HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS

Project No. 4033-01
December 28, 2012

RBF Consulting
4540 Duckhorn Drive, Suite 202
Sacramento, CA 95834-2597

Attention: Alex Jewell, Senior Project Manager

Reference: ***Housing Element Rezone Program***
Nevada County, California

Subject: ***Addendum to Preliminary Geotechnical Engineering Report***

Dear Mr. Jewell,

At your request, Holdrege & Kull has provided a geotechnical engineering review of three additional parcels which have been added to the list of candidate sites associated with the Nevada County Housing Element Rezone Program. Specifically, we have expanded the scope of our geotechnical services to include Assessor's Parcel Numbers 35-412-16, 35-412-20 and 35-550-15, which comprise approximately 16.92 acres located near Brunswick Road and Town Talk Road in Grass Valley. These parcels were not considered during our previous study for the Nevada County Rezone Program, as documented in our June 8, 2012 *Preliminary Geotechnical Engineering Report.* This letter should be considered an addendum to our preliminary geotechnical report.

The additional parcels comprise approximately 17 acres and are located adjacent to parcels previously reviewed as a part of our initial study. Based on our review of recent mapping documents provided by RBF Consulting, we understand that the numerical designation of the proposed sites has changed. Attached to this letter is Figure 1 which depicts the three additional parcels considered in this study, and also the neighboring parcels considered in the scope of the original study. The numerical designations of the original parcels have been updated from those used in the preliminary report in an effort to match the current parcel designations being used by RBF Consulting.

The following sections summarize our observations and conclusions regarding the additional parcels.

General Site Vicinity

The three additional parcels and their neighboring rezone candidate sites are located on Brunswick Road, north of its intersection with Idaho Maryland Road and south of its intersection with Bubbling Wells Road. The sites on the west side of Brunswick Road are accessed by Triple Crown Drive. The sites on the east side of Brunswick Road are accessible from Brunswick Road and Bubbling Wells Road.

USDA Soil Survey

H&K reviewed the *Soil Survey of Nevada County Area, California* (USDA Soil Conservation Service, 1975, reissued 1993) and the USDA's online *Web Soil Survey* accessed at http://websoilsurvey.nrcs.usda.gov/ (May 2012). Figure 1, attached to this letter, presents the corresponding soil classifications mapped in the vicinity of the candidate parcels. Soil conditions mapped by the soil survey are generalized, and the mapped delineations or contacts between soil classifications should be considered approximate. Actual soil conditions would be verified in the field as part of a future design-level geotechnical investigation prior to development. Descriptions of the relevant soil series are summarized below.

Alluvial Land, Clayey

According to the soil survey, a significant portion of the three parcels located to the east of Brunswick Road are likely underlain by materials designated as Alluvial Land, Clayey (Ao). The soil survey describes the Alluvial Land, Clayey soils as narrow areas of alluvial material consisting of mostly dark-gray to dark grayish-brown clay loam to clay to an approximate depth of 30 to 45 inches below the ground surface (bgs). This clay to clay loam is overlain in places by a sandy loam or loam to an approximate thickness of 3 to 10 inches. Permeability is moderately slow.

Mariposa – Rock Outcrop Complex

The soil survey depicts Mariposa Rock Outcrop Complex (MkE) as being located in the northeastern portion of the project area, generally within the low-lying area between Bubbling Wells Road and an unnamed surface water drainage on APN 35-550-15.

The Mariposa series soil is described as well drained residual soil underlain by slightly weathered slate and shale. The surface soil typically consists of 3 inches of

brown gravelly loam. The surface soil is typically underlain by yellowish brown gravelly heavy loam and reddish yellow gravelly clay loam. Slightly weathered slate or shale are typically encountered at a depth of 20 inches bgs. The soil survey notes that the soil series possesses a moderate corrosion rating for uncoated steel and a moderate shrink-swell potential.

Sites Series

The candidate sites located to the west of Brunswick Road are mapped as containing Sites series soils (SlB, SlC, and SlD). The soil survey describes the Sites Series as consisting of well drained soil underlain by tilted metasedimentary and metabasic rock. Permeability is moderately slow. The surface soil layer typically consists of brown and yellowish-red heavy loam to an approximate depth of 12 inches bgs. The heavy loam is typically underlain by yellowish-red clay loam and red clay, and light clay to an approximate depth of 78 inches bgs. The clay loam is typically underlain by weathered metasedimentary and basic rock at depths greater than 78 inches bgs.

General Site Geology

To determine the geology of each site, we reviewed the *Geologic Map of the Chico Quadrangle, California* (Saucedo, G. J., and Wagner, D. L., 1992); *California Mineral Land Classification of Nevada County, California, Special Report 164* (California Department of Conservation, Division of Mines and Geology, 1990); and the unpublished thesis *Structural and Stratigraphic Relations in the Grass Valley Colfax Area of the Northern Sierra Nevada foothills, California* (Tuminas, Alvydas, 1983). According to the geologic maps, the geology of the subject sites primarily consists of Mesozoic aged plutonic and metavolcanic rocks. The Mesozoic era spans the time between 65 and 230 million years before present.

We reviewed the following historical mining maps to determine whether mining claims or ore processing facilities were depicted on the subject sites.

- Plate 2A, *Maps of the Mineral Land Classification of Nevada County, California*. Special Report 164, California Department of Conservation Division of Mines and Geology (CDMG), 1990.
- *Map of the Grass Valley Quadrangle* from the Nevada City Folio (Lindgren, 1896).

- *Survey Map of Township 16 North, Range 8 East, Mt. Diablo Meridian* United States Bureau of Land Management (1874).

No mining features are mapped on these sites.

Regional Faulting and Seismic Sources

Regional faulting is associated with the central area of the Foothills Fault System which includes the Spenceville Fault, Wolf Creek Fault Zone, Bear Mountains Fault Zone (Highway 49 lineament), Grass Valley Fault, Weimar Fault Zone, and the Cleveland Hill Fault. The Foothills Fault System is a broad zone of northwest trending east dipping normal faults formed along the margin of the Great Valley and the Sierra Nevada geologic provinces on the western flank of the Sierra Nevada and southern Cascade mountain ranges. The central part of the fault zone is split into branches: the Malones Fault Zone to the east, the Cleveland Hill fault to the northwest, the Spenceville Fault to the west, and the Wolf Creek Fault Zone in the area of the candidate sites.

H&K reviewed the 1997 version of Special Publication 42, *Fault Rupture Hazard Zones in California*, which describes active faults and fault zones (activity within 11,000 years), as part of the Alquist-Priolo Earthquake Fault Zoning Act. The document and the 1999 on-line update indicate that the sites are not located within an Alquist-Priolo active fault zone. According to the *Fault Activity Map of California and Adjacent Areas* (Jennings, 1994), the closest known active fault which has surface displacement within Holocene time (about the last 11,000 years) is the Cleveland Hill Fault. The Cleveland Hill Fault is located approximately 25 miles northwest of the subject sites and is associated with ground rupture during the Oroville earthquakes of 1975.

Tuminas (1983) depicts a fault trace along the east side of the current Brunswick Road alignment which would pass through the western edge of the parcels to the east of Brunswick Road, as well as a thrust fault approximately 800 feet east of the candidate sites. Saucedo and Wagner (1992), show the fault as being located in the same general area, although it appears to be depicted to the west of Brunswick Road in the vicinity of the sites. The mapped fault is presented as pre-quaternary in the *Fault Activity Map of California*, indicating that there is no evidence of displacement in the past 1.6 million years.

Site Observations

We performed an initial observation of the sites during May and June 2012 as a part of our preliminary geotechnical investigation for the Housing Element Rezone project. We returned to the sites described in this letter on December 20, 2012 to observe the surface conditions on the three additional parcels.

Sites West of Brunswick Road

The sites in the area west of Brunswick Road are generally located on a forested hilltop. These sites are forested with madrone, incense cedar, ponderosa pine, and associated chaparral typical of the area. Blackberry bushes and other plants associated with moist soil conditions were observed in the lower portions of the sites, particularly near the southern and western boundaries of the parcels. The surface soil at the sites was typically obscured by forest litter, recent timber harvest debris, and surface vegetation. However, where observed, the surface soil appeared to typically consist of reddish brown fine sandy silt with common gravel-size rock fragments. We noted an apparent increase in the gravel content of the surface soil in the upper portions of the sites which may be indicative of a thinner soil profile at these hilltop locations and shallower depths to resistant rock.

We observed minor apparent rock outcrop at isolated areas on the western parcels which may indicate the potential for relatively shallow soil and resistant, variably weathered rock conditions. We also observed an abandoned small wood structure in the eastern, downslope portion of APN 35-412-15, near an abandoned irrigation ditch alignment. Areas of shallow irregular topography were also observed in the southern portion of the parcel, generally between the abandoned irrigation ditch and a tributary to Wolf Creek which flows near the eastern boundary. This irregular topography appeared to be the result of past excavation or trenching in this area. Areas of dense blackberry bushes were also observed in the eastern portion of the study area at locations in close proximity to the creek.

We did not observe evidence of significant surface water flow except in the lowermost portions of the sites, generally at locations near the southern and western property boundaries.

During our site observations we observed what appeared to be an exploratory excavation or glory hole in the northwestern portion of the study area. The approximate excavation location, as well as the locations of observed boulders and areas of rock outcrop, are depicted on Figure 1.

Sites East of Brunswick Road

Three parcels (APNs 35-550-15, 35-412-20, and 35-412-21) associated with this study are located to the east of Brunswick Road, as shown on attached Figure 1.

These forested sites are gently to moderately sloping to the southwest, with estimated slope gradients ranging from approximately 20 percent in the northeastern portion of the sites to relatively flat in the west and southwestern portions of the sites, near Brunswick Road. Recent timber harvest in the southern most parcel and past brush clearing in the northern parcel had exposed areas of surface soil at several locations, which typically consisted of dark reddish brown silty fine sand. Saturated surface soil conditions and areas of standing water were observed in the study area particularly in low lying areas adjacent to Brunswick Road. In addition, we observed surface water flowing in an established drainage swale which generally flowed in a southerly direction from Bubbling Wells Road toward Brunswick Road. The approximate location of the drainage swale and areas of standing water are presented on Figure 1.

We also observed boulders and areas of apparent rock outcrop in the western portion of the study area, at the approximate locations depicted on Figure 1.

We observed a previously graded, gently sloping bench which crossed the study area in an approximate northwest to southeast direction. Existing residential and storage structures had been built on a portion of this bench on APN 35-550-15. This previously graded bench is presumed to be attributable to the historical Nevada County Narrow Gauge Railroad alignment. The presence of the bench alters natural surface water drainage, particularly in the southern portion of APN 35-412-21 where we observed areas of standing water and saturated surface soil conditions on the upslope side of the bench. We also observed sloughing and erosion of the bench at a location near the southernmost property boundary, where the apparent railroad alignment crossed a tributary to Wolf Creek. This crossing location is likely outside of the study area, on the neighboring parcel to the south.

Conclusions

Based on our literature review, field observations and our experience in the area, our opinion is that residential development on the sites depicted on Figure 1 is feasible from a geotechnical standpoint.

During our site observations, we noted areas of saturated surface soil, standing water, and surface water drainage in the low lying portions of the parcels on the

east side of Brunswick Road. The consideration of appropriate surface water drainage improvements and potential subsurface drainage will be an important part of the successful development of the low-lying areas, if proposed in the future.

The conclusions and recommendations presented in our previous, June 8, 2012 preliminary geotechnical report apply to the subject parcels. This letter should be considered an addendum to our previous report.

We appreciate the opportunity to work with you on this project. Please feel free to contact us if you have any questions.

Sincerely,

HOLDREGE & KULL

REGISTERED PROFESSIONAL ENGINEER
ROBERT E. FINGERSON
No. 2699
Exp. 12/13
GEOTECHNICAL
STATE OF CALIFORNIA

Robert Fingerson, G.E. 2699
Principal Engineer

Attachments: Figure 1

Copies: Electronic copy in PDF format to RBF /Attn: Alex Jewell, AJewell@RBF.com

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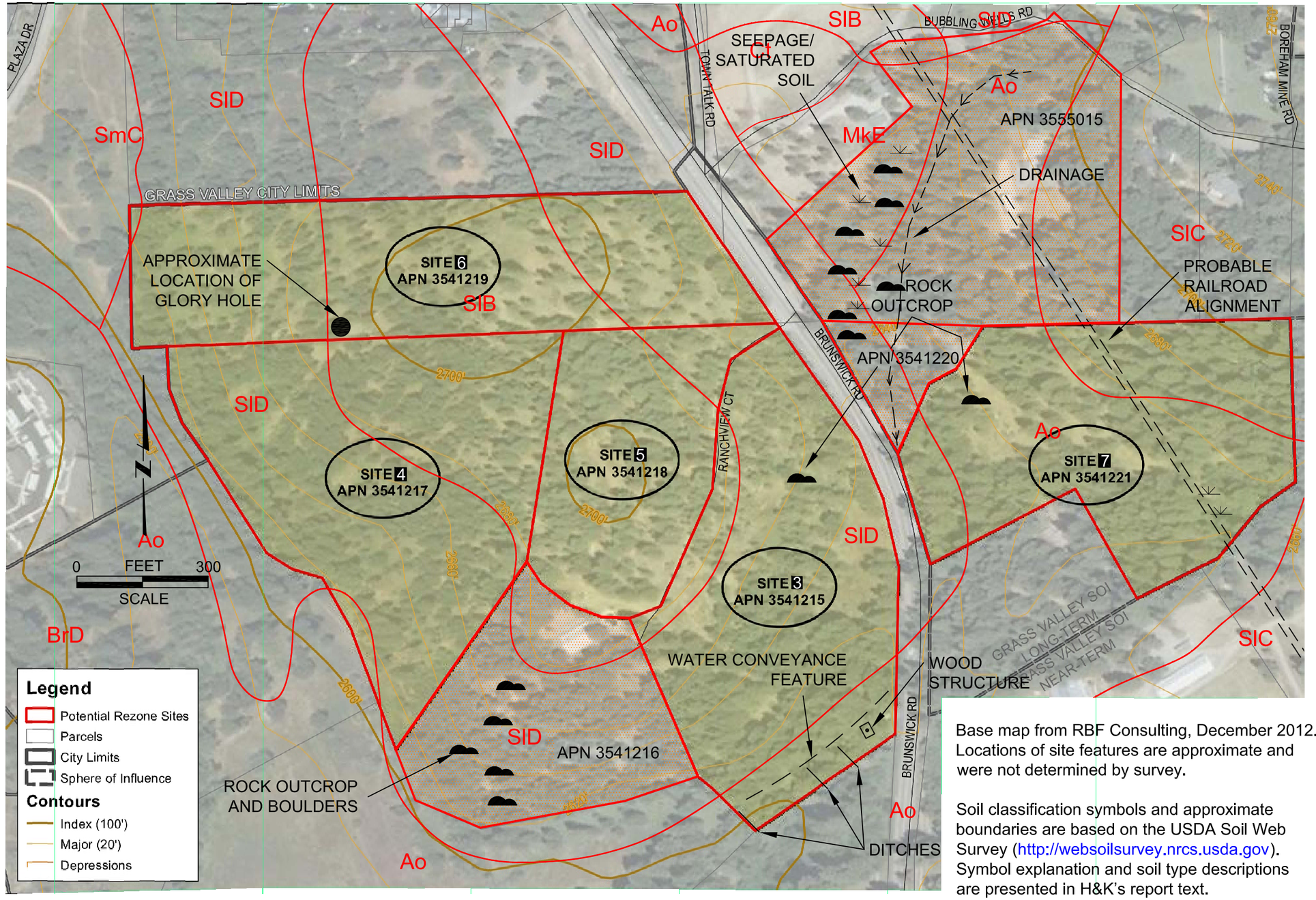

Base map from RBF Consulting, December 2012. Locations of site features are approximate and were not determined by survey.

Soil classification symbols and approximate boundaries are based on the USDA Soil Web Survey (http://websoilsurvey.nrcs.usda.gov). Symbol explanation and soil type descriptions are presented in H&K's report text.

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SITE MAP FOR GEOTECHNICAL REPORT AMMENDMENT

2009-2014 HOUSING ELEMENT REZONE

NEVADA COUNTY, CALIFORNIA

DRAWN BY:	DEVITT
CHECKED BY:	REF
H&K PROJECT:	4033-01
DATE:	DECEMBER 2012

FIGURE 1

PRELIMINARY GEOTECHNICAL ENGINEERING REPORT for HOUSING ELEMENT REZONE Nevada County, California

Prepared for:
RBF Consulting
4540 Duckhorn Drive, Suite 202
Sacramento, California 95834

Prepared by:
Holdrege & Kull
792 Searls Avenue
Nevada City, California 95959

Project No. 4033-01
June 8, 2012

HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS

Project No. 4033-01
June 8, 2012

Axel H. Jewell
RBF Consulting
4540 Duckhorn Drive, Suite 202
Sacramento, California 95834

Reference: ***Nevada County Rezone Program***
Various Sites, Nevada County, California

Subject: ***Preliminary Geotechnical Engineering Report***

Dear Mr. Jewell:

Holdrege & Kull (H&K) prepared this *Preliminary Geotechnical Engineering Report for the Nevada County Housing Element Rezone Program* candidate sites located in Nevada County, California. The purpose of this report is to present the findings of our investigations and preliminary geotechnical recommendations associated with each of the 16 candidate sites (Sites 1, 3 through 8, and Sites 10 through 18) investigated. H&K did not perform investigations of Sites 2 and 9 because the property owners withdrew from the project.

The preliminary findings presented in this report are based on our review of selected geologic references and our experience with subsurface conditions from previous investigations. Based on our experience in the region, our opinion is that the future development on the subject parcels is feasible from a geotechnical engineering standpoint.

Prior to the future design of improvements on the parcels, we should be retained to perform a design-level investigation to confirm the preliminary recommendations presented in this report and provide site specific geotechnical design criteria and construction recommendations based on the subsurface conditions encountered. Additionally, we should be retained to perform testing and observation services during grading to confirm the preliminary recommendations presented in this report.

Please contact us if you have any questions regarding our observations or the preliminary recommendations presented in this report.

Sincerely,
HOLDREGE & KULL

Prepared by:

Heidi Cummings

Heidi Cummings, P.G. 7732
Project Geologist

Reviewed by:

Rob Fingerson, G.E. 2699
Senior Engineer

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copies: 3 to RBF Consulting / Attn: Alex Jewell

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APPENDICES

1 INTRODUCTION

Holdrege & Kull (H&K) performed preliminary geotechnical engineering investigations for the Housing Element Rezone candidate sites located in Nevada County, California. The purpose of this report is to present the findings of our investigations and preliminary geotechnical recommendations associated with each of the candidate sites. A total of 16 candidate sites were investigated (Sites 1, 3 through 8, and Sites 10 through 18). H&K did not perform an investigation for Sites 2 and 9 because the property owners withdrew from the project.

The preliminary geotechnical investigations were performed in general accordance with the scope of services presented in our August 23, 2011 proposal for the project, a copy of which is provided as Appendix A of this report. For your review, Appendix B contains a document prepared by ASFE entitled *Important Information About Your Geotechnical Engineering Report*, which summarizes the general limitations, responsibilities, and use of geotechnical reports.

1.1 SCOPE-OF-SERVICES

H&K performed a limited scope geotechnical review of the subject sites to identify potential geologic hazards that may negatively impact the site and require design mitigation and to develop preliminary geotechnical engineering design recommendations for earthwork and structural improvements. Our limited scope preliminary investigations included:

- **Field Reconnaissance:** H&K performed preliminary site investigations to observe the existing surface conditions. No samples were collected or analyzed for their engineering or environmental properties during the investigations, nor was there any subsurface investigation performed.
- **Literature Review:** H&K reviewed literature pertaining to the project site to characterize general site geology, identify potential geologic and seismic hazards, and identify areas of known historical mining. H&K reviewed geologic and seismic literature, United States Department of Agriculture (USDA) soil survey, aerial photos, and previous environmental, geotechnical, and geological reports pertaining to the candidate sites.
- **Preliminary Geotechnical Report:** H&K prepared this report to present the findings, conclusions and preliminary geotechnical engineering recommendations for future improvements at the sites.

1.2 SITE LOCATIONS AND DESCRIPTIONS

The 16 candidate sites are generally located near the communities of Grass Valley, Penn Valley, and Lake of the Pines in Nevada County, California. The locations of each site and approximate parcel boundaries within the three areas are depicted on Figures 1, 2, and 3, respectively. The latitude, longitude, Nevada County Assessor's parcel numbers (APNs), land use zoning designation, acreage, approximate minimum and maximum elevations, and approximate total relief are summarized in Table 1. Site descriptions are provided below.

1.2.1 Grass Valley Area

1.2.1.1 **Site 1**

Site 1 is located in the southern portion of Grass Valley, on the southeast side of McCourtney Road between Personeni Road and Genes Road. Site 1 is generally undeveloped and gently slopes to the northwest with 13 feet of relief. The site is periodically used as a fee parking lot for events at the Nevada County Fairgrounds, which is located across McCourtney Road, northwest of the site. Site 1 is bound by commercial buildings to the west and east and single family residences to the southeast. Beyond the single family residences is the northwest boundary of the North Star property, a site of historical hard rock gold mining and known environmental hazards.

1.2.1.2 **Site 3**

Site 3 is located on La Barr Meadows Road south of the intersection with McKnight Way. Site 3 is undeveloped and moderately slopes toward the southwest with an estimated slope gradient of 20 percent. There is a single dirt access road entering the south end of the site from La Barr Meadows Road which passes through the property and onto adjacent property to the east. The road was likely used for timber harvesting and/or clearing of the site, as evidenced by the presence of brush piles and earthen berms on the site. Site 3 is bound by commercial and residential land uses on the northwest and south, La Barr Meadows Road and State Route 49 on the southwest, the Empire Mine State Historic Park on the north, and a portion of the approximately 45-acre La Barr Meadows property on the east. Site 3 comprises the western portion of the La Barr meadows property which consists of Nevada county APNs 09-620-10 and 12, 22-150-23 and 30, and 29-350-12 (Site 3). An ephemeral drainage was evident in the southern portion of the site.

Past uses of Site 3 include hard rock gold mining. Environmental conditions at Site 3 were investigated during a Preliminary Endangerment Assessment (PEA)

conducted in 2006 for the entire La Barr Meadows property. The PEA findings are presented in the *Preliminary Endangerment Assessment of La Barr Meadows Property* (H&K, January 12, 2007). The potential for impacts to Site 3 from recognized environmental conditions on the adjacent Empire Mine State Historic Park (SHP) property, including former mining and mine processing, are also addressed in the findings of H&K, 2007. A brief summary of the current environmental status is presented in Section 2.1.1.2 of this document.

1.2.1.3 Sites 4 through 8

Sites 4, 5, 6, 7, and 8 are located on Brunswick Road, north of Idaho Maryland Road and south of Bubbling Wells Road. Sites 4, 5, 6, and 7 are on the west side of Brunswick Road and are accessed by Triple Crown Drive. Sites 4, 5, 6, and 7 are undeveloped contiguous parcels with an irregular shape. Site 8 lies across Brunswick Road to the east and also has an irregular shape. These parcels are gently to moderately sloped and have moderate to high relief. Sites 4, 6, and 7 are bound by Brunswick Road on the east. Sites 5 and 7 are bound by undeveloped land to the southwest, west, and north. A single family residence is adjacent to the southern boundary of Site 6 with access to the residence by Triple Crown Drive along the boundary of Sites 4 and 6. Undeveloped land lies southeast of Site 4. Agricultural development is apparent south of Site 8 and single family residences are located to the north. Sites 4 and 8 are bordered by an unnamed tributary to Wolf Creek.

1.2.2 Penn Valley Area

1.2.2.1 Sites 10 and 11

Sites 10 and 11 are undeveloped contiguous parcels located in the Penn Valley Area south of State Route 20, on the north side of Penn Valley Drive, and east of the intersection with Broken Oak Court. Site 11 is gently sloped to the northwest with approximately 7 feet of relief. Site 10 slopes very gently to the northeast and is topographically lower than the surrounding properties to the west and east. The northern section of Site 10 is transected by Squirrel Creek, and is bound by the riparian zone, the Creekside Village mobile home park wastewater percolation ponds, and Site 13. Mixed use commercial and residential properties surround the sites on the east, west, and south. A large culvert enters Site 10 from beneath Penn Valley Road on the south with the primary flow path in the swale along the western boundary, where it then exits the western boundary of the site to another culvert.

1.2.2.2 Site 12

Site 12 is southwest of Sites 10 and 11 across Penn Valley Road on Broken Oak Court. This site is undeveloped and flat lying. This site is surrounded by single and multifamily residential development. A seasonal drainage swale is present on the north side of the site and appears to follow the property boundary from the east, then passes through the northwest portion of the site.

1.2.2.3 Site 13

Site 13 is bordered by State Route 20 to the north, rural residential development to the east, Squirrel Creek to the south, and presently undeveloped land to the west. Site 13 is very gently sloping to flat lying, with estimated slope gradients typically less than 5 percent. Two seasonal drainage swales flow across the project site from the State Route 20 boundary toward Squirrel Creek.

An existing, circular percolation pond is located adjacent to Site 13, near Squirrel Creek. The percolation pond functions as the primary component of the wastewater treatment and disposal system for the Creekside Village mobile home park, which is located south of Site 13, across Squirrel Creek. Access to Site 13 is currently provided by an easement through the Creekside Village mobile home park and a concrete stream crossing over Squirrel Creek.

1.2.3 Lake of the Pines Area

1.2.3.1 Site 14

Site 14 is located northeast of the intersection of State Route 49 and Combie Road, on the south side of Cameo Drive, in southern Nevada County. Site 14 is an undeveloped parcel on moderately sloped terrain, with an estimated slope gradient of 20 percent. Site 14 is bound by State Route 49 on the west, rural residential development to the north and east, and the Higgins Fire Station to the south. No significant drainages were present.

1.2.3.2 Sites 15 and 16

Sites 15 and 16 are located southeast of the intersection of State Route 49 and Combie Road and Site 14. Access to these sites is from Woodridge Drive off of State Route 49. Site 15 and 16 are contiguous parcels on gently to moderately sloping terrain, with estimated slope gradients up to 20 percent. Site 15 is presently developed with a single family residence. Site 16 is largely undeveloped, except for a wastewater disposal field and associated groundwater monitoring well network and pump building. The wastewater disposal field services the commercial

development on the corner of State Route 49 and Combie Road to the northwest. Power transmission lines transect the eastern portion of the property. No significant drainages were evident.

1.2.3.3 Site 17

Site 17 is densely vegetated and undeveloped on moderately sloping terrain with an estimated slope gradient of 12 percent. Site 17 is bound by single family residential property on the south, Rosewood Road and undeveloped land to the east, undeveloped land to the west, and commercial development across Combie Road to the north. Ragsdale Creek runs along the north boundary of Site 17. Most of this site was obscured by the dense, north slope, vegetation.

1.2.3.4 Site 18

Site 18 is located southeast of Sites 15, 16, and 17 on the north side of Combie Road. Site 18 is generally an undeveloped parcel on moderately to steeply sloped terrain, with estimated slope gradients of 13 to 30 percent. The northern portion of Site 18 is occupied by the Hole 6 green of the adjacent Darkhorse Golf Course. Site 18 is bound on the north and east by the Darkhorse Golf Course, on the west and south by single family residential development and open space. An ephemeral drainage transects the northwest portion of the property.

1.3 PROPOSED IMPROVEMENTS

Our understanding of the proposed project is based the March 28, 2012 Project Kickoff Meeting Notes issued by the County of Nevada Housing Element. Presently the project is in the feasibility study phase to determine the feasibility of future development of high-density residential housing on the 16 candidate sites. The parcels range in size from approximately 1.08 to 20.10 acres, and associated improvements would likely include single or multilevel buildings, parking and landscape areas, and extensions of public utilities and infrastructure.

2 SITE INVESTIGATION

The following sections summarize our literature review and field reconnaissance.

2.1 LITERATURE REVIEW

H&K performed a limited review of available literature that was pertinent to the candidate sites. The following summarizes our findings.

2.1.1 Previous Investigations

2.1.1.1 Site 1

Site 1 is located near the northwestern boundary of the approximately 705-acre North Star property, on which extensive historical hard rock gold mining was performed. H&K performed a Phase I Environmental Site Assessment (ESA) of the North Star property in 2011, as documented in *Phase I Environmental Site Assessment, North Star Property, Grass Valley, Nevada County, California* (H&K, March 23, 2011). In 2006, H&K performed an additional assessment of the North Star property as described in our December 27, 2006 *Preliminary Endangerment Assessment* which characterized metals concentrations associated with abandoned mine features. The PEA report was prepared pursuant to the August 8, 2005 VCA between the California Department of Toxic Substances Control (DTSC) and North Star/Grass Valley, LLC. The DTSC Docket Number is HSA-A 05/06-022.

Although the *Geologic Map of the Grass Valley Quadrangle and Adjacent Area, Nevada County, California* (W.D. Johnson, Jr., 1940) depicts no record of mining activity at the Site 1 location, the site is located near the historical North Star group of mines, and numerous unrecorded workings are known to exist in the site vicinity which could impact the property.

2.1.1.2 Site 3

Site 3 comprises the western portion of the approximately 45-acre La Barr Meadows property, which consists of Nevada County Assessor's parcel numbers (APNs) 09-620-10 and 12, 22-150-23 and 30, and 29-350-12 (Site 3). Site 3 is bordered by the Empire Mine SHP on the north and by the remainder of the La Barr Meadows property on the east.

Past uses of Site 3 include hard rock gold mining. Adjacent recognized environmental conditions include former mining and mine processing on the Empire Mine SHP property. Based on review of potential transport mechanisms, H&K's opinion is that significant impact to Site 3 from the Empire Mine SHP property is unlikely.

Pursuant to a voluntary cleanup agreement (VCA) with California Department of Toxic Substances Control (DTSC), H&K performed a PEA of the La Barr Meadows property to provide information for use in determining whether past site use or adjacent recognized environmental conditions released hazardous substances that present a risk to human health or to the environment. The PEA findings are presented in H&K's *Preliminary Endangerment Assessment of La Barr Meadows*

Property (January 12, 2007). DTSC approved the PEA report in a letter dated March 27, 2007.

The PEA identified abandoned mine features on Site 3 (referred to as features M2, M5 and M6). Figure 2 of the PEA showing the locations of the features is provided in Appendix C. The constituents of potential concern (COPCs) include arsenic, cadmium, lead, mercury and other metals. Potential exposure routes include ingestion, dermal contact and inhalation of soil dust. Based on a human health risk assessment performed as part of the PEA, assessment area M5 was determined to be suitable for unrestricted land use. The mine waste in areas M2 and M6 pose a potential human health risk and are not acceptable for unrestricted land use.

H&K also presented procedures for conducting remedial activities to address chemical hazards posed by abandoned mine features, as described in our September 8, 2008 *Final Removal Action Workplan for La Barr Meadows Property, APNs 09-620-10 and 12, 22-150-23 and 30, and 29-350-12, Nevada County, California* (RAW). The RAW was approved by DTSC in a letter dated August 19, 2008, and DTSC issued a Notice of Exemption (NOE) under the California Environmental Quality Act (CEQA) for the proposed remedial action. Public documents can be found at the DTSC's Envirostor Web site (Envirostor ID No. 29000004, Site Code 101724). The objectives of site remediation for mining assessment areas M2 and M6 are to:

1) Excavate the mine waste and underlying soil containing metals concentrations that exceed remedial goals;

2) Obtain soil samples for analysis to verify that the remedial goals have been met; and

3) Place the excavated mine waste and soil on-site in a deed restricted area.

The RAW locates the waste placement area near the eastern boundary of Site 3. The RAW can be modified to adjust the location of the mine waste placement area, and any modifications would need to be reviewed by the DTSC. It is possible that the mine waste can be removed from Site 3 and placed east of Site 3 on the adjacent remainder of the La Barr Meadows property. The waste placement area would be subject to land use restrictions which would likely allow commercial development but not residential development at the waste placement area.

If site activities are performed prior to site remediation as presented in the RAW, the remediation areas should be identified and marked in the field so that the areas may be avoided. Potential site activities that may result in disturbance of the mine

waste stockpiles and impacted soil areas include timber harvest, grading and road construction, brush clearing, and other ground disturbing activities. The DTSC should be allowed to review any proposed ground disturbing activities if the activities are to be performed prior to the implementation of the recommended remedial procedures.

The *Map of Township No. 16 North, Range No. 8 East, Mt. Diablo Meridian* (United States Bureau of Land Management, 1874) depicts a mine adit in the vicinity of Area M2. Similarly, the *Map of the Grass Valley Quadrangle,* Nevada City Special Folio, California: U.S. Geological Survey Folio 29 (Waldemar Lindgren, 1896) depicts one mine adit and a stockpile of mine waste in the vicinity of Area M2. It is unknown whether the adit at area M2 has been backfilled, or is simply obscured from view by dense vegetation. General guidelines for physical closure are presented in the RAW. Future development proposed at Site 3 should consider potential physical hazards resulting from mine excavations. Recommendations regarding the mine excavations should be provided in a design-level geotechnical engineering report for proposed future development.

2.1.1.3 Sites 4 through 8 and 10 through 12

There are no known previous geotechnical or environmental investigations of Sites 4 through 8 and 10 through 12.

2.1.1.4 Site 13

Previous investigations conducted at Site 13 include a soils evaluation for wastewater disposal and a geotechnical investigation for residential development. The findings of the soil evaluation for wastewater disposal were reported in the *Preliminary Wastewater Disposal Field Design Report for Proposed Penn Valley Oaks Residential Development* (H&K, November 22, 2002) and the findings of the geotechnical investigation were reported in the *Geotechnical Investigation Report for Cross Creek Oaks Residential Development* (H&K, July 24, 2002).

Soils within Site 13 are reported (H&K, 2002) to be variable across the site. In the western portion of the previously planned Cross Creek Oaks development soils consisted of dark brown to brown, dry to damp, loose to medium dense, silty sand and moderately cemented, fine sandy silt. This surface soil was generally underlain by brown, damp to moist, medium dense, silty sand. Thin layers of grayish brown, damp, loose sand were also noted at depths between 2 and 3 feet bgs.

In the eastern portion of the project site, soils consisted of striated alluvial material described as yellowish brown, brown, and grayish brown, silty fine sand, sand, and

gravelly sand. In the northern portion of this area, the soils were finer grained, alluvial materials described as yellowish brown, reddish brown, strong brown, and grayish brown, clayey silt, sandy silt, and sand.

Redoxymorphic features, which indicate seasonal or periodic saturation, were noted across the site at depths less than 12 inches bgs and at depths greater than 4 feet bgs. The investigation was conducted during the summer and a period of extended dry weather. No groundwater or shallow seepage was observed at that time. However, seepage was encountered during previous trenching performed for the nearby Creekside Village mobile home park wastewater disposal field evaluation, which suggests that seasonally shallow groundwater may be encountered across the project site.

A primary concern with development of Site 13 is the proximity to the Squirrel Creek stream channel and areas of indistinct drainage. We anticipate that areas of standing surface water and periodic flooding may occur at isolated areas across the project site. Further review of the site conditions may reveal that grades within future areas of improvement may need to be raised through the placement of compacted fill to mitigate potential drainage problems. General recommendations regarding site drainage are presented in this report. However, a detailed review and analysis of drainage conditions onsite or stream channel hydrology should be addressed in a design-level geotechnical engineering investigation.

2.1.1.5 Sites 14 and 15

There are no known previous geotechnical or environmental investigations of Sites 14 and 15.

2.1.1.6 Site 16

Percolation testing was previously conducted by Anderson Geotechnical Consultants and reported in the *Report Letter on Preliminary Percolation Study* (September 11, 1990). This report was not available for review during this literature review.

H&K conducted a soils evaluation for wastewater disposal at Site 16, including percolation testing, as reported in *Higgins Corner Project, Additional Percolation Testing* (H&K, January 18, 2002) and mantle testing as reported in *Proposed Higgins Village Wastewater Disposal Field, Mantle Trench Observations* (H&K, September 11, 2002). The results of the percolation and mantle testing were used by others to design the existing wastewater disposal field.

In general, percolation test results indicated that an average or design percolation rate of 27 minutes per inch at a depth of 36 inches below ground surface (bgs) and that percolation rates may decrease with depth, as is typically observed in the residual soil found in the region.

The mantle observations revealed that the surface soil across the proposed disposal area typically consisted of dark reddish brown and yellowish red sand loam and silt loam. The surface soil extended to depths ranging between 1.2 feet and 2.8 feet bgs.

Underlying the surface soil layer, horizons of silt loam and silty clay loam extending to and beyond the anticipated depths of the disposal trenches were observed. Completely weathered and severely weathered, friable volcanic or metavolcanic rock was encountered to depths of approximately 9 feet bgs. The completely weathered and severely weathered rock was easily excavated by the backhoe, was friable by hand, and was textured as sandy loam and silty clay loam, and sandy loam with gravel. Resistant rock which would be considered a limiting condition to subsurface effluent disposal was not observed in the mantle trenches which were excavated to depths ranging between 10 feet and 11 feet bgs.

H&K designed and installed the groundwater monitoring well network for the wastewater disposal field. Boring logs, monitoring well construction diagrams, and depths to groundwater are reported in *Monitoring Well and Sampling Report for the Proposed Higgins Village Disposal Area* (H&K, June 1, 2002). Three borings were drilled to depths ranging between 60 and 80 feet bgs.

The soil and/or rock units encountered in the borings were generally stratigraphically continuous across the site; however, the units may slightly vary in thickness. The units encountered in general stratigraphic sequence during drilling at Site 16 consisted of approximately 22 feet of sandy silt, silt, and completely weathered rock, underlain by very severely to severely weathered metavolcanic rock to approximately 45 feet bgs, and moderately to slightly weathered metavolcanic rock from 45 feet bgs to the total depths of the borings. Groundwater was documented to occur at depths ranging from 56 to 75 feet bgs.

2.1.1.7 Site 17

There are no known previous geotechnical or environmental investigations of Site 17.

2.1.1.8 Site 18

Although there are no known previous geotechnical or environmental investigations of Site 18, geotechnical investigations have been conducted on the adjacent Darkhorse Golf Course property where similar geologic conditions are expected to exist. The findings and recommendations of the geotechnical investigations are documented in the following reports:

- *Preliminary Geotechnical Investigation for Darkhorse Golf Course and Residential Community* (H&K, August 14, 1996);
- *Geotechnical Engineering Report for Serene Hill and Darkhorse Lower Tanks* (H&K, July 2, 2002);
- *Geotechnical Engineering Report for Proposed Darkhorse Golf Course* (H&K, May 2, 2001);
- *Soil Evaluation Report for Darkhorse Clubhouse, APN 11-181-10* (H&K, May 15, 2003); and
- *Proposed Darkhorse Wastewater Disposal Fields, Soil Evaluation for Additional Disposal Areas* (H&K, September 20, 2004).

H&K identified geologic conditions at various locations across the Darkhorse Golf Course which may impact development at the site including: fine-grained potentially expansive soil, shallow soil, resistant rock outcrop, shallow groundwater seepage, and poor draining soils. These conditions should be addressed during a design level geotechnical engineering investigation.

During our previous investigations in this area, expansive predominantly fine grained soil was generally encountered near the soil/weathered rock interface. This soil may not be suitable for use within proposed paved areas, building footprints, or any other improvements which may be susceptible to swell or expansive soil induced distress without mitigation.

Localized groundwater seepage or saturated soil conditions are often encountered in the area and may exist at the site particularly during or immediately following the rainy season.

Variably weathered, resistant rock would likely be encountered during grading of Site 18. Blasting, pre-ripping, splitting, or pneumatic hammers may be required to facilitate excavation in resistant rock.

2.2 USDA SOIL SURVEY

H&K reviewed the *Soil Survey of Nevada County Area, California* (USDA Soil Conservation Service, 1975, reissued 1993) and the USDA's online Websoil Survey accessed at http://websoilsurvey.nrcs.usda.gov/ (May 2012). Soil classifications for each site are listed in Table 2. Figures 4 through 13 show soil classification locations for each site. The soil conditions mapped by the soil survey are generalized, and the mapped locations are presented approximately. Actual soil conditions would need to be verified in the field as part of a design-level geotechnical investigation. The soil series characteristics are summarized below.

Ahwahnee Series

The soil survey describes the Ahwahnee Series soils as consisting of well drained soil underlain by weathered granodiorite. Permeability is moderately rapid. The surface soil layer typically consists of dark grayish brown sandy loam to an approximate depth of 2 inches bgs. The surface soil is typically underlain by brown sandy loam to an approximate depth of 16 inches bgs. The sandy loam is typically underlain by yellowish brown to reddish yellow, heavy sandy loam to an approximate depth of 38 inches bgs. Below 38 inches bgs, weathered granodiorite is generally encountered. Noted limitations to site development are severe shallow soils for septic tank filter fields.

Aiken Series

The soil survey describes the Aiken Series soils as consisting of well drained soil underlain by cobbly andesitic tuff and conglomerate. Permeability is moderately slow. The surface layer is littered with forest debris such as pine needles, oak leaves, and other vegetative material. Similar material below the surface becomes more decomposed as depth increases. The mineral surface layer typically consists of dark brown to yellowish-red loam and heavy loam to an approximate depth of 21 inches bgs. The loam to heavy loam is typically underlain by yellowish-red and reddish-yellow heavy loam to heavy clay loam and clay to an approximate depth of 64 inches bgs. The heavy loam to heavy clay loam and clay is typically underlain by weathered andesitic tuff typically at depths greater than 64 inches bgs.

Alluvial Land, Clayey

The soil survey describes the Alluvial Land, Clayey soils as narrow areas of alluvial material consisting of mostly dark-gray to dark grayish-brown clay loam to clay to an approximate depth of 30 to 45 inches bgs. This clay to clay loam is in places

overlain by a sandy loam or loam to an approximate thickness of 3 to 10 inches. Permeability is moderately slow.

Alluvial Land, Loamy

The soil survey describes the Alluvial Land, Loamy soils as narrow areas of recent alluvial material along stream channels. The material is typically stratified and consists of coarse sandy loam to loam with gravels, to approximate depths of 30 to 45 inches bgs. This sandy loam to loam is typically underlain by gravel, cobblestones, or underlying bedrock. Permeability is moderate.

Argonaut Series

The soil survey describes the Argonaut Series soils as well-drained and underlain by metabasic or basic rock. Permeability is very slow. The typical soil profile consists of approximately 2 inches of brown, gravelly loam. The surface soil is generally underlain by an 8-inch thick stratum of reddish brown, gravelly loam. Reddish brown gravelly loam is typically underlain by 7 inches of reddish-brown gravelly clay which is underlain by 11 inches of light yellowish-brown clay loam and weathered diabase. Weathered basic rock is encountered at depths greater than 28 inches bgs.

Auburn Series

The soil survey describes the Auburn Series soils as well-drained and underlain by weathered diabase and metabasic rock. Permeability is moderate. The typical soil profile consists of approximately 9 inches of brown and reddish-brown loam and heavy loam. The surface soil is generally underlain by a 7-inch thick stratum of yellowish-red light clay loam. The light clay loam is typically underlain by weathered diabase or metabasic rock at depths greater than 16 inches bgs.

Boomer

The soil survey describes the Boomer soils as well-drained and underlain by weathered basic rock. The typical soil profile consists of approximately 11 inches of brown, dark brown, and reddish brown loam. The surface soil is generally underlain by a 26-inch thick stratum of reddish brown, heavy loam and yellowish red, clay loam. Reddish yellow loam and weathered diabase is generally encountered at depths greater than 37 inches bgs. Fractured diabase is typically encountered at a depth of 47 inches bgs. The Boomer-Rock Outcrop Complex generally has rock outcrop covering between 10 percent and 25 percent of the ground surface. Noted limitations to site development include rock outcrop,

moderate corrosion potential of uncoated steel, and moderate shrink-swell potential.

Musick Series

The soil survey describes the Musick Series soils as consisting of well drained soil underlain by weathered granodiorite. Permeability is moderately slow. The surface soil layer typically consists of brown and reddish-brown sandy loam to an approximate depth of 25 inches bgs. The sandy loam is typically underlain by yellowish-red and red heavy clay loam to an approximate depth of 98 inches bgs. The heavy clay loam is typically underlain by weathered granodiorite rock at depths greater than 98 inches bgs.

Placer Diggings

The soil survey describes the Placer Diggings deposits as remnants of Tertiary river deposits. These are hydraulically mined areas, placer-mined areas along stream channels, areas of natural deposits and areas of exposed bedrock. The deposits are highly variable consisting of 90 to 100 percent stones, cobblestones, or gravel with some varying percentages of soil material. The deposits range from 6 inches to 10 feet thick.

Rescue Series

The soil survey describes the Rescue Series soils as well-drained and underlain by weathered basic rock. The typical soil profile consists of approximately 3 inches of brown, loam. The surface soil is generally underlain by a 30-inch thick stratum of brown, heavy loam and reddish-brown, clay loam. The heavy loam and clay loam are typically underlain by 17 inches of brownish-yellow heavy loam that is slightly acid. Slightly weathered or fractured diabase is generally encountered at depths greater than 50 inches bgs. The Rescue-Rock Outcrop Complex generally has rock outcrop covering between 10 percent and 25 percent of the ground surface. Noted limitations to site development include rock outcrop, moderate corrosion potential of uncoated steel, and moderate shrink-swell potential.

Sierra Series

The soil survey describes the Sierra Series soils as consisting of well drained soil underlain by weathered granodiorite. Permeability is moderately slow. The surface soil layer typically consists of dark brown to brown sandy loam to an approximate depth of 9 inches bgs. The sandy loam is typically underlain by reddish brown, heavy sandy loam to an approximate depth of 16 inches bgs. The heavy sandy

loam is generally underlain by yellowish red to reddish yellow sandy clay loam to an approximate depth of 45 inches bgs. The sandy clay loam is typically underlain by light yellowish brown, weathered granodiorite, typically at depths greater than 45 inches bgs.

Sites Series

The soil survey describes the Sites Series soils as consisting of well drained soil underlain by tilted metasedimentary and metabasic rock. Permeability is moderately slow. The surface soil layer typically consists of brown and yellowish-red heavy loam to an approximate depth of 12 inches bgs. The heavy loam is typically underlain by yellowish-red clay loam and red clay, and light clay to an approximate depth of 68 inches bgs. The heavy loam is generally underlain by yellowish red clay loam to an approximate depth of 78 inches bgs. The clay loam is typically underlain by weathered metasedimentary and basic rock at depths greater than 78 inches bgs.

2.3 REGIONAL GEOLOGY

The candidate properties are located in the Sierra Nevada Foothills, on the western side of the Sierra Nevada geomorphic province. The Sierra Nevada province is an elongate, north-west/south-east trending structural block that is tilted upward to form a steep scarp above the adjacent Basin and Range province to the east. The western slope of the Sierra Nevada dips gently westward, and extends beneath sediment of the Great Valley province. Sediment within the Great Valley is derived from continual uplift and erosion of the Sierra Nevada.

2.4 SITE GEOLOGY

To determine the geology of each site, we reviewed the *Geologic Map of the Chico Quadrangle, California* (Saucedo, G. J., and Wagner, D. L., 1992); the *California Mineral Land Classification of Nevada County, California, Special Report 164* (California Department of Conservation, Division of Mines and Geology, 1990); and the unpublished thesis *Structural and Stratigraphic Relations in the Grass Valley Colfax Area of the Northern Sierra Nevada foothills, California* (Tuminas, Alvydas, 1983). According to the geologic maps, the geology of the subject sites primarily consists of Mesozoic aged plutonic and metavolcanic rocks. The Mesozoic era spans the time between the 65 and 230 million years before present. The geology of each site is listed in Table 1 and a brief description is provided below.

We reviewed the following historical mining maps to determine whether mining claims or ore processing facilities were depicted on the subject site.

- Plate 2A, *Maps of the Mineral Land Classification of Nevada County, California*. Special Report 164, California Department of Conservation Division of Mines and Geology (CDMG), 1990.
- *Map of the Grass Valley Quadrangle* from the Nevada City Folio (Lindgren, 1896).
- *Survey Map of Township 16 North, Range 8 East, Mt. Diablo Meridian* United States Bureau of Land Management (1874).

2.4.1 Grass Valley Area

The geology of Site 1 consists of early Mesozoic Lake Combie Complex, massive diabase. These rocks occur as discordant plutonic masses intrusive into all other Lake Combie Units. No mining features were identified on this site; however, as discussed in Section 2.1.1.1, this site is near the northwestern boundary of the historic North Star group of mines, and numerous unrecorded workings are known to exist in the site vicinity.

The geology of Site 3 consists of Mesozoic massive granitic intrusives that are referred to as the La Barr Meadows quartz diorite. The *Survey Map of Township No. 16 North, Range No. 8 East, Mt. Diablo Meridian* (USBLM, 1874) and the *Map of the Grass Valley Quadrangle* (Lindgren, 1896) depict one mine adit near the boundary of Site 3. See Section 2.2.1.2 of this document regarding the status of this mining feature and potential hazards that are known to exist on Site 3.

Sites 4 through 8 are underlain by early Mesozoic Lake Combie Complex, gabbroic rocks that occur as massive to undifferentiated gabbro to quartz diorite. No mining features are mapped on these sites.

2.4.2 Penn Valley Area (Sites 10 through 13)

The geology of sites 10 through 13 consists of Mesozoic gabbroic rock associated with the Penn Valley Pluton. No mining features are mapped on these sites and H&K did not observe evidence of historic mining activities on the sites.

2.4.3 Lake of the Pines Area (Sites 14 through 18)

The geology of sites 14 through 18 consists of early Mesozoic Lake Combie Complex, metavolcanics. No mining features are mapped on these sites and H&K did not observe evidence of historic mining activities on the sites.

2.5 REGIONAL FAULTING AND SEISMIC SOURCES

Regional faulting is associated with the central area of the Foothill Fault System which includes the Spenceville Fault, Wolf Creek Fault Zone, Bear Mountains Fault Zone (Highway 49 lineament), Grass Valley Fault, Weimar Fault Zone, and the Cleveland Hill Fault. The Foothill Fault System is a broad zone of northwest trending east dipping normal faults formed along the margin of the Great Valley and the Sierra Nevada geologic provinces on the western flank of the Sierra Nevada and southern Cascade mountain ranges. The central part of the fault zone is split into branches: the Malones Fault Zone to the east, the Cleveland Hill fault to the northwest, the Spenceville Fault to the west, and the Wolf Creek Fault Zone in the area of the candidate sites.

H&K reviewed the 1997 version of Special Publication 42, *Fault Rupture Hazard Zones in California*, which describes active faults and fault zones (activity within 11,000 years), as part of the Alquist-Priolo Earthquake Fault Zoning Act. The document and the 1999 on-line update indicate that the sites are not located within an Alquist-Priolo active fault zone. According to the *Fault Activity Map of California and Adjacent Areas* (Jennings, 1994), the closest known active fault which has surface displacement within Holocene time (about the last 11,000 years) is the Cleveland Hill Fault. The Cleveland Hill Fault is located approximately 24 to 38 miles northwest of the subject sites and is associated with ground rupture during the Oroville earthquakes of 1975. Figure 17 shows the approximate locations of the candidate Sites on the *Fault Activity Map of California and Adjacent Areas.*

Additionally, we reviewed the California Department of Conservation Division of Mines and Geology Special Report 164, Mineral Land Classification of Nevada County, California (1990) and *Structural and Stratigraphic Relations in the Grass Valley Colfax Area of the Northern Sierra Nevada Foothills, California* (Tuminas, 1983).

There are no faults mapped within the candidate sites, with the exception of Sites 4 and 8. Tuminas, 1983 shows a fault trace on Site 8 and a thrust fault approximately 800 feet east of Site 8. Saucedo and Wagner, 1992 show a fault trace on Site 4. Sites 1, 14, 15, 16, and 17 are within 500 to 4000 feet of the Wolf Creek Fault Zone which is generally located in the study area, mapped on the west side of State Route 49 (Saucedo and Wagner, 1992, and Tuminas, 1983). None of these faults are considered to be active. Table 1 lists the faults associated with each candidate site.

2.6 FIELD OBSERVATIONS

H&K performed site reconnaissance on May 21, 22 and 23 and June 6, 2012 and made observations of surface conditions at each of the candidate sites.

2.6.1 Surface Conditions

2.6.1.1 Site 1

Site 1 is located in an area with other successful development. The site gently slopes toward McCourtney Road with no notable landforms, drainage features, or vegetation. This site has previously been cleared and the exposed surface consisted primarily of gravel with a finer matrix soil. This site is periodically used for a parking lot.

2.6.1.2 Site 3

Site 3 is moderately sloping, with areas of dense blackberry bushes which may be indicative of seasonal shallow groundwater conditions. Portions of the site appeared to have recent timber harvesting and/or clearing, as indicated by the presence of brush piles and earthen berms on the site. Exposed surface soils consisted of a red, silty sand, with a few granitic cobbles strewn across the site. The vegetation consisted of grasses, shrubs, and trees including gray pine and a few madrone. An ephemeral drainage swale was observed in the southern portion of the site, however, evidence of large flow was not observed. The surface of the drainage swale was largely covered in plant litter.

H&K observed potential evidence of past mining activity in the southern portion of the site, as hummocky surfaces (tailings piles), exploratory excavations (glory holes), and berms potentially associated with water conveyance. The berms were located downslope of the adit that is mapped near the eastern Site 3 boundary. Approximate locations of observed features are depicted on Figure 5.

2.6.1.3 Sites 4 through 8

Our observation of Sites 4 through 7 revealed that these sites were generally located on a forested hilltop location. These sites are forested with madrone, incense cedar, ponderosa pines, and associated chaparral typical of the area. Blackberry bushes and other plants associated with moist soil conditions were observed in the lower portions of the sites, particularly on Sites 4, 5 and 7. The surface soil at the sites was typically obscured by forest litter, recent timber harvest debris, and surface vegetation. However, where observed, the surface soil appeared to typically consist of reddish brown fine sandy silt with common gravel-

size rock fragments. We noted an apparent increase in the gravel content of the surface soil in the upper portions of Sites 5, 6, and 7, which may be indicative of a thinner soil profile at these hilltop locations and shallower depths to resistant rock.

On site 4 we observed minor apparent rock outcrop in the eastern portion of the parcel which may indicate the potential for relatively shallow soil. We also observed an abandoned small wood structure in the eastern, downslope portion of the site, near an abandoned irrigation ditch alignment. Areas of shallow irregular topography were also observed in the eastern portion of the site, generally between the abandoned irrigation ditch and a tributary to Wolf Creek which flows near the eastern boundary of the site. This irregular topography appeared to be the result of past excavation or trenching in this area. Areas of dense blackberry bushes were also observed in the eastern portion of the project site at locations in close proximity to the creek.

The southern half of irregularly shaped Site 5 was dominated by a broad swale which sloped downward to the southwest. We did not observe evidence of significant surface water flow in the swale except in the lowermost portions of the site, near the southwestern property boundary.

During our site observations we observed what appeared to be an exploratory excavation or glory hole in the western portion of Site 7, near the boundary with Site 5. The approximate excavation location is depicted on Figure 6.

Site 8 is located to the east of Sites 4 through 7, on the east side of the Brunswick Road alignment. This forested site is gently to moderately sloping to the southwest, with estimated slope gradients varying from approximately 20 percent in the northeastern portion of the site to relatively flat in the west and southwestern portions of the site, near Brunswick Road. Recent timber harvest activities here had exposed areas of surface soil at several locations on the site, which typically consisted of dark reddish brown silty fine sand. Saturated surface soil conditions and areas of standing water were observed in the central portion of the site and also in the low lying areas in the western portion of the site, adjacent to Brunswick Road. Although these moisture conditions were attributable in part to intense thunderstorms the day prior to our site observations and likely compounded by recent disturbance of the surface soil and from timber harvest activities, shallow seepage or groundwater conditions may be present at this site. We also observed an area of rock outcrop in the western portion of the site, at the approximate location shown on Figure 6.

We observed a previously graded, gently sloping bench which crossed the site, descending from northwest to southeast. This previously graded bench is presumed to be attributable to the historical Nevada County Narrow Gauge Railroad alignment. The presence of the bench alters natural surface water drainage, particularly in the southern portion of the site where we observed areas of standing water and saturated surface soil conditions on the upslope side of the bench. We also observed sloughing and erosion of the bench at a location near the southern property boundary, where the apparent railroad alignment crossed a tributary to Wolf Creek. This crossing location is likely off of the subject site, on the neighboring parcel to the south.

2.6.1.4 Sites 10 and 11

Site 10 is undeveloped and very gently slopes to the northeast toward Squirrel Creek. This site is topographically lower than the surrounding properties and appears to have poor drainage. Surface soils were largely obscured by dense grasses. Site vegetation consisted of primarily grasses and localized blackberry bushes, and riparian zone plants near Squirrel Creek. There were drainage courses meandering throughout the property and it is likely that runoff from the surrounding properties drains to Site 10.

In addition to water entering the site from the adjacent properties, a large culvert enters the site from beneath Penn Valley Road which may periodically contribute a large flow volume. The culvert waters flow along the the western side of the property in a ditch that had a large hole scoured out. The hole was approximately 4 feet in diameter and 4 feet deep. Soils in this hole consisted of fine grained silts and sand with some gravel. Standing water was also observed at several locations along this ditch. Drainage improvements will likely be needed in order to develop this site and should be addressed in a design-level geotechnical investigation.

There was a soil stockpile located on the southeast corner of Site 10, the source of which is unknown. Approximate locations of features observed on Site 10 are depicted on Figure 7.

Site 11 gently slopes toward Site 10 and is vegetated primarily with grasses and a few oak trees. There were a few scattered granitic boulders ranging from 3 to 6 feet in diameter.

2.6.1.5 Site 12

Site 12 is largely undeveloped and generally flat lying. Broken Oak Court by which the site is accessed is a paved road. Vegetation on this site consisted of grasses and a few large oak trees. Surface soils were mostly obscured by vegetation but were observed in a recently disturbed area (associated with tree removal) and consisted of fine grained silt and sand with some gravel. A seasonal drainage swale is present on the north side of the site and appears to follow the property boundary from the east, then passes through the northwest portion of the site. The approximate location of the drainage is depicted on Figure 8. There was one large granitic boulder on the south side of the site that appeared to have been placed during previous development.

2.6.1.6 Site 13

Site 13 is undeveloped, gently rolling terrain. Surface soils were largely obscured by vegetation, which consisted of grasses, shrubs, oak and pine trees. Two indistinct seasonal drainage swales transect the site from the State Route 20 boundary and flow is toward Squirrel Creek to the south.

2.6.1.7 Site 14

Site 14 is an undeveloped parcel on moderately sloping terrain. Surface soils were largely obscured by vegetation consisting of grasses, shrubs, oak and pine trees. H&K observed two rock outcroppings, which may be indicative of shallow soils, and several shallow trenches that were likely associated with previous soil evaluations for wastewater disposal. The approximate locations of these features are shown on Figure 10. This site is located in an area of other successful development, but shallow soils and rock outcrops may need to be considered during design.

2.6.1.8 Sites 15 and 16

Sites 15 and 16 are partially developed with a single family residence, high power transmission lines, and a wastewater disposal field and pump house. The parcels occupy moderately sloping terrain and are vegetated with grasses, shrubs, oak and pine trees. Vegetation is dense on the westerly facing slopes. The eastern portion of Site 16 is transected by high power transmission lines, and the central portion of is occupied by a wastewater disposal system that would limit development in these areas.

2.6.1.9 Site 17

Site 17 is undeveloped on moderately sloping terrain and with very dense vegetation that obscured most of the site. Thus observations were made from Rosewood Road on the west side of the property because very limited portions of the site were accessible.

2.6.1.10 Site 18

Site 18 is an undeveloped parcel on moderately to steeply sloped terrain. Vegetation consisted of grasses, shrubs, oak and pine trees. H&K observed rock outcrop in the southern portion of the site centered on the topographic high and extending southwest along the ridge. Tree trunks on the northwest slope of Site 18 have a notable curvature, which may be an indication of soil creep on the relatively steep slopes in the area. An ephemeral drainage transects the northwest portion of the property. Shallow soil and rock outcrop may limit development of this site and slope instability should be addressed in a design-level geotechnical investigation.

2.6.2 Ground Water Conditions

Based on our experience in the area, we anticipate that saturated soil conditions and seasonally shallow seepage will be encountered in drainage swales, shallow soils, and onsite excavations during or following extended periods of wet weather.

Deeper groundwater conditions have not been documented at the majority of the sites. In general, depth to groundwater is highly variable dependent on site specific conditions and groundwater in the region is predominantly governed by fracture flow. Site 16 is the only site with an existing monitoring well network, associated with the wastewater disposal field, with groundwater documented to occur at depths ranging from 56 to 75 feet bgs. (H&K, 2002d)

3 LABORATORY TESTING

Laboratory testing was not conducted for this preliminary geotechnical engineering investigation. Laboratory testing is typically performed as part of a design-level geotechnical engineering investigation.

4 CONCLUSIONS

The following conclusions are based on our field observations and our experience in the area.

- Based on the results of our preliminary geotechnical investigation, our opinion is that residential development on the candidate sites is feasible from a geotechnical standpoint.
- Our primary concern regarding future residential development on the sites is the possible presence of potentially expansive, clay soil, particularly at the sites in the Lake of the Pines area. Our experience in the area has shown that, where encountered, potentially expansive soil often occurs as a relatively thin horizon near the soil/rock interface. Expansive clay is often successfully mitigated in this area by over excavation and mixing with granular material during grading, or by deepening proposed footings through the clay layer into underlying, more competent soil or weathered rock. The scope of future, design-level geotechnical investigations at the individual sites should include the excavation of exploratory trenches and laboratory testing to determine the presence of potentially expansive soil and derive project specific mitigation approaches, if appropriate.
- We anticipate that areas of seepage will likely be encountered during grading, particularly during the rainy season and/or in excavations which reveal the surface soil/weathered rock contact. Preliminary recommendations regarding subsurface drainage are presented in this report.
- Based on the site geology and our experience in the region, we anticipate that relatively shallow, resistant rock may be on many of the sites during grading or excavation for subsurface utilities. Preliminary recommendations for resistant rock are presented in the following sections. Fill material resulting from excavation onsite may contain significant gravel and oversized rock that will require specific recommendations for use as fill. General recommendations for placement of rock fill and oversized material are presented in this report.
- Our preliminary opinion is that the future residential development at the sites will likely be able to utilize conventional shallow footings and incorporate standard grading practices employed in the region. Deepened footings may be an option to mitigate the presence of expansive soil or previously placed, undocumented fill, if encountered during future design-level investigations of the individual sites.
- Based on our site observations and review of published references, we anticipate that the sites are generally underlain by relatively thin, medium dense soil derived from residually weathered rock. We anticipate that at

many of the sites variably weathered rock will be encountered at relatively shallow depths ranging from (10 to 30 feet bgs) in the native soil profile. Based on these assumptions, and considering the distance to known active faults, we consider the potential for liquefaction, ground lurching, surface rupture, or lateral spreading in native soil/rock onsite to be minimal. However, areas of loose colluvium or sediments adjacent to drainage courses and previously placed, loose fill, if present, may be susceptible to seismic-induced liquefaction, settlement, or lateral spreading. Potential geologic hazards would be explored more fully during the course of a design-level geotechnical investigation of the individual sites. Our opinion is that the primary seismic activity which may affect the site is moderate ground shaking associated with an offsite fault. Small scale, seismically induced slope instability could occur on cut or fill slopes established onsite, particularly if surface soil was saturated at the time of earthquake induced ground shaking. This hazard could be reduced by removing relatively loose fill, if present, and ensuring that cut and fill slopes established onsite are constructed and drained in accordance with recommendations provided in a design-level geotechnical report. Seismically induced settlement could be a factor for buildings placed directly on the unconsolidated fill areas.

- In general, the sites are expected to contain relatively shallow residual soils derived from the weathering of underlying rock. Provided that future residential development is restricted to areas with native slope gradients of 30 percent or less, our preliminary opinion is that it is unlikely that large scale slope instability would impact the subject sites. Steeper slopes may experience shallow, long term slope displacement or creep, and over-steepened cut or fill slopes may be susceptible to slumping. The potential magnitude for creep and confirmation of subsurface conditions in areas of proposed development should be performed as a part of future, design-level geotechnical investigations at the individual sites.
- The sites are located in the Sierra Foothills, a region associated with past and present mining. Based on our literature review, Site 3 is the only location with documented historical mining activity. However, significant prospecting, exploratory excavation, and smaller scale mining has occurred in the area which may not be described in historical literature. Abandoned mining features such as glory holes, adits, or stockpiles may be encountered during the course of future investigations or grading and construction which will require mitigation on a case-by-case basis.

5 PRELIMINARY RECOMMENDATIONS

The following preliminary geotechnical engineering recommendations are included to provide an awareness of the practices in the area and are based on our literature review, our field observations during site surface reconnaissance and previous subsurface investigations, and our experience in the area. The recommendations are preliminary, and are provided for planning purposes. The preliminary conclusions and recommendations presented in this report should be confirmed by a design-level geotechnical engineering investigation and project specific design criteria established by subsurface observation and laboratory testing.

5.1 GRADING

5.1.1 Clearing and Grubbing

Areas proposed for fill placement, paved areas, and building pads should be cleared and grubbed of vegetation and other deleterious materials as described below.

1. Strip and remove organic surface soil containing shallow vegetation and any other deleterious materials. Organic soil can be stockpiled onsite and used in landscape areas, but is not suitable for use as fill. The actual depth of stripping may vary across the site. Areas of deeper organic surface soil may be encountered in drainage swales and low lying areas.
2. Over excavate any loose fill, debris and/or other onsite excavations to underlying, competent material. Possible excavations include exploratory trenches, glory holes, mantles or soil test pits, tree stump holes and abandoned drainage improvements.
3. Remove rocks greater than 8 inches in greatest dimension (oversized rock) by scarifying to a depth of 12 inches or to resistant weathered rock, if shallower, in proposed building pads and areas to support pavement, slabs-on-grade, and other flatwork. Oversized rock should be placed in deep fill per the recommendations of the project geotechnical engineer, stockpiled for later use in landscape areas, drainage features, or stacked rock walls, or placed outside areas of proposed improvements.
4. Vegetation, tree stumps and exposed root systems, and any other deleterious materials and oversized rocks not used in landscape areas should be removed from areas of proposed improvements.

5.1.2 Preparation for Fill Placement

Upon completion of site clearing, grubbing and over excavation, the exposed native soil should be observed by the project geotechnical engineer prior to placement of fill at the project site. Fill placed on slopes steeper than 5:1, H:V, should be benched and keyed into the existing slope to allow placement of fill in horizontal lifts.

5.1.3 Fill Placement

Fill should be placed according to the following guidelines:

1. Material used for fill construction should consist of uncontaminated, predominantly granular, non-expansive native soil or approved import soil. Rock used in fill should be no larger than 8 inches in diameter. Rocks larger than 8 inches are considered oversized material and should be placed in deep fill per the recommendations of the project geotechnical engineer, stockpiled for use in landscape areas or rock walls, or removed from the site.
2. Imported fill material should be predominantly granular, non-expansive and free of deleterious or organic material.
3. Potentially expansive clay soil, if encountered, is typically not suitable for use in building pads or beneath pavements without mitigation. Options to mitigate potentially expansive soil include overexcavation and replacement with predominantly granular soil, mixing with suitable material, project specific moisture conditioning and compaction specifications, and the use of mitigative foundation design.
4. Fill should be uniformly moisture conditioned and placed in maximum 8-inch thick loose lifts (layers) prior to compacting.
5. The moisture content, density and relative compaction of fill needs to be confirmed by routine testing and observation during placement.

5.1.4 Slope Grading

1. Cut and fill slopes should generally be no steeper than 2:1, H:V. Based on our experience in the area, steeper cut slope gradients will be feasible in areas that have significant rock structure. Steeper cut slope gradients must be verified based on the results of laboratory testing and observation of slope conditions. Steeper fill slope gradients may be feasible with the use of geotextile reinforcement, increased compaction specifications, or the use of rock buttressing or facing.

2. Fill slopes should be constructed by overbuilding the slope face and then cutting it back to the design slope gradient. Fill slopes should not be constructed or extended horizontally by placing soil on an existing slope face and/or compacted by track walking.
3. Benching during placement of fill on an existing slope must extend through loose surface soil into firm material, and be performed at intervals such that no loose soil is left beneath the fill.

5.1.5 Excavation

Our observation of rock outcrops across the site and our experience in the area has shown that areas of moderately or slightly weathered rock that is difficult to excavate with conventional grading equipment may be encountered during grading or trenching. Pre-ripping, blasting, or splitting may be required in these areas. The scope of a future design-level investigation should include excavation of exploratory trenches along proposed road and utility trench alignments to allow observation of subsurface soil and rock conditions.

5.1.6 Erosion Control

Graded portions of the sites should be seeded following grading to allow vegetation to become established prior to and during the rainy season. In addition, grading that results in greater than one acre of soil disturbance or in sensitive areas may require the preparation of a storm water pollution prevention plan. As a minimum, the following controls should be installed prior to and during grading to reduce erosion.

1. Prior to commencement of site work, fiber rolls should be installed down slope of the proposed area of disturbance to reduce migration of sediment and small rocks from the site.
2. Soil exposed in permanent slope faces should be hydroseeded or hand seeded/strawed with an appropriate seed mixture compatible with the soil and climate conditions of the site as recommended by the local Resource Conservation District or other local agency.
3. Following seeding, jute netting or erosion control blankets should be placed and secured over graded slopes steeper than 2:1, H:V, to keep seeds and straw from being washed or blown away. Tackifiers or binding agents may be used in lieu of jute netting.
4. Surface water drainage ditches should be established as necessary to intercept and redirect concentrated surface water away from cut and fill slope

faces. Surface water should not be directed over slope faces. The intercepted water should be discharged into natural drainage courses or into other collection and disposal structures.

5.1.7 Subsurface Drainage

If grading is performed during or immediately following the rainy season, seepage will likely be encountered. If groundwater or saturated soil conditions are encountered during grading, we anticipate that dewatering may be possible by gravity or by temporary installation of sump pumps in excavations.

Control of subsurface seepage at the base of fill areas can typically be accomplished by placement of an area drain. Underlying, saturated soil is typically removed and replaced with free draining, granular drain rock enveloped in geotextile fabric to an elevation above the encountered groundwater. Fill soil can be placed over the granular rock. H&K should review proposed drainage improvements with regard to the site conditions prior to construction.

5.1.8 Surface Water Drainage

Proper surface water drainage is important to the successful development of the project. The following measures are typically adopted to reduce surface water drainage problems:

1. Slope final grade adjacent to structural areas so that surface water drains away from building pad finish subgrades at a minimum 2 percent slope for a minimum distance of 10 feet. Where interior slabs-on-grade are proposed, we recommend that the exterior subgrade have a minimum slope of 4 percent away from the structure for a minimum distance of 10 feet. Additional drainage and slab-on-grade construction recommendations would be provided in a design-level geotechnical report.
2. Compact and slope all soil placed adjacent to building foundations such that water is not retained to pond or infiltrate. Backfill should be free of deleterious material.
3. Direct rain-gutter downspouts to a solid collector pipe which discharges flow to positive drainage and away from building foundations.

5.2 FOUNDATION SYSTEMS

Our preliminary opinion is that conventional shallow spread footings will be suitable for relatively lightly loaded, framed structures across much of the subject sites. Footings should be founded on native, undisturbed soil, weathered rock or

compacted and tested fill. Project specific foundation design criteria and construction recommendations are typically provided as part of a design-level geotechnical engineering report.

Footings should be deepened through expansive clay soil, if encountered at the base of the footing excavations. Expansive clay soil is typically encountered in relatively thin layers near the soil/weathered rock interface.

Shallow, resistant rock may be encountered during construction which limits footing excavation. The presence of shallow rock within building footprints may require the use of rock anchors or dowels to provide uplift and sliding resistance. H&K can provide site specific anchor recommendations during construction if requested.

6 REFERENCES

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7 LIMITATIONS

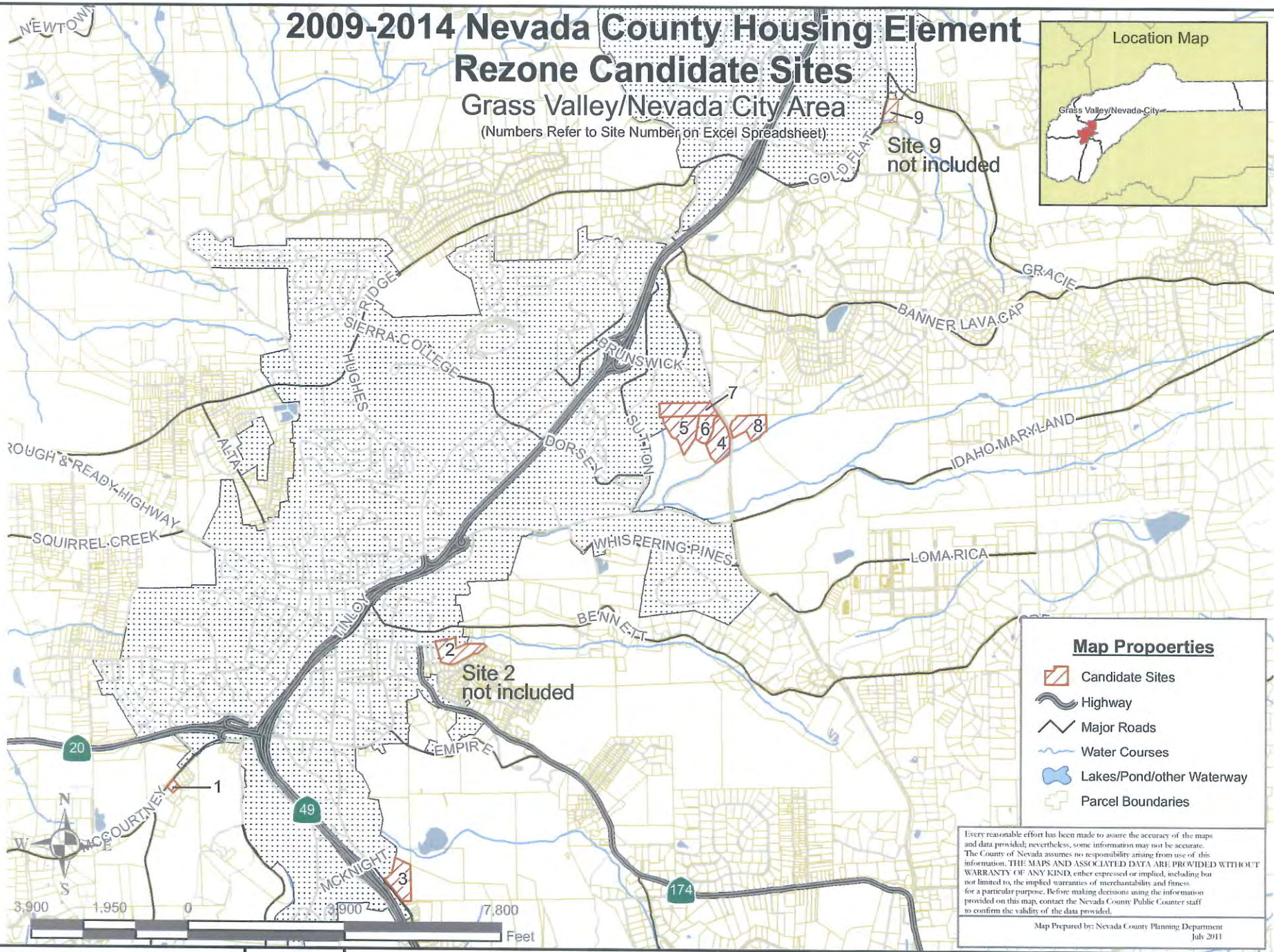
The following limitations apply to the findings, conclusions and recommendations presented in this report:

1. Our professional services were performed consistent with the generally accepted geotechnical engineering principles and practices employed in northern California. This warranty is in lieu of all other warranties, either expressed or implied.
2. These services were performed consistent with our agreement with our client. We are not responsible for the impacts of any changes in environmental standards, practices or regulations subsequent to performance of our services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this report. This report is solely for the use of our client. Any reliance on this report by a third party is at the risk of that party.
3. If changes are made to the nature or design of the project as described in this report, then the conclusions and recommendations presented in this report should be considered invalid by all parties. Only our firm can determine the validity of the conclusions and recommendations presented in this report. Therefore, we should be retained to review all project changes and prepare written responses with regards to their impacts on our conclusions and recommendations. Subsurface investigation and laboratory testing will be required to develop design-level recommendations.
4. The analyses, conclusions and recommendations presented in this report are preliminary, based on site conditions as they existed at the time we performed our surface observations. The subsurface conditions should be confirmed by a design-level geotechnical investigation prior to construction.
5. Our scope of services did not include evaluating the project site for the presence of hazardous materials. Project personnel should be careful and take the necessary precautions should hazardous materials be encountered during construction.
6. The findings of this report are valid as of the present date. Changes in the conditions of the property can occur with the passage of time. The changes may be due to natural processes or to the works of man, on the project site or adjacent properties. In addition, changes in applicable or appropriate standards can occur, whether they result from legislation or the broadening of

knowledge. Therefore, the recommendations presented in this report should not be relied upon after a period of two years from the issue date without our review.

FIGURES

2009-2014 Nevada County Housing Element
Rezone Candidate Sites
Grass Valley/Nevada City Area
(Numbers Refer to Site Number on Excel Spreadsheet)



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Map Prepared by: Nevada County Planning Department
July 2011

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LOCATION MAP - GRASS VALLEY / NEVADA CITY AREA
2009-2014 HOUSING ELEMENT REZONE
NEVADA COUNTY, CALIFORNIA

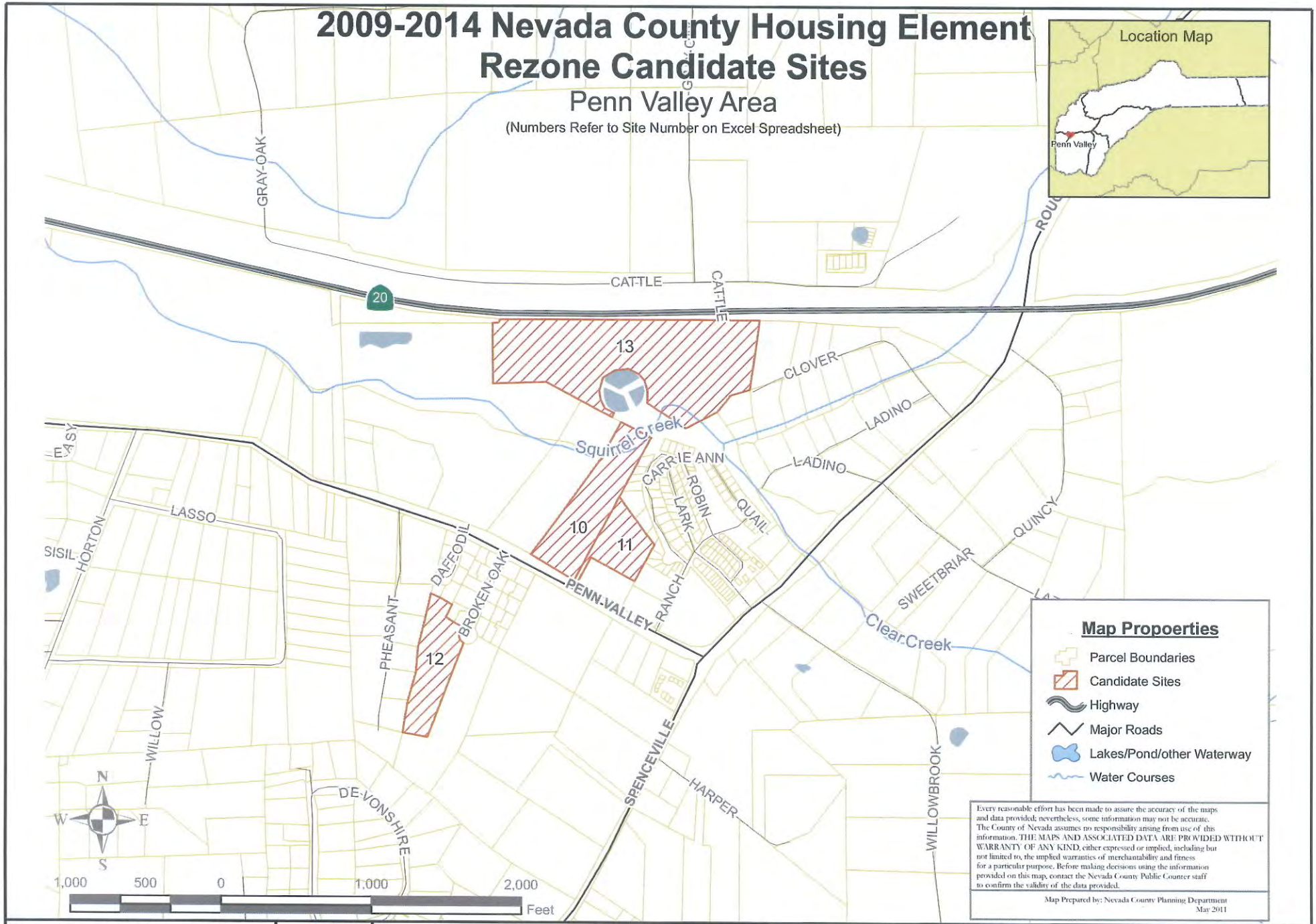
DRAWN BY:	DEVITT
CHECKED BY:	MUIR
H&K PROJECT:	4033-01
DATE:	JUNE 2012

FIGURE 1

2009-2014 Nevada County Housing Element Rezone Candidate Sites

Penn Valley Area

(Numbers Refer to Site Number on Excel Spreadsheet)



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LOCATION MAP - PENN VALLEY AREA
2009-2014 HOUSING ELEMENT REZONE
NEVADA COUNTY, CALIFORNIA

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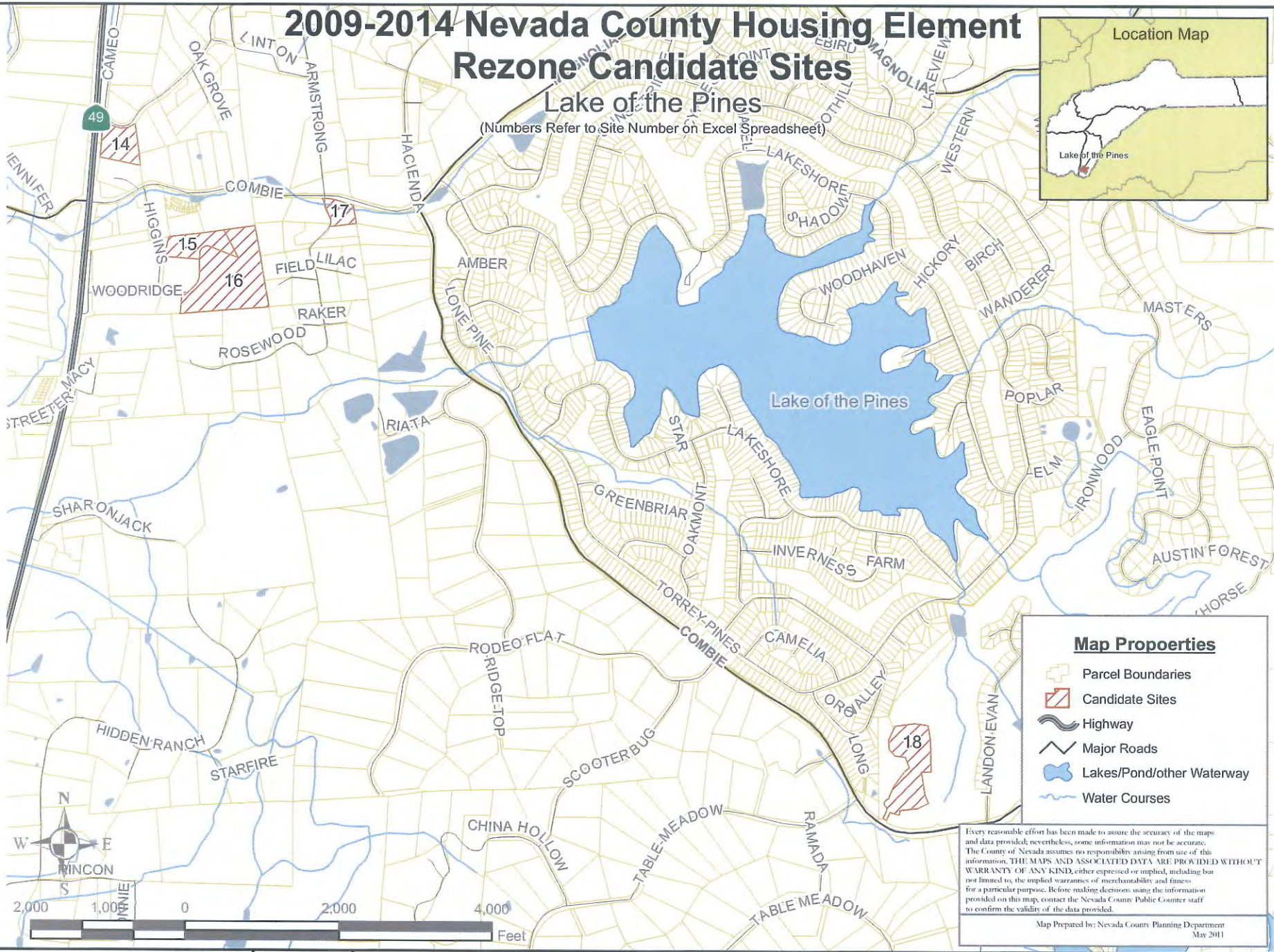
FIGURE 2

2009-2014 Nevada County Housing Element
Rezone Candidate Sites
Lake of the Pines
(Numbers Refer to Site Number on Excel Spreadsheet)



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LOCATION MAP - LAKE OF THE PINES
2009-2014 HOUSING ELEMENT REZONE
NEVADA COUNTY, CALIFORNIA

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DATE:	JUNE 2012

FIGURE 3

Base map from RBF Consulting, April 2012

Soil classification symbols and approximate boundaries are based on the USDA Soil Web Survey (http://websoilsurvey.nrcs.usda.gov). Symbol explanation and soil type descriptions are presented in H&K's report text.

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SOIL MAP - SITE 1

2009-2014 HOUSING ELEMENT REZONE

NEVADA COUNTY, CALIFORNIA

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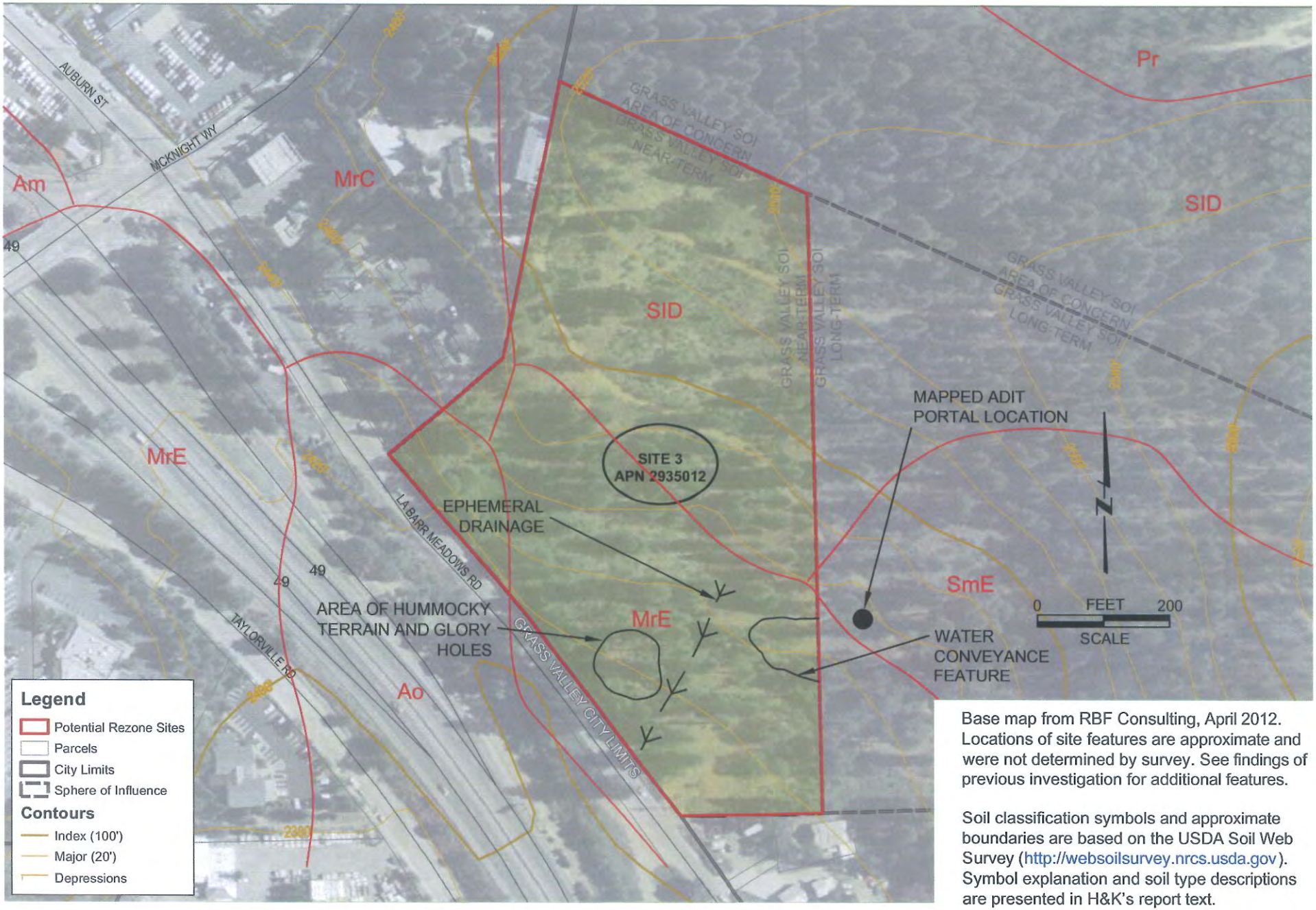
FIGURE 4



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SOIL MAP - SITE 3

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NEVADA COUNTY, CALIFORNIA

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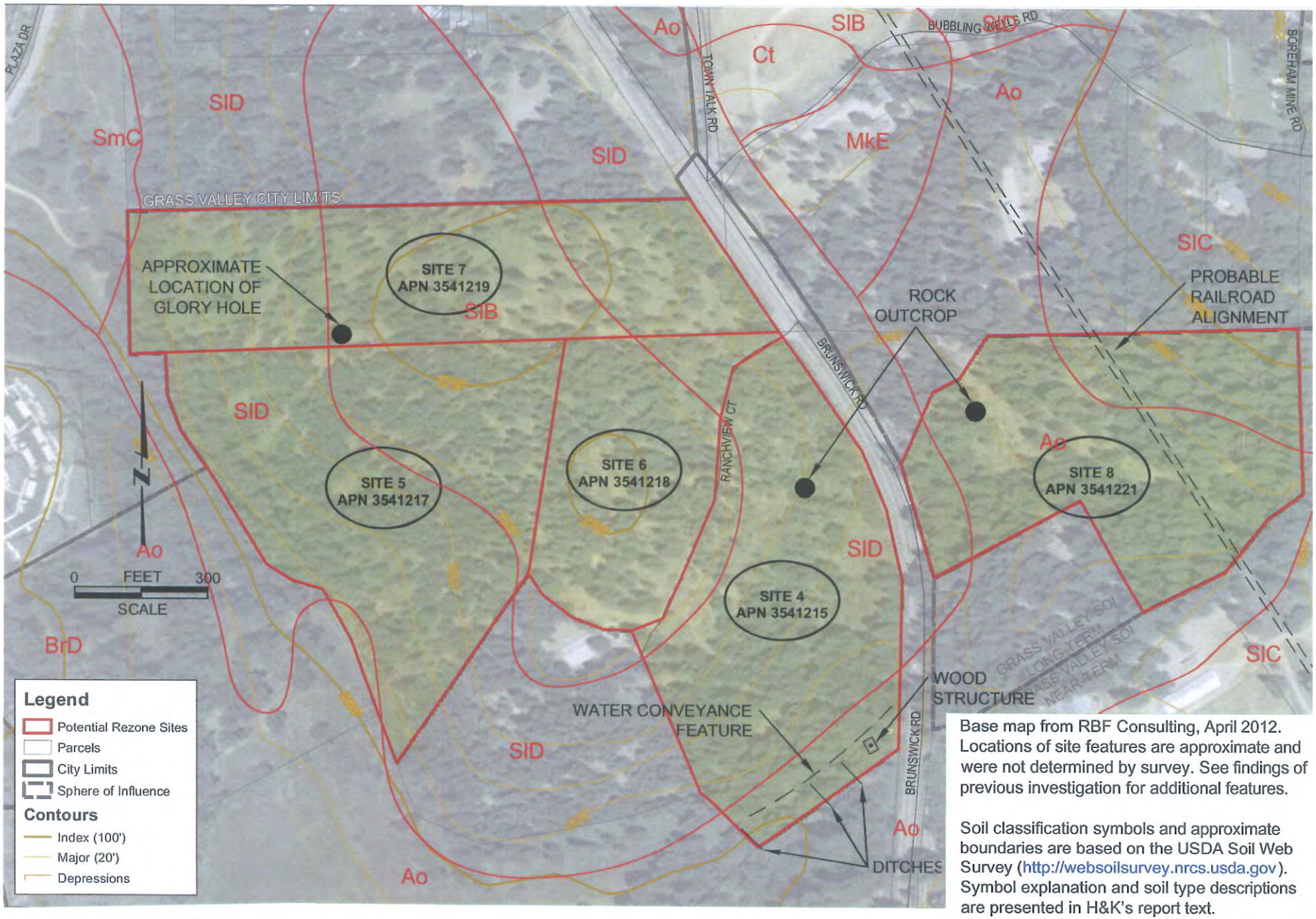
FIGURE 5



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SOIL MAP - SITES 4 THROUGH 8

2009-2014 HOUSING ELEMENT REZONE

NEVADA COUNTY, CALIFORNIA

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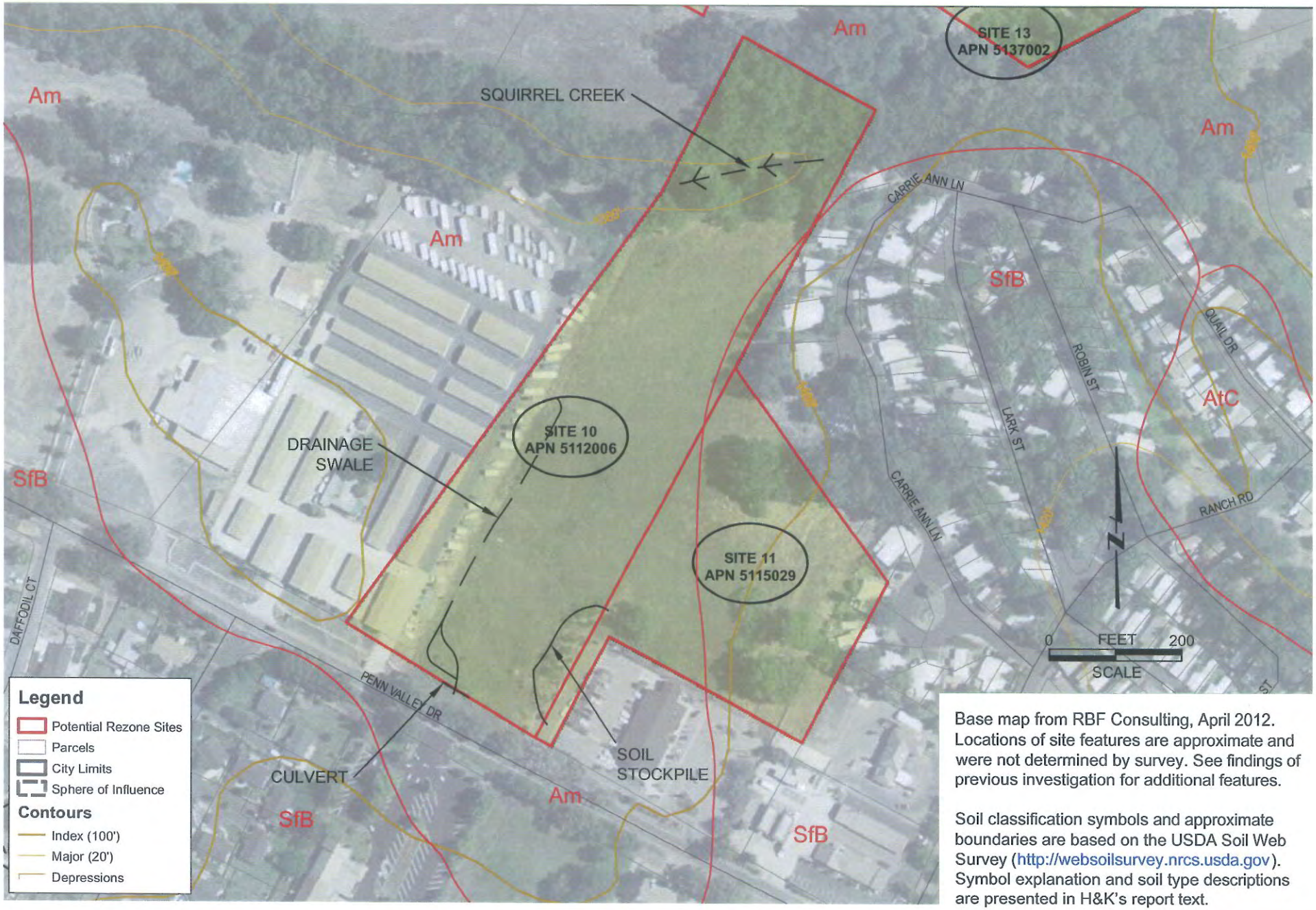
FIGURE 6



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SOIL MAP - SITES 10 AND 11

2009-2014 HOUSING ELEMENT REZONE

NEVADA COUNTY, CALIFORNIA

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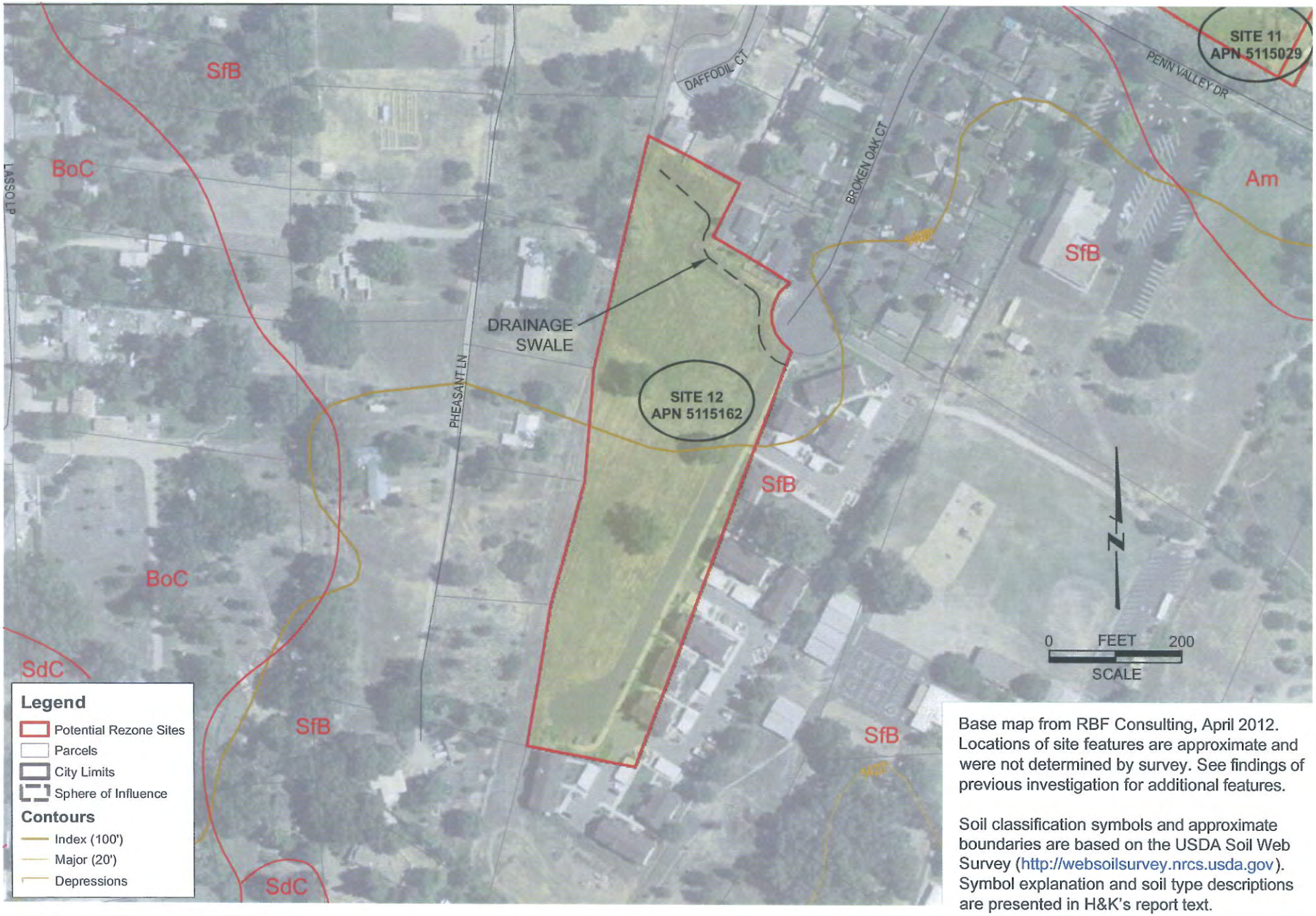
FIGURE
7



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SOIL MAP - SITE 12

2009-2014 HOUSING ELEMENT REZONE

NEVADA COUNTY, CALIFORNIA

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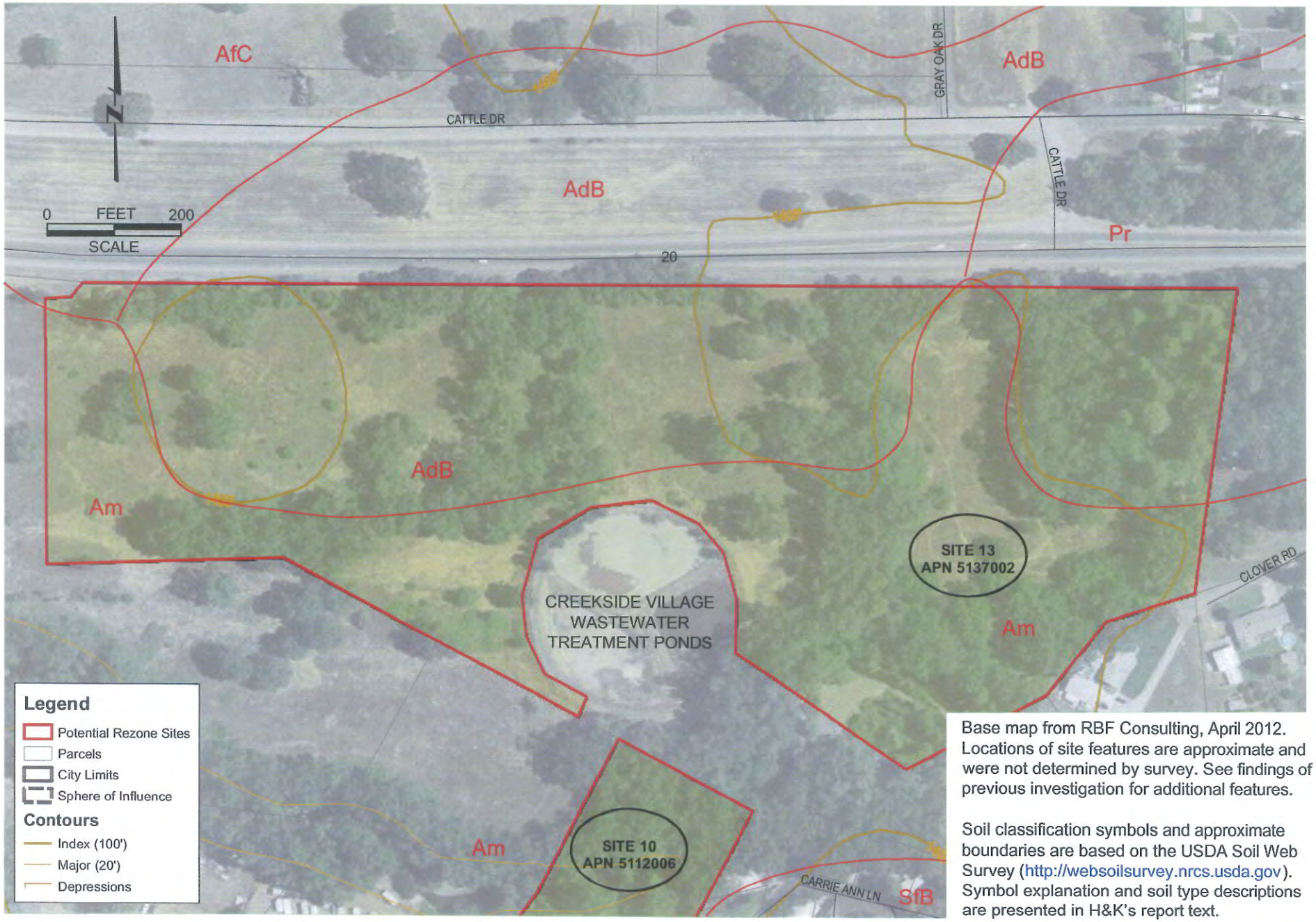
FIGURE 8



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SOIL MAP - SITE 13

2009-2014 HOUSING ELEMENT REZONE

NEVADA COUNTY, CALIFORNIA

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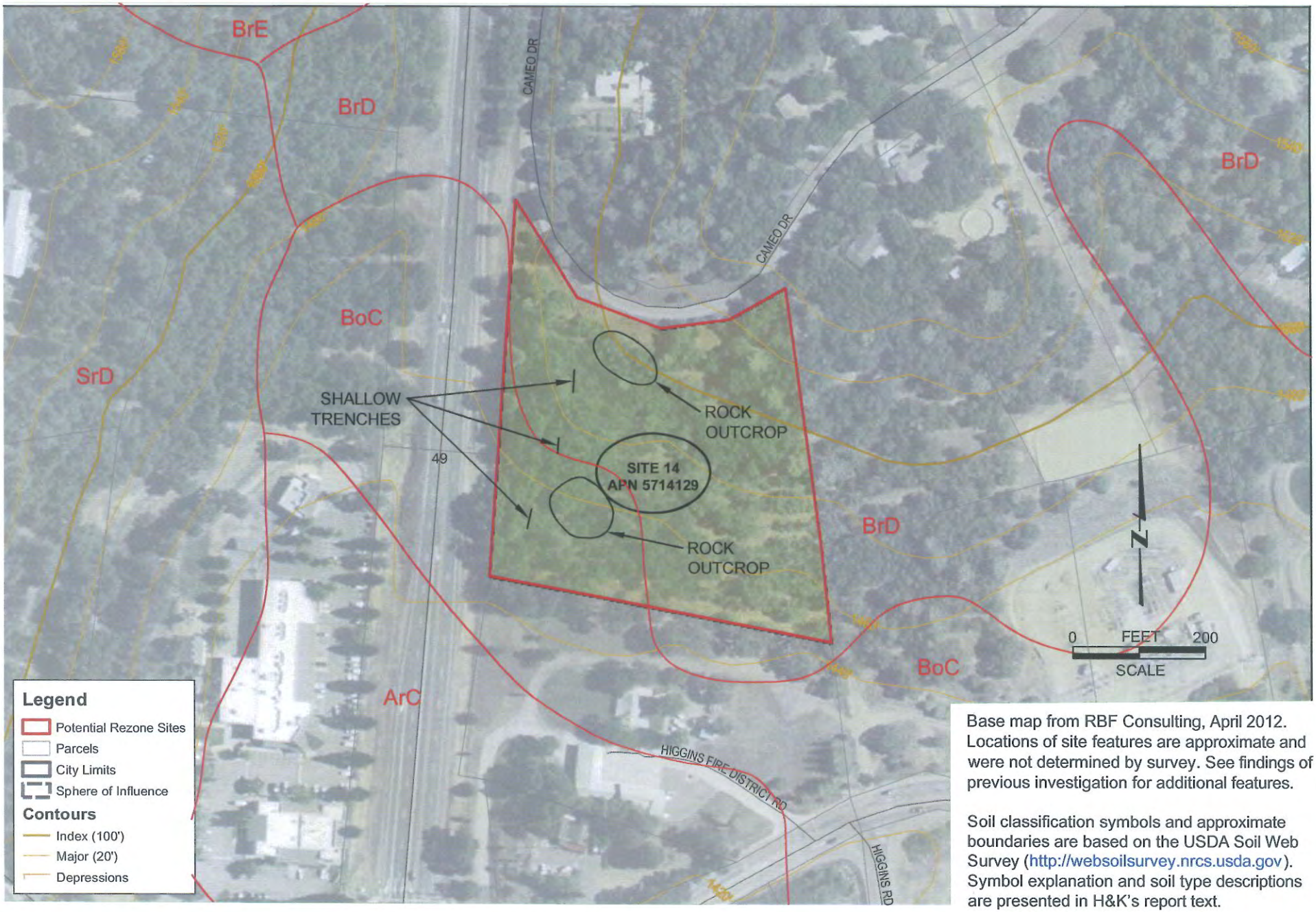
FIGURE 9



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SOIL MAP - SITE 14

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NEVADA COUNTY, CALIFORNIA

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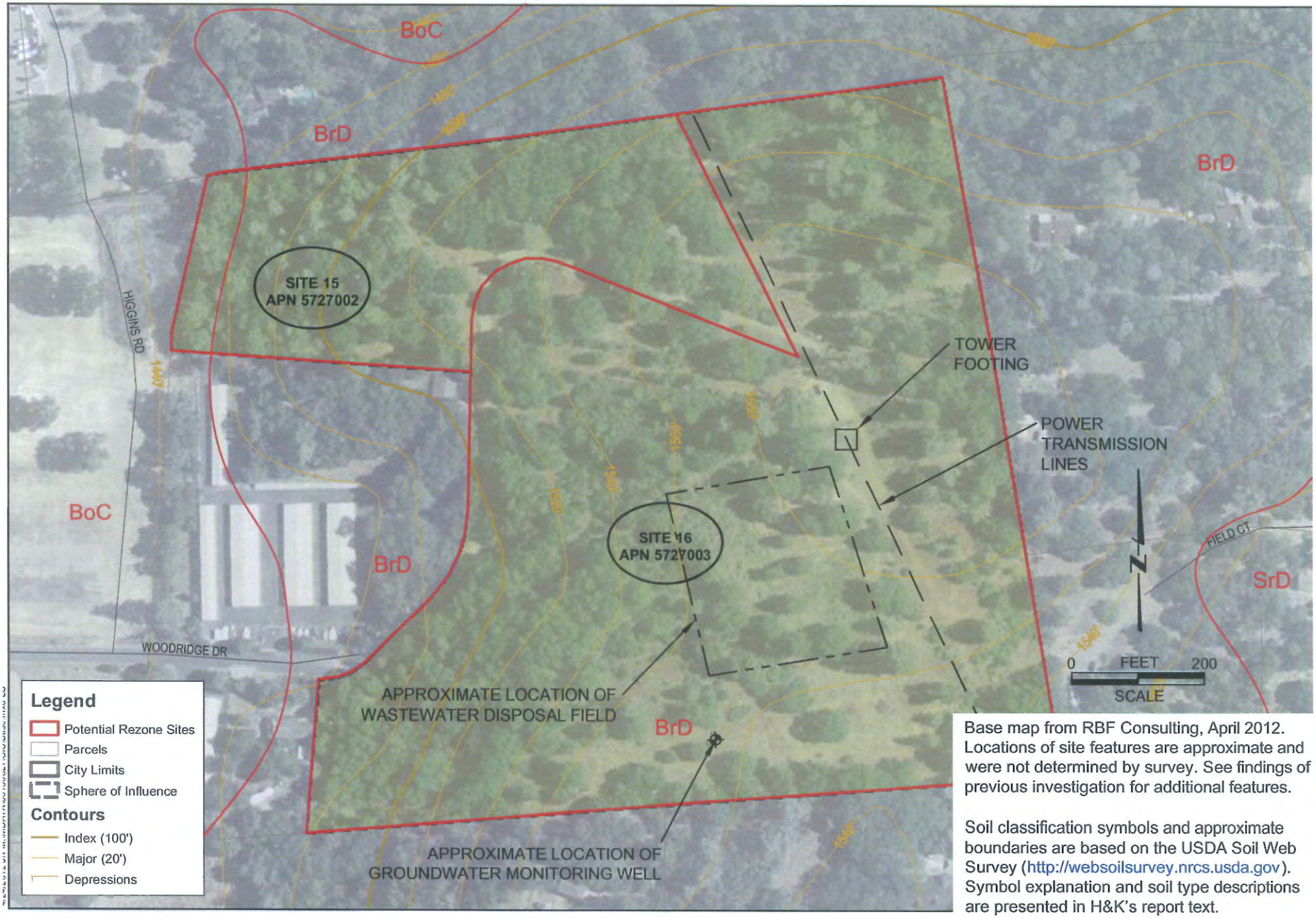
DATE:	JUNE 2012

FIGURE
10



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SOIL MAP - SITES 15 AND 16

2009-2014 HOUSING ELEMENT REZONE

NEVADA COUNTY, CALIFORNIA

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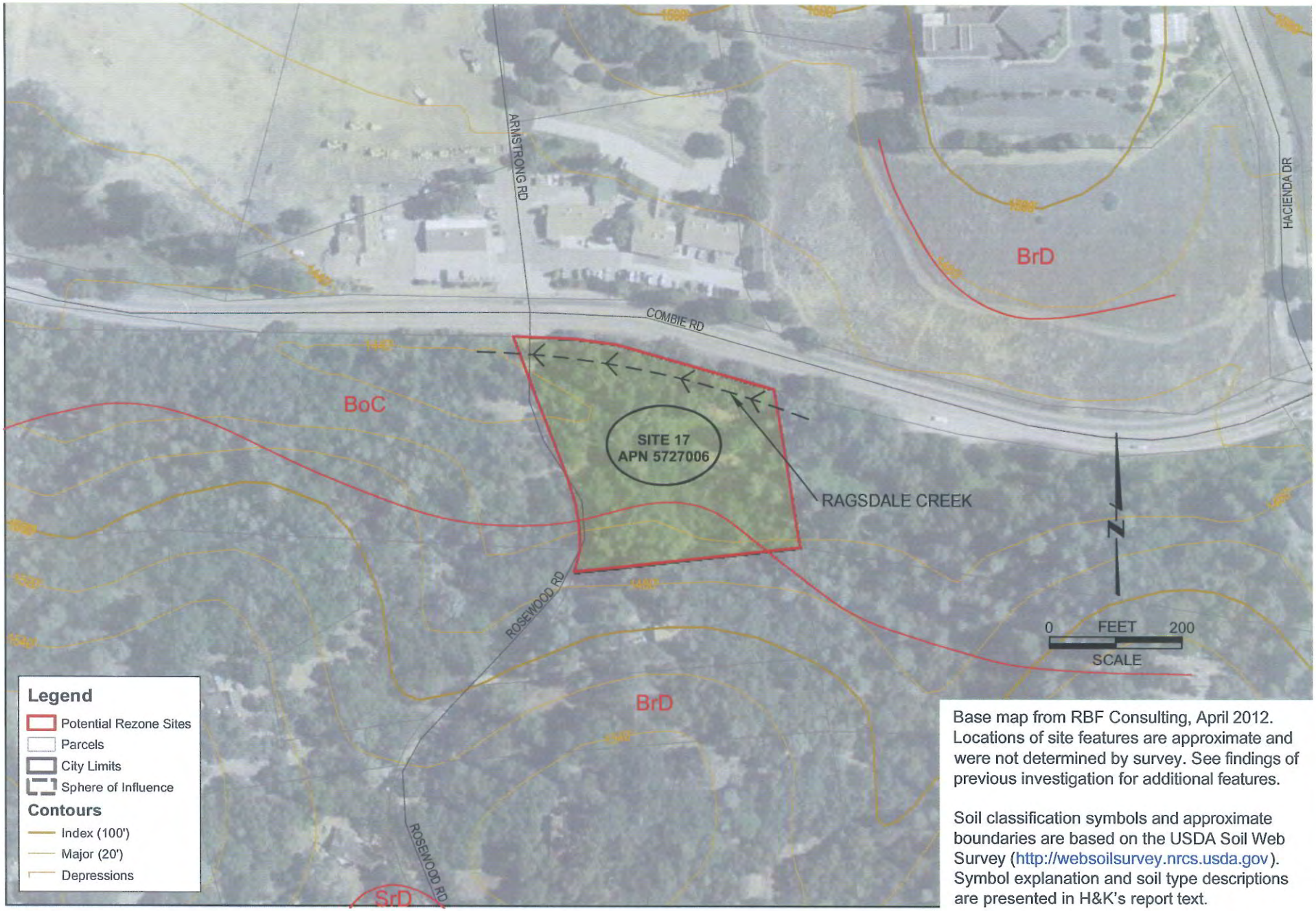
FIGURE
11



Base map from RBF Consulting, April 2012. Locations of site features are approximate and were not determined by survey. See findings of previous investigation for additional features.

Soil classification symbols and approximate boundaries are based on the USDA Soil Web Survey (http://websoilsurvey.nrcs.usda.gov). Symbol explanation and soil type descriptions are presented in H&K's report text.

HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS
792 SEARLS AVENUE NEVADA CITY CALIFORNIA 95959
(530) 478-1305 phone www.HOLDREGEandKULL.com (530) 478-1019 fax
NEVADA CITY • TRUCKEE • YUBA CITY • CHICO • JACKSON

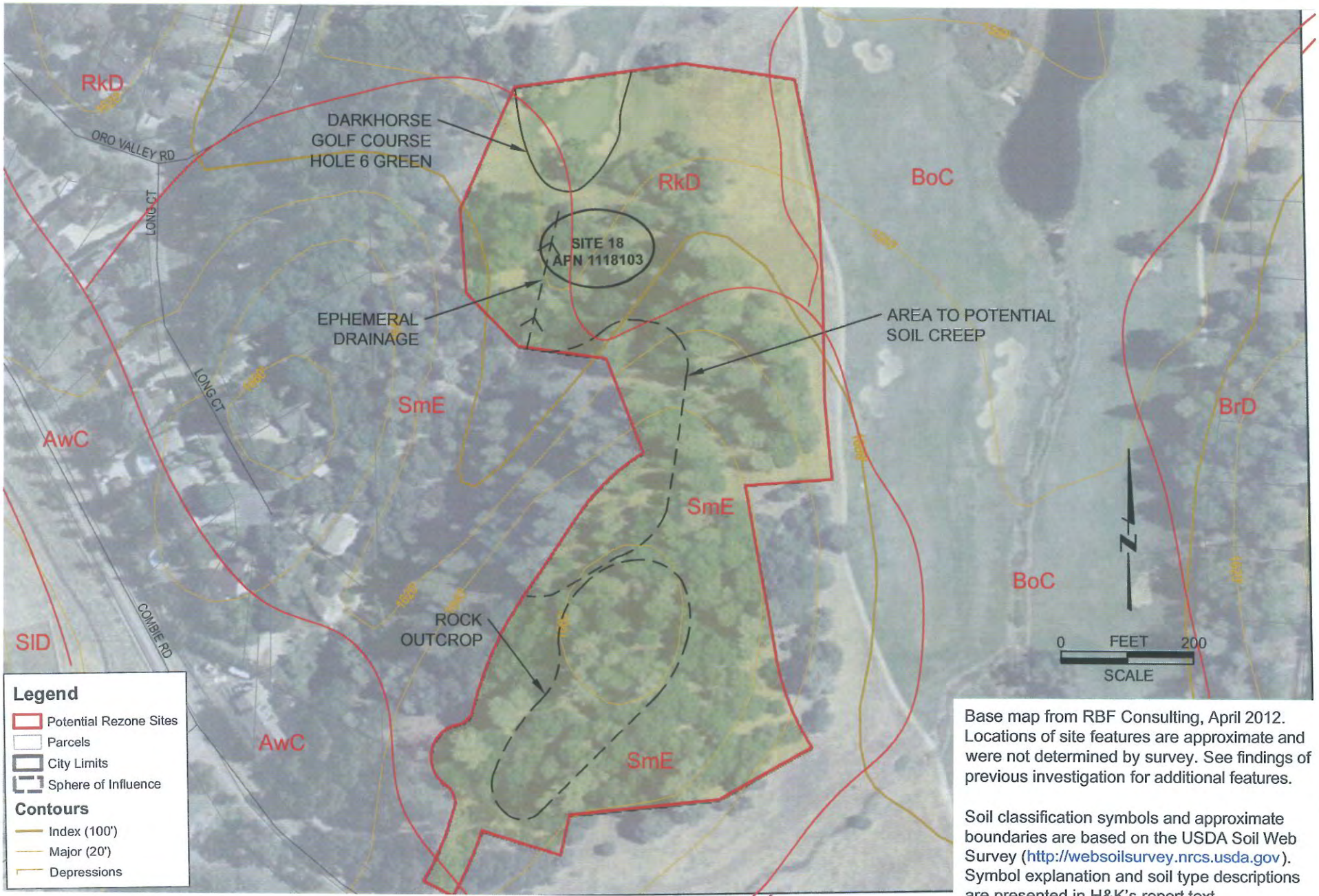
SOIL MAP - SITE 17

2009-2014 HOUSING ELEMENT REZONE

NEVADA COUNTY, CALIFORNIA

DRAWN BY:	DEVITT
CHECKED BY:	MUIR
H&K PROJECT:	4033-01
DATE:	JUNE 2012

FIGURE 12



Base map from RBF Consulting, April 2012. Locations of site features are approximate and were not determined by survey. See findings of previous investigation for additional features.

Soil classification symbols and approximate boundaries are based on the USDA Soil Web Survey (http://websoilsurvey.nrcs.usda.gov). Symbol explanation and soil type descriptions are presented in H&K's report text.

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SOIL MAP - SITE 18

2009-2014 HOUSING ELEMENT REZONE

NEVADA COUNTY, CALIFORNIA

DRAWN BY:	DEVITT
CHECKED BY:	MUIR
H&K PROJECT:	4033-01
DATE:	JUNE 2012

FIGURE 13

Rezone Candidate Sites

Grass Valley/Nevada City Area

(Numbers Refer to Site Number on Excel Spreadsheet)

Geologic symbols and approximate boundaries are based on Saucedo and Wagner (1992). Symbol explanation and geologic descriptions are presented in H&K's report text.

Map Propoerties

- Candidate Sites
- Highway
- Major Roads
- Water Courses
- Lakes/Pond/other Waterway
- Parcel Boundaries

Map Prepared by: Nevada County Planning Department
July 2011

3,900 1,950 0 3,900 7,800 Feet

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GEOLOGY MAP - GRASS VALLEY / NEVADA CITY AREA
2009-2014 HOUSING ELEMENT REZONE
NEVADA COUNTY, CALIFORNIA

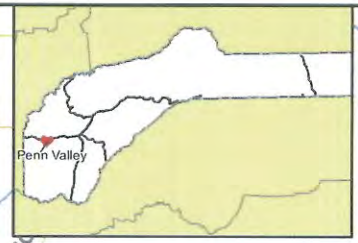
DRAWN BY:	DEVITT
CHECKED BY:	MUIR
H&K PROJECT:	4033-01
DATE:	JUNE 2012

FIGURE 14

Rezone Candidate Sites

Penn Valley Area

(Numbers Refer to Site Number on Excel Spreadsheet)



gb

gb

gb

gb

13

10

11

12

GRAY-OAK

CATTLE

CATTLE

20

CLOVER

LADINO

LADINO

Squirrel Creek

CARRIE ANN

ROBIN

LARK

QUAIL

QUINCY

SWEETBRIAR

Clear Creek

EASY

HORTON

LASSO

SISIL

PHEASANT

DAFFODIL

BROKEN-OAK

PENN-VALLEY

RANCH

WILLOW

DE-VONSHIRE

WILLOWBROOK

N

W

E

S

1,000 500 0 1,000 2,000

Feet

Geologic symbols and approximate boundaries are based on Saucedo and Wagner (1992). Symbol explanation and geologic descriptions are presented in H&K's report text.

Map Propoerties

- Parcel Boundaries
- Candidate Sites
- Highway
- Major Roads
- Lakes/Pond/other Waterway
- Water Courses

Map Prepared by: Nevada County Planning Department
May 2011

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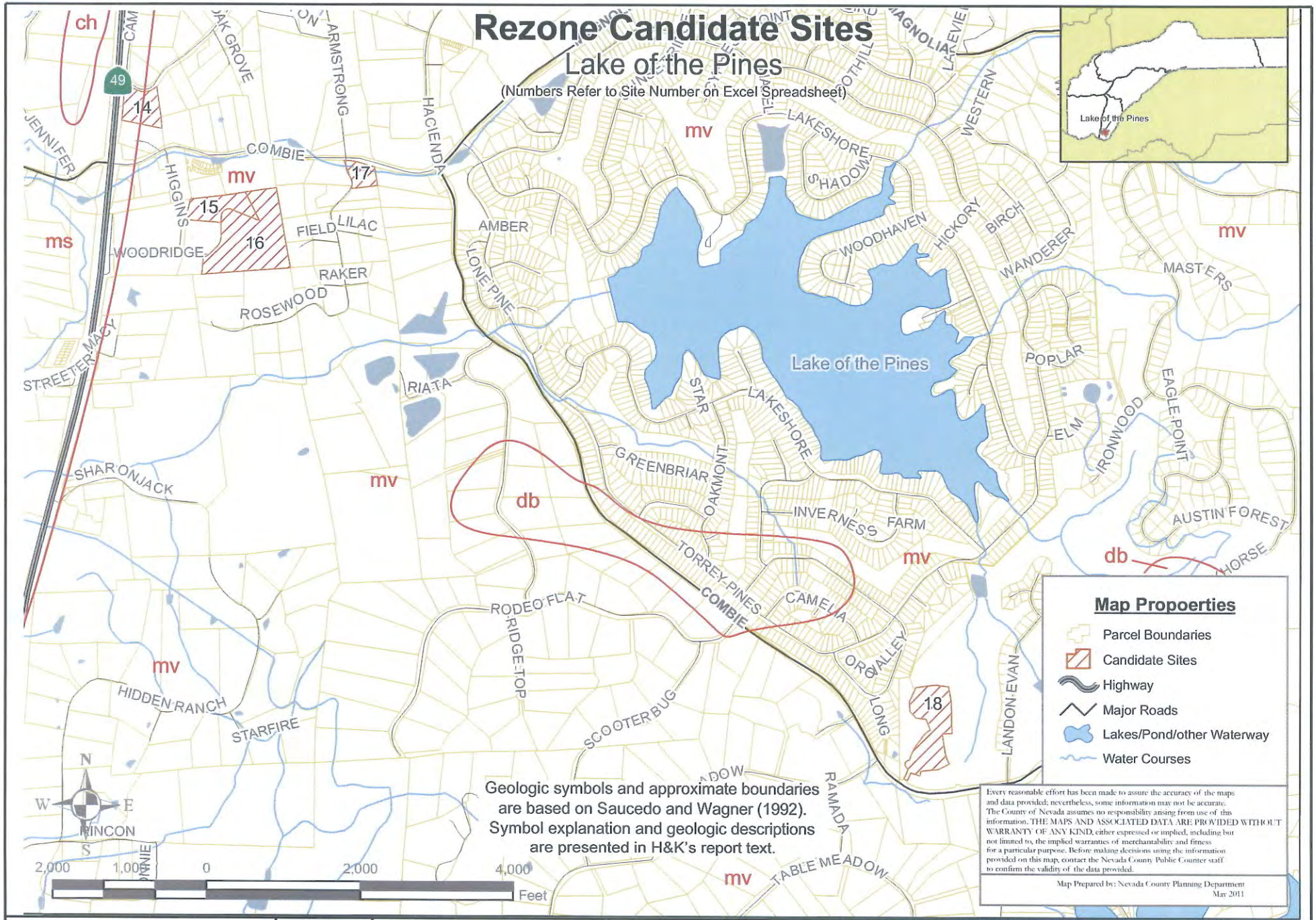
GEOLOGY MAP - PENN VALLEY AREA

2009-2014 HOUSING ELEMENT REZONE

NEVADA COUNTY, CALIFORNIA

DRAWN BY:	DEVITT
CHECKED BY:	MUIR
H&K PROJECT:	4033-01
DATE:	JUNE 2012

FIGURE 15



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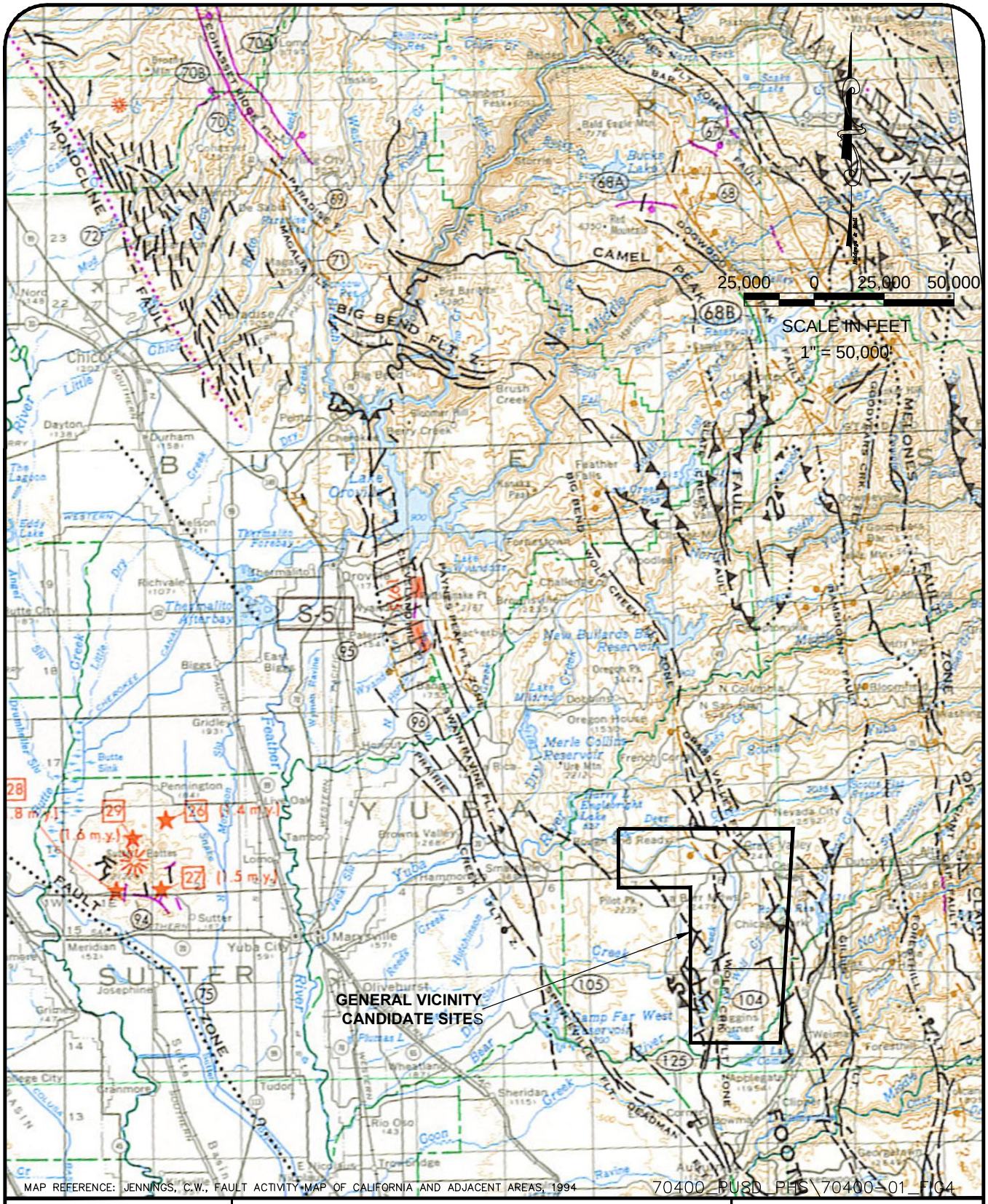
GEOLOGY MAP - LAKE OF THE PINES
2009-2014 HOUSING ELEMENT REZONE
NEVADA COUNTY, CALIFORNIA

DRAWN BY:	DEVITT
CHECKED BY:	MUIR
H&K PROJECT:	4033-01
DATE:	JUNE 2012

FIGURE
16



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FAULT ACTIVITY MAP
HOUSING ELEMENT REZONE
NEVADA COUNTY, CALIFORNIA

PROJ NO.: 4033-01

DATE: JUNE,2012

FIGURE NO.: 17

TABLES

Table 1. Site Information

Preliminary Geotechnical Investigation Report

Housing Element Rezone, Nevada County

Area	Site Number	Nevada County General Plan Zoning Designation	Latitude (decimal degrees)	Longitude (decimal degrees)	APN	Acreage	Elevation Minimum (feet msl)	Elevation Maximum (feet msl)	Relief (feet)	Waterways	Slope	FEMA Floodzone Designation	Soils	Geology	Active Fault
Grass Valley	1	OP	39.206051	-121.075986	07-380-17	1.08	2450	2463	13	No	Less than 30%	X	Sites Loam	LC db	No
	3	BP	39.199532	-121.056031	29-350-12	11.36	2398	2542	144	No	Less than 30%	X	Sites Loam, Musick Sandy Loam, Alluvial Lands	KJqd	No
	4	UMD	39.229574	-121.027402	35-412-15	9.15	2598	2680	82	Yes: stream along property line	Less than 30%	X	Sites Loam	gb	No, Prequaternary fault trace.
	5	UMD	39.230234	-121.030748	35-412-17	11.35	2588	2693	105	No	Less than 30%	X	Sites Loam	gb	No
	6	UMD	39.230338	-121.028841	35-412-18	4.50	2644	2693	49	No	Less than 30%	X	Sites Loam	gb	No
	7	UMD	39.23151	-121.030289	35-412-19	9.70	2591	2703	112	No	Less than 30%	X	Sites Loam	gb	No
	8	UMD	39.230462	-121.024821	35-412-21	9.90	2621	2693	72	Yes: stream along property line	Less than 30%	X	Sites Loam/ Majority of site is shown as Alluvial Lands	gb	No
Penn Valley	10	CC	39.199817	-121.179644	51-120-06	5.95	1400	1400	0	Yes: stream along property line	Less than 30%	X, large area of Zone A and D	Alluvial Land	gb	No
	11	CC	39.199065	-121.178973	51-150-29	3.10	1400	1407	7	No	Less than 30%	X	Sierra Sandy Loam and Alluvial Land	gb	No
	12	UMD	39.196791	-121.183528	51-151-62	4.37	1397	1414	17	No	Less than 30%	X	Sierra Sandy Loam	gb	No
	13	PD	39.202677	-121.178772	51-370-02	20.10	1391	1404	13	Yes: Intermitent Stream through site	Less than 30%	X and A, 0.2% chance of flooding	Ahwanhee Sandy Loam, Placer Diggins and Alluvial Lands	gb	No
Lake of the Pines	14	OP	39.044592	-121.09333	57-141-29	5.00	1436	1525	89	No	Less than 30%	X	Boomer Rock Outcrop and Boomer loam	LCmv	No, Wolf Creek Fault within 500 feet
	15	PD	39.041087	-121.089877	57-270-02	5.00	1453	1581	128	No	Some areas over 30%	X	Boomer-Rock Outcrop Complex	LCmv	No Wolf Creek Fault within 2000 feet
	16	PD	39.039981	-121.08827	57-270-03	18.12	1463	1591	128	No	Some area over 30%	X	Boomer-Rock Outcrop Complex	LCmv	No Wolf Creek Fault within 2000 feet
	17	UMD	39.042149	-121.083175	57-270-06	2.36	1436	1482	46	Yes: Ragsdale Creek	Less than 30%	X	Boomer Loam	LCmv	No Wolf Creek Fault within 4000 feet
	18	USF	39.022457	-121.056963	11-181-03	11.03	1587	1689	102	No	Marjority of site less than 30%, some avoidable areas under 30%	X	Sites Very Stony Loam, 15 to 30% slopes; Rescue-Rock Outcrop Complex, 5 to 30% slopes, Boomer Loam, 5 to 15%	LCmv	No

gb	Lake Combie Complex, Gabbroic Rocks
LCdb	Early Mesozoic Lake Combie Complex, massive Diabase
LCmv	Early Mesozoic Lake Combie Complex, meta Volcanics
KJqd	Mesozoic Plutonic Rock, quartz diorite, tonalite, tondhjemite, quartz monzonite
msl	mean sea level

Table 2. Site Soils
Preliminary Geotechnical Investigation Report
Housing Element Rezone, Nevada County

Site Number	USDA Soil Map Symbol	Map Unit Description
Grass Valley Area		
1	SIB	Sites loam, 2 to 9 percent slopes
3	SID	Sites loam, 15 to 30 percent slopes
	MrE	Musick sandy loam, 15 to 50 percent slopes
	Ao	Alluvial land, clayey
	MrC	Musick sandy loam, 5 to 15 percent slopes
	SmE	Sites very stony loam, 15 to 50 percent slopes
4	SID	Sites loam, 15 to 30 percent slopes
	Ao	Alluvial land, clayey
	SIB	Sites loam, 2 to 9 percent slopes
5	SID	Sites loam, 15 to 30 percent slopes
	Ao	Alluvial land, clayey
	SIB	Sites loam, 2 to 9 percent slopes
6	SID	Sites loam, 15 to 30 percent slopes
	SIB	Sites loam, 2 to 9 percent slopes
7	SID	Sites loam, 15 to 30 percent slopes
	SIB	Sites loam, 2 to 9 percent slopes
	SmC	Sites very stony loam, 2 to 15 percent slopes
8	Ao	Alluvial land, clayey
	SIC	Sites loam, 9 to 15 percent slopes
	SID	Sites loam, 15 to 30 percent slopes
Penn Valley Area		
10	Am	Alluvial land, loamy
	SfB	Sierra sandy loam, 2 to 9 percent slopes
11	SfB	Sierra sandy loam, 2 to 9 percent slopes
	Am	Alluvial land, loamy
12	SfB	Sierra sandy loam, 2 to 9 percent slopes
	BoC	Boomer loam, 5 to 15 percent slopes
13	AdB	Ahwahnee sandy loam, 2 to 9 pecent slopes
	Am	Alluvial land, loamy
	Pr	Placer diggins
	AfC	Aiken loam, 9 to 15 percent slopes
Lake of the Pines Area		
14	BrD	Boomer-Rock outcrop complex, 5 to 30 percent slopes
	BoC	Boomer loam, 5 to 15 percent slopes
15	BrD	Boomer-Rock outcrop complex, 5 to 30 percent slopes
	Boc	Boomer loam, 5 to 15 percent slopes
16	BrD	Boomer-Rock outcrop complex, 5 to 30 percent slopes
17	BoC	Boomer loam, 5 to 15 percent slopes
	BrD	Boomer-Rock outcrop complex, 5 to 30 percent slopes
18	SmE	Sites very stony loam, 15 to 50 percent slopes
	RkD	Rescue-Rock outcrop complex, 5 to 30 percent slopes
	Awc	Auburn-Argonaut complex, 2 to 15 percent slopes
		Auburn part
		Argonaut part

Soil designations are from the *Soil Survey of Nevada County Area, California* (USDA Soil Conservation Service, 1975, reissued 1993) and the USDA's online Websoil Survey (http://websoilsurvey.nrcs.usda.gov/ Accessed [May 2012]).

APPENDIX A PROPOSAL

HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS

Proposal No. PN11130
August 23, 2011

RBF Consulting
500 Ygnacio Valley Road, Suite 270
Walnut Creek, CA 94596

Attention: Kristie Wheeler

Reference: ***Housing Element Rezone Program Implementation***
Nevada County, California

Subject: ***Proposal for Geotechnical Engineering Services***

Dear Ms. Wheeler,

Holdrege & Kull (H&K) proposes to provide geotechnical engineering services on an as-needed basis for the Nevada County Housing Element Rezone Program Implementation. We understand that RBF Consulting may require technical studies related to the evaluation and/or environmental review of certain candidate properties. Based on our experience in the area, we can offer local knowledge of geotechnical, geologic and hazardous materials conditions on several of the candidate properties and the general vicinity.

For example, we have previously performed site characterization and developed a cleanup plan for one of the candidate properties. The cleanup plan was reviewed and approved by the California EPA, and presents mitigation measures for past mining activity on the site. Our experience with this property and other candidate properties can streamline the environmental review process.

SCOPE OF SERVICES

Our proposed scope of services is based on our review of the County's request for proposals (July 15, 2011) and our discussion of the project with you. We would be able to modify the scope of geotechnical feasibility study as needed for specific candidate properties, and we would also be able to consult regarding hazardous materials conditions, if needed.

H&K's services will be managed by Jason Muir, P.E., G.E., or Rob Fingerson, P.E., G.E. Field services will be performed by an engineer or geologist from our firm. Resumes and representative projects are attached.

Literature Review

H&K will review pertinent geologic, soil survey and historic mining literature to ascertain the potential for recorded geologic constraints on each candidate site.

Field Investigation

Field investigation typically includes surface reconnaissance, but can be modified to include subsurface investigation and soil sampling, if required. The field reconnaissance will focus on the areas most likely suitable for development, and potential constraints areas as identified during the literature review.

Preliminary Geotechnical Report

Following completion of the above tasks, we will compile a report that will include:

- Conclusions regarding the feasibility of the project from a preliminary geotechnical standpoint;
- Description of site geology, soil types and existing site conditions;
- A site map depicting significant features identified during the investigation;
- Discussion of anticipated materials and conditions to be encountered during site development, based on our local experience; and
- Proposed mitigation measures, as appropriate.

FEE

H&K's fee will vary from property to property depending upon the parcel size and level of review required, which is dictated by existing property conditions. Typical fees for preliminary geotechnical investigation range from to . per site.

SCHEDULE

We can typically complete a preliminary geotechnical investigation within four weeks of receiving authorization to proceed. We would be able to expedite our services if needed.

If this proposal meets with your approval, please contact us to develop a services agreement for the project. We appreciate the opportunity to provide this proposal and we look forward to working with you. Please contact us if you have any questions.

Sincerely,

HOLDREGE & KULL

Jason W. Muir, P.E., G.E.
Principal Engineer

Attached: Resumes
Example Projects

F:\2 Proposals\PN1130 Nev Co Housing Element Rezone\PN1130 Nev Co Housing - Geotechnical Proposal.doc

APPENDIX B ***IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT (Included with permission of ASFE, Copyright 2004)***

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you —* should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

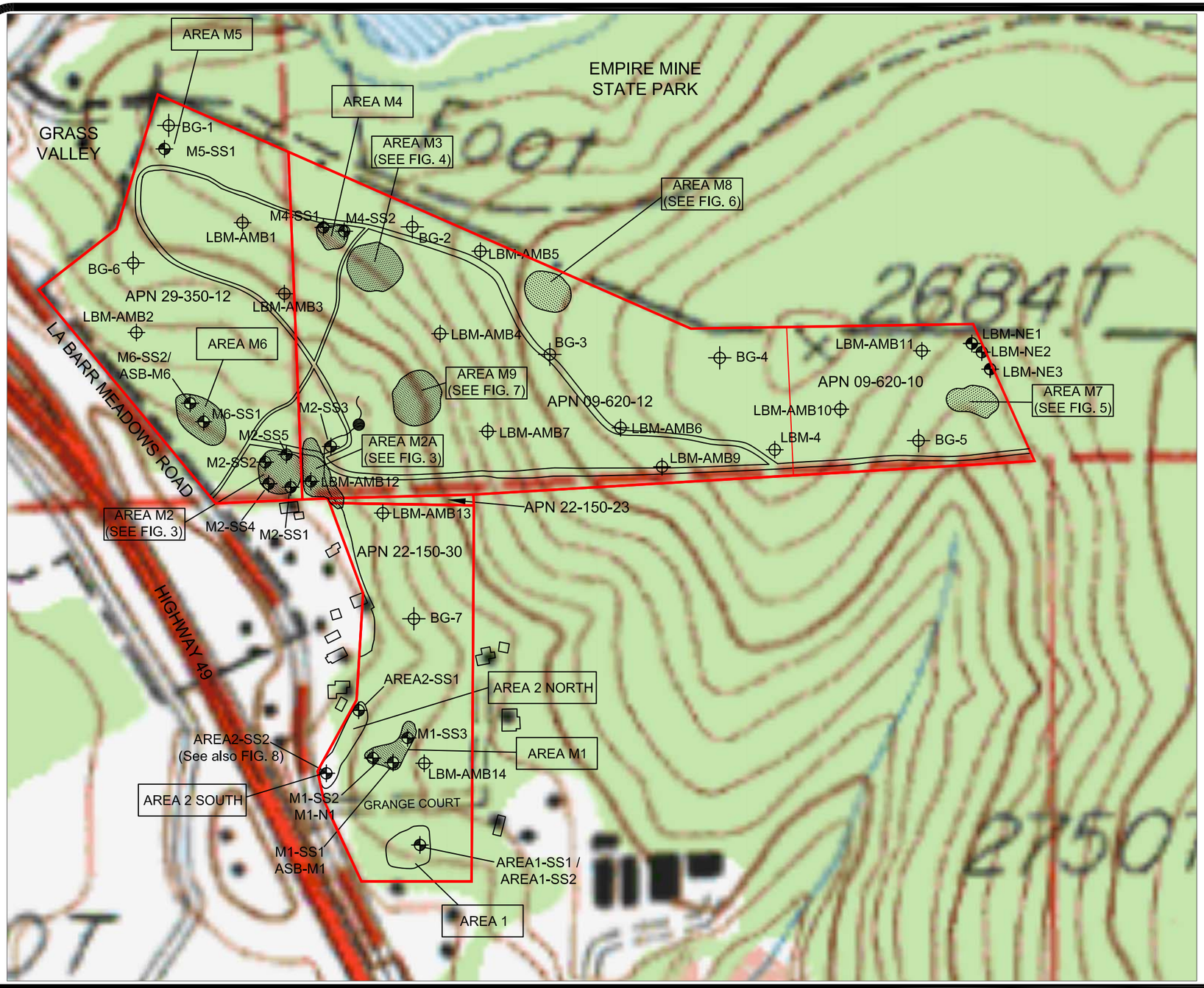
Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

IIGER06045.0M

APPENDIX C ***FIGURE 2 FROM PRELIMINARY ENDANGERMENT ASSESSMENT OF LA BARR MEADOWS PROPERTY (H&K, JANUARY 2007)***



APPROXIMATE SCALE IN FEET
1" = 300'

LEGEND

- APPROXIMATE LOCATION OF APPARENT FORMER MINING AREA
- APPROXIMATE LOCATION OF AREA OF FORMER SCATTERED DEBRIS
- APN 09-620-12 — ASSESSOR'S PARCEL NUMBERS
- M1-SS1 — SOIL SAMPLE LOCATION
- BG-1 — AMBIENT SAMPLE LOCATION
- APPROXIMATE LOCATION OF GROUNDWATER SEEP/SPRING
- PVC CONDUIT PIPE FROM GROUNDWATER SEEP/SPRING TO RESIDENCE AT APN 22-150-18
- EXISTING UNIMPROVED ROAD / TRAIL

1928–11–FIG2

HOLDREGE & KULL
CONSULTING ENGINEERS • GEOLOGISTS
792 SEARLS AVENUE
NEVADA CITY, CA 95959
(530) 478–1305 FAX 478–1019

SITE MAP

LA BARR MEADOWS PROPERTY

NEVADA COUNTY, CALIFORNIA

DRAWN BY: DFD	CHECKED BY: SLD
PROJECT NO.: 1928–11	
DATE: OCTOBER 2007	
FIGURE NO.: 2	