Attachments to Standard Form 299, "Application for Transportation and Utility Systems and Facilities on Federal Lands"

This is a request to allow our proposed activities under a "Casual Use" determination

STANFORD UNIVERSITY RUBY SEISMIC EXPERIMENT
NORTHEASTERN NEVADA

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1. Project Summary

The National Science Foundation's Earthscope Science program is teaming with Stanford University to sponsor a three-dimensional (3D) study of the classic Ruby Mountain Metamorphic Core Complex and its adjacent regions to look for evidence of crustal flow into the metamorphic core. This region is being targeted because the existing data that surround the Ruby Mountains allow detailed interpretation of the new geophysical results in a larger 3D volume. The proposed array of passive, broadband seismometers will provide subsurface geophysical data to link with surface geologic data to develop understanding of continental structure, deformation and evolution, and the lithospheric-scale processes involved in extensional orogens. Established passive-recording techniques (ambient-noise tomography, receiver-function velocity inversions, common-conversion point imaging, crustal anisotropy analyses) are being applied in 3D instead of the more commonplace two dimensions, and at a higher resolution (down to 5-km spacing) than is yet typical for this class of studies.

The most highly-extended regions of continental crust, known as core-complexes, and their bounding structures, typically mapped as low-angle faults even though these defy predictions of the mechanical behavior of the crust, are among the most controversial aspects of continental extension. These features have defied easy explanation because scientists have lacked clear images of their deep underpinnings. National Science Foundation's Earthscope Science program is funding, and providing instrumentation for, a two-dimensional array at the surface, allowing reconstruction of a three-dimensional (3D) image volume at depth.

The Basin-and-Range Province in Nevada offers unparalleled exposure of diverse styles of extension, including the metamorphic core complexes that juxtapose ductilely deformed mid-crustal rocks with unmetamorphosed, brittly-deformed supracrustal rocks. This relationship implies significant horizontal extension, compensated at the scale of the whole crust either by large-magnitude simple shear or significant lateral and vertical flow of the lower crust. Elucidating the relationship between simultaneous deformation of the upper and lower crust requires geophysical data of sufficient resolution to convincingly show how the surface geology is linked to — or disconnected from — features at depth. Uncertainty in the total stretching involved is a major unknown in tectonic reconstruction of extensional provinces wherever such core complexes occur around the world.

Results of this experiment will allow evaluation of models for crustal flow at depth beneath extending regions, and thereby help understand the progression of lower-crustal strain in space and time across extending regions. Characterizing these processes in more detail is a fundamental step towards advancing our knowledge of continental rifting and the evolution of sedimentary basins world-wide. The results will help understand the geologic framework that gave rise to Nevada's most destructive earthquake for over 50 years (the February 2008 Wells magnitude 6 earthquake). The results will also be of interest to gold-mining companies active in Nevada: the Ruby Range may expose underpinnings of the adjacent "Carlin Trend", the largest gold-producing region in the Americas.

2. Reasons to request a determination of "Casual Use"

A casual use determination not only saves the BLM and Stanford University the time and funds incurred in obtaining a formal permit, but will also *greatly expedite the project*. The National Science Foundation (NSF) has allocated funds to this project that are to be expended in the period July 1, 2009 to June 30, 2012, and are intended to allow Ms. Sally Thurston, a graduate student at Stanford University, to acquire and analyse data for her PhD thesis. If we can begin recording seismic data in fall 2009, we will complete recording in summer 2011, and Ms. Thurston will still have one year of funding left in which to analyse and write up her data. Furthermore, the national instrumentation facility of the NSF Earthscope program has allocated the necessary seismometers to our project starting in November 2009, for the nominal term of 18 months. If we cannot start recording until summer 2010, we will record for a significantly shorter time period, hence significantly fewer earthquakes, hence the data will be less complete and the results less conclusive. We could not begin a permitting process in advance of the formal notice of award of funds from NSF to Stanford University in January 2009, hence the short timeline.

3. Project conformity with “Casual Use” category of activities.

This proposal is a non-commercial, short-term use of a tiny area of public lands that will cause no appreciable disturbance or damage to the public lands, resources or improvements and therefore does not require a right-of-way grant or temporary use permit under the FLPMA right-of-way regulations (43 CFR 2800).

The proposed operation is a non-commercial public-interest project of the United States government National Science Foundation, through a tax-exempt organization, Stanford University.

The proposed operation will affect a cumulative surface area of less than one-fortieth of an acre.

The proposed operation will require a total human and vehicle presence at each site of less than one work week, spanning a two year period.

As normally permitted under “casual use”, our work will include use of hand-tools to move tiny volumes of earth (less than 1 yard), but will not include use of mechanized earth-moving equipment. We will use motorized vehicles only for access, and consistent with the terms of any temporary closures ordered by BLM.

Our proposed use is intended to comply with all BLM land use decisions and designations, i.e., Wilderness Study Areas or Special Area Designations and Wilderness Interim Management Policy.

Our proposed use is not publicly advertised, poses minimal risk for damage to public land or related water resource values, and generally requires no monitoring. On completion of our project there will be no significant change to the appearance of public lands.

Our proposed use is designed to create no Endangered Species Act (ESA) disturbance issues and to produce a "no affect" call under the ESA. Our work will avoid any obvious or active bird or mammal nests, whether or not these are of threatened or endangered species.

During our project, I am responsible for ensuring that the operations will not create unnecessary or undue degradation of the federal lands, and compliance with all pertinent federal and state laws, including reasonable mitigation measures and reclamation of disturbed areas.

I am responsible for ensuring compliance with federal laws pertaining to air quality, water quality, solid waste disposal, protection of fish, wildlife and plant habitat, protection of cultural and paleontological resources, and protection of survey monuments.

All aspects of our project are subject to inspection by BLM representatives to insure compliance with regulatory requirements, and the BLM will be notified when reclamation has been completed so that an inspection can be made to determine its adequacy.

Based on the foregoing, I believe it would be appropriate to determine that this activity is a “casual use” as defined by the regulations at 43 CFR 2800.0-5(m), in order to avoid the expenditure of time and funds incurred in issuing a formal permit.

4. Methods of work

Stanford University and its designates, as part of the Ruby Seismic Experiment, are committed to conducting our research with minimal impact on public and private lands.

As part of this commitment,

(1) All research will follow this project description and maps, as described verbally by telephone calls with BLM staff, and at (any) future meeting with BLM staff at your district office.
No off-road vehicle travel is permitted, and vehicles traveling in fire-sensitive areas will carry a 5-gallon water jug, a shovel, and a satellite or cell-phone for use in case of fire.

(2) All research activities on public and private land will follow "Leave No Trace" guidelines.

(3) We will follow all state and local laws and ordinances that apply to all BLM administered public land. This includes, but is not limited to, laws and ordinances governing (a) operation and use of motor vehicles, aircraft, and boats; (b) hunting and fishing; (c) use of firearms; (d) injury to person or destruction of property; (e) air and water pollution; (f) littering; (g) sanitation; and (h) use of fire. We will not use or operate aircraft or boats; nor engage in any hunting or fishing; nor use firearms.

(4) We will not use vehicles on roads during periods when the soil is too wet to adequately support traffic. If such traffic creates ruts in excess of 4 inches deep, the soil shall be deemed too wet to adequately support the traffic.

(5) We will not interfere with other valid uses occurring on the public land such as grazing, mining, and recreation.

(6) We accept that the BLM does not guarantee the use of specific public areas, nor do we request the exclusive use of any area.

(7) We will not intentionally or wantonly destroy, deface, remove or disturb any public building, sign, equipment, marker or other government property, cultural sites, historic structures, natural features, vegetation or wildlife, except as legally taken.

(8) All trash, equipment, fencing and other debris will be removed from site and disposed of at an authorized disposal site upon completion of the project. There will be no burning of trash (or any other use of fire).

(9) We will contact the BLM District Office, either verbally or in writing, at least 3 days before installation of the seismometer sites is scheduled to begin. Researchers will check with the BLM District Office during the summer and fall for updates on fire conditions and if any fire closures are in effect.

(10) All crews will carry a copy of this permit application when conducting research in the area. All crews will show this permit application to BLM officials if they are contacted concerning their activities.

(11) The BLM will be provided with copies of all scientific information resulting from this experiment, including scientific posters presented at research meetings, and any published papers, in order to assist the BLM in its management of the public lands.

5. Description of proposed installations

What does the array do? The portable seismic monitoring systems are capable of detecting extremely small movements of the earth generated by both distant earthquakes and by the small earthquakes that occur in Eastern Nevada but are too small to be felt by seismometers located elsewhere. The actual ground motion is far too small to be felt by humans (millionths of an inch), and as such, the recording instrument must be very sensitive and background noise at its lowest. The seismic stations will remain in place for no more than 2 years and will record ground motion continuously during that time. Unless problems are detected with the equipment, instruments will be checked and the data collected every three to six months during the time they are in the ground.

Siting considerations. The signals received from distant earthquakes are extremely faint, therefore stations need to be placed as far from "cultural" noise (traffic, railroads, farm equipment, etc.) as possible. We also look for sites where the seismometer can be placed directly on bedrock, preferably with about 3 feet of soil cover, and where there is little danger of flooding or groundwater infiltration. It is important that the whole vault assembly be watertight. To protect against vandalism, sites away from view of traffic are preferred. The solar panels require a south-facing aspect largely unobstructed by tree cover. In remote areas with almost no traffic, the receivers can be placed in or adjacent to the existing road prism, in existing disturbed areas, and to the extent possible sites are chosen so as not to disturb vegetation. Nonetheless, reclamation will be performed at all sites to restore the original soil character and level.

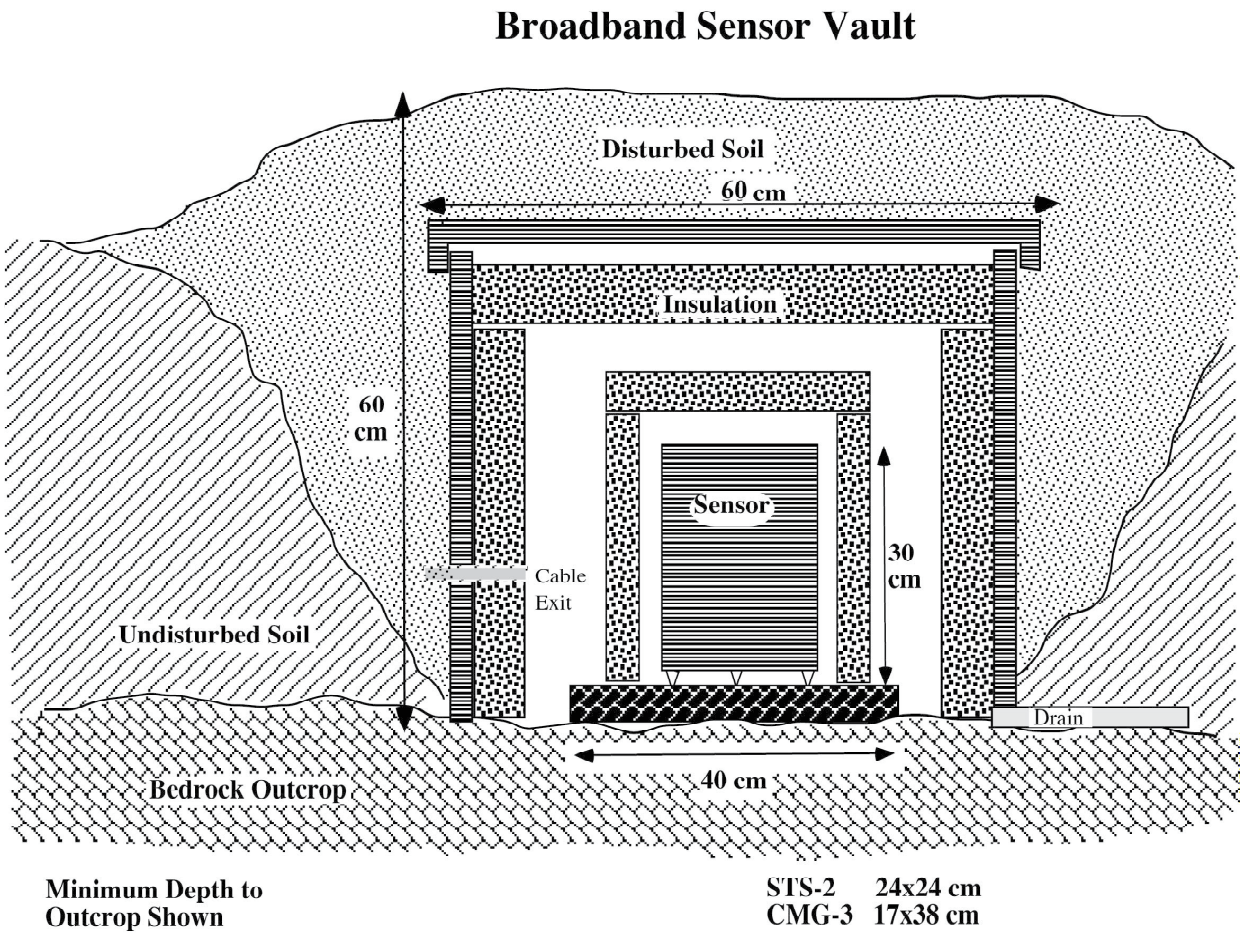
Data Acquisition. The seismograph is buried below ground in a tightly sealed 30-gallon drum or PVC pipe. The top of the drum is slightly below ground level. Cables run from the seismometer to the recording unit are fed out of the drum via PVC pipe installed through a watertight coupling in the top of the drum. The electronic recording equipment is housed in a buried cooler-size container, with its top just above grade to permit access during servicing. The data are written to a swappable hard drive or to memory cards (as used in digital cameras, for example) with several months recording capacity. A GPS antenna, mounted with a good view of the sky, feeds signals that provide millisecond timing accuracy to the recording unit, as well as accurate station coordinates. Once installed, the stations are serviced at 3 to 6 month intervals and memory disks are swapped out and returned to a service center in Elko for copying. Power is provided by a 12V truck battery and solar panel.

Site construction. The fenced area can be as small as 9 ft by 9 ft, with a nominal 4ft barbed wire/metal stake fence. Two holes approx. 2 ft deep, 2 ft wide, 2 ft long are required, to be hand-dug. Excavated soil will be used to further bury the seismometer vault (to reduce wind noise and reduce temperature variations at the seismometer), so no material will be transported off-site. We would like to construct (dig and fence) these sites in summer 2009; install the seismometers and data-loggers in fall 2009; make check-up visits at 3-to-6-monthly intervals, spring and fall 2010; then decommission, remove all equipment and remediate sites in spring-summer 2011. It takes a two-person, one-vehicle team one day to construct each site; a half-day to install each seismic recorder; a couple of hours for each service visit; and one day for removal and remediation, so the total time on-site at each site is less than one work week.

Typical seismograph (Guralp CMG-30T); and same installed in a 30-gallon drum, weighted with a rock.

Drum containing seismograph after installation in ground (Burns District, BLM, Oregon), 2007

Schematic of seismometer "vault", with typical dimensions

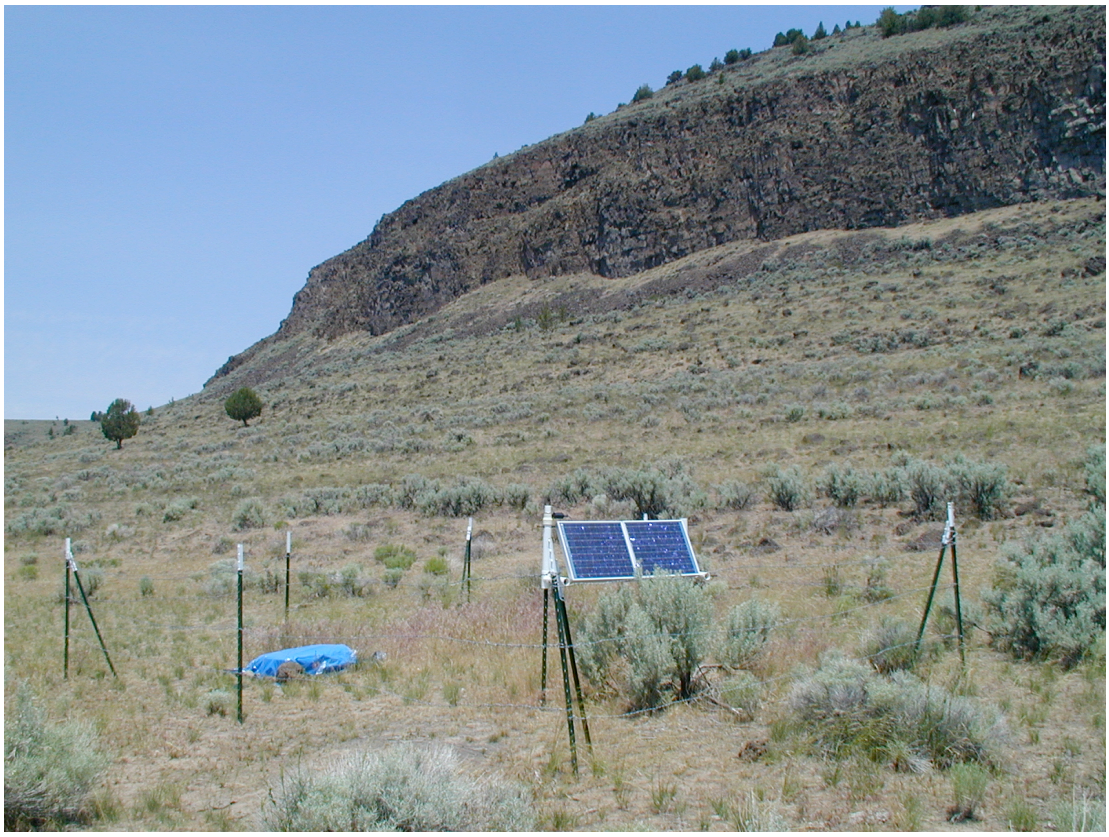


Detail of recording equipment and battery, as placed in buried weatherproof box on BLM land in Winnemucca District, Nevada, 2004.

Example installation of passive seismometer, on BLM land in Winnemucca District, NV, 2004. Note equipment is fenced to protect cattle.

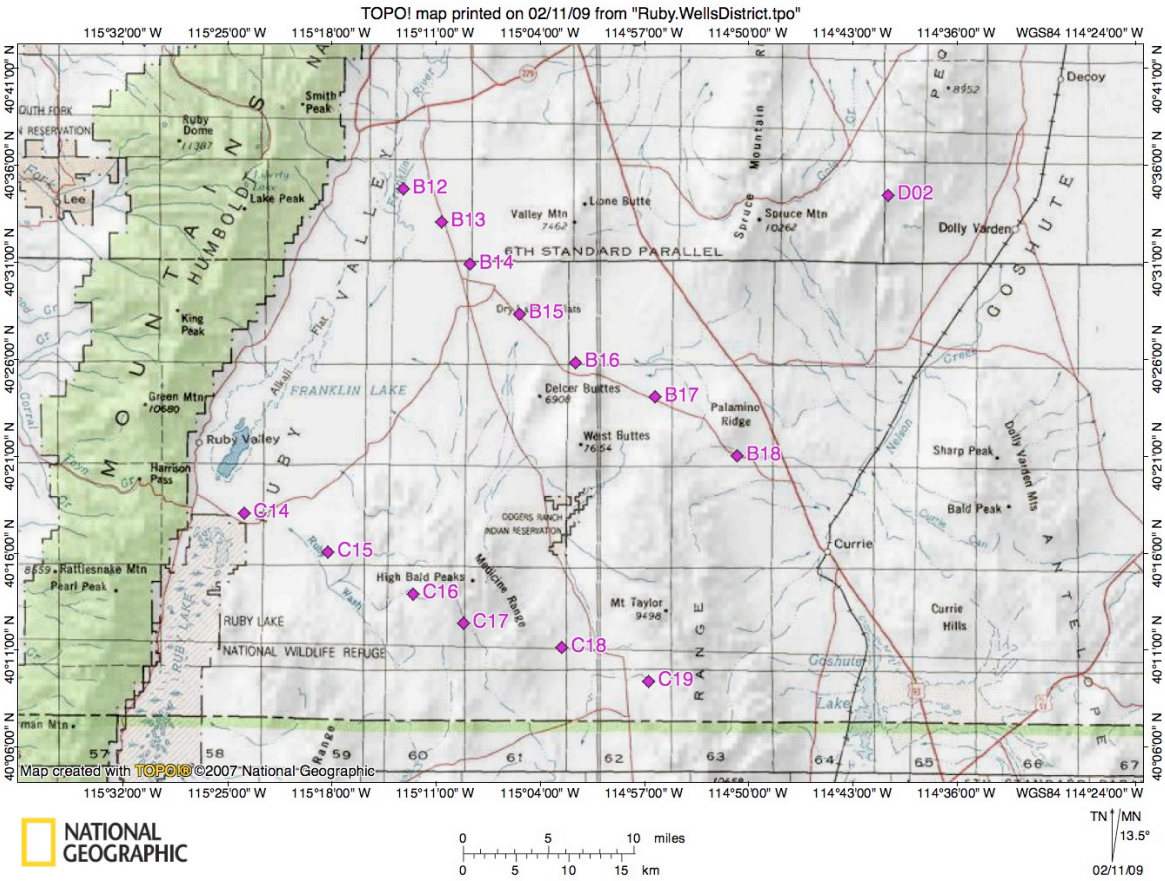
Example installation of passive seismometer (BLM Burns District, southeast Oregon), 2007. Note solar panel and GPS antenna remains on surface.

Example completed installation of passive seismometer (BLM Burns District, southeast Oregon), 2007. View from south showing solar panel and partially buried equipment box.



Same installation, view from north, showing location a few hundred feet from a paved county road.

6. Overview and maps of proposed seismometer locations, Wells District, BLM



Following table and 14 maps provide details of the 14 sites (referenced by codes above), with township, range, section, and quarter-section. For two sites where the proposed location is close to a section boundary, quarter-of-quarter sections are described in adjacent sections.

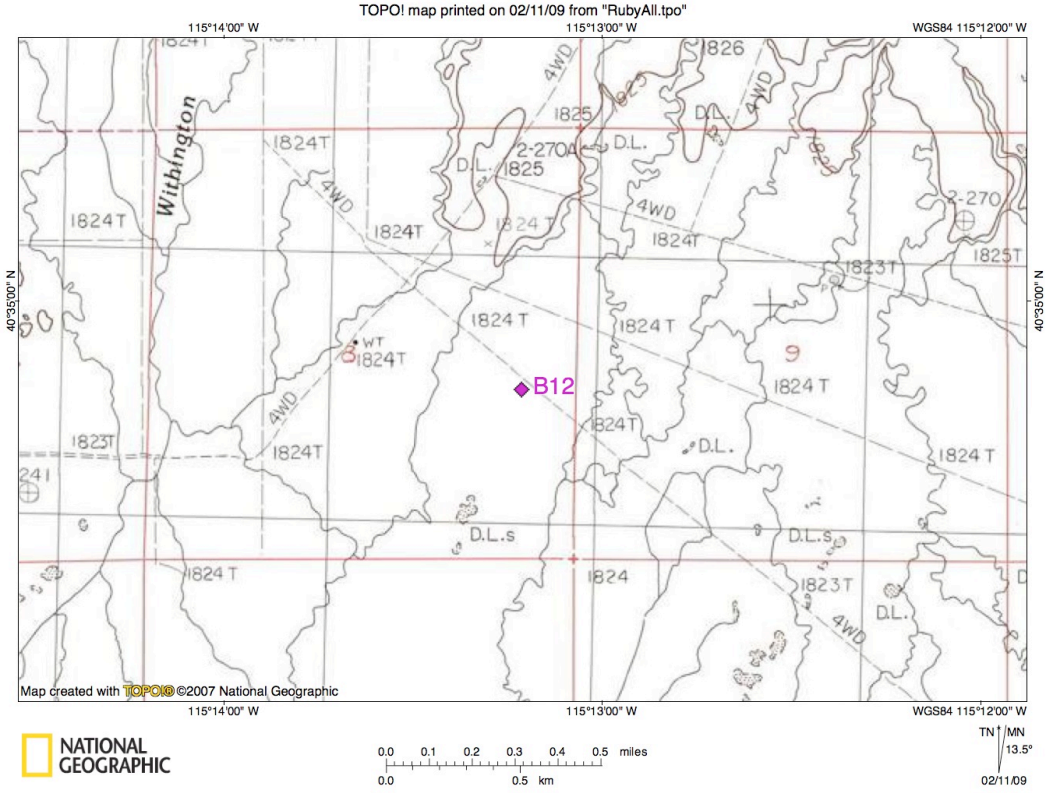
Site Code	Township	Range	Section	¼, or ¼ of ¼
B12	T31N	R60E	8	SE
B13	T31N	R60E	23	SW
B14	T31N	R61E	6	NW of NW, or T30N R60E Sect36 SE of SE
B15	T30N	R61E	15	SW of SW, or Sect16 SE of SE, or Sect21 NE of NE, or Sect22 NW of NW
B16	T30N	R62E	31	SW
B17	T29N	R62E	12	SW
B18	T29N	R63E	34	NE, or S35 NW
C14	T28N	R58E	14	SE
C15	T28N	R59E	34	NE
C16	T27N	R60E	9	SE
C17	T27N	R60E	24	NE
C18	T27N	R61E	25	SE
C19	T26N	R62E	2	SE
D02	T31N	R65E	7	SW

All locations are nominal at this time: they will be adjacent to existing motorable roads, and placed on previously disturbed ground, typically in or adjacent to the existing road prism. By specifying quarter sections, we can find previously disturbed ground adjacent to the half-mile or so of track running through a quarter-section. Precise site locations will be selected to minimize disturbance to vegetation, minimize visual intrusion, avoid damage to any wildlife, avoid interference with other uses of BLM land, and provide easy digging of the required 2-ft-deep holes, where possible close to subsurface bed-rock, in a location with a generally south-facing aspect and minimal tree cover above our solar panels and GPS antenna.

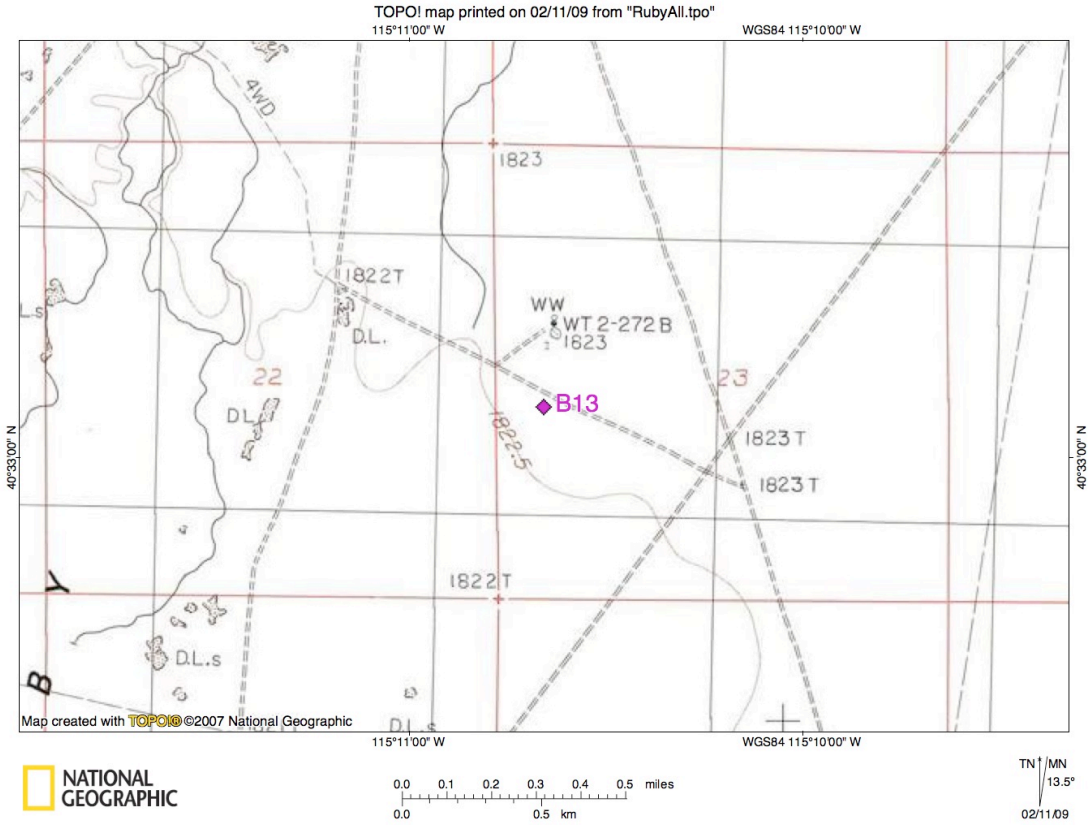
At the time of this preliminary application, we would welcome any information from BLM staff of land use decisions and designations, e.g. Wilderness Study Areas or Special Area Designations, that would render our proposed sites inappropriate. In such case we will work with BLM staff to identify nearby sites that are more suitable for our proposed work.

Following feedback from BLM staff, and site visits, precise locations will be provided to BLM for final approval.

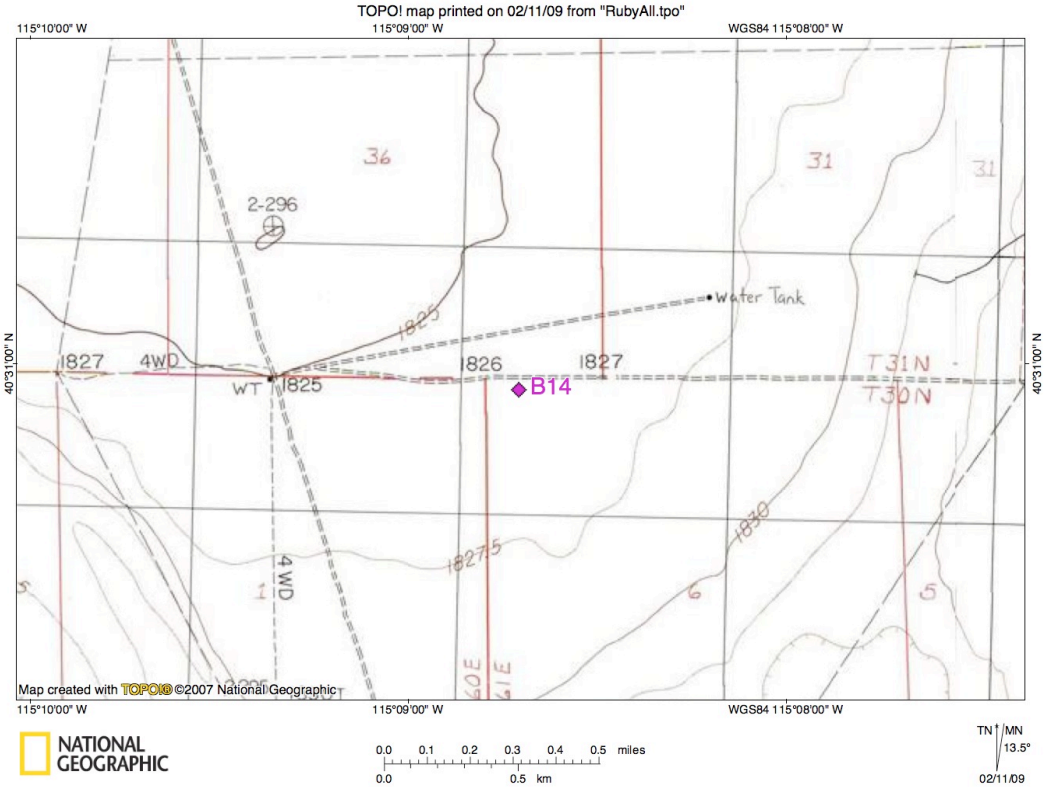
Proposed site B12 **T31N R60E S8 SE¼**



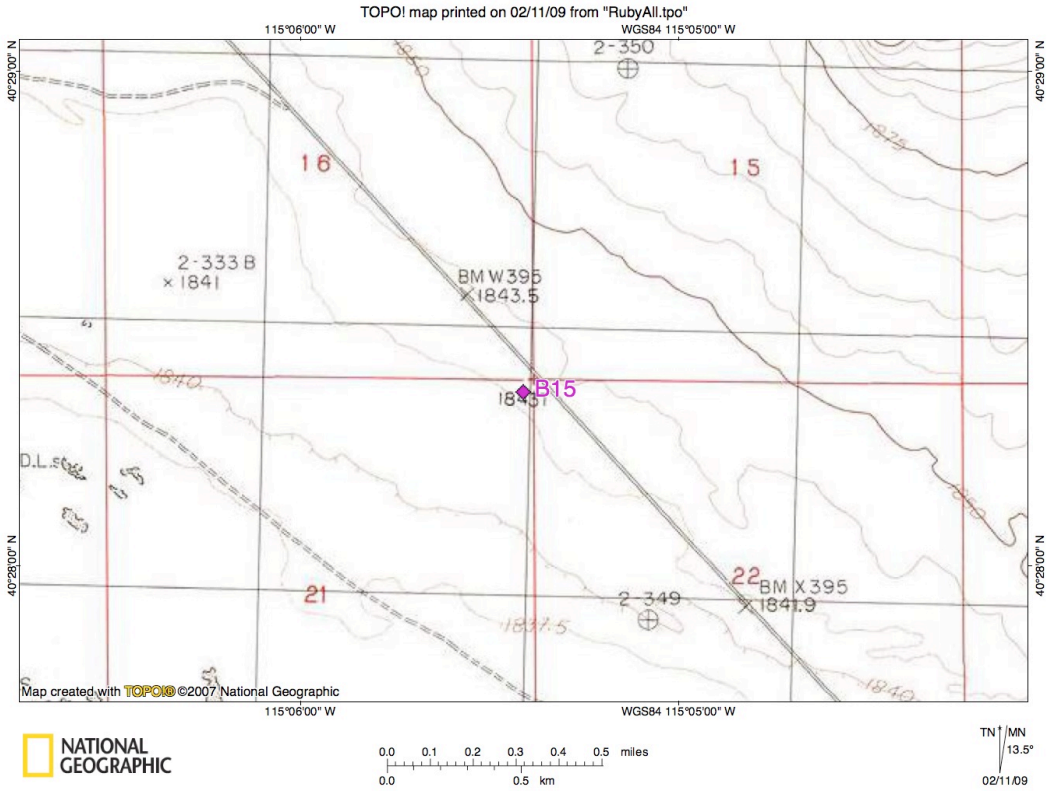
Proposed site B13 **T31N R60E Section 23 SW¼**



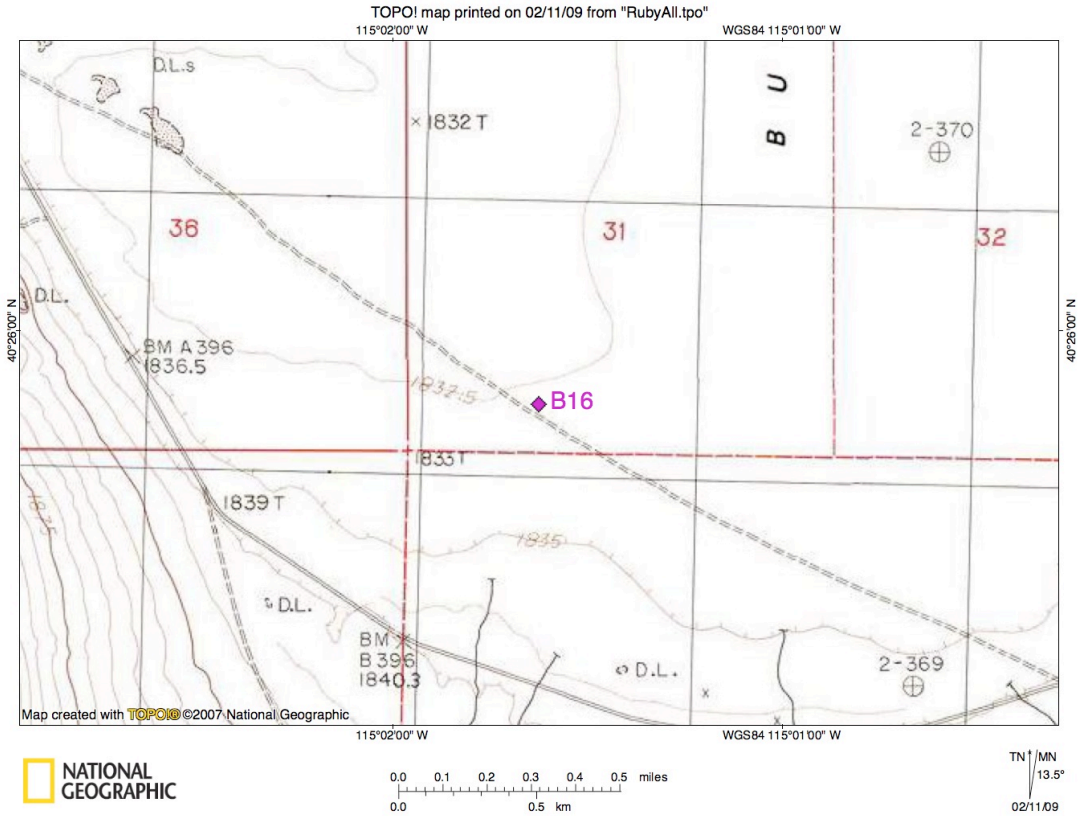
Proposed site B14 **T31N R61E S6 NW¼ of NW¼, or T30N R60E Section 36 SE¼ of SE¼**



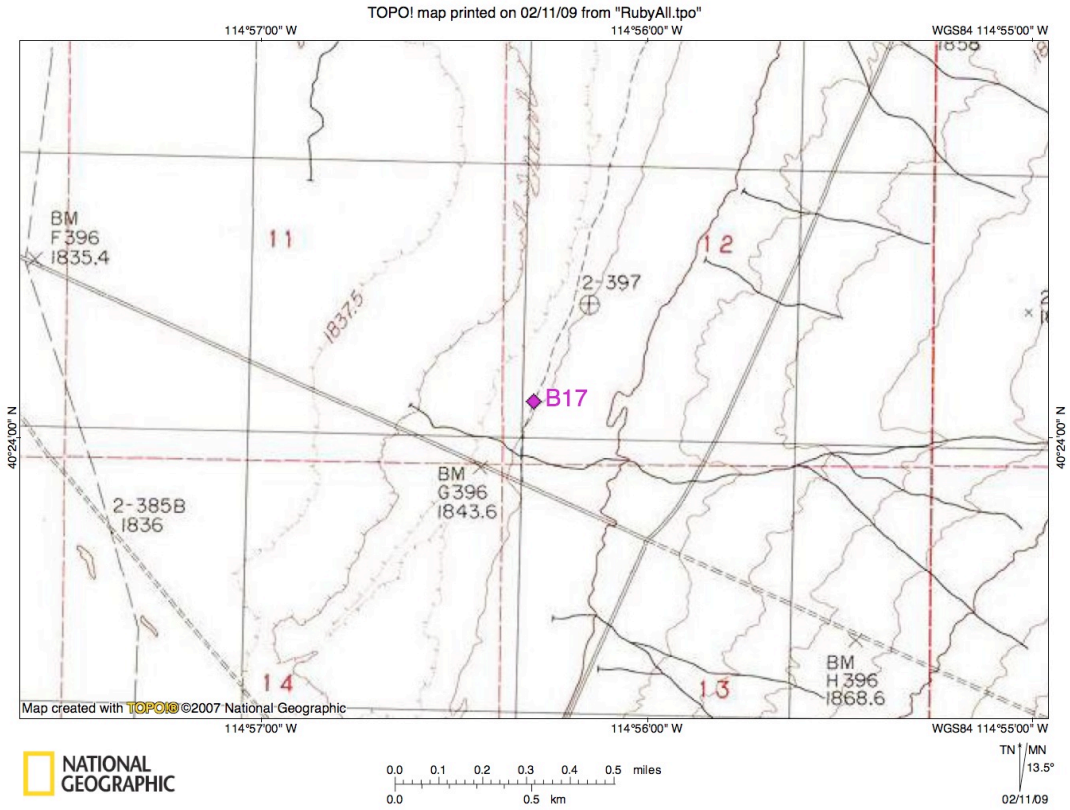
Proposed site B15 **T30N R61E Section 15 SW¼ of SW¼, or Section 16 SE¼ of SE¼, or Section 21 NE¼ of NE¼, or Section 22 NW¼ of NW¼**



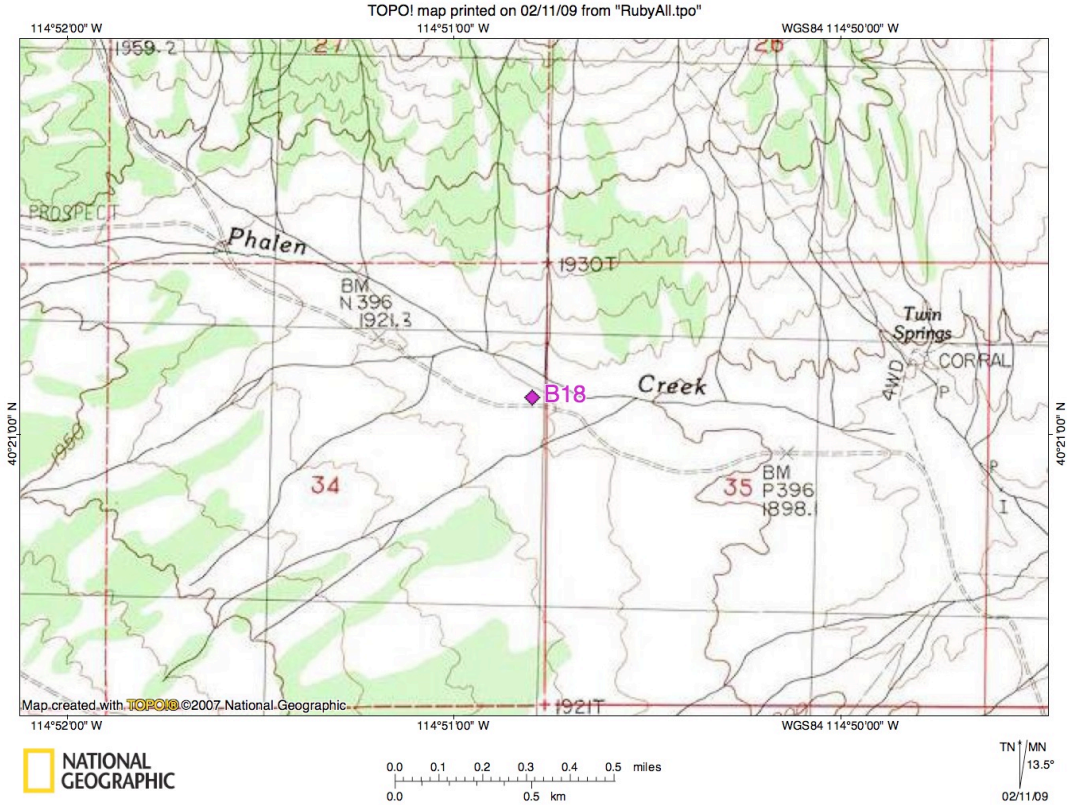
Proposed site B16 **T30N R62E S31 SW¼**



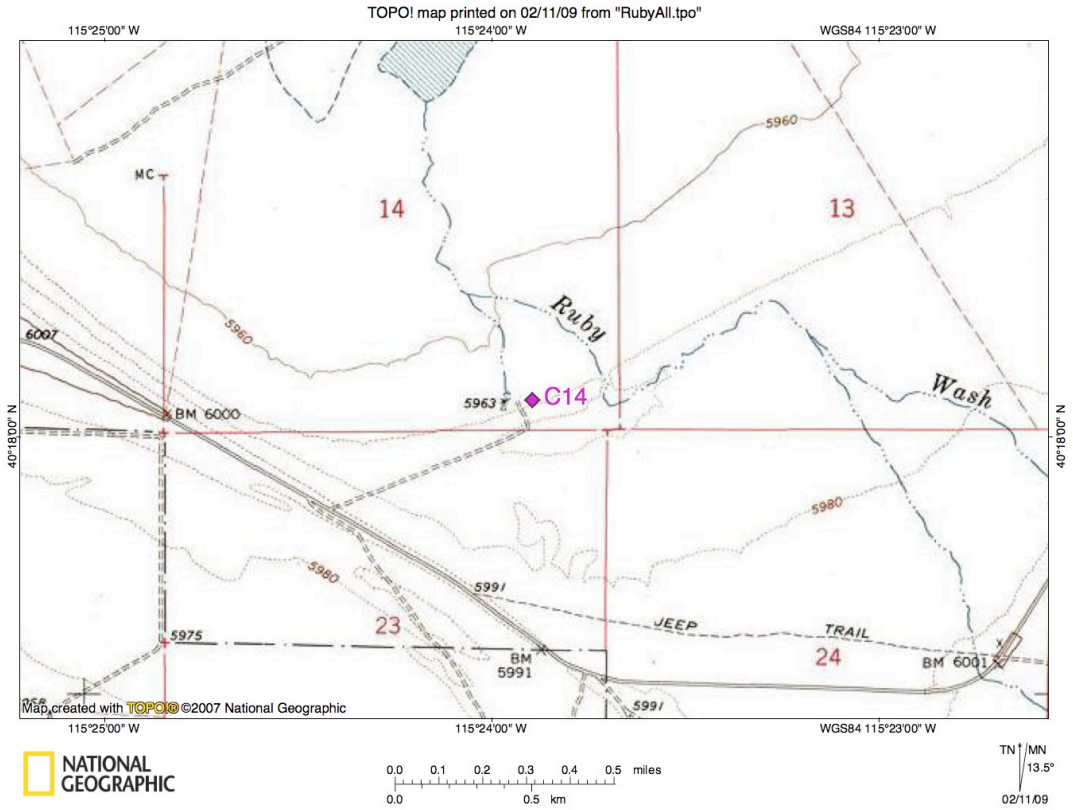
Proposed site B17 **T29N R62E Section 12 SW¼ ¼**



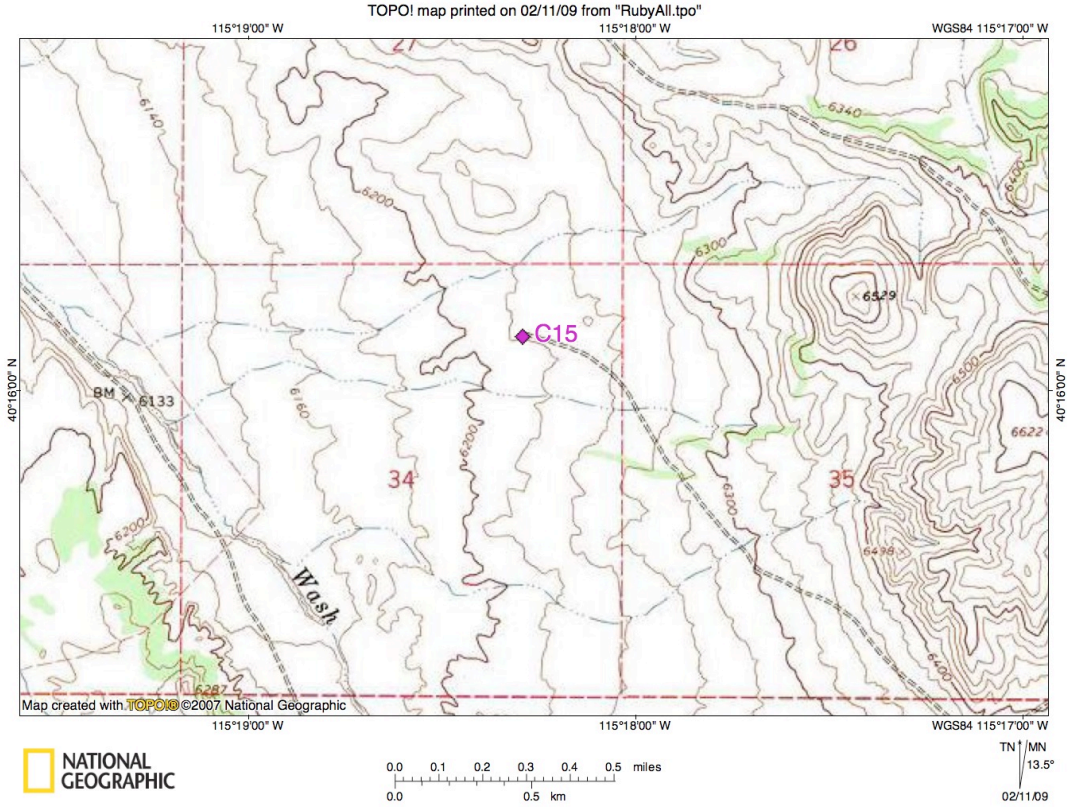
Proposed site B18 **T29N R63E S34 NE¼, or Section 35 NW¼**



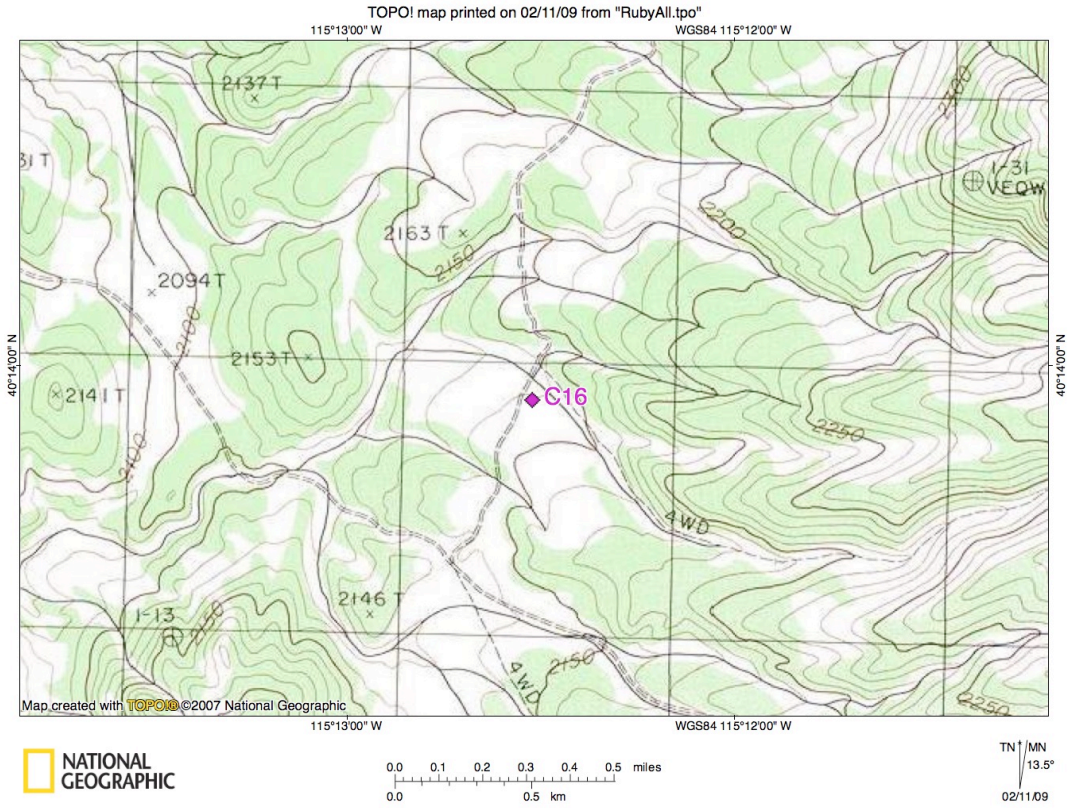
Proposed site C14 **T28N R58E Section 14 SE¼**



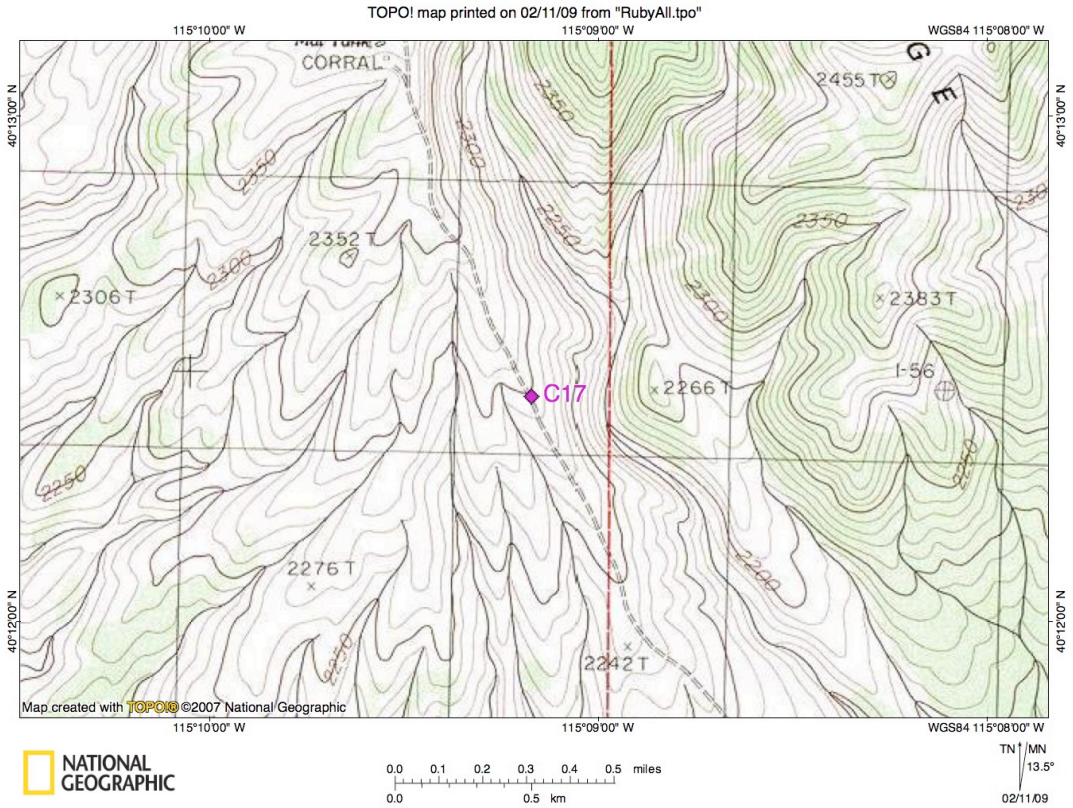
Proposed site C15 **T28N R59E Section 34 NE¼**



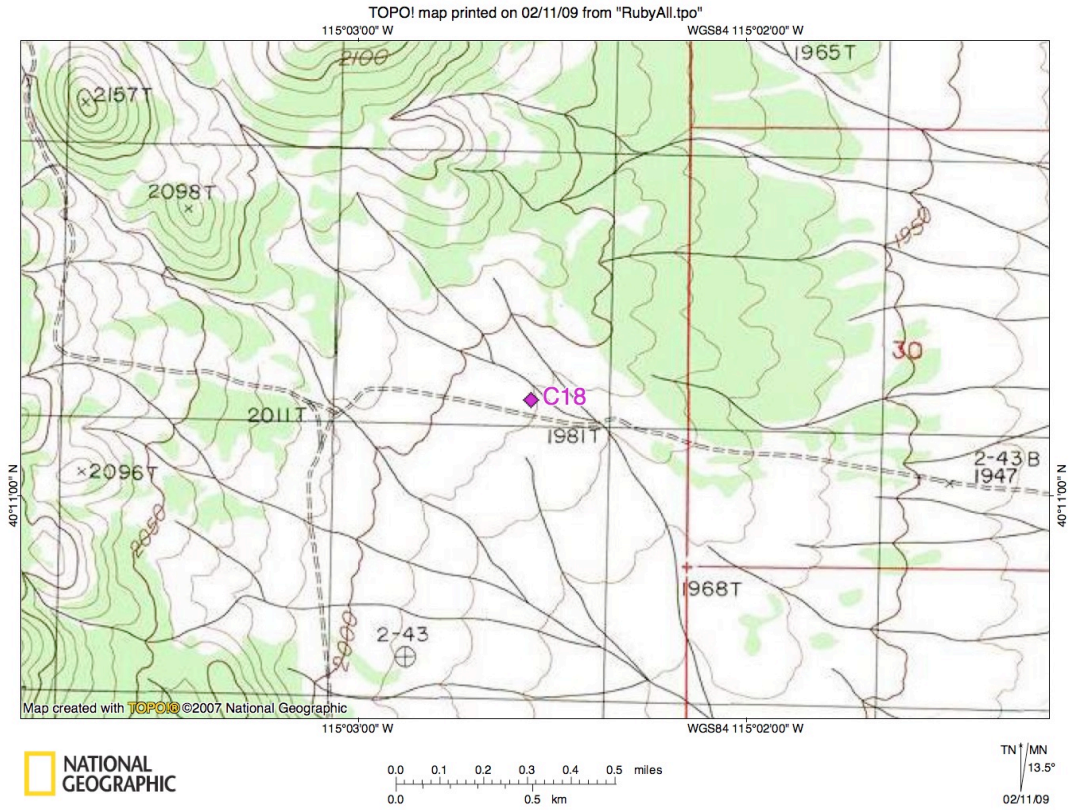
Proposed site C16 **T27N R60E S9 SE¼**



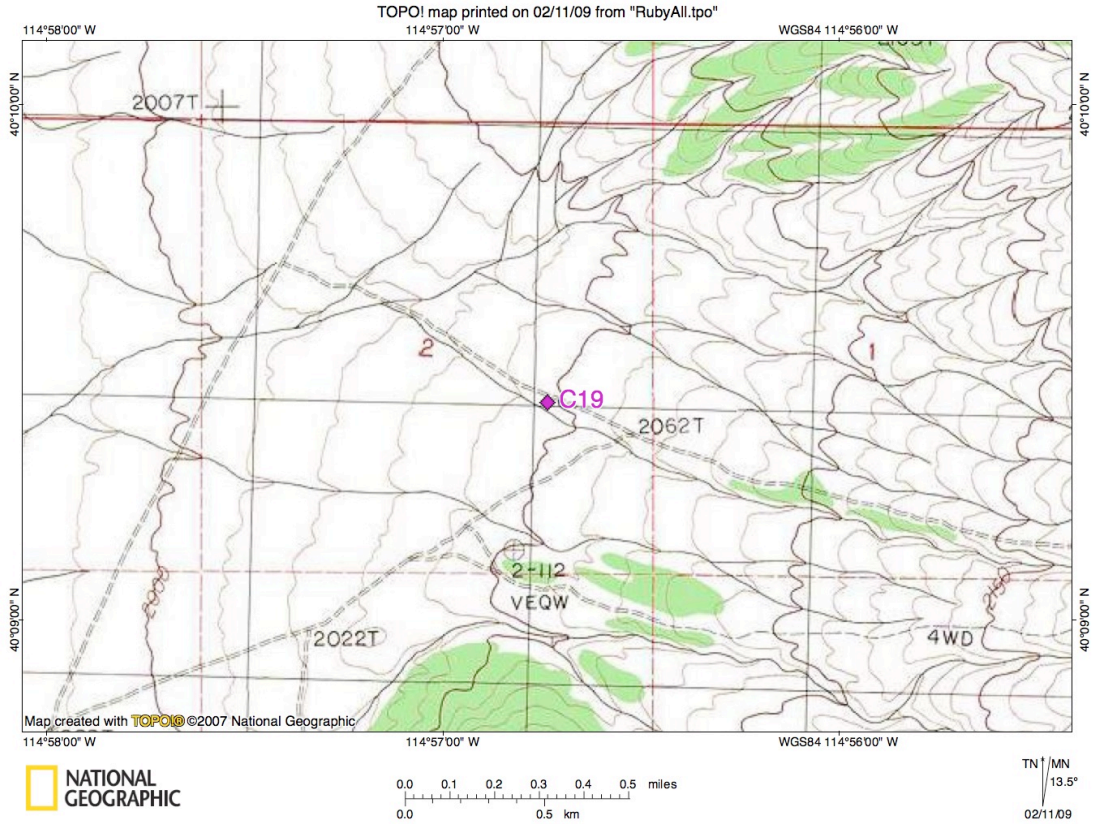
Proposed site C17 **T27N R60E Section 24 NE¼**



Proposed site C18 **T27N R61E Section 25 SE¼**



Proposed site C19 **T26N R62E Section 2 SE¼**



Proposed site D02 **T31N R65E S7 SW¼**