximum slope for development, following the lead of many other local jurisdictions from the Salt Lake Valley, Wasatch Front, and Utah.

In 1994 Salt Lake City again updated its foothills protection ordinances and integrated policies to protect the city from the impacts of development on the community not only for safety reasons, but also for aesthetics. The City improved standards in its foothills protection ordinances relating to building heights, appearance (including color, glass reflectivity, and façade appearance), and fencing, as well as slope cuts for construction of buildings and roads to reflect new community values. Maximum building heights were lowered to 28 feet. Slope measurements were defined more clearly so that natural and man-made slopes were distinguished and cuts across slopes were limited to certain lengths. Retaining walls were required to be broken into shorter vertical increments.

In 1995, as part of the citywide rezoning, Salt Lake City added an Open Space (OS) Zoning District to the Zoning Ordinance and mapped portions of the city to protect undeveloped and natural areas. Only uses such as community recreational centers, country clubs, golf courses, natural areas, and zoos are allowed. In addition, new foothill residential zoning districts were created and applied to residentially developed and undeveloped foothill areas. Development was restricted on slopes over 30 percent.

In 1997 the city enacted a Goundwater Source Protection Ordinance that created a Groundwater Source Protection Zoning Overlay District. This overlay district, which applies to portions of the foothills, places special restrictions on use of certain potentially hazardous or polluting substances and septic systems in designated groundwater recharge areas.

In 2001, minor changes were made to the city's site development regulations and Zoning Ordinance. These changes included a definition of slope to clarify how slopes are measured over distances and a requirement that larger buildable areas meet the base

[1] According to staff, the F1 overlay was replaced by other foothill zoning districts in 1995.

zoning minimum lot size requirement or gain approval for smaller buildable areas through the conditional use planned development process.

On November 1, 2005, the city established a Natural Open Space (NOS) Zoning District, the purpose of which is to protect and ensure stewardship of important natural open space lands of citywide or regional importance. Two areas—one on the Northeast Bench near the Davis County Gravel Pits and one above the Capitol—were designated under this new district. Only open space preserves and natural areas are allowed uses in this district.

In April 2006 the city commissioned preparation of a Critical Lands Inventory and Preservation Priority Assessment by Landmark Design. This report inventoried properties zoned agricultural, foothill protection, and open space along with other characteristics. It also recommended several open space zoning categories.

In recent years, Salt Lake City has faced challenges to its foothills/steep slope regulatory system through litigation and threats of litigation. After considering these challenges, the city council determined it was time for a comprehensive review of its policies and procedures to determine whether a major overhaul or significant changes should be made to address issues relating to Salt Lake City's foothills.

In the following sections, the Bear West Consulting Team summarizes its analysis of the existing ordinances and recommends changes that will strengthen Salt Lake City's management of its foothills and sensitive lands.

Diagnosis

Overview of Findings

While there are a number of opportunities to improve and refine Salt Lake City's foothill and slope development policies and regulations, overall they compare favorably in their fundamentals to those in other progressive western jurisdictions. For example, the key regulation that limits development on slopes in excess of 30 percent has been adopted in other cities like Reno, Nevada, and Colorado Springs, Colorado. Similarly, the Groundwater Source Protection Overlay District that covers much of the foothills and upper bench areas of the city is similar to aquifer protection regulations in Austin, Texas. Additionally, the Foothills Protection District requires a minimum lot area of 16 acres, which is quite large for steep slope areas compared with some cities. As a result, existing regulations provide a solid foundation upon which to build.

That is not to say some significant revisions and additions are not called for. Interviews with neighborhood organizations, city staff, and developers revealed a number of revisions that need to be made to accomplish the city's goals of protecting the foothills environment and making the development review process more efficient and understandable. These revisions will be particularly important as development pressure on the foothills and other sensitive steep slope areas increases. As one developer put it, "the low-hanging fruit is gone. Most of the easy sites have been developed, and the parcels that are left will be tough."

This section identifies six areas where the city needs to make significant revisions or take action to address gaps and weaknesses in the current foothills regulatory regime.

1. Scope/Applicability—A significant number of steep slope parcels lay outside the boundaries of the Foothills Protection District (e.g., in the Capitol Hill area). Pressure for development in these sensitive and highly visible areas is likely to increase. The same is true of steep slopes along creeks outside the foothills.
2. Stream buffers and development setbacks—The city's Lowland Conservancy District Overlay and Site Development Ordinance contain minimal stream protection regulations, but some do not apply to foothills parcels. Overall, they are weak compared with many other jurisdictions. Moreover, they do not cover the foothills and many creeks within the city (e.g., Red Butte, Emigration, and Parley's Creeks). Notably, in January 2008, the city council adopted a Riparian Corridor Overlay District that includes some important setback restrictions on development near riparian areas.
3. Wildland (wildfire) regulations—An increasing number of western jurisdictions, like Flagstaff, Arizona, and Bend, Oregon, are adopting comprehensive wildfire protection standards. Salt Lake City has nothing comparable in place. The existing municipal water system is not designed to fight wildfires on the urban edge and in many foothills areas.
4. Procedural/administrative efficiency—The most common complaints about the foothills regulations focused on the difficulty staff and users have in interpreting and applying sometimes conflicting and overlapping provisions.

The Site Development Ordinance was cited repeatedly as being particularly problematic.

5. Defensibility—The rationale for limiting development on slopes in excess of 30 percent is being increasingly questioned. Additionally, the method by which the city calculates density on steep slope parcels and the limited uses allowed on parcels that carry Open Space District zoning have raised "takings" issues.[2]
6. Substantive standards—The current regulations do not deal adequately or at all with a host of issues commonly addressed in modern steep slope and sensitive lands protection regulations. These include, among others, vegetation protection, fencing standards (especially related to wildlife protection), access to public lands, private roads and utilities, and lighting.

Detailed Discussion of Findings

As noted above, significant revisions need to be made in six specific areas:

Scope/Applicability

A recurring comment that we heard from many people we interviewed—both citizens and developers alike—was that most of the easy development sites in the foothills were gone, and development is now pushing into areas that are ever steeper, less accessible, and more environmentally sensitive. They also pointed out that many of these as yet unbuilt private steep-slope areas are outside the Foothills Protection (FP) District, which is a special purpose zoning district requiring a minimum lot size of 16 acres, but which is limited to a defined geographic area (see Figure 1). As this figure illustrates, while the foothills extend across the city's entire eastern boundary, only a few specific areas are protected within the FP District's boundaries. Interviewees pointed to the Research Park environs, the Avenues, East Bench, and Capitol Hill as prime examples of areas with extensive steep slopes that are not covered by the FP District. Likewise, there are steep slope areas along streams and creeks outside the FP District that may warrant protection. The City also has a number of Foothills Residential Zoning Districts (e.g., the FR-1, FR-2, and FR-3 Zones), but they allow development on lots one acre or less and provide few restrictions on development except prohibiting building on slopes exceeding 30 percent.

We recommend that in revising the city's steep slope protection regulations as suggested in this document, that they be applied throughout the city rather than to a discrete foothill area. The city's current panoply of resource protection regulations (some might say mish-mash) are difficult to understand and administer and have gaps because they have been enacted piecemeal over the years and often through the vehicle of limited overlay districts (e.g., foothills, lowland conservancy, groundwater). Applying regulations to steep slope areas jurisdiction-wide will ensure that the values these sensitive resources represent are adequately protected wherever they exist. However, we also recommend that the following exceptions to broader application of steep slope protection regulations be considered: (1) previously subdivided, platted, and or approved lots that meet all other

[2] The "taking" issue refers to the Fifth Amendment to the U.S. Constitution that provides private property shall not be taken for public use without just compensation. The courts have held that a land use regulation may amount to a taking in the unusual circumstance that it denies an owner of all reasonable use of a property.

city requirements, (2) certain non-residential public uses such as zoos, museums, and hospitals, and (3) scientific/research studies (e.g., in riparian areas).

A second issue related to the proper scope of the foothills regulations is whether moderately steep slopes of 20 to 30 percent should be subject to additional restrictions. The report prepared for the project team by Western Geologic (Appendix A) documents the fact that 23 percent of all landslides in Salt Lake County take place on slopes less than 30 percent. Many communities, including several along the Wasatch Front (e.g., Ogden, Centerville, Layton, and Provo), do regulate moderately steep slopes by either increasing the minimum lot size over the base district zoning or requiring geologic or geotechnical reports that meet certain criteria. The city's site development ordinance requires soils and geologic reports for individual building sites. This requirement should be expanded to all development (including subdivisions) in areas with steep or moderately steep slopes. In summary, we recommend that the city further review the ordinances in other Utah jurisdictions and seriously consider adopting some protective standards for development on moderately steep slopes. Figure 2 illustrates the relationship of several of these slope and ownership variables, including city ownership, slopes between 20 and 30 percent, parcel locations, and the boundaries of various zones in the city's foothill areas.

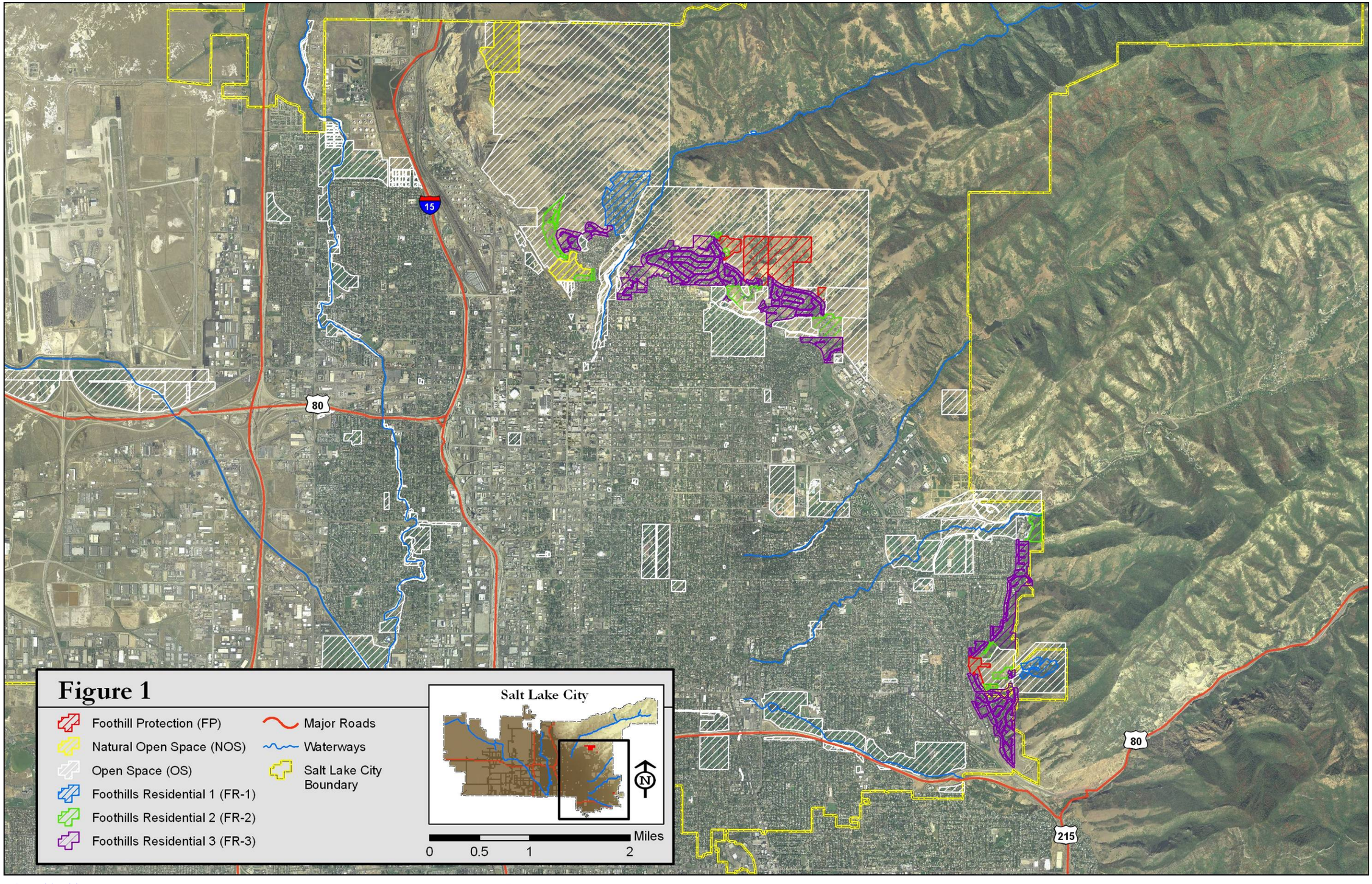
Stream Buffers/Development Setbacks

One of the most sensitive and important features of the foothills area is its streams and creeks. They provide critical wildlife habitat as well as serving other important functions like storm water management/erosion control, water quality protection, recreation, and community aesthetics.

The city currently has several ordinances and regulations on the books designed to protect stream corridors, but they are not up to modern standards. For example, the Lowland Conservancy Overlay District, enacted in 1995, applies only to a limited number of the city's watercourses including the Jordan River, Surplus Canal, and an area designated as lowland protection. This overlay does not apply to most foothills streams. Moreover, the district standards are quite weak—they require only a 25-foot setback for residential uses and a 50-foot setback for nonresidential.

The city's site development ordinance contains Canyon Development Special Regulations (Section 18.28.30) that require a 100-foot development setback from streams. However, the regulations apply only to land zoned Residential Canyon "R-1C" and Business Canyon "B-3C" which, according to staff, were never mapped and have been repealed.

In view of the limited reach of the city's current stream corridor protection regulations and the standards being adopted by other jurisdictions, in the initial draft of this diagnosis, we recommended that the city adopt stronger development setback regulations and apply them jurisdiction-wide. As the public review draft of this diagnosis was being written, the city council recognized these shortcomings and in January 2008 created a Riparian Corridor Overlay District. The new district, among other things, creates a 100-foot riparian buffer area within which most development and land disturbance is either prohibited (within 25 feet of the average high water level) or carefully regulated. That


15
80
80
215
Figure 1
Foothill Protection (FP)
Natural Open Space (NOS)
Open Space (OS)
Foothills Residential 1 (FR-1)
Foothills Residential 2 (FR-2)
Foothills Residential 3 (FR-3)
Major Roads
Waterways
Salt Lake City Boundary
Salt Lake City
N
Miles
0
0.5
1
2

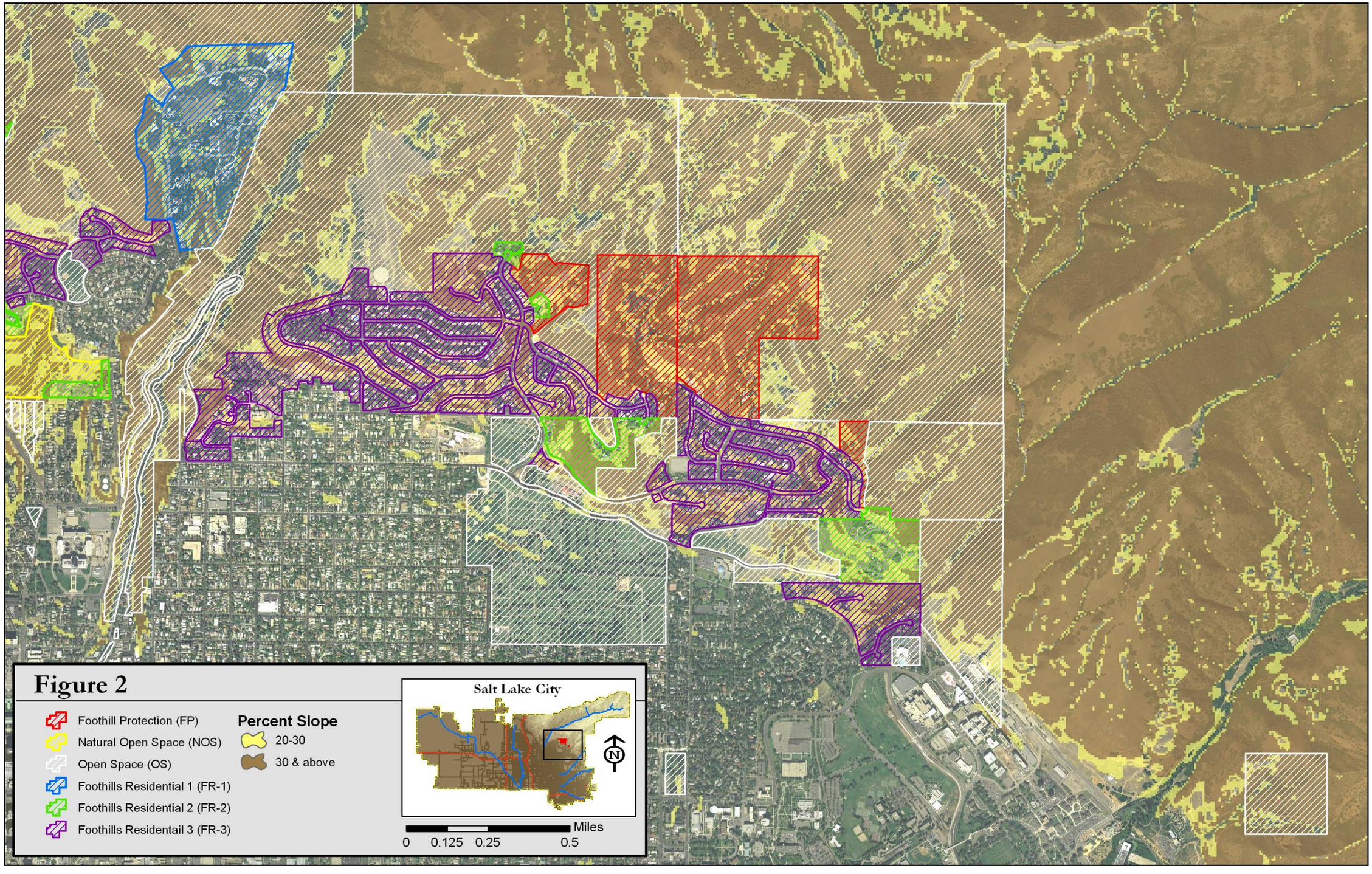


Figure 2
Foothill Protection (FP)
Natural Open Space (NOS)
Open Space (OS)
Foothills Residential 1 (FR-1)
Foothills Residential 2 (FR-2)
Foothills Residentail 3 (FR-3)
Percent Slope
20-30
30 & above
Salt Lake City
N
Miles
0 0.125 0.25 0.5

new district should go a long way toward addressing the issues raised above. The district is now under review and will be fine-tuned over the next five months.

The new ordinance reflects steps that have been taken to protect riparian corridors and wetlands in other progressive jurisdictions. For example, Fort Collins, Colorado, has adopted a River Conservation District with 300-foot development setbacks along the Poudre River. Eugene, Oregon, has a Waterside Protection Overlay and a Wetland Buffer Overlay that contain similar standards.[3] The setbacks range from 60 to 100 feet, depending on the quality of the resource and whether the applicant undertakes site enhancement or restoration. Salt Lake County also requires a minimum 100-foot stream setback, which may be increased if necessary. Additionally, developments are not generally permitted to alter natural waterways or drainage patterns.

In conducting the review of the new riparian overlay district, the city might consider increased buffers (e.g., 200 feet) in sensitive areas such as the foothills. Provisions might also be considered that would require or provide incentives to enhance or restore riparian vegetation as is done in Eugene, Oregon. Importantly, the city will need to consider safety-valve provisions for existing developments or platted lots and smaller lots in urban areas that may have difficulty meeting increased setbacks. Other jurisdictions allow reduced setbacks in highly urbanized areas and infill development situations, but typically require enhanced natural landscaping in the reduced buffer area.

Wildland (wildfire) Regulations

The growth of residential communities in forested and vegetated areas, coupled with 100 years of fire suppression, has increased the threat of uncontrolled wildfires dramatically throughout Utah and the West. Following on the heels of highly publicized wildfires like the tragic Storm King fire in western Colorado, literally hundreds of communities have enacted wildland urban interface wildfire regulations. These include Utah jurisdictions such as Summit County, Sundance, and Alpine City among others. Typically, these local regulations require creation of defensible space (fuel breaks) around buildings in fire-prone areas, multiple access roads, adequate water supplies for fire fighting, and requirements for fire-resistant construction materials, and road specifications.

Currently, despite the widespread development in heavily vegetated and forested steep-slope areas, Salt Lake City has not adopted similar standards. The city's fire department has a working group addressing the issue and has recommended that the city adopt the International Urban-Wildland Interface Code (UWI), a model code promulgated by the International Code Council. The UWI code requires creation of a minimum 50-foot defensible space around structures in high hazard areas. It has been adopted in total or in part by dozens of communities and is similar in key aspects to other model codes such as NFPA 144: Standard for Protection of Life and Property from Wildfire, and those published by the states of California and Florida.

We recommend that the city proceed quickly to adopt some form of wildfire protection regulations addressing issues such as access and defensible space. In doing so, other city departments such as Community Development, Public Services, and Public Utilities

[3]Please note that the Utah state legislature has significantly restricted the ability of local governments to designate or regulate wetlands unless designated by the U.S. Army Corps of Engineers (Title 10, Chpt. 9a-521).

should be consulted to ensure that other city goals such as vegetation protection, stream corridor preservation, natural open space conservation, and view corridors are considered. Additionally, the issue of wildfires and firefighting on steep slopes should be considered in updating the rationale behind the foothills regulations. We heard serious concerns from fire department personnel about the physical difficulty and safety issues they face when called upon to fight fires on such inhospitable terrain.

Procedural/Administrative Efficiency

Interestingly, the most common complaints that we heard about the foothills regulations related less to substantive issues and more to the difficulty staff and users have in interpreting and applying sometimes conflicting and overlapping provisions. Indeed, the impetus behind this current assessment of the foothills regulations stems directly from the city council's experience with apparently contradictory provisions in city's site development ordinance and fire code relating to maximum permissible street grade. The site development ordinance allows street grades up to 14 percent while the fire code limits them to 10 per cent.

A related problem is that certain resource protection issues are scattered about in various ordinances. For example, the site development ordinance contains steep slope protection provisions that are redundant with those found in the zoning and subdivision regulations. Thus the zoning ordinance residential districts address ridgeline protection in somewhat different language than does the site development ordinance (which has a section entitled "Ridge and Gully Topographic Features Protection").

The site development ordinance also contains a host of standards that are exceedingly vague and thus difficult to administer. To illustrate, the section of vegetation protection proclaims that "Vegetation shall be removed only when absolutely necessary…" Contrast this to modern development codes that contain quantitative standards on the amount of vegetation that can be removed from a site and specific mitigation measures that must be carried out. Staff pointed out a number of other areas in which the site development ordinance does not have clear requirements including access, geotechnical issues, and utilities.

While there are a number of quick fixes that can be made to address the issues of vague and conflicting regulatory provisions like the vegetation protection "standard" noted above, the real heart of the matter is that over the years the city has amended and revised its land development regulations in an incremental and piecemeal fashion. This approach is not unusual in larger cities where comprehensive development code revisions are challenging affairs. As a result, there are multiple layers of regulations, overlay districts, and ordinances that apply to the foothills, steep slopes, and other sensitive natural areas. The following is just a sampling:

- Foothills Protection District (Title 21A-Zoning)
- Lowland Conservancy Overlay District (Title 21A-Zoning)
- Groundwater Source Protection Overlay District (Title 21A-Zoning)
- Open Space District (Title 21A-Zoning)
- Natural Open Space District (Title 21A-Zoning)
- Three Foothill Residential Districts (Title 21A-Zoning)
- Floodplain Hazard Protection (Title 18)

- Storm Water Management Regulations
- Subdivision Regulations (Title 20)
- Watershed Area Regulations (Title 17)
- Site Development Ordinance (Title 18)

An applicant who wanted to build a house in the foothills would have to search several chapters of the zoning code, the subdivision regulations, and the site development ordinance for applicable substantive regulations—and then could still not be certain that all applicable standards had been unearthed.

In contrast to this scattershot approach, modern practice is to combine as many of these land development regulations into one unified development code (UDC). Typically all the zoning, subdivision, site planning, and floodplain provisions would be consolidated in the UDC. Moreover, all substantive review standards would be grouped in one chapter of the UDC for ease of use with cross references to other relevant ordinances such as storm water management.

All of this points to the need to address a larger and more significant challenge that goes beyond trying to consolidate or at least eliminate conflicts, overlap, and redundancies within the city's foothills standards.

Defensibility/Takings

The rationale for limiting development on slopes in excess of 30 percent is being increasingly questioned by property owners and their legal counsel. Additionally, the method by which the city calculates density on steep slope parcels and the limited uses allowed on parcels that carry Open Space District zoning have raised "takings" issues.

Thirty percent slope development limit. Based on studies in the mid-1980s of major landslides and slope failures, the Salt Lake City lowered its maximum buildable slope from 40 percent to 30 percent. That limit is similar to others in place throughout Utah and the West. Recently, however, some property owners and their legal counsel have asserted that with proper engineering, these very steep slopes can be built upon safely.

We recommend for several reasons that the slope development limit not be relaxed beyond 30 percent. First, the report submitted as part of this project by Western Geologic (Appendix A) confirms that 77 percent of all landslides in the county occur on slopes steeper than 30 percent. Moreover, landslides in the county have caused millions of dollars in damages to public and private property, roads, and utilities. For that reason alone, we believe that the city is on firm grounds in rejecting suggestions to weaken the slope standards. Second, the claim that steep slopes can be engineered and built on safely ignores the many other legitimate and strong rationales to continue to restrict steep slope development. These include fire safety (both for residents and firefighters), wildlife habitat projection, water quality and storm water management, and community aesthetics, among others. For example, Public Utilities staff points out that the Salt Lake City water system is not designed to fight wildland fires, even at the interface of developed properties. It is common for foothill residential units to be located as high up a slope as possible, often limited by pressure in the water system. This means that within approximately 100 feet of the rear of the house, there will be little if any water pressure available to fight fires.

All of these additional rationales should be specifically added to the city's steep slope regulations or expanded wherever they currently are mentioned in various ordinances and regulations. Moreover, the zoning and site development ordinances should be amended as necessary to make clear that as part of every application for development in steep slope/geo-hazard areas, the applicant must produce necessary geo-hazard studies, prove that the site will have all needed utilities, including adequate water pressure for fire fighting, and adequate access. The regulations should also make clear that the city will not approve roads, driveways, and installation of utilities unless the applicant demonstrates he owns the property for such improvements or has written permission from the owner of such property.

Density Calculation. A second legal defensibility issue revolves around the way in which the city reportedly calculates density on parcels containing steep slopes. According to staff, steep slope areas on a site are not counted toward satisfying the minimum lot size—which means that existing lots with very steep slopes may not have enough buildable area to satisfy the applicable zone district minimum lot area. The practical result may be that the lot is rendered unbuildable, which raises serious "takings" issues under the U.S. and Utah Constitutions. While it is not unusual for a jurisdiction to refrain from giving full credit for steep slope areas in calculating allowable density on a site, some give partial credit—often on a sliding scale basis. Some other western jurisdictions give substantial partial-percent credit for sensitive natural areas like riparian buffers, wetlands, and steep slopes in calculating overall site density. For example, in Sammamish, Washington, (in the foothills just outside Seattle), the city gives 50 percent credit for critical-area buffers on a site. Similarly, its neighbor Duvall gives a credit for steep slope areas, but on a sliding scale. The higher the percentage of steep slope areas, the less credit is given. Thus a site with zero to ten percent steep slopes would get 100 percent credit, but one with 30 percent coverage by steep slopes would get only 80 percent.

In this light, we recommend that the city discuss giving at least partial credit for steep slope areas in calculating overall site density, particularly if the applicant agrees to undertake mitigating measures such as restoration of disturbed areas on a site or enhancement of riparian habitat. The partial credit might also be limited to situations in which lack of such credit would render a lot unbuildable and raise potential legal issues.

The city should also further investigate a system by which owners of small lots are given development rights credits if they agree to consolidate those lots into larger parcels that can be more easily developed without damaging sensitive resources. Those credits could then be transferred or sold off-site to allow increased density in more appropriate areas (e.g., downtown).

Open Space. A final defensibility issue centers on the city's Open Space District zoning classification. The permitted use list in this district is exceedingly narrow, mainly non-economic uses such as cemeteries, recreational centers, and zoological parks. No residential development is allowed. Reportedly, however, this district classification has been applied to some private property in the foothills that has development potential and is not undevelopable for other reasons—which raises a significant issue as to whether such parcels would have a viable economic use—the basic test to determine if an

unconstitutional taking has occurred. There are several options for the city to consider in addressing this issue. First, the city should examine private parcels within the district and determine their developability. If a parcel is undevelopable for reasons unrelated to steep slopes (e.g., lack of water/sewer, location in a high-hazard slide area, no access, storm drainage problems), then the zoning might stay in place. However, if steep slopes are the only limiting factor, then the city should consider rezoning the property to another classification that allows at least some limited residential development. A second option would be to allow at least one residential dwelling on any private parcel in an Open Space District or to allow sale or transfer of a development credit(s) if an owner agreed not to develop. Finally, the city could codify a beneficial use provision in the Zoning Ordinance that would require property owners claiming they had no viable use of their land in the Open Space District to submit to a process by which they would be required to establish the lack of any viable use and give the city an opportunity to waive the restrictions or purchase the property. Such a provision has been used in other jurisdictions such as Teton County, Wyoming, to insulate themselves from takings claims.

The city should also consider the other side of the coin of the taking issue, that is, the long-recognized responsibility of property owners to utilize their land in a matter that does not harm neighboring properties. For example, the city might add a provision to the Zoning or Site Development Ordinances that requires owners who develop on steep slope to hold the city harmless and pay for any damages to down-slope properties cause by up-slope development (e.g., flooding, sliding, etc.). At the very least, such a provision would put developers on steep slopes on notice of potential dangers and liability.

Substantive Standards

While the city's basic regulations in the Foothills Protection District, Site Development Ordinance, and other regulations provide a modest level of protection for steep slopes, they do not address a host of issues commonly addressed in modern steep slope and sensitive lands protection regulations. These include, among others, vegetation protection, fencing standards (especially related to views and wildlife protection), access to public lands, private roads, and lighting.

Vegetation protection. Perhaps one of the most significant gaps in the city's sensitive lands protection regulations relates to vegetation protection. Numerous western cities and counties have enacted vegetation and tree protection standards to preserve wildlife habitat, control storm water, sequester carbon emissions, and enhance community appearance. In the context of steep slopes, for example, Park City requires every developer to carefully define a limited building envelope on a site (including areas for septic, driveways, etc.). No disturbance or vegetation removal is allowed outside that building envelope. The only comparable provision in the Salt Lake City zoning ordinance is found in the Foothills Protection District. Site disturbance is limited to two acres—which is actually a significant amount of land for a single-family home, driveways, and accessory uses/structures. The Site Development Ordinance does contain some vague language authorizing the Planning Commission to "determine that certain areas…cannot be built upon or landscaped more extensively than its natural state" (Section 18.28.30).

Other communities such as Franklin, Tennessee, (outside Nashville) which has extensive steep forested hillsides, take a somewhat different approach, requiring that a certain percentage of the existing tree canopy or vegetation on a site (e.g., 20-70%) be preserved depending on the type of use.[4] This approach was popularized by Lane Kendig in his influential book, *Performance Zoning*, and has been adopted by many communities, including a number in the West.[5] For example, El Dorado County, California (in the Lake Tahoe region) has adopted sliding scale canopy retention standards requiring sites with 80-100 percent canopy cover to protect 60 percent of the existing canopy, while sites with lower canopy cover must protect a higher percentage (e.g., 20-39% existing cover must protect 85%).

Another important aspect of vegetation protection is mitigation when trees or vegetation have been removed or destroyed during development. While the Salt Lake City zoning ordinance contains some weak language about revegetating disturbed sites, other communities are far more specific. For example, Clayton, Missouri, (an attractive, inner-ring suburb of St. Louis), requires inch-for-inch (in diameter) of trees that are removed during residential development. Lake County, Illinois (just outside Chicago), requires trees and vegetation to be replaced elsewhere on a development site. Windsor, California, (north of San Francisco) has strong tree replacement requirements that carry out a "no net loss" of trees policy.

One of the most important recent trends is that of jurisdictions requiring developers to revegetate sites that have been previously disturbed. For example, the City of Austin's Hill Country Roadway Corridor Ordinance requires a 100-foot vegetated buffer along designated highways in this scenic area. In cases where the buffer has previously been disturbed, the developer must revegetate with native trees, shrubs, and grasses. Similarly, many communities in Maryland, following state legislation to protect the Chesapeake Bay, have adopted ordinances requiring reforestation of development sites that have less than 20 percent forest cover so that they are brought up to that level by new plantings.

Salt Lake City should consider adding several of these tree and vegetation provisions to the zoning ordinance. These might include:

- A procedure in its zoning ordinance similar to that being used successfully in Park City that would require delineation of a very limited building envelope on each development site or lot and a prohibition against vegetation removal, disturbance, and grading outside that area. This approach has the advantage of not only protecting larger trees, but also important foothills shrub vegetation, sage, and native grasses. It would also work well in coordination with the city's required stormwater management and pollution prevention plans on larger sites.
- A requirement to mitigate for any trees removed for a site on an inch-by-inch diameter basis.
- A revegetation standard for previously disturbed sites.

Fencing. The city has some modest standards for fencing scattered throughout the Zoning and Site Development Ordinances. For example, the Foothills Protection District stipulates that areas designated as undevelopable in any subdivision must use low

[4] Christopher Duerksen with Suzanne Richman, Tree Conservation Ordinances, Planning Advisory Service No. 446 (Chicago: American Planning Assn. 1993).
[5] Lane Kendig, Performance Zoning, (Chicago: Planners Press, 1980).

visibility see-through fencing that is non-barbed steel wire. Sight-obscuring fencing must be earth-tone colors or materials similar to the primary dwelling. Additionally, vegetation cannot be removed when fencing along boundary lines, and fence materials and designs "must not create a hazard for big game wildlife species." The Site Development Ordinance contains similar language (Section 18.28.30).

While these provisions are a start, they are not applicable to all development (only subdivisions) and some are very vague. Contrast this to other progressive jurisdictions that often adopt detailed fence regulations to ensure that they are "wildlife friendly" and do not block or detract from significant views. To illustrate, fence regulations in Marana, Arizona (near Tucson), require specific spacing and transparency to protect public views of scenic resources. Many communities in the West have also adopted wildlife friendly fence standards such as those recommended by the Colorado Division of Wildlife.[6] These regulations are very specific regarding maximum height (typically 40 inches), materials (smooth wire and wood), minimum spacing between strands, and a minimum ground clearance for the bottom strand. Summit County, Colorado (Breckenridge), and Blaine County, Idaho (Sun Valley) go a step further, prohibiting fencing in key wildlife habitat areas and limiting fencing to enclose defined building envelopes except for agricultural purposes.

Salt Lake City should build on its current fencing regulations, augmenting them particularly in the area of wildlife-friendly fencing as discussed above. All fencing regulations should be consolidated in once place in the Zoning Ordinance for ease of reference.

Public Access to Public Lands. As development expands into increasingly remote areas of the city's foothills, we heard that historic, informal public access trails across private to public lands are being cut off. This is a growing problem throughout the Intermountain West, and other jurisdictions are responding by requiring that such existing public access routes be preserved as part of subdivision open space and trails standards or planned unit development requirements. Currently, the city's Site Development Ordinance requires that subdivisions in the foothills submit a report "assuring there is provision made for dedicated rights-of-way to provide access to public or private land adjacent" to the proposed development. Staff reports that access is typically negotiated on a case-by-case basis.

Before development of the foothills, Salt Lake City residents enjoyed relatively free access through private land to United States Forest Service public lands and the Wasatch Mountains. The Wasatch Mountains are one of the prime features of Salt Lake City's character and attractiveness for residents and visitors. As private lands developed, public routes to the foothills were reduced or sometimes eliminated. Salt Lake City has negotiated to retain trail access across the foothills in some locations as subdivisions have occurred. In other locations, trails that may have provided informal public access have been eliminated.

---

[6] *Fences For Man and Beast*, Colorado Division of Wildlife, U.S. Forest Service, and the U.S. Bureau of Land Management (Westcliffe, CO: Crestone Graphics undated). For a discussion, see Focused Case Study 14 in Christopher Duerksen and James van Hemert, True West: Authentic Development Patterns for Small Towns and Rural Areas, (Chicago: Planners Press 2003) at p. 151.

Salt Lake City has often secured trail access as part of the subdivision approval process. With the development of the Bonneville Shoreline Trail approximating the Bonneville Bench, trail access has become even more important for Salt Lake City residents. It has also become important to provide for the trail users without unduly imposing on adjacent property owners and neighbors.

The Bear West Consulting Team recommends that Salt Lake City clearly identify access points to public lands that have not been protected and provide for adequate access through acquisition or as part of the development approval process. Language giving the city authority to require access to public lands should be inserted in the Zoning Ordinance so that it applies to all development, not just subdivisions. Access points should provide for parking, signage, and projected use of the trail system, considering the effects and needs of neighbors to the trail systems.

In requiring dedication of these access routes to public lands or easements preserving public access, the County will need to be careful that such an exaction is not disproportionate to the demand for open space or trails being created by a development. In some instances of a very small development or subdivision with few lots, the city may be in a position of having to acquire such access (see discussion of acquisition funding below).

Private Roads and Private Utilities. Private roads are often proposed to save developers money because they are cheaper to build since standards are typically lower than for public roads. In other instances, private roads are proposed so that they can be gated to limit public access to a subdivision. The Site Development Ordinance (Section 18.28.30.C) gives the Planning Commission discretion to approve private streets and alleys with little guidance. Private utilities—most commonly water, sewer, and storm drainage systems—are also proposed by developers for the same reasons.

We heard significant complaints from city staff—planning, public utilities, and the fire department—about problems related to private roads in subdivisions and developments throughout the foothills. These problems range from poor maintenance and spotty snow plowing to inadequate access routes, among others. In some instances the results can be threats to safety of both residents and EMS workers and political pressure by residents for the city to take over maintenance and repairs. These complaints are very common among other western cities and counties. While private roads are allowed in some western rural jurisdictions if they meet a host of specific standards (e.g., construction to public street standards (including drainage), safe emergency vehicle access, multiple access points, etc.), most major cities such as Denver simply ban them. Salt Lake City should seriously consider such a ban.

The city should also consider banning or strictly limiting private utility systems in steep slope areas. The track record of private water and sewer systems in the West, especially when maintained by homeowner associations (HOAs), is mixed at best. Many HOAs do not have the financial wherewithal to adequately maintain such systems or to repair them, especially when they are allowed to be installed across very steep slopes. At a minimum, the city should adopt regulations prohibiting installation of private utility systems across steep slopes where they will be difficult and extensive to maintain and repair.

Open Space Funding. Salt Lake City has relied on negotiations with property owners, use of the Watershed Protection Fund in watershed areas, federal funds, and a recently created open space bond fund to acquire critical open space lands. With increasing real estate market values, Salt Lake City needs a consistent funding source to provide non-regulatory means to protect open space it deems of particular value. An effective regulatory program can only protect so much ground and control development. In instances when any development is contrary to the community's desires, the regulatory program must have a parallel acquisition program to protect open space. Forbidding all development through regulations can raise serious constitutional "takings" issues.

A critical starting point is a comprehensive inventory and prioritization of open space parcels in Salt Lake City. While partial reviews have been conducted, there are gaps in the inventory and the information has not been compiled in one location. That information will be the foundation for assessing future open space acquisitions.

The next important step will be for Salt Lake City to identify a consistent funding source for open space protection. The watershed protection fund serves that function in Salt Lake City's watershed areas, but much of the foothills and lowland areas do not have a regular source of funding. The $5 million general revenue bond that was passed in the 2001 city general election will provide a modest, one-time source to acquire some critical lands. However, to plan for and protect open space in Salt Lake City, a dependable, regular source of funding should be put in place.

Experience in other progressive communities nationwide provides some useful guidance for Salt Lake City. Bond funding can be a good, reliable source of acquisition money, but the amounts must be significantly higher than Salt Lake City's $5 million fund. For example, Dane County (Madison), Wisconsin, passed a $30 million bond for open space acquisition, and in Dekalb County (Atlanta area), Georgia, citizens approved a $125 million open space bond. Similarly, Pima County (Tucson), Arizona, voters recently approved a $112 million bond for open space with the potential to acquire 600,000 acres.

Colorado jurisdictions like Fort Collins and Larimer County have taken advantage of state enabling legislation allowing them to earmark part of their local sales tax for open space acquisition. While they are typically adopted by referendum just like bonds, they tend to provide funds for a longer period—usually five to ten years and more.

Importantly, relatively small sales tax levies have generated hefty sums of money. In Fort Collins, by 2013 a voter-approved ¼ cent sales tax levy will produce $55 million. A similar levy in Larimer County (a very conservative jurisdiction) produced $50 million in only 6 years between 1996 and 2002. Unfortunately, the Utah Legislature has rejected a local-option sales tax several times for open space protection. Use of this source of revenues would only be possible if Salt Lake City worked with other local governments and open space protection interests to obtain authorization through State legislation. This effort should be pursued through the Utah League of Cities and Towns.

Another promising long-term, reliable source of open space acquisition and management funds that local governments are tapping into is local utility revenues. For example, in Austin, Texas, the city established the necessary legal and policy links between its water utility and open space preservation. In this instance, water tap fees are used to acquire

and manage lands to protect aquifer recharge areas—Austin pumps much of its water from wells. It just so happens that these recharge areas are also prime wildlife habitat, so the purchases serve double duty. The city should explore whether its utility funds might legitimately be used for similar purposes.

Finally, dozens of communities throughout the West are utilizing parks and open space impact fees to fund open space acquisition. Such fees are common in Colorado municipalities and often generate $500-$1,000 per new home constructed. Care must be taken in establishing such fees so that they are set at a level that reflects the need created by new development, not to correct any perceived existing deficiencies.

The Bear West Consulting Team recommends further consideration by the city council of a number of possible sources of funding: impact fees dedicated to open space (available under state statute), increasing watershed protection fund assessment for areas applicable to watershed protection (including possible application to groundwater recharge areas), and pursuit of a taxing ability from the Utah Legislature. (A local-option sales tax has been pursued unsuccessfully several times, but remains of interest to many Utah local governments.)

Open Space Management. Salt Lake City has obtained various open space parcels in the foothills through the development approval process and occasional purchases with city funds. There is no defined management responsibility for those open space parcels and interviewees told us that many open space parcels are left to fend for themselves with no access monitoring or habitat management. This leads to questions about protection of those parcels in the long-term and dealing with issues like access management, encroachment, and habitat protection and enhancement (including control of weeds and exotic plants).

As open space land acquisition expands either through dedication in the development review process or through purchase with city funds, it is increasingly important that part of the acquisition include money for maintenance and management of the open space resources, and that an enforcement system be established within city government. Moreover, responsibility must be assigned and personnel funded for adequate protection of sensitive areas. In communities like Fort Collins, Colorado, that have major successful land acquisition programs, officials have found that land management can cost up to 15-30% as much as their annual land acquisition expenditures.

Possible entities to assume the responsibility for management and enforcement are the Salt Lake City Parks Division or a local land trust like Utah Open Lands.

Lighting. A recurring comment we heard was that new development in the foothills was obscuring the night sky, one of the area's most distinctive assets. Currently, the city's zoning ordinance contains some very vague standards aimed at preventing lighting spillover. For example, most zone districts contain the following (or very similar) provision: "On-site lighting shall be located, directed, or designed in such a manner as to contain and direct light and glare only to the property on which it is located." Section 21A.58.070, *Standards for Site Plan Review*, states that "All developments shall provide adequate lighting so as to assure safety and security. Lighting installations shall not have an adverse impact on traffic safety or on the surrounding property. Light sources shall be

shielded, and shall not shine onto adjacent properties." Such standards are what might be called "first-generation" regulations found in zoning ordinances 20 years ago. Experience throughout the West and in Salt Lake City demonstrates that they are hard to administer and virtually impossible to enforce.

Local governments throughout the West have adopted much more sophisticated and comprehensive approaches to controlling night lighting with the goal of protecting dark skies. Several model codes are available that provide templates for local jurisdictions that are considering upgrading their lighting standards. Most notable are those from the International Dark-Sky Association (Outdoor Lighting Code Handbook) and the Illuminating Engineering Society of North America (Lighting Handbook).

Modern local lighting ordinances typically cover the following topics:

- *Type of Lighting:* Increasingly, communities such as San Juan Capistrano, California, are banning mercury vapor and incandescent lighting for commercial uses. For energy conservation and quality of lighting, metal halide and high- and low-pressure sodium are preferred.
- *Type of Fixtures:* Many local governments have banned floodlighting of signs, billboards, buildings, and landscaping. Cottonwood, Arizona (near Sedona), is a good example. Outdoor floodlighting above the horizontal is flatly prohibited.
- *Hours of Illumination.* An increasingly common feature of modern ordinances is a limit on nighttime lighting. This is especially true for nonresidential lighting, but more and more jurisdictions are requiring outside residential lighting to be turned off at night or placed on a motion-sensor system. Douglas County, Colorado, south of Denver (and one of the fastest growing urban counties in the nation) requires all lights, except for security, be extinguished one hour after the end of business hours. Cottonwood, Arizona, requires all lights to be shut off by 10 P.M. unless the area is in active use. Salt Lake City recently participated in a "Lights Out" program during which lights were turned out on many public buildings and in some neighborhoods throughout the city for an hour between 9 and 10 p.m. While this program was tied mainly to energy conservation, it demonstrates the interest in this subject and perhaps provides a foundation for further action as outlined above.
- *Shielding.* Probably the most common feature of modern ordinances is to require full cut-off shielding on all outdoor lighting, including parking lot lighting (all light must be projected below the horizontal plane of the light fixture). Jurisdictions from small cities like Erie, Colorado, to major cities like Anchorage, Alaska, have adopted such standards.
- *Lighting Plans and Budgets.* The Outdoor Lighting Handbook noted above recommends a lumen per acre light budget for developments. Different levels are established depending on the type of use (greater for commercial, lower for residential). This approach is easy to administer because each proposed light fixture has a lumens number associated with it. By adding these numbers, a site plan reviewer can easily determine if the limit has been exceeded before construction commences.

Salt Lake City should undertake a process to develop a comprehensive lighting ordinance that would apply not only in the foothills, but city wide. This process should involve full community involvement and education. As a stop-gap, the city should consider some simple regulations such as requiring full cut-off shielding on all outdoor lighting.

Annexation. A key to development proceeding in the foothills is availability of municipal services, particularly water and sewer. The city currently has a singular policy that once a property is annexed into the city, no matter where located, it has a right to these services. The result is that once the city annexes a property, even a relatively undevelopable area in the foothills with steep slopes, it must provide services.

The city council should reconsider whether a one-size-fits-all annexation policy that applies both to the valley floor and the foothills makes sense. It might explore the approach taken by Boulder, Colorado, which established a Blue Line in the foothills west of the city, above which it will not annex or provide city services. Similarly, Salt Lake City might draw a line in the foothills at an elevation above which it would not annex or extend city services because of the costs and risks involved (unless an area had already been approved for development). In doing so, the city council would need to weigh the risk that an adjacent jurisdiction might approve the development and provide services or allow the developer to install private utilities.

Minor Revisions

In addition to these six major areas of concern, city staff and other interviewees pointed to a host of more minor, yet important revisions that need to be undertaken in any comprehensive rewrite of the city's foothill and related sensitive area regulations. These include, for example, prohibiting placement of lift stations below flood level and standards governing water tank water quality.

Appendices

Appendix A: Geologic Report

September 24, 2007

SUBJECT: Geologic Analysis **DRAFT**
Zoning and Standards Development Review
Foothill, Hillside, and Slope Areas
Salt Lake City, Utah, 2007

This letter report presents results of a geologic review and evaluation conducted by Western GeoLogic, LLC (Western GeoLogic) for development standards pertaining to foothill, hillside, and slope areas in Salt Lake City, Utah. Our analysis is part of a larger ongoing review of the current Salt Lake City development standards and regulations, and involves mainly section C.2.e.3 of the Scope of Work in RFP No. 0103RFP060029. The limited purpose of our analysis under this RFP section was to evaluate and provide geologic evidence to be used as a basis for defining unbuildable areas using a 30%+ slope. However, we also provide below a summary discussion of slope ordinances in seven nearby communities as an indication of current standard of practice along the Wasatch Front. It is our understanding that a more thorough evaluation of "best practices" data from other cities will be provided by others under section B of the RFP Scope of Work.

WASATCH FRONT STANDARD OF PRACTICE DISCUSSION
Section 21A.32.040 of the Salt Lake City Municipal Code currently defines a Foothills Protection (FP) District to protect foothill areas from intensive development in order to protect the scenic value of these areas and to minimize flooding and erosion. 21A.32.040H indicates that no building shall be constructed on any portion of the site that exceeds a thirty percent (30%) slope for lots in subdivisions granted preliminary approval by the Planning Commission after November 4, 1994.

Appendixes 1 and 2 in Christenson (1987) provide a statewide summary of County and selected City geologic hazards ordinances related to hillside protection with regard to steep slopes. As of the date of this publication, only about one fifth of the selected city governments had slope ordinances. We expect that fraction would be higher today, roughly 20 years later. Christenson (1987) shows, for agencies that had ordinances and codes addressing geologic hazards, development was commonly restricted on slopes between 10% and 30%, and prohibited on slopes exceeding 25% to 46%.

Below is a summary of current ordinances pertaining to slope development for seven Wasatch Front communities near Salt Lake City. The slope ordinances commonly follow two approaches: (1) increasing minimum lot sizes as slopes steepen, with a defined gradient (cut off) above which no building is allowed; or (2) a cut-off gradient above which no development is allowed, with a geologic or geotechnical report required for gentler slopes. Of the seven cities below, six use a 30% slope as the cut-off gradient; Alpine instead uses a lower 20% to 25% cut off. The above cut offs are similar to those

reported by Christenson (1987), suggesting that the current practices stem from a basic standard in place for at least the past 20 years.

- The Bountiful City Zoning Ordinance, sections 14-4-101 and 102, Residential Foothill (R-F) subzone of the Single Family Residential Zone, provides standards, guidelines, and criteria which permit reasonable development of private property while minimizing flooding, erosion, and other environmental hazards, and which protect the scenic character of foothill areas. In the R-F subzone, land with a slope of less than 30% is useable land, and land with a slope of 30% or greater is unusable for any purpose, except when conditions merit a reasonable discretionary exception following six defined guidelines.

- The Centerville City Planning and Zoning Ordinance, section 12-330-2, defines a Hillside Overlay District for protection of steep slopes and hillsides to insure urban development that minimizes the potential for flooding, erosion, and other environmental hazards, and protects the natural scenic beauty of the foothills. The ordinance specifies that lots have a minimum of 5,000 square feet of contiguous space on undisturbed virgin slopes of less than 30%. Lot sizes in slopes between 10% and 20% are 1.5 times the minimum requirements, and are 2.0 times the minimum requirements for lots between 20% and 30%.

- The Layton City Municipal Code, section 19.07.010, defines a Sensitive Land Overlay Zone to provide standards, guidelines, and criteria to minimize flooding, fire, erosion, and other natural and man-made hazards, and protect people and property while protecting the natural scenic character of the sensitive land areas not suitable for development. Section 19.07.090 indicates minimum lots sizes on average slopes of 15-20% are 10,000 square feet, and 15,000 square feet for lots on average slopes between 20% and 30%. No development is permitted on slopes exceeding 30%.

- The Ogden City Municipal Code, section 15-27-1, defines a Sensitive Area Overlay Zone to provide standards, guidelines, and criteria for protection from natural hazards from runoff and erosion, minimize hillside fire threat and establish protection measures, preserve wildlife habitat and open space, retain natural topographic features, preserve visual and environmental quality, assure adequate transportation systems and ingress and egress for emergency vehicles, and encourage developmental designs that are compatible with natural terrain. Section 15-27-4 indicates minimum lots sizes on average slopes of 15-20% are 10,000 square feet, and 15,000 square feet for lots on average slopes between 20% and 30%. No development is permitted on slopes exceeding 30%.

- The Provo City Municipal Code, Title 15, chapter 15.05 defines a Sensitive Lands Zone to minimize floods, erosion, and other environmental hazards; to protect the natural scenic character of foothill areas not suitable for development, and to insure efficient expenditure of public funds. The hillside development standards in section 15.05.160 indicate no development is allowed on slopes greater than 30%. Slopes between 10% and 30% require a geologic report meeting various zoning ordinance standards and requirements.

- The Alpine City Municipal Code establishes zones for mountainous and hillside areas that have steep slopes, unique soil characteristics, wildfire hazard, or similar natural conditions considered environmentally sensitive. The zones set minimum standards for land use to establish guidelines for development activities, balance property owner rights and the need to preserve safe living environments and sensitive environments, mitigate potentially unsafe conditions, and prevent development that might increase hazards. In Country Residential Zones (Articles 3.3 and 3.4), minimum lot sizes are multiplied by 1.5 for slopes between 10% and 15%, times 2.0 for slopes between 15% and 20%, and times 3.0 for slopes between 20% and 25%. Lots in these zones are not buildable on slopes exceeding 25%. No building is also allowed on slopes exceeding 20% that are within the Geologic Hazards Overlay defined in Article 3.12.6.2.

- The Draper City Municipal Code, chapter 9-16, defines a Sensitive Lands Overlay Zone with (in part) objectives of preserving natural vegetation, geologic features, wildlife habitat, and open space; minimizing grading and scarring; and ensuring retention of vegetation that stabilizes steep hillsides, prevents erosion, and enhances the beauty of the natural landscape. Slope areas in excess of 30% may not be developed, and no more than thirty percent (30%) of a development's slope areas in excess of a 30% steepness may be included in the area calculation to determine density. Developments in slopes above the highest Bonneville shoreline of Lake Bonneville that exceed 25% also require a geologic or geotechnical report.

GEOLOGIC DISCUSSION

Slope stability hazards such as landslides, slumps, and other mass movements can develop along moderate to steep slopes where a slope has been disturbed, the head of a slope loaded, or where increased ground-water pore pressures result in driving forces within the slope exceeding restraining forces. Slopes exhibiting prior failures, and also deposits from large landslides, are particularly vulnerable to instability and reactivation. Geologic and geotechnical evaluations prior to building can identify landslide-prone areas and unstable slopes, and provide recommendations for hazard mitigation or avoidance.

Landslides have caused hundreds of millions of dollars in damage in the Wasatch Front corridor, and historically have been one of the most damaging geologic hazards in Utah. Lund (1990) indicates slope instability has not been a major problem in the Salt Lake City area, but is becoming a major issue as development moves higher into adjacent foothills and canyons. During the wet period of 1983-84, numerous slope failures and resulting debris flows and floods caused extensive damage to urban areas north of Salt Lake City (Anderson and others, 1984). Christenson and others (1987) and Lund (1990) indicate similar failures occurred in undeveloped areas of Salt Lake County, but damage was restricted to roads and utility corridors. Historically, residential sites in City Creek Canyon, Olympus Cove, Little Cottonwood Canyon, Canyon Cove, and Emigration Canyon have been threatened or damaged by landslides, including the East Capitol Boulevard-City Creek landslide that has caused damage in excess of $300,000 since 1998 (Giraud and Ashland, 2007).

Figure 1 shows the relation between slope steepness and mapped landslides for Salt Lake County (right) and western Wasatch County (left). The Sale Lake County data is based on a compilation of all landslides in the county in the late 1980s (Christenson and others, 1987), whereas the landslide data for western Wasatch County is based on similar, but more detailed, study conducted in the mid- to late-1990s (Hylland and Lowe, 1997). Western Wasatch County is in a more landslide-prone geologic regime, but the data provides a useful comparison to the Salt Lake County data. For Wasatch County, the upper histogram (Figure 1) shows the number of mapped landslides in each of 10% slope steepness increment categories, for all landslides (in gold) and Holocene landslides (those in the past 10,000 years, in yellow). The lower histogram shows the percentage of total failures in each slope increment category, and was derived from the upper histogram to provide a direct comparison to the Salt Lake County data (Figure 1, right). The Salt Lake County data in Christenson and others (1987) does not identify landslide age.

Seventy-seven percent (77%) of all landslides in Salt Lake County occur on slopes steeper than 30%, and 58 percent are on slopes steeper than 40% (Figure 1). By subtraction, 23 percent of landslides in Salt Lake County would therefore be on slopes deemed buildable under current Salt Lake City zoning regulations. The Salt Lake County data also show a distinct increase in landslides above the 30% slope break, with landslide frequency in the three slope increments between 31% and 60% (18.7%, 19.3%, and 18.0%; respectively) being almost double the previous two increments (at 9.7%; Figure 1, right). Fifty-six percent (56%) of landslides in Salt Lake County occur in 31% to 60% slopes, a statistic which prompted Salt Lake County in 1986 to lower its maximum allowable buildable slope from 40% to 30% (Lund, 1990).

For western Wasatch County, 69 percent of all the landslides are on 30% or steeper slopes, and 47 percent are on slopes steeper than 40% (Figure 1, lower left). The western Wasatch County data show a distinct increase in landslides above the 10% slope break, as would be expected in a landslide-prone area. However, younger Holocene landsliding (Figure 1; upper left, in yellow) peaks in 31% to 60% slopes, which is similar to the relation discussed above for the Salt Lake County data. Fifty percent (50%) of Holocene landslides in western Wasatch County are in 31% to 60% slopes. Christenson (1987) indicates development is not permitted above the 30% slope break in Wasatch County, which the above data confirms has an increased risk for Holocene landsliding.

CONCLUSIONS

Salt Lake City municipal code currently defines a Foothill Protection Zone in which no building is allowed on slopes exceeding 30%. County and city governments with slope ordinances in 1987 had similar development prohibitions on slopes exceeding 25% to 46%. Six of seven nearby Wasatch Front communities surveyed for this report, including the cities of Ogden, Layton, Centerville, Bountiful, Provo, and Draper currently adopt a 30% slope break, similar to Salt Lake City. The remaining community, Alpine City, uses a lower (25%) slope break.

Landslide data for Salt Lake County and western Wasatch County show an increased risk for landsliding above the 30% slope break. For Salt Lake County, over 75 percent of all mapped landslides are in slopes steeper than 30%, and 56 percent of the landslides are in 31% to 60% slopes. Western Wasatch County shows a similar landslide frequency, although it is in a more landslide-prone geologic regime. For western Wasatch County,

69 percent of all mapped landslides are in slopes steeper than 30%. Fifty percent (50%) of Holocene (younger than 10,000 years) landslides in western Wasatch County are in 31%-60% slopes. The data sets for Salt Lake County landslides and Holocene western Wasatch County landslides show a similar peak in landslide frequency for slopes in the 31%-60% range.

Based on the above, the 30% slope break appears to be a prudent gradient to efficiently reduce landslide risk in steep slope areas of Salt Lake City. Twenty-three percent (23%) of the landslides in Salt Lake County are in gentler slopes below 30%. Assuming the landslide risk is correlative to their frequency at various slope gradients, this frequency represents the inherent hazard risk. Decreasing the slope cut off to 20% only reduces the risk to about 14 percent, whereas increasing it to 40% increases the risk to 42 percent. Given the past historical damage caused by landsliding in Utah, and in Salt Lake City, such an increase in risk may not be desirable. The relatively small decrease in risk may also not be desirable, considering the land that would no longer be buildable.

LIMITATIONS

This investigation was performed at the request of the Client using the methods and procedures consistent with good commercial and customary practice designed to conform to acceptable industry standards. The analysis and recommendations submitted in this report are based upon the data obtained from compilation of known geologic information. This information and the conclusions of this report should not be interpolated to adjacent properties without additional site-specific information. In the event that any changes are later made in the location of the proposed site, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or approved in writing by the engineering geologist.

This report has been prepared by the staff of Western GeoLogic for the Client under the professional supervision of the principal and/or senior staff whose seal(s) and signatures appear hereon. Neither Western GeoLogic, nor any staff member assigned to this investigation has any interest or contemplated interest, financial or otherwise, in the subject or surrounding properties, or in any entity which owns, leases, or occupies the subject or surrounding properties or which may be responsible for environmental issues identified during the course of this investigation, and has no personal bias with respect to the parties involved.

The information contained in this report has received appropriate technical review and approval. The conclusions represent professional judgment and are founded upon the findings of the investigations identified in the report and the interpretation of such data based on our experience and expertise according to the existing standard of care. No other warranty or limitation exists, either expressed or implied.

The investigation was prepared in accordance with the approved scope of work outlined in our proposal for the use and benefit of the Client; its successors, and assignees. It is based, in part, upon documents, writings, and information owned, possessed, or secured by the Client. Neither this report, nor any information contained herein shall be used or relied upon for any purpose by any other person or entity without the express written permission of the Client. This report is not for the use or benefit of, nor may it be relied upon by any other person or entity, for any purpose without the advance written consent

of Western GeoLogic.

In expressing the opinions stated in this report, Western GeoLogic has exercised the degree of skill and care ordinarily exercised by a reasonable prudent environmental professional in the same community and in the same time frame given the same or similar facts and circumstances. Documentation and data provided by the Client, designated representatives of the Client or other interested third parties, or from the public domain, and referred to in the preparation of this assessment, have been used and referenced with the understanding that Western GeoLogic assumes no responsibility or liability for their accuracy.

The independent conclusions represent our professional judgment based on information and data available to us during the course of this assignment. Factual information regarding operations, conditions, and test data provided by the Client or their representative has been assumed to be correct and complete. The conclusions presented are based on the data provided, observations, and conditions that existed at the time of the field exploration.
It has been a pleasure working with you on this project. Should you have any questions please call.

Sincerely,
Western GeoLogic, LLC

Bill. D. Black, P.G.
Senior Engineering Geologist

Reviewed by:

Craig V Nelson, P.G., R.G., C.E.G.
Principal Engineering Geologist

ATTACHMENTS

Figure 1. Landslide-Slope Comparisons

REFERENCES

Anderson, L.R., Keaton, J.R., Sarinen, T.F., and Wells, W.R., II, 1984, The Utah landslides, debris flows, and floods of May and June 1983: Washington D.C., National Academy Press, National Research Council, 96 p.

Christenson, G.E., 1987, Suggested approach to geologic hazards ordinances in Utah: Salt Lake City, Utah Geological Survey Circular 79, 16 p.

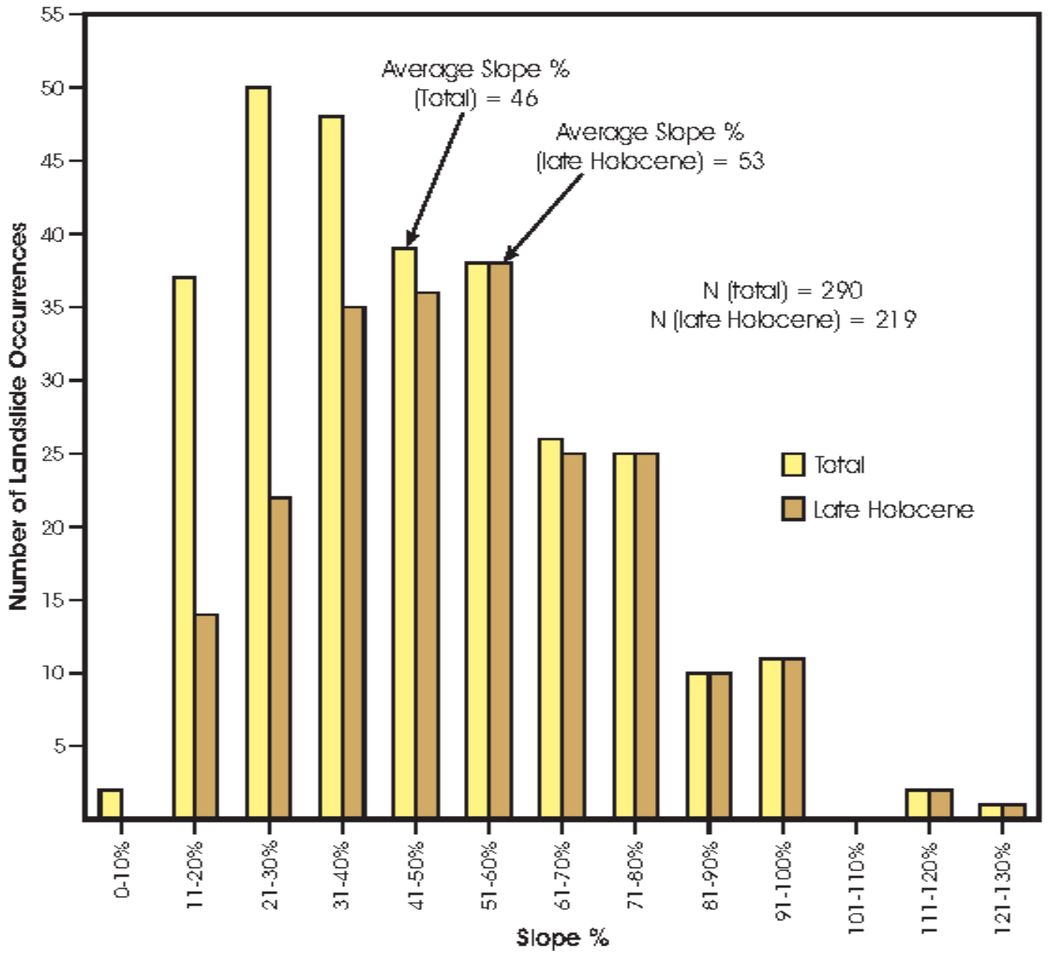
Christenson, G.E., Lowe, M.V., Nelson, C.V., and Robison, R.M., 1987, Geologic hazards and land-use planning, Wasatch Front: Salt Lake City, Utah Geological Survey, Survey Notes, v. 21, no. 1, p. 3-7, 10-14.

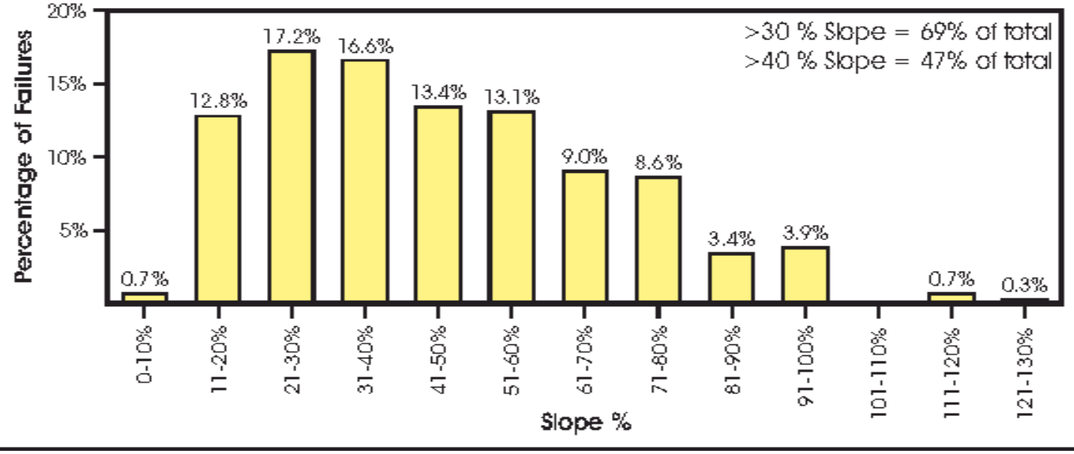
Giraud, R.E., and Ashland, Francis, Another year (2006) of damaging landslides in northern Utah: Salt Lake City, Utah Geological Survey, Survey Notes, v. 39, no. 1, p. 6-7.

Hylland, M.D., and Lowe, Mike, 1997, Regional landslide-hazard evaluation using landslide slopes, western Wasatch County, Utah: Environmental and Engineering Geoscience, v. 3, no. 1, p. 31-43.

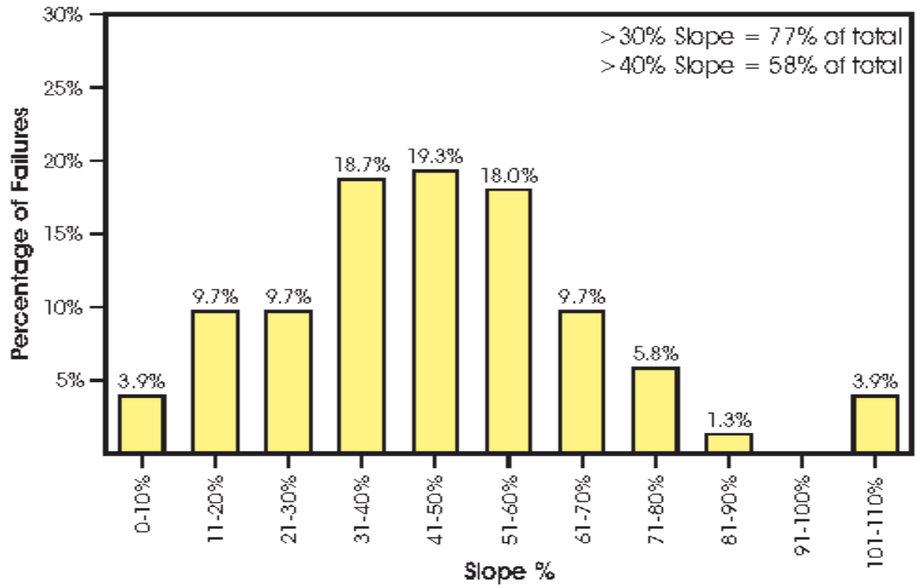
Lund, W.R., Christenson, G.E., Harty, K.M., Hecker, Suzanne, Atwood, Genevieve, Case, W.F., Gill, H.E., Gwynn, J.W., Klauk, R.H., Mabey, D.R., Mulvey, W.E., Sprinkel, D.A., Tripp, B.T., Black, B.D., and Nelson, C.V., 1990, Geology of Salt Lake City, Utah: United States of America, Bulletin of the Association of Engineering Geologists, v. 27, no. 4, p. 391-478.

WESTERN WASATCH COUNTY





SALT LAKE COUNTY



Sources: Christenson and others (1987), Hylland and Lowe (1997).

WESTERN GEOLOGIC

LANDSLIDE-SLOPE COMPARISONS

GEOLOGIC ANALYSIS
Zoning and Development Standards Review
Foothill, Hillside, and Slope Areas
Salt Lake City, Utah, 2007

FIGURE 1