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PRINTED: 09/12/2002

ARIZONA DEPARTMENT OF MINES AND MINERAL RESOURCES AZMILS DATA

PRIMARY NAME: WORKMAN GROUP

ALTERNATE NAMES:

ANOMALY B6-8  
SUCKERITE GROUP  
LITTLE JOE GROUP  
HOPE GROUP  
JON GROUP  
LUCKY STOP GROUP  
LOST DOG GROUP

GILA COUNTY MILS NUMBER: 333A

LOCATION: TOWNSHIP 6 N RANGE 14 E SECTION 19 QUARTER SW  
LATITUDE: N 33DEG 50MIN 55SEC LONGITUDE: W 110DEG 57MIN 45SEC  
TOPO MAP NAME: MCFADDEN PEAK - 15 MIN

CURRENT STATUS: EXP PROSPECT

COMMODITY:  
URANIUM

BIBLIOGRAPHY:

ADMMR WORKMAN GROUP FILE  
USAEC 172-480 GILA CTYPRELIM RECONN REPT 1954  
P 65 & 150  
GRANGER H C & R B RAUP GEO U DEP DRIPPING SPR  
ING QUARTZITE USGS PP 595 1969 P 35-38, 65,  
71 & 76  
GRANGER & RAUP USGS BULL 1046-P 1959 P 440,  
441, 470-472  
SEE: WYOMING MINERALS CORPORATION FILE

*See: Hoop collection*



REMOVAL ACTION APPROVAL MEMORANDUM

DATE: OCT 04 2010

SUBJECT: Request for a Removal Action at the Workman Creek Uranium Mines Site, Tonto National Forest, Gila County, Arizona

FROM: Anne P. Fischer, On-Scene Coordinator (OSC)

TO: Regional Forester

THROUGH: Donal Luhrsen, District Ranger, Pleasant Valley Ranger District  
Gene Blankenbaker, Forest Supervisor, Tonto National Forest  
Maria McGaha, Regional Environmental Engineer, Southwestern Region  
Danny Montoya, Regional Engineer, Southwestern Region

I. PURPOSE

A release or a significant threat of a release that poses a threat to public health or welfare or the environment is occurring on lands under the jurisdiction, custody, or control of the U.S. Department of Agriculture Forest Service (Forest Service), Pleasant Valley Ranger District of the Tonto National Forest, Arizona. The purpose of this Memorandum is to request and document approval of the proposed non-time critical removal action described herein. This non-time critical removal action at the Workman Creek Uranium Mines (Site) will reduce the potential for exposure to radium-226, arsenic, uranium, cadmium, copper, lead, vanadium, and zinc, the contaminants of concern (COC).

This Non-Time Critical Removal Action Approval Memorandum documents and explains the commencement of a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA; 42 U.S.C. 9601 *et seq.*) removal action at the Site. The Forest Service's role is to protect the public health and welfare and the environment and to respond to a hazardous substance release on lands under the jurisdiction of the Forest Service, pursuant to the authority found in 42 U.S.C. 9604(a), Executive Order 12580, and 7 C.F.R. 2.60(a)(39). In general, for response actions on National Forest System lands, the Forest Service is the lead agency as defined by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) 40 C.F.R. Part 300. The Forest Service conducts response actions consistent with the NCP.

## II. SITE CONDITION AND BACKGROUND

### A Site Description

#### 1. Physical Location

The Site is located approximately 21 miles south of Young, Arizona and 15 miles northwest of Globe. Access to the Site is via State Route (SR) 188 north (15 miles) of Globe to SR 288 north (30 miles) to Forest Road (FR) 487.

The Site boundaries encompass 3 campground areas and 8 mine group areas. The 3 campgrounds are Creekside Campground, Cascade Campground, and Falls Campground. The 8 mine group areas are Little Joe Mines, Workman Mines, Hope Mine, Lost Dog Mine, Lucky Strike Mines, Jon Mines, Unknown Mine, and Suckerite Mine.

The 3 campgrounds and 2 group areas, Jon and Unknown Mines, are located adjacent to FR 487 and readily accessible. Access to the Little Joe, Workman, Lucky Stop, Lost Dog, Hope, and Suckerite mine group areas is through abandoned mine roads off of FR 487 and requires all-terrain or four-wheel drive vehicles and/or foot travel.

The legal description is Township 6 North, Range 14 East, Sections 19, 20, 24, 29, 30, 31, and 32. The latitude and longitude at Creekside Campground, the approximate center of the Site, are 33°50' 22" north and 110°57' 14".

The average annual precipitation is approximately 28 inches from 1971 to 2000. On the average, precipitation falls at a relatively even rate throughout the year; however, February and March receive the highest rate of precipitation mostly in the form of snowfall. May and June represent the driest months. The average maximum temperature ranges from 52 °F in December to 90 °F in July. The average minimum temperature ranges from 31 °F in December to 63 °F in July.

#### 2. Site Characteristics

The Site consists of inactive uranium mines in Gila County, Arizona. Waste rock (approximately 31,000 cubic yards) and 33 mine features are situated within the boundaries of the Tonto National Forest on land administered by the Forest Service, and are under the jurisdiction of the Pleasant Valley Ranger District. A mine feature (feature) is defined as an adit, shaft, trench, and/or waste rock source. This is the first removal action at the Site.

The Workman Creek Watershed, from its confluence with Reynolds creek to the Headwaters, occupies 17 square miles and ranges in elevation from 4,757 feet at Reynolds Creek to 7,735 feet at the summit of Aztec Peak. Workman Creek is a tributary to Salome Creek in the Salome Wilderness Area. Salome Creek flows directly into Roosevelt Lake, a major water supply reservoir for the Phoenix metropolitan area. In the watershed, Workman Creek has reaches of perennial flow. The watershed is located within the Sierra Ancha Mountains.

The 8 mine group areas are made up of one to several mine features in close proximity to each other. Most group areas have waste piles nearby but no tailings. No documentation indicates that the ore was processed in the watershed. Rather, the ore was either shipped

directly out of state or to an Atomic Energy Commission (AEC) uranium ore-buying depot outside of Globe, Arizona.

The Site is located in a narrow canyon with steep side walls. The downhill direction of the creek is roughly east to west with a steep gradient. Vegetation is lush in the canyon bottom and on the north facing slopes with pine, fir, maples, and columbine. The south facing slope is densely vegetated with scrub oak, juniper, and Manzanita. All the mine group areas, except the Jon Mine, are located on the steep hillsides. Access to the group areas is on old mining roads that are only traversable on foot or possibly all-terrain vehicles (ATV).

#### Mining History:

Uranium was discovered in the area as early as 1950 when above normal radioactivity was detected. Development was slow due to the spotty nature of the deposits and the inaccessibility of the area. Active mining did not occur until 1954, and in 1955 U.S. Atomic Energy Commission (AEC) built a uranium ore-buying depot in Globe, which received ore shipments from the Workman Creek mines. This period of mining was directly related to a push by the AEC to develop new sources of uranium. In general, most of the uranium produced from the area was of low-grade and was uneconomical to mine. By 1957, ore production from the area mines stopped and the ore-buying station was closed.

Exploratory work occurred off and on through the 1980's and included mining, drilling, and sampling to evaluate the remaining uranium reserves. A large corporation had the majority of claims within the Workman Creek Watershed. As many as 15 miles of new roads to drill pads were constructed. Approximately 100 holes were drilled for exploration. The national demand for nuclear power was waning in the early 1980s resulting in a cessation of exploration in the Sierra Anchas. The corporation did install numerous heavy wooden doors over many of the adits. Available information indicates that the current location of the Creekside and Cascade Campgrounds may have been used as ore staging areas during active mining.

### 3. Removal Site Evaluation

Studies conducted by the Forest Service identified 31,000 cubic yards of waste rock and 33 mine features that pose a potential threat to human health and the environment. Approximately 500 cubic yards are located within the 2 campgrounds and approximately 30,500 cubic yards are located within the 8 mine groups.

In 2003, the Forest Service completed a limited gamma survey at the Creekside, Cascade, and Falls Campgrounds. Results of the survey indicated elevated gamma radiation at Creekside and Cascade, but not at Falls Campground. As a result, the Creekside Campground and the Cascade campgrounds were converted from overnight use to day-use-only picnic areas due to the elevated radium-226 levels. The Falls Campground was eliminated from further study and from further action. It remains as an overnight use area. An area adjacent to FR 487 leading to the Hope Mine Group (termed the Hope Mine Hot Spot) was also surveyed. The results of the survey documented elevated levels of gamma radiation and migration from radioactive contaminants on the Site.

In 2004, on behalf of the Forest Service, SAIC prepared a Preliminary Assessment/Site Inspection (PA/SI) for the Workman Creek Watershed. Site investigation activities included soil and waste rock sampling, surface water and sediment sampling. The sampling occurred

throughout the Site covering Workman Creek, ephemeral drainages, campground areas, mining group areas and the local ATV roads. The sampling results indicated significantly elevated levels of gamma radiation over the ore-staging areas within the Creekside and Cascade Campgrounds. In addition, sampling results also indicated that the radioactive contamination is being transported from the Site via runoff and surface water flow.

As a result of historic uranium mining practices, the watershed is littered with mine features such as open adits, waste rock piles, and areas of mixed waste rock and road cut materials. These mine features present a physical safety hazard to the public and a potential threat to human health from the elevated levels of gamma radiation.

The contaminants of concern based on the protection of human health are arsenic, uranium, and radium-226. The contaminants of concern based on ecological receptors are cadmium, copper, lead, vanadium, and zinc.

#### **4. Release or Threatened Release into the Environment of a Hazardous Substance, or Pollutant, or Contaminant**

Some of the approximately 31,000 cubic yards of uncontained waste rock at the Site are documented to contain elevated levels of radium-226, arsenic, uranium, cadmium, copper, lead, vanadium, and zinc. Any contaminated waste rock piles, surface soils, mine features, or water flowing from Jon Mine adit containing radium-226, arsenic, uranium, cadmium, copper, lead, vanadium, or zinc above risk levels pose a continual threat of release to the surrounding environment, specifically Workman Creek, Salome Creek and Roosevelt Lake.

Human health and ecological contaminants of concern above background levels are present at the Site. These contaminants of concern are hazardous substances as defined by Section 101(14) of CERCLA, 42 U.S.C. § 9601(14).

The majority of the waste rock pile and mine features are not vegetated resulting in a direct exposure pathway for metals. The direct exposure pathway for metals is dust inhalation and incidental ingestion of dust and soil. Incidental soil ingestion and fugitive dust inhalation make minor contributions to total radiation risk. The dominant radiological exposure route for human receptors is external gamma radiation.

Contaminants in the waste sources may also be released through emanation, wind erosion, surface water runoff, infiltration, and uptake by vegetation. Surface water runoff and the transportation of contaminated soil from the waste sources into the drainages may subsequently be carried downstream, thereby degrading sediment quality.

Uranium and Radium-226 undergo radioactive decay to form daughter radionuclides. When radium-226 decays, alpha, beta, and gamma radiation is released. The primary contributors to gamma exposure are the decay products (daughters) of radium, and the higher the radium present, the higher the ultimate gamma exposure rate. The dominant radiological exposure route for human receptors is external gamma radiation.

EPA has determined that radionuclides are a human carcinogen. Exposure to even low levels of radium over a long period of time may result in harmful effects including anemia, cataracts, fractured teeth, cancer (especially bone cancer), and death. Some of these effects may take years to develop. Radium gives off gamma radiation, which can travel fairly long

distances through air. Therefore, just being near radium at the high levels that may be found at some hazardous waste sites may be dangerous to human health. (ATSDR, 1990)

Uranium is considered a chemical and radiological hazard. Uranium is the only radionuclide that is toxic to kidneys as well as a potential carcinogen. Uranium gives off particles in a process known as ionizing radiation. Radium-226 produces far greater quantities of ionizing radiation than does uranium.

## 5. National Priorities List (NPL) Status

This site is not listed on the NPL.

### B. Other Actions to Date

#### A. Previous Actions

- *Ground Survey of Campgrounds and Preliminary Radiological Survey*, Tonto National Forest unpublished data
- Steve Germick, Tonto National Forest Archeologist, *An Overview of Uranium Development in the Sierra Ancha, 2001*
- Science Application International Corporation (SAIC), *Workman Creek Watershed Final Combined Preliminary Assessment/Site Inspection (PA/SI) Report – Volumes 1 and 2, Tonto National Forest, 2005*
- Weston Solutions, *Final Engineering Evaluation/Cost Analysis (EE/CA), Workman Creek Uranium Mine Sites, Pleasant Valley Ranger District, Tonto National Forest, Arizona, 2008*
- The Rocky Mountain Research Station of the USDA Forest Service has studied the upper watershed for decades, recording changes in flow and stream channel conditions.
- Harry C. Granger and Robert B. Raup prepared two Geological Survey reports on the geology of and uranium-bearing deposits in the Dripping Spring Quartzite formation in Gila County, Arizona. Both were prepared on behalf of the U.S Atomic Energy Commission in 1969.
- F. J. Williams, also for the U.S. Atomic Energy Commission, wrote *Structural Control of Uranium Deposits, Sierra Ancha Region, Gila County, Arizona*, in 1957.

#### B. Current Actions

- The Forest Service has evaluated alternate ATV routes to avoid the elevated gamma radiation areas.
- The Forest Service is not allowing overnight camping at the Cascade Campground and the Creekside Campground. Interpretive signs are posted describing the human health hazards associated with abandoned uranium mines in the area.

### C. State and Local Authorities Roles

#### State, Tribal, and local actions to date

1. In response to Forest Service's request for comment on the EE/CA report, Arizona Department of Environmental Quality sent a letter dated February 24, 2009, supporting the

- recommended alternative and also identified the State Applicable or Relevant and Appropriate requirements (ARARs).
2. In response to Forest Service's request for comment on the EE/CA report, the Arizona Mining Reform Coalition sent a letter dated March 6, 2009, supporting the cleanup work and also providing input on the implementation of the cleanup work.
  3. In response to Forest Service's request for comment on the EE/CA report, the Hopi Tribe sent a letter requesting notification of any finds during cleanup relating to prehistoric or Traditional and Cultural Properties.
  4. In response to Forest Service's request for comment on the EE/CA report, the White Mountain Apache Tribe sent a letter supporting the cleanup work as the recommended alternative would not have an effect to the White Mountain's Apache Tribe's Cultural Heritage Resources and/or historic properties.

### III. THREATS TO PUBLIC HEALTH, WELFARE, OR TO THE ENVIRONMENT, AND STATUTORY AND REGULATORY AUTHORITIES

Conditions at the Site represent a release, and potential threat of a release, of a CERCLA hazardous substance threatening the public health or welfare, or the environment, based on the factors set forth in the NCP at 40 C.F.R. §300.415(b)(2). These factors include:

#### 1. Actual or potential exposure to hazardous substances or pollutants or contaminants by nearby populations of the food chain

An actual or potential exposure to arsenic, uranium, radium-226, cadmium, copper, lead, vanadium, and zinc contained in the soils, waste rock, and at mine adits may threaten public health who are visiting, camping, fishing, hunting, riding ATVs, and hiking the Site. No residential use is planned for the Site; however, sensitive receptors including young children and pregnant women were included in the camping exposure scenario (EE/CA). Workers with the Forest Service are also potential receptors.

Potential receptors would likely visit the area for short periods of time; however, many visitors from surrounding communities visit the area more than once per year. Within Workman Creek, overnight camping is permitted by the Forest Service at the Falls Campground for 14-day periods. Once the radiological hazards at Cascade and Creekside campgrounds are mitigated, the Forest Service will permit overnight camping. Overnight camping for maximum 14-day periods are permitted at Rose Creek Campground, located south of the Site. Due to proximity, visitors to the Rose Creek Campground may also visit the Site during their stay. Boy Scout and other youth groups visit the Elks Camp on weekends from May through September. Day visitors from the Globe-Miami area or other nearby communities often frequent the Site.

Native fish inhabiting Workman Creek include the Speckled Dace, Desert Sucker, Sonora Sucker, Long-fin Dace, and Round tail Chub (which is a listed sensitive species). The Arizona Game and Fish Department stocks Workman Creek twice a year (during spring and early summer) with rainbow trout. While no investigations have been performed to determine if hazardous substances are in the fish tissue, the potential exposure route for these substances is ingestion of sediment or plants in the creeks.

#### 2. High levels of hazardous substances or pollutants or contaminants in soils at or near the surface that may migrate

There are high concentrations of arsenic, uranium, radium-226, cadmium, copper, lead, vanadium, and zinc contained in the soils, and waste rock in the areas of the Creekside and Cascade campgrounds; the 33 mine features and on the roads accessing the mine features. These areas include soils and waste rock from the drainage pathways, roads, and waste rock piles (where up to 661 pCi/g of radium-226 concentrations were found). Uranium concentrations at the Little Joe Mine were documented up to 2,500 mg/kg.

### **3. Actual or potential contamination of drinking water supplies or sensitive ecosystems**

Concentrations of uranium and gross alpha collected at the Jon Mine adit during low flow conditions exceed State drinking water standard, however, the water that collects at this location is not a designated drinking water source. Neither of these radionuclides was detected in concentrations above the drinking water standard during high-flow conditions.

### **4. Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be release**

Rain, snow and other adverse weather conditions increase the erosion of uncontained waste rock and mobilize contaminants from the Site into the drainages of Workman Creek. The waste piles and contaminated soils are all exposed to the weather. Rain and snow can cause movement from current locations down drainages to the creek.

### **5. Threat of fire or explosion**

In the past several years, there have been significant wildfires in the watershed located above the Site. While it is unlikely that the waste on Site would cause a fire, the location of this Site within the National Forest and the present dry weather increases the risk of fire at the Site. Any wildfire could exacerbate the runoff from the Site, and thereby lead to additional hazardous substances entering the Workman Creek watershed.

## **IV. ENDANGERMENT DETERMINATION**

Actual or threatened releases of hazardous substances from the Site, if not addressed by implementing the response action selected in this Removal Action Approval Memorandum, may present an imminent and substantial endangerment to public health, welfare, or the environment due to exposure primarily due to external gamma radiation.

## **V. PROPOSED ACTIONS AND ESTIMATED COSTS**

### **A. Proposed Actions**

#### **1. Proposed action description**

Based on the analysis and findings of the PA/SI and the EE/CA, three primary Areas of Interest (AOI) for the site were identified: (1) Campground Soils, (2) Mine Group Area Soils and Waste Rock, and (3) ATV Roads. The Removal Action Objectives (RAOs) for the response action were developed for each AOI:

- 1) Reduce human exposure to external gamma radiation on ATV roads to levels that do not result in unacceptable site-related risks to drivers;

- 2) Reduce exposure of humans and ecological receptors to COCs in soils at the Creekside and Cascade Campgrounds to levels that do not result in unacceptable site-related risks;
- 3) Reduce exposure of humans and ecological receptors to COCs in soil and waste rock areas to levels that do not result in unacceptable site-related risks. Reduce the physical and radiological hazards posed by open or partially open adits present at the mining areas.

To accomplish these RAOs, the Forest Service has decided to use the Arizona Soil Remediation Levels (SRLs) for Non-Residential uses for the heavy metals and EPA's Soil Screening Levels (SSLs) for Radium-226. The SSLs were based on recreational exposure assumptions. The SRLs and the SSLs will be used as the cleanup action levels for the Site.

In general, the construction activities in the proposed action include excavation of approximately 275 cubic yards at the 2 campgrounds, 60 cubic yards on Lost Dog/Lucky Stop mine, and 200 cubic yards at the Hope Hot Spot and placement in an on-Site repository; the 33 mine features at the 8 mine groups will be closed using 133 cubic yards of the 30,500 cubic yards of waste rock. Several alternatives were evaluated in the EE/CA to address the remainder of the waste rock. Due to the high costs associated with the implementability of the alternatives, the remainder of this waste rock will be left in-place and undisturbed. However, to protect the public from these areas, the roads to access these areas will be obliterated and the ATV traffic will be diverted and re-routed to other road segments that avoid these areas. The mine features will be closed to protect any hikers or wildlife from falling or entering these mine features.

The following further describes the proposed actions for each of the AOIs.

Creekside and Cascade Campgrounds (AOI 1): The Forest Service proposes to safely remove and contain surface mine waste that exceed the cleanup action levels in an on-Site repository. The repository will be designed to have minimal maintenance requirements for the first year after installation and have no maintenance needs once wastes inside and restoration measures on the cover have stabilized. Following the removal and containment of the waste, cleanup verification samples will be collected and analyzed after excavation to ensure the RAOs are met for the Site.

The cleanup levels for AOI (1) are:

COC	Cleanup Action Level
Arsenic	10 mg/kg
Uranium	200 mg/kg
Radium-226	7.57 pCi/g
Cadmium	510 mg/kg
Copper	41,000 mg/kg
Lead	800 mg/kg
Vanadium	1,000 mg/kg
Zinc	310K mg/kg

Mine Group Areas (AOI 2): The proposed action for the 33 mine features at the 8 mine group areas is closure of the openings.

Each group has unique engineering design elements that vary from one to another. The proposed action includes closing the mine features with waste rock and/or polyurethane foam

applicable to a Site, address problems or situations sufficiently similar to those encountered at the site that their use is well suited to the particular site. Once the agency determines that a requirement is relevant and appropriate, then the agency must comply with the requirement to the same extent as if it were applicable.

State requirements may also be ARARs. In order for a state requirement to be an ARAR it must be promulgated, of general applicability, and legally enforceable. It must be more stringent than Federal requirements. Finally, the State must have identified the requirement in a timely manner.

There are three different types of ARARs: (1) chemical-specific, (2) location-specific, and (3) action-specific. Chemical-specific ARARs are typically health- or risk-based numerical values that represent cleanup standards. Location-specific ARARs are restrictions on the concentration of hazardous substances or the conduct of activities in environmentally sensitive areas. Action-specific ARARs are usually technology- or activity-based requirements or limitations on cleanup actions.

Sometimes there are no ARARs to serve as cleanup levels for a particular site or contaminant. In these situations, the agency may consider non-promulgated criteria, advisories, guidance, and proposed standards issued by Federal or State governments. This category of cleanup goals is called "to be considered" or TBCs. Agencies may rely on TBCs in making cleanup decisions, but TBCs are not potential ARARs because they are neither promulgated nor enforceable.

Agencies must comply only with the substantive portions of a given ARAR for CERCLA cleanups conducted entirely on-site. Agencies need not comply with administrative requirements such as obtaining a permit, record keeping, and reporting for on-site actions. "On-site" means the areal extent of the contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action. Agencies must comply with both the substantive and administrative requirements of applicable laws and regulations for actions taken off-site.

Removal actions, as opposed to remedial actions, need only comply with ARARs to the extent practicable given the exigencies of the situation and the scope of the removal action. During most non-time critical removal actions, such as the one being contemplated for the Workman Creek Uranium Mines Site, there is sufficient time to identify and evaluate ARARs. Only ARARs that address activities within the scope of the removal action need be considered. For example, ARARs pertaining to treatment of a contaminated ground water aquifer are outside the scope of a cleanup involving capping a waste pile.

#### ARARs for the Workman Creek Uranium Mines Site

The EE/CA includes a streamlined risk evaluation and identifies the potential ARARs for the Site in Appendix B. The Forest Service evaluated the streamlined risk evaluation and the potential ARARs to determine the cleanup levels for the Site. Specific ARARs are not available for some of the COCs on this Site. In these cases, To Be Considered (TBC) guidance or criteria define the cleanup level for the COC. Below is a discussion of the streamlined risk evaluation and some of the key ARARs and TBCs.

#### **Chemical Specific ARARs for Surface Water:**

The streamlined risk evaluation process assessed the potential threats to human health and the environment from exposure to contaminated soil, waste rock, and surface water at the Site. The

(PUF); and minor road improvements to mobilize heavy equipment to each mine group area. These roads will be obliterated after the project is complete.

ATV Roads (AOI 3): The proposed action is to reroute the traffic away from the adits and highly affected areas. This will be accomplished by closing those roads adjacent to adits and other mine features, and waste rock piles.

Site restoration may include the backfilling of excavated areas with clean soil and/or re-contouring to establish stability and minimize runoff of soils in Site.

The cleanup levels for this AOI (3) are:

COC	Cleanup Level
<b>ATV Roads</b>	
External gamma radiation	42 $\mu$ R/hour

## 2. Contribution to remedial performance

The proposed response action is consistent with any long-term remedy: eliminating or reducing the direct exposure to external gamma radiation, ingestion, inhalation, dermal contact and surface water pathways. No further response action is anticipated at the Site. However, based upon available information, the present removal action will not impede or affect a future response action if one is deemed necessary.

## 3. Engineering Evaluation/Cost Analysis (EE/CA)

The Evaluation/Cost Analysis (EE/CA) for the Workman Creek Watershed Uranium Mines Watershed, located in the Administrative Record, documents the alternative actions considered for this non-time critical removal action. The EE/CA was completed on October 13, 2008. A Technical Response to Comments document provides a written response to significant comments on the EE/CA. All supporting documentation is in the Administrative Record.

## 4. Applicable or relevant and appropriate requirements (ARARs)

Section 300.415(j) of the NCP requires that removal actions under CERCLA section 104 and pursuant to CERCLA section 106 attain applicable or relevant and appropriate requirements (ARARs) to the extent practicable considering the exigencies of the situation. ARARs may form the basis of removal action objectives for the Site. Finally, ARARs help agencies determine how "clean is clean" at a site and are a guide in remedy implementation.

ARARs are either applicable or relevant and appropriate. Applicable requirements are those cleanup standards, standards of control, or other substantive environmental protection requirements, criteria or limitations promulgated under federal or state environmental laws that specifically address a hazardous substance, pollutant, contaminant, cleanup action, location, or other circumstance found at a CERCLA site. Applicable requirements are those that an agency would have to comply with by law if the same action was taken using legal authorities other than CERCLA. Relevant and appropriate requirements are those cleanup standards that, while not

streamlined risk evaluation was completed by identifying the COCs and comparing their concentrations to potential chemical-specific ARARs and/or risk-based guidelines or criteria, e.g., state soil standards, preliminary remediation goals, and soil screening levels. The risk-based chemical concentrations resulting from the Site streamlined risk evaluation are generally more conservative than chemical-specific ARARs.

Arizona Water Quality Criteria provides designated uses for Workman Creek headwaters to the confluence with Reynolds Creek. These uses are aquatic and wildlife cold water (A&Wc), full-body contact (FBC), fish consumption (FC), agricultural irrigation (AgI), and livestock watering (AgL). The same designated uses apply to the segments of creek from Reynolds to Salome, and from Salome to the in-stream terminus. Water quality in these stream segments did not exceed any of the criteria established to protect the designated uses. Therefore, the Forest Service has determined that Arizona Water Quality Criteria are not ARARs for this Site.

#### **Chemical-Specific ARARs for Soils:**

The chemical-specific ARARs for soils are the Arizona Soil Remediation Levels for Non-residential uses (heavy metals) and the EPA Soil Screening Levels (for Radium-226).

#### **Action-Specific ARARs:**

The proposed response action includes on-Site consolidation. For these actions, the key action-specific ARARs include state requirements for the control of storm water and fugitive dust.

Certain provisions of the State of Arizona hazardous and solid waste regulations are relevant and appropriate.

The proposed response action is comprised primarily of construction activities which will require the use of small haul trucks and heavy equipment for the excavation of the waste source, the re-routing of All Terrain Vehicle roads, and the closure of the adits. Road reconstruction will be kept to the minimum level necessary for access during construction.

#### **Location-Specific ARARs:**

The Endangered Species Act, the National Historic Preservation Act, and the Archeological and Historic Preservation Act are applicable to this Site.

### **5. Project Schedule**

Once the Forest Service completes the design and engineering for the removal action, the construction contractor will begin in the fall of 2010 and complete by the summer of 2011. The construction activities for the proposed plan will require approximately 180 on-Site days to complete.

#### **B. Estimated Costs**

The estimated cost to implement the proposed action is \$ 600,000, which includes design and engineering costs.

### **VI. EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN**

Given the Site conditions, the nature of the hazardous substances documented at the Site, and the potential exposure pathways to visitors and employees, actual or threatened releases of hazardous substances from the Site, if not addressed may present an imminent and substantial endangerment to public health, or welfare, or the environment.

#### **VII. OUTSTANDING POLICY ISSUES**

No outstanding policy issues with the Site have been identified at this time.

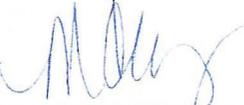
#### **VIII. ENFORCEMENT**

There are no viable Potentially Responsible Parties (PRPs) to address this non-time critical removal action. USDA's Hazardous Materials Management Division concurred in this conclusion for the Site through memoranda dated August 2, 2007.

**IX. RECOMMENDATION**

This decision document represents the selected Removal Action for the Workman Creek Uranium Mines Site on the Pleasant Valley Ranger District of the Tonto National Forest, Arizona, developed in accordance with CERCLA and the NCP.

Conditions at the Site meet the NCP section 300.415(b)(2) criteria for a removal and I recommend your approval of the proposed Removal Action.

Recommended By:  ANNE P. FISCHER P.E. On-Scene Coordinator	Date: 9/22/10	Concur:  DONAL LUHRSEN District Ranger	Date: 9/21/10
Concur:  GENE BLANKENBAKER Forest Supervisor	Date: 9/27/10	Concur:  MARIA A. MCGAHA, P.E. Regional CERCLA Coordinator	Date: 10/4/10
Concur:  DANNY MONTOYA Regional Engineer	Date: 10/4/10	Approved By:  CORBIN NEWMAN Regional Forester	Date: 10/4/2010

Cc:  
 Anne Fischer, Arizona Statewide On-Scene Coordinator  
 Donal Luhrsen, Pleasant Valley Ranger District Ranger  
 Gene Blankenbaker, Tonto National Forest Supervisor  
 Rita Skinner, Regional Office, Appeals and Litigation  
 Karyn Harbour, Forest Geologist  
 Maria McGaha, Regional Environmental Engineer  
 William Medina, Assistant Regional Environmental Engineer  
 Mary Ann Joca, USDA OGC Albuquerque  
 Mike Hope, USDA OGC Denver  
 Holly Flinau, USDA HMMG  
 Kathleen Adam, WO Engineering  
 Workman Creek Uranium Mines Mailing List  
 Administrative Record

***TECHNICAL RESPONSE TO COMMENTS  
WORKMAN CREEK URANIUM MINES (SITE)  
Engineering Evaluation/Cost Analysis Report***

*Tonto National Forest  
Pleasant Valley Ranger District*

*Prepared By:*

*USDA Forest Service  
Southwestern Region*

July 20, 2010

## INTRODUCTION

The United States Department of Agriculture, Forest Service (Forest Service) has prepared this Technical Response to Comments (TRC) Report to address comments received on the Engineering Evaluation/Cost Analysis (EE/CA), Workman Creek Uranium Mines (Site), Tonto National Forest, Arizona, which was made available to the public for review and comment on January 22, 2009.

The Forest Service is exercising its authority as lead agency pursuant to 42 U.S.C. 9604(a); Executive Order 12580, as amended; and 7 C.F.R. 2.60(1)(39) for this Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) action. As part of a Non-Time Critical Removal Action, an EE/CA was prepared in accordance with 40 CFR 300.415(b)(4). The EE/CA was prepared by Weston Solutions and was completed in October 2008.

On January 28, 2009 a legal notice of availability of the EE/CA was published in the *Mesa Tribune* and the *Arizona Silver Belt*. Comments were accepted until March 1, 2009. In addition to the press release, a notice of availability was sent to the Environmental Protection Agency Region 9, Arizona Game and Fish Department, Arizona Department of Environmental Quality, US Fish and Wildlife Service, Federal, State, Local and County Officials and interested public.

The Forest Service received significant comments in response to the notice of availability. This Technical Response to Comments Report will address these comments.

### **COMMENT 1 – Arizona Reform**

To make this clean-up effort cost effective, the area involved in the clean-up should be withdrawn from mineral entry and any current claims should be closed. It makes little economic sense to spend taxpayer money to clean up an abandoned mine if someone can turn around, stake another mining claim, and make another mess. There are additional reasons that the area should be withdrawn from mining other than pure economics. It's a very scenic, popular area with recreationists that should not be further degraded by uranium mining.

### **FOREST SERVICE RESPONSE**

Forest Service policy is to foster and encourage private enterprise in the development of economically sound and stable industries, and in the orderly and economic development of domestic resources to help assure satisfaction of industrial, security, and environmental needs. Minerals are part of the agency's multiple-use policy.

Any future exploration and mining operations conducted on the Forest under the 1872 Mining Law will be properly administered and bonded for full reclamation under our 36 CFR 228 Subpart A regulations for locatable minerals. It has been standard policy since these regulations were published in 1974 to require full reclamation bonding for mining plans of operation.

### **COMMENT 2 – Arizona Reform**

Every effort should be made to identify and hold responsible for their actions current and/or former owners of these mines to save taxpayers money. Only if, after a diligent search for responsible parties, no private entities can be found to be responsible for the clean-up should the bill be footed by taxpayers.

### **FOREST SERVICE RESPONSE**

The Forest Service has an Enforcement First policy where every effort is made to identify and pursue responsible parties for their actions. The Forest Service prepared a Potentially Responsible Party search report where databases and other tools are used to identify responsible parties at the Site. In many cases of abandoned mines, the responsible companies no longer exist, miners have passed away, or the responsible party is financially unable to pay for a cleanup. For this Site, USDA's Office of the General Counsel determined that there were no liable or viable responsible parties; therefore, federal funding was identified to address the potential threats to human health and the environment.

### **COMMENT 3 – Arizona Reform**

We would rather see the contaminated material removed from the Forest and disposed of in an approved facility, but understand that with so few disposal sites and the great distance involved in transporting material to existing disposal sites that this is economically unfeasible. We instead hope and trust that the methods outlined in this report will protect the public and wildlife. We would advise the Forest Service to build in long term monitoring of these sites.

### **FOREST SERVICE RESPONSE**

The Forest Service has evaluated the alternatives presented in the EE/CA. The off-site disposal alternative is not cost effective due to the associated transport and landfill fees.

The Forest Service agrees that there are few facilities, and none in Arizona, that would likely accept the waste. Transporting the material in trucks on the dirt road towards Globe or Pleasant Valley could be a serious safety hazard for other vehicles on the many curves. All care will be taken to properly cover the material to avoid direct contact, water will be diverted around the disposal area to reduce erosion, and the cover material will be seeded with native vegetation. The access road to the disposal area will be closed to further reduce contact.

The Forest Service does have an established monitoring program for removal action conducted under CERCLA.

#### **COMMENT 4 – Arizona Reform**

We urge the Forest Service to consult with Native American Tribes to make sure that the cleanup methods and approach are acceptable and that every effort be made to protect and preserves any remaining cultural heritage.

#### **FOREST SERVICE RESPONSE**

The Forest Service did notify Native American Tribes of the availability of the EE/CA report.

#### **COMMENT 5 – Arizona Reform**

We urge the Forest Service to monitor and protect wildlife to the utmost during the proposed clean-up efforts. We understand that wildlife surveys have taken place, but we urge the Forest Service and its contractors to remain vigilant during the cleanup.

#### **FOREST SERVICE RESPONSE**

The Forest Service shall comply with environmental laws for the protection of human health and the environment, including wildlife. A Forest Service biologist will be present during cleanup work and will be available for any issues that may arise during the work.

#### **COMMENT 6 – Arizona Department of Environmental Quality**

The Forest Service received a letter from Arizona Department of Environmental Quality (ADEQ) in response to a request for comment on the Workman Creek Mine Site Engineering Evaluation/Cost Analysis (EE/CA) and recommended removal actions. The letter quotes “ADEQ fully supports the recommended removal actions for the ATV Roads (Alternative 3), Campgrounds (Alternative 4), and Mine Groups (Alternative 2). These removal alternatives will protect human health, aquatic life, and wildlife.

ADEQ anticipates that the U.S. Forest Service (USFS) will follow the recommended Applicable or Relevant and Appropriate Requirements (ARARs) set forth in the EE/CA, Appendix B. Although Workman Creek has not been designated as a Domestic Water Source (DWS), ADEQ supports the USFS service decision to use the 0.03 µg/L DWS water quality standard for uranium as a basis for characterizing the current conditions of the creek. Historically the ADEQ Ambient Water Quality Monitoring Program has sampled Workman Creek above the site near the falls. ADEQ data includes field measurements, inorganic, nutrient, total and dissolved metal results, but does not contain any radionuclide data.

Special consideration should be given to the design of the campground and mine group onsite disposal cells to ensure that the potential risk of human exposure and the contamination of surface water or groundwater are minimized. Additional investigation may be warranted to identify the sources of the drain pipes (PVC drain pipe below Little Joe 4, Photograph No. 88), seeps (Drainage from Hope 2 and 3 above runs down

through the Haulage Adit opening, Photograph No.35), and pools (Jon Adit pool, Table C1) referenced in the EE/CA. These may be potential sources of contamination (as indicated the Jon Adit pool results) and continue to degrade water quality after the completion of the proposed remedial actions.”

#### **FOREST SERVICE RESPONSE**

The Forest Service appreciates ADEQ’s comments and support for the project. The selected remedy will be documented in the Removal Action Approval Memorandum for Workman Creek Uranium Mines Site.

The designated uses for Workman Creek are aquatic and wildlife (coldwater), full body contact (FBC), fish consumption (FC), agricultural irrigation AgI, and agricultural livestock watering (AgL). There are no EPA or ADEQ regulatory standards for these designated uses for uranium total or dissolved. The dissolved uranium standard for Drinking Water Supply (DWS) was included in the EE/CA document for information and as an indicator of hazard, not as an enforceable standard. Only the two samples from pond water near the Jon Adit exceeded the indicator level for DWS.

Site visits determined that the primary source of water for the pools at the Jon Adit is water flowing down the original channel above the entrance to the adit. Observations of the old channel leading to the adit have lead to conclusions that the miners dug out the channel, possibly mining the excavated material, then began underground workings when the excavation became too deep. The channel does not effectively drain rainwater and creek flow so water ponds near the adit. On several occasions Forest Service personnel have observed water flowing from the original channel above and to the left of the adit. This water pours over the cliff and into the depression in front of the adit. On these occasions, water was not seen flowing from the adit. The proposed cleanup work includes closing the adit and restoring proper drainage in the area.

The photograph label on the Hope Haulage Adit was misleading. Water from the small watershed above the Hope Adit flows down the drainage and pours over the rock ledge above the Hope Haulage Adit. Water then continues to flow down the drainage. The adit floor is visible through a small opening in the wooden closure structure and is well below the level of the material piled in front of the wooden structure. Water does not flow out of the adit.

ADEQ noted a photograph in the EE/CA of a small pipe with flowing water near the Little Joe #4 Adit. Forest Service investigated the situation and determined that the pipe is linked to a seep on an embankment above and to the left of the adit. The pipe does not appear to have anything to do with the adit. The actual purpose of the pipe is unknown, but the Forest Service speculates that miners may have tapped the seep for a water supply.

#### **COMMENT - White Mountain Apache Tribe**

The White Mountain Apache Tribe reported that the project is within an area of probable cultural or historical importance to the Tribe. They prefer Alternative 3 for the ATV Roads, Alternative 4 for the Campgrounds and Alternative 2 for the Mines group. They determined that the proposed action will not have an effect on the White Mountain Apache tribe’s Cultural Heritage Resources and/or historic properties. If construction activities should encounter human remains and/or funerary objects, the tribe asks that all activities are to be stopped and proper authorities notified.

#### **FOREST SERVICE RESPONSE**

The Forest Service respects the request of the White Mountain Apache Tribe to cease operations in the event of discovering human remains and/or funerary objects. Work will be stopped in the event of a discovery and the Forest Service Archeologist will be notified immediately.

**COMMENT - Hopi Tribe**

The Hopi Tribe claims cultural affiliation prehistoric cultural groups on the Tonto National Forest. They find it incongruous that the Forest Service cannot deny uranium mining yet can clean up the sites afterwards. If any prehistoric archaeological sites are found as a result of this project, the Tribe wants to be notified and all reports copied to them.

**FOREST SERVICE RESPONSE**

The Forest Service respects the request for notification of findings of a prehistoric cultural nature.



MINING & ENVIRONMENTAL CONSULTANTS, INC.  
8805 W. Union Hills Drive, Suite 201  
Peoria, AZ 85382  
(623) 376-6435  
[www.miningengineering.com](http://www.miningengineering.com)

February 21, 2005

Pleasant Valley District, Tonto National Forest  
P.O. Box 450  
Young, AZ 85554

ATTN: Mr. Dave Frew, Recreation, Lands and Minerals

Reference: Plan of Operations – Workman Creek

Dear Mr. Frew:

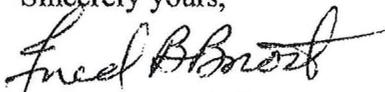
Thank you again for your hospitality for our meeting on February 2.

Enclosed is a revised Plan of Operations for Mining Activities for the Cooper Minerals/Ashworth Explorations Workman Creek Project near Young, Arizona. This revised plan is to replace the plan submitted November 15, 2004. Changes include the use of a more portable drill, an ATV or horse to transport the drill and supplies to the drill pads, and far less work to improve the access roads. As with the previous plan, all of the disturbance – drill pads and access roads, will be entirely on areas disturbed by a previous drilling program.

As discussed at our February 2 meeting, the biological assessment will be done by an approved consulting firm.

Please feel free to contact me either by phone or email, [fbrost@cox.net](mailto:fbrost@cox.net), if you have questions or need additional information.

Sincerely yours,



Fred B. Brost, P.E.  
President

Cc: Ms. Karyn Harbour, Minerals Administrator, Tonto N.F., with enclosure  
Mr. Clive Ashworth, President, Ashworth Explorations Ltd., with enclosure  
Mr. Nick Barr, N. Barr & Assoc., with enclosure

**PLAN OF OPERATIONS FOR MINING ACTIVITIES  
ON NATIONAL FOREST SYSTEM LANDS**

The use of the form is optional. Refer to 36 CFR 228.4 for more details regarding information for a Plan of Operations

Submitted by: Fred B. Brest Signature Agent Title 07/21/05 Date  
(mm/dd/yy)

Plan Received by: \_\_\_\_\_ Signature \_\_\_\_\_ Title \_\_\_\_\_ Date  
(mm/dd/yy)

**I. GENERAL INFORMATION**

- A. Name of Mine/Project: Workman Creek
- B. Type of Operation: Exploration drilling  
(lode, placer, mill, exploration, development, production, other)
- C. Is this a (new/continuing) operation? (check one). If continuing a previous operation, this plan (replaces/modifies/supplements) a previous plan of operations. (check one)
- D. Proposed start-up date (mm/dd/yy) of operation: 06/01/05
- E. Expected total duration of this operation: 7-10 days
- F. If seasonal, expected date (mm/dd/yy) of annual reclamation/stabilization close out: \_\_\_\_\_
- G. Expected date (mm/dd/yy) for completion of all required reclamation: 07/01/05

**II. PRINCIPALS**

- A. Name, address and phone number of operator: Clive Ashworth, Ashworth Explorations Ltd, 4491 Marine Drive, West Vancouver, BC Canada V7W 2N8 (604) 928 9201
- B. Name, address, and phone number of authorized field representative (if other than the operator). Attach authorization to act on behalf of operator. Nicholas Barr, N. Barr & Associates, PO Box 6688, Apache Jct., AZ 85278 (480) 671-1035
- C. Name, address and phone number of owners of the claims (if different than the operator): Cooper Minerals, Inc. 635 E. Plum Lane, Reno, NV 89502 (775) 323-5282 (Reno) (604) 908-9201 (Vancouver)

(If more space is needed to fill out a block of information, use additional sheets and attach form)

D. Name, address and phone number of any other lessees, assigns, agents, etc., and briefly describe their involvement with the operation, if applicable:

*Mining & Environmental Consultants, Inc. 9514 W. Willowbrook Dr.  
Sun City, AZ 85373 - Permitting consultants/agents*

**III. PROPERTY OR AREA**

Name of claim, if applicable, and the legal land description where the operation will be located.

AMC#	Name	Section	Township	Range
<i>360882</i>	<i>WC 13</i>	<i>19</i>	<i>6N</i>	<i>14E</i>
<i>360909</i>	<i>Lucky Stop 10</i>	<i>30</i>	<i>6N</i>	<i>14E</i>

**IV. DESCRIPTION OF THE OPERATION SEE ATTACHED SHEETS**

A. **Access.** Show on a map (USGS quadrangle map or a National Forest map, for example) the claim boundaries, if applicable, and all access needs such as roads and trails, on and off the claim. Specify which Forest Service roads will be used, where maintenance or reconstruction is proposed, and where new construction is necessary. For new construction, include construction specifications such as widths, grades, etc., location and size of culverts, describe maintenance plans, and the type and size of vehicles and equipment that will use the access routes.

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B. **Map, Sketch or Drawing.** Show location and layout of the area of operation. Identify any streams, creeks or springs if known. Show the size and kind of all surface disturbances such as trenches, pits, settling ponds, stream channels and run-off diversions, waste dumps, drill pads, timber disposal or clearance, etc. Include sizes, capacities, acreage, amounts, locations, materials involved, etc.

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*(If more space is needed to fill out a block of information, use additional sheets and attach form)*

## IV. DESCRIPTION OF THE OPERATION

**A. Access.** The drill, water and supplies will be transported to trailheads along Workman Creek Road by pick-up truck. The drill, water and supplies will be transported from the trailheads to the drill pads either by small quad ATV's (Bombardier Traxter 650 or similar) if approved, or by horse. In either case, the disassembled drill will be pulled on a narrow skid made for the purpose. About 48" of road width is required for either the ATV or horse and skid.

Access routes are along existing roads (see attached maps). The route to the pads north of Workman Creek is approximately 2500' (road distance) from the trailhead. Work is required to:

- 1) remove hillside slough and spread it on the road surface at several points
- 2) remove a large dead tree that has fallen across the road about 1000' from Workman Creek Road
- 3) trim branches intruding into the roadway at a few points.

The route to the pads south of Workman Creek is approximately 3600' (road distance) from the trailhead. Work is needed to:

- 1) remove hillside slough and spread it on the road surface at a few points
- 2) temporarily move one or two boulders at the barricade located about 600' from Workman Creek Road
- 3) move a few small felled trees lying across the road
- 4) trim branches intruding into the roadway at as few points
- 5) provide a temporary crossing at Workman Creek.

Because the project is of short duration, no maintenance is planned. Maintenance to keep the road open will be done if the need arises. Culverts are not required.

The above described work will be done by hand labor. Hand saws or a chainsaw (if permitted) will be used to trim branches and cut felled trees. The boulders will be rolled aside using a block and tackle.

**B. Map, Sketch or Drawing.** Access routes are shown on the attached maps. The drill pads are shown on the attached sketches. Runoff diversion, timber disposal, etc. will not be needed. There are no streams or springs in the vicinity of the drill pads. Workman Creek will be crossed using a temporary plank bridge to minimize disturbance of the creek bed.

**C. Project Description.** The purpose of the project is to confirm a large uranium orebody explored by Wyoming Minerals (Westinghouse) in the 1970s.

The first phase of the project, which is the subject of this Notice/Plan of Operations, is to drill four "twin" holes near existing holes drilled by Wyoming Minerals to confirm the assays reported in the drill data. Two holes are located north of Workman Creek and two south.

Existing roads and drill pads will be used. There will be no new surface disturbance. The drill sites and roads will be reclaimed at the end of the drilling program.

Future phases of the project depend on favorable findings during this first phase. Planned subsequent phases include surface mapping, a scintillometer survey and sampling and testing of mineralized areas. The long-term objective, if economically, technically and environmentally feasible, is the establishment of a uranium mine

The work required for the first phase is establishing access on two existing roads as described above, minor trimming and leveling of existing drill pads, excavation of small (approx. 4' x 4' x 2') settling pits on the pads, drilling and sampling the holes, and closure of the drill pads and roads. The holes to be drilled are described below. All holes will be approximately 5 inches in diameter.

Hole #	Length	Collar Elev	Angle	Northing	Easting
W328	37'	6013'	-45°	1036756'	259849'
W330	93	6026	-45	1036795	259970
W361	207	6029	-90	1032492	259733
W362	179	6047	-45	1032330	259733

This phase of the project is estimated to take approximately seven days.

**D. Equipment and Vehicles.** The following equipment will be used:

A ¾ ton pick-up truck will be used to transport the drillers, drill, water and supplies to and from the trailheads to the drill pads. It will also be used to transport drill core from the trailheads. The truck will be used daily during the program. An average of two trips per day, over a period of about seven days is anticipated.

A chainsaw or hand saw will be used to cut downed trees lying in the roadway and trim branches. About two days use is anticipated.

If permitted, one Bombardier 650 Traxter or similar quad ATV and fabricated skid will be used to pull the disassembled drill, water drums and supplies to the drill pads. If the ATV is not permitted, a horse will be used to pull the skid.

A Hydracore 28 light-weight core drill (see attached brochure) will be used for drilling. This drill is designed for portability and can be broken down into five pieces, the heaviest of which weighs 670 lbs. Four to five days of drilling is anticipated.

**E. Structures.** None

## V. ENVIRONMENTAL PROTECTION MEASURES

**A. Air Quality.** Drilling will be wet. No dust will be generated.

**B. Water Quality.** Fresh water for drilling will transported to the drill pad in drums. Water from the drilling process will be collected in a plastic-lined settling pit and recycled to the drill. Estimated quantity of water required is less than 200 gallons per

hole. No chemicals will be used. Bentonite clay may be used to seal holes during drilling if water loss is excessive.

There will be no runoff or groundwater contamination. Drilling water will be obtained off site.

Drill holes will be filled and closed as described in Section H, below. Water bars on the access roads disturbed by transporting the drill and supplies will be repaired when the road is reclaimed.

**C. Solid Wastes.** In core drilling, a cylinder of rock is cut from the hole by a diamond bit. A small amount of ground-up rock (drill cuttings) is produced in the process of cutting the core. The only solid waste generated will be drill cuttings, mixed with the drilling water. The water and cuttings will be collected in the settling pit, the cuttings settled, and the water recycled to the drill. When drilling is complete, the settled drill cuttings will be shoveled back into the hole as part of the hole closure process. Trash will be collected and removed from the drill pad daily.

**D. Scenic Values.** Slash will be scattered off the road. Reclamation will be done when drilling is complete.

**E. Wildlife.** A Biological Assessment will be done to comply with the Endangered Species Act. Measures recommended to protect wildlife in the survey, by the U.S. Fish and Wildlife Service or the Forest Service will be taken. Contact with wildlife will be avoided.

The drill is powered by a 55 to 100 horsepower diesel engine (depending on availability). A muffler will be used to reduce exhaust noise to less than 85 dbA (SAE test procedure J1169). This noise level is equivalent to a hand saw or noisy vacuum cleaner, according to information published by the League for the Hard of Hearing. If required, muffling boards can be used to reduce noise levels further.

Drilling will not be conducted within 200 feet of live streams. The Workman Creek crossing will be done using a temporary plank bridge.

**F. Cultural Resources.** All work contemplated under this Plan will be done on previously-disturbed roads or drill pads. There will be no new surface disturbance. If cultural resources are found before or during operations, all surface disturbing activity will stop until a professional archaeologist can evaluate the resource.

**G. Hazardous Substances.** The drill will be diesel-fuelled and will have a tank with about 40 gallons capacity. Minor quantities of grease and lubricants will be used on the drill.

The drill will be fuelled before arriving at site, and at Workman Creek Road between drilling of the holes on the north and south sides of Workman Creek. If refueling is

necessary at the drill pad, fuel will be brought to the drill in a drum and pumped into the drill tank. Care will be taken to avoid spills. It is highly unlikely that a reportable quantity of diesel fuel could be spilled, but in that event, measures will be taken to control the spill by berming. The National Response Center will then be contacted (800) 424-8802. Contaminated soil from any leak or spill will be shoveled into drums, removed from site and disposed of at an approved landfill.

**H. Reclamation.** Any clean water remaining will be sprinkled over the drill pad. The settled drill cuttings will be removed from the settling pits and used to partially fill the drill holes. Drill holes will be closed as required by the Arizona Department of Water Resources *Well Abandonment Handbook*. The pit liner will be removed, folded and disposed of at an off-site landfill. Drill pads will be leveled, raked and seeded with a Forest Service approved seed mix. Mulch and fertilizer will be applied if required.

Water bars and barricades will be reestablished on the roads. The roads will be raked and seeded with a Forest Service approved seed mix. Mulch and fertilizer will be applied if required. The plank bridge will be removed from the Workman Creek crossing.



- B. **Bond.** Reclamation of all disturbances connected with this plan of operations is covered by Reclamation Performance Bond No. \_\_\_\_\_, dated (mm/dd/yy) \_\_\_\_\_, signed by \_\_\_\_\_ (Principal) and \_\_\_\_\_ (Surety), for the penal sum of \_\_\_\_\_. This Reclamation Performance Bond is a guarantee of faithful performance with the terms and conditions listed below, and with the reclamation requirements agreed upon in the plan of operations. This Reclamation Performance Bond also extends to and includes any unauthorized activities conducted in connection with this operation.

The bond amount for this Reclamation Performance Bond was based on a bond calculation worksheet. The bond amount may be adjusted during the term of this proposed plan of operations in response to changes in the operations or to changes in the economy. Both the Reclamation Performance Bond and the bond calculation worksheet are attached to and made part of this plan of operations.

Acceptable bond securities (subject to change) include:

1. Negotiable Treasury bills and notes which are unconditionally guaranteed as to both principle and interest in an amount equal at their par value to the penal sum of the bond; or
2. Certified or cashier's check, bank draft, Post Office money order, cash, assigned certificate of deposit, assigned savings account, blanket bond, or an irrevocable letter of credit equal to the penal sum of the bond.

## *VII. TERMS AND CONDITIONS*

- A. If a bond is required, it must be furnished before approval of the plan of operations.
- B. Information provided with this plan marked confidential will be treated in accordance with the agency's laws, rules, and regulations.
- C. Approval of this plan does not constitute certification of ownership to any person named herein and/or recognition of the validity of any mining claim named herein.
- D. Approval of this plan does not relieve me of my responsibility to comply with other applicable state or federal laws, rules, or regulations.
- E. If previously undiscovered cultural resources (historic or prehistoric objects, artifacts, or sites) are exposed as a result of operations, those operations will not proceed until notification is received from the Authorized Officer that provisions for mitigating unforeseen impacts as required by 36 CFR 228.4(e) and 36 CFR 800 have been complied with.
- F. This plan of operations has been approved for a period of \_\_\_\_\_ or until (mm/dd/yy) \_\_\_\_\_. A new or revised plan must be submitted in accordance with 36 CFR part 228, subpart A, if operations are to be continued after that time period.

*(If more space is needed to fill out a block of information, use additional sheets and attach form)*

**VIII. OPERATING PLAN ACCEPTANCE**

I/We have reviewed and agreed to comply with all conditions in this plan of operations including the required changes, modifications, special mitigation, and reclamation requirements.

I/We understand that the bond will not be released until the Authorized Officer in charge gives written approval.

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Operator (or Authorized Representative)

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(Date)  
(mm/dd/yy)

**IX. OPERATING PLAN APPROVAL**

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(Name)

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(Title)

---

(Authorized Officer)

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(Date)  
(mm/dd/yy)

*(If more space is needed to fill out a block of information, use additional sheets and attach form)*

WORKMAN GROUP

GILA COUNTY  
SIERRA ANCHA DIST.  
T6N, R14E, sec 19

REFERENCES:

- See: AEC 172-480, p. 65. In AEC files.  $eU_{308}$  0.13  
See: Open File Report of PP 595, pp. 36, 85, 86, 140-144.  
In AEC files. *SUPPLEMENT*
- See: PP 595, pp. 2, 3, 20, 31, 35, 37, 38, 65, 71, 76, 80, 86,  
87, 88, 91, 102.
- See: USGS Bull. 1046, pp. 417, 440, 441, 445, 446, 470--472.

*Wyoming Minerals (file)*

USGS MF 1162-H

12 5 03 000m

12 5 04 000m

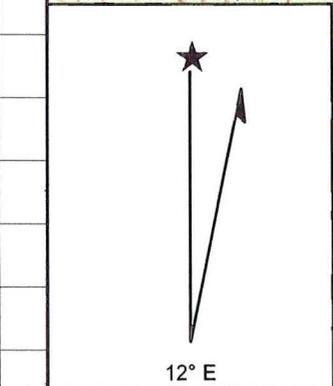
12 5 05 000m

37 45 000m

37 45 000m

37 44 000m

37 44 000m



12° E

12 5 03 000m

12 5 04 000m

12 5 05 000m

Name: AZTEC PEAK  
 Date: 11/11/2004  
 Scale: 1 inch equals 1000 feet

Location: 12 0503834 E 3744418 N  
 Caption: WORKMAN CREEK PROJECT  
 DRILLING PROGRAM

12 5 03 000m

12 5 04 000m

12 5 05 000m

37 45 000m

37 45 000m

37 44 000m

37 44 000m

37 43 000m

37 43 000m

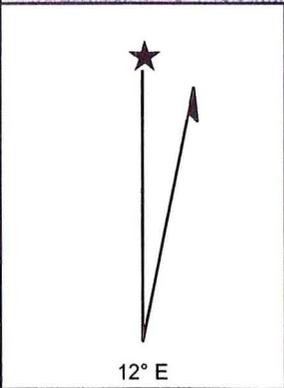
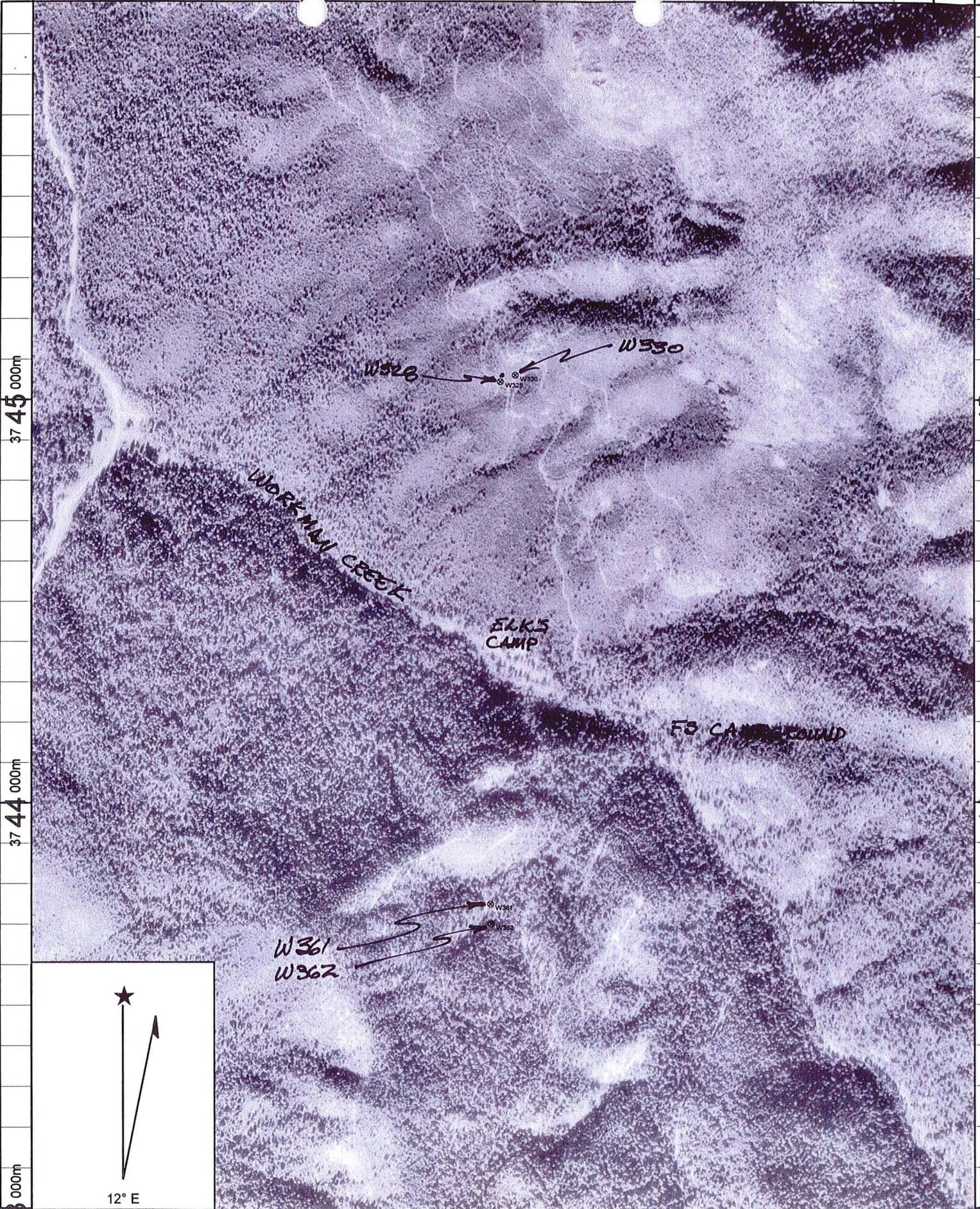
12 5 03 000m

12 5 04 000m

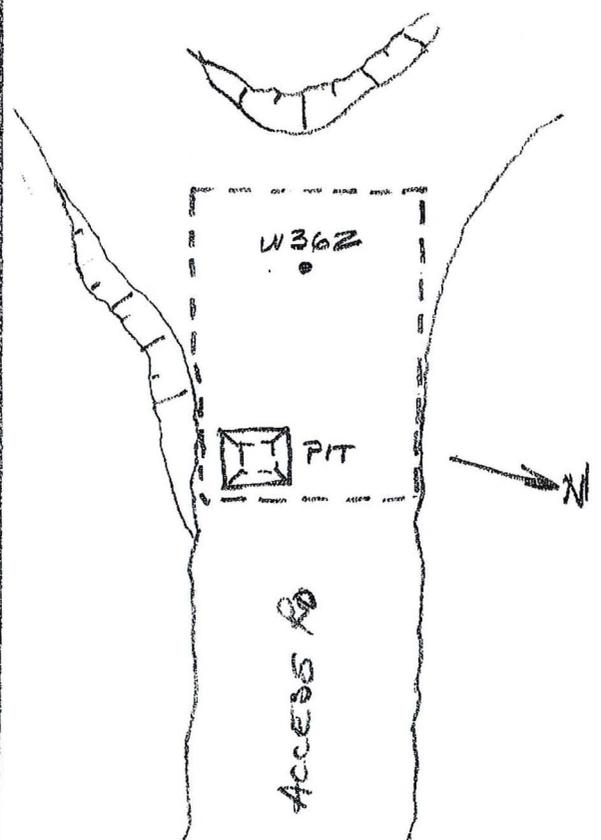
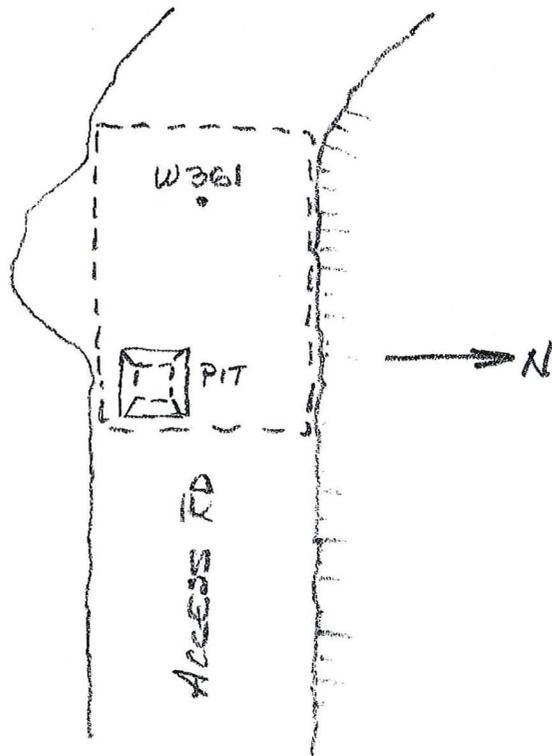
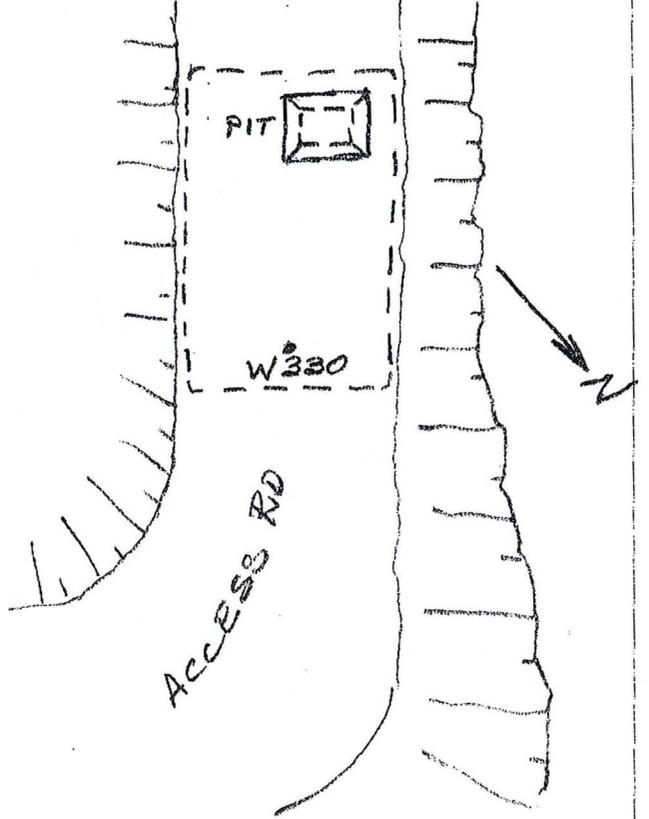
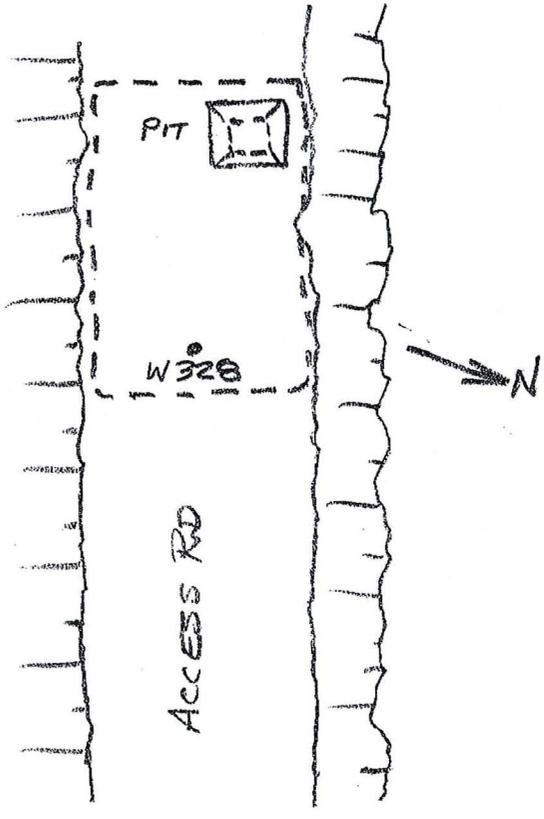
12 5 05 000m

37 43 000m

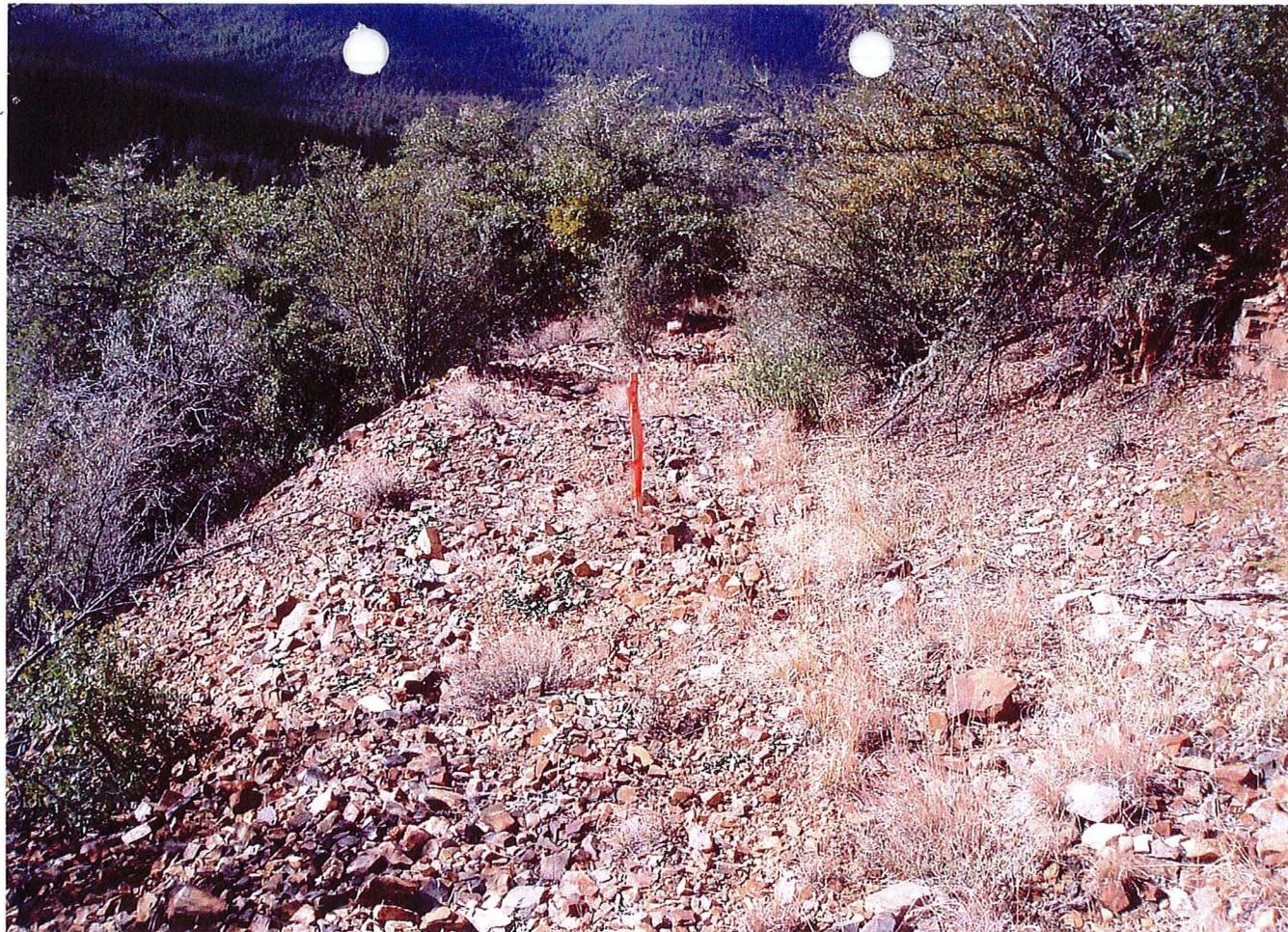
37 43 000m



22-141 50 SHEETS  
22-142 100 SHEETS  
22-144 200 SHEETS



F. FROST 11/12/04  
1" = 10'



W328



W330

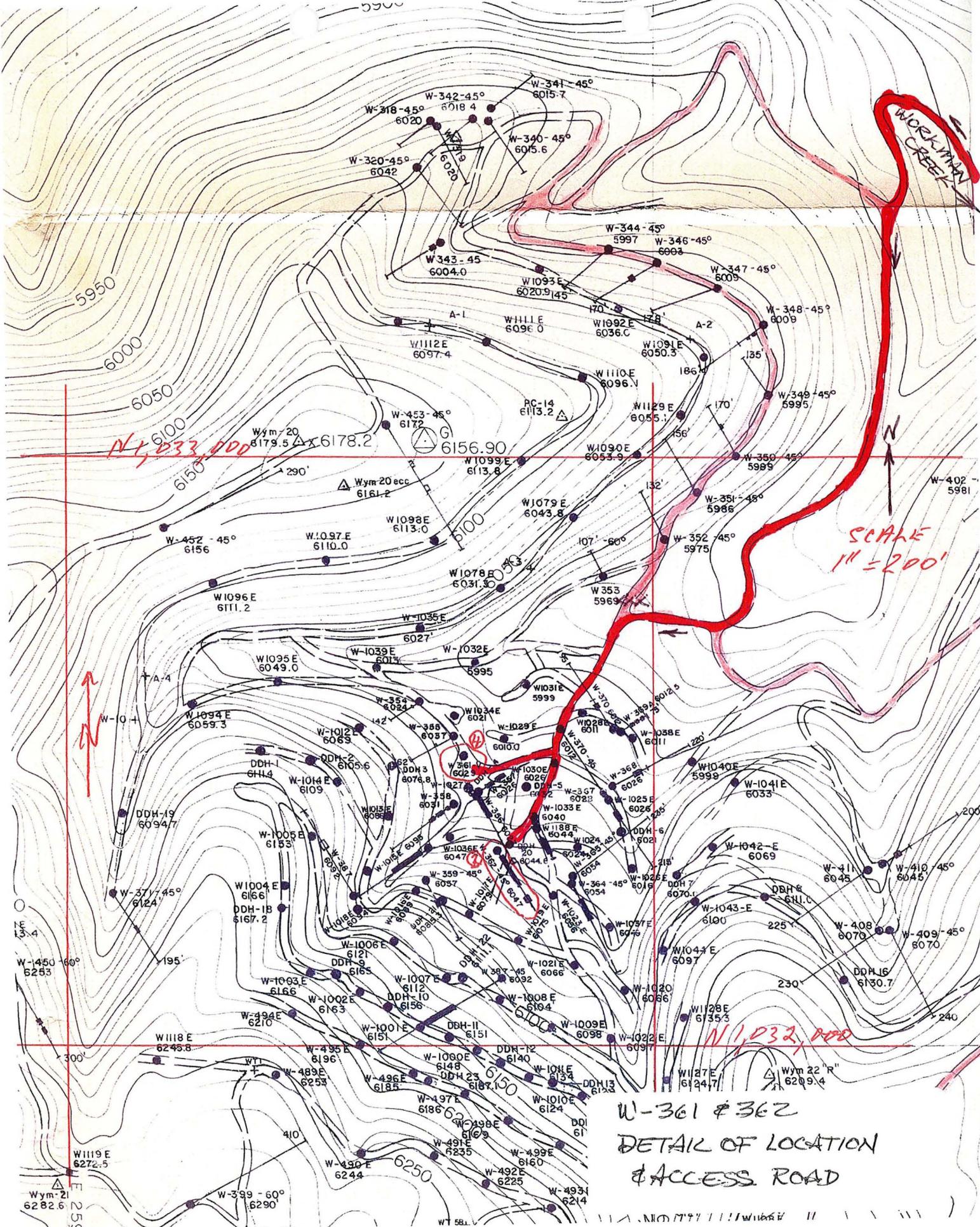


W361



W362





SCALE  
1" = 200'

W-361 & 362  
DETAIL OF LOCATION  
& ACCESS ROAD

N 1,033,000

N 1,033,000

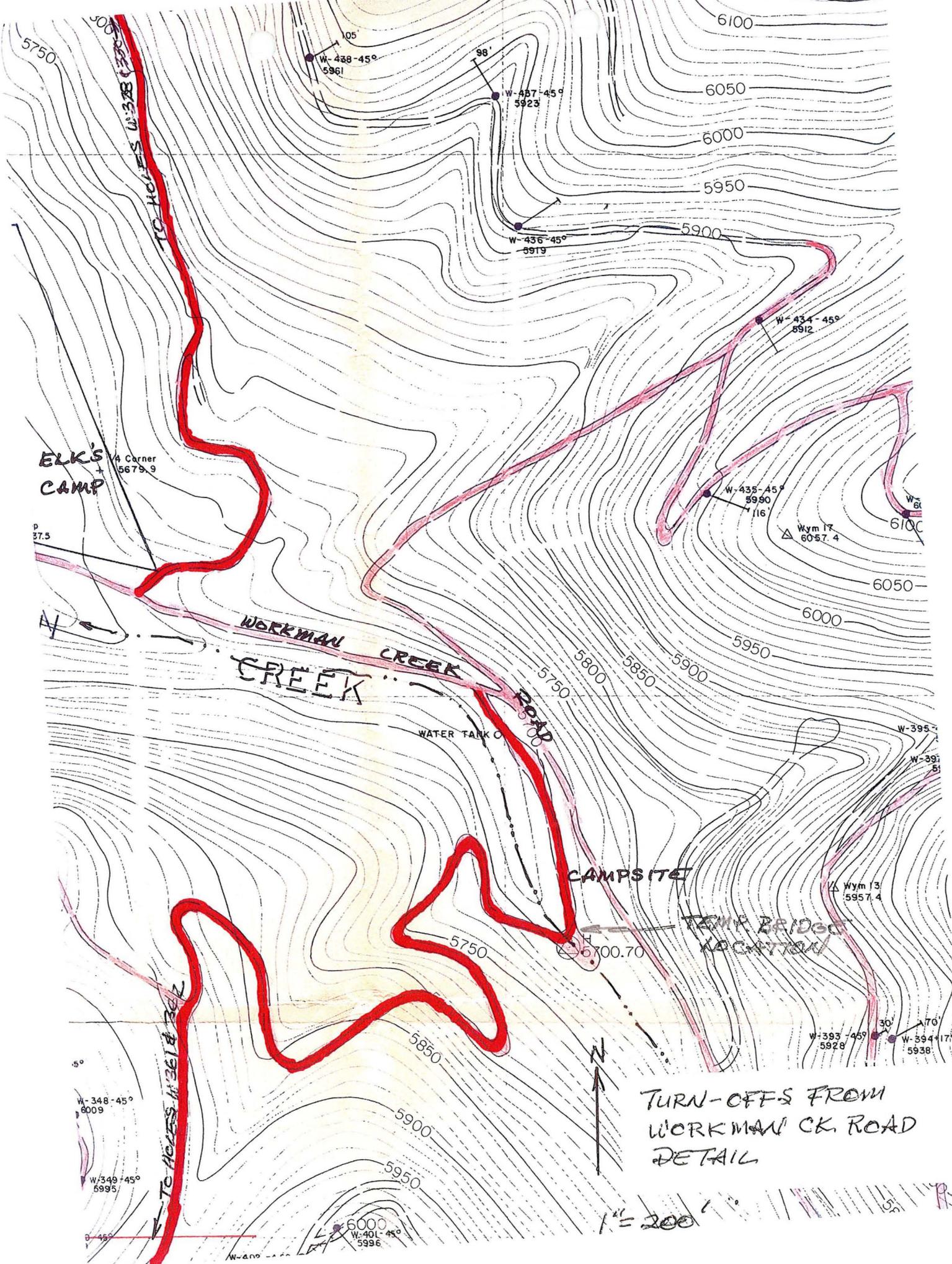
NE 13.4

Wym-21  
6282.6

Wym 22 "R"  
6209.4

WT 58.1

W-361 & 362



TURN-OFFS FROM  
WORKMAN CK ROAD  
DETAIL

1" = 200'

**MINING & ENVIRONMENTAL CONSULTANTS, INC.**

8805 W. Union Hills Dr., Suite 203

Peoria, AZ 85382

Phone and Fax: (623) 376-6435

Email: [fbrost@cox.net](mailto:fbrost@cox.net)

Website: [www.miningengineering.com](http://www.miningengineering.com)

**FAX COVER SHEET**

DATE: May 31, 2005

TO: Mr Dave Frew, Recreation/Lands/Minerals

COMPANY: USFS Pleasant Valley

FAX NO: 928-462-4346

NUMBER OF PAGES INCLUDING THIS PAGE: 2

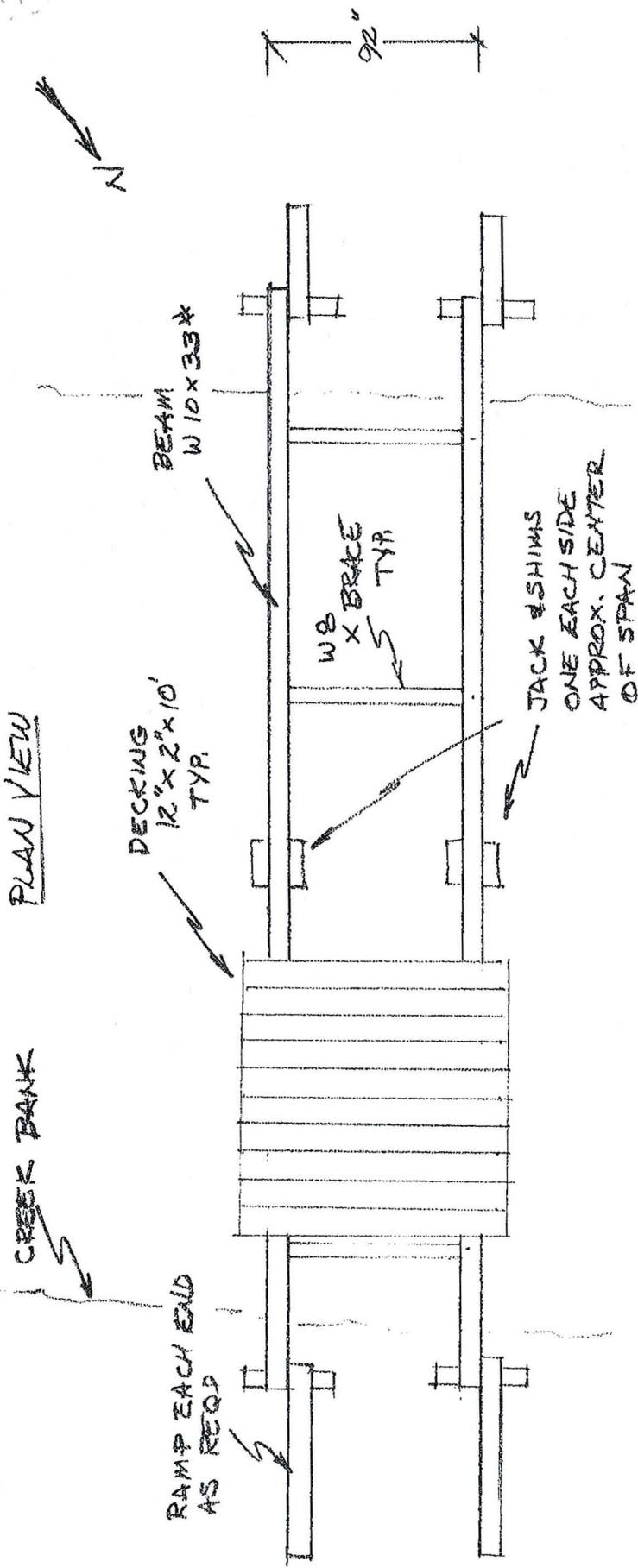
Following, as requested, is a sketch of the temporary bridge for the Workman Creek project.

Please call if you have questions.

Regards,

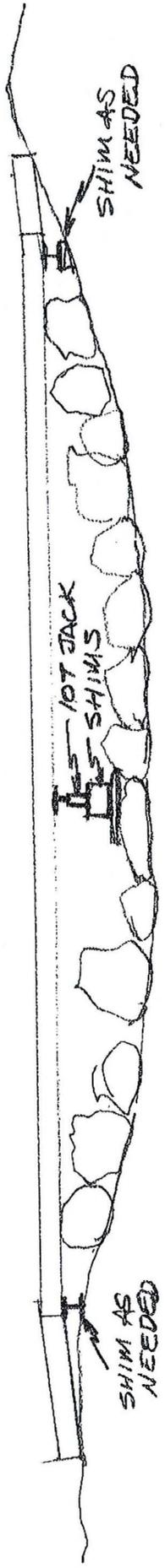
Fred Brost

PLAN VIEW



140' (OR LESS)

ELEVATION VIEW (LOOKING UPSTREAM)



CONCEPTUAL SKETCH  
WORKMAN CK TEMP. BRIDGE  
F. BROST 5/26/05

SCALE 1" = 6'

**Property File Listing**

Location	Project	
Arizona, Gila County	Dripping Springs Project, Workman Creek, 1977	DDH 301-310
Arizona, Gila County	Dripping Springs Project, Workman Creek, 1977	DDH 311-320
Arizona, Gila County	Dripping Springs Project, Workman Creek, 1977	DDH 321-330
Arizona, Gila County	Dripping Springs Project, Workman Creek, 1977	DDH 331-340
Arizona, Gila County	Dripping Springs Project, Workman Creek, 1977	DDH 341-350
Arizona, Gila County	Dripping Springs Project, Workman Creek, 1977	DDH 371-380
Arizona, Gila County	Dripping Springs Project, Workman Creek, 1977	DDH 383-388
Arizona, Gila County	Dripping Springs Project, Workman Creek, 1977	DDH 391-400
Arizona, Gila County	Dripping Springs Project, Workman Creek, 1977	DDH 401-410
Arizona, Gila County	Dripping Springs Project, Workman Creek, 1977	DDH 411-420
Arizona, Gila County	Dripping Springs Project, Workman Creek, 1977	DDH 421-430
Arizona, Gila County	Dripping Springs Project, Workman Creek, 1977	DDH 431-440
Arizona, Gila County	Wyoming Mineral Corp. Dripping Spring Project Feasibility Study for Uranium Mine and Mill M7585 by Dravo Engineering 1980	

I:\COUNTIES\LIBRARY\Collections\HOHNE.DOC 12/31/2001

**WYOMING MINERAL CORP. DATA - URANIUM**

M7585  
WYOMING MINERAL CORPORATION  
DRIPPING SPRING PROJECT  
FEASIBILITY STUDY  
FOR  
URANIUM MINE & MILL

( IN 110 (FN) BOXES )  
2005

**Dravo**

WYOMING MINERAL CORPORATION  
DRIPPING SPRING PROJECT  
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## INTRODUCTION

On August 26, 1980, Wyoming Mineral Corporation (WMC) authorized Dravo Engineers and Constructors to begin a study to determine the capital and operating costs for the mine and mill complex in Gila County, Arizona, known as the Dripping Spring Project. This volume presents the results of that study.

This report is divided into sections as follows:

- I. Introduction and Summary
- II. Mine (includes tailing disposal).
- III. Mill
- IV. Environmental
- V. Cost Estimate

Two areas of ore have been defined and preliminary mining plan has been developed for both. This method uses a combination of open pit and underground mining in both areas. Estimated in-the-ground resource at a cut-off grade of 0.05%  $U_3O_8$  is 4,408,000 tons containing 9,805,000 lbs.  $U_3O_8$ . Identified reserve is estimated at 3,249,000 tons containing 7,495,000 lbs.  $U_3O_8$  and mineable reserves are 3,190,000 tons containing 6,643,000 lbs.  $U_3O_8$ . At a mill recovery of 93%, in the can  $U_3O_8$  should be about 6,178,000 lbs.

Open pit mined ore is estimated to total approximately 2,130,000 tons containing approximately 3,799,000 pounds of  $U_3O_8$  for an average grade of approximately 0.09%. To mine this ore approximately 6,702,000 BCY of associated waste and 11,327,000 BCY of stripping waste must be extracted for a total approximately 18,029,000 BCY of waste material. This yields combined waste to mined ore ratio of approximately 8.46 BXY to one ton of ore sent to the mill.

## Rodinia Minerals Inc. Company Links

(last updated 5 Nov 2004)

### RODINIA MINERALS INC.

#### Shareholders

- 
- 

#### Head Office

**Rodinia Minerals Inc.**  
600 – 580 Hornby Street  
Vancouver, B.C. V6C 3B6  
Canada  
Tel.: +1-604-518-8294, Fax: +1-604-688-9611

> Search [company's SEDAR filings](#) 

---

#### Subsidiaries

(uranium related ones only)

- 100% - [Workman Creek deposit](#), Arizona (to be acquired from Cooper Minerals Inc.)

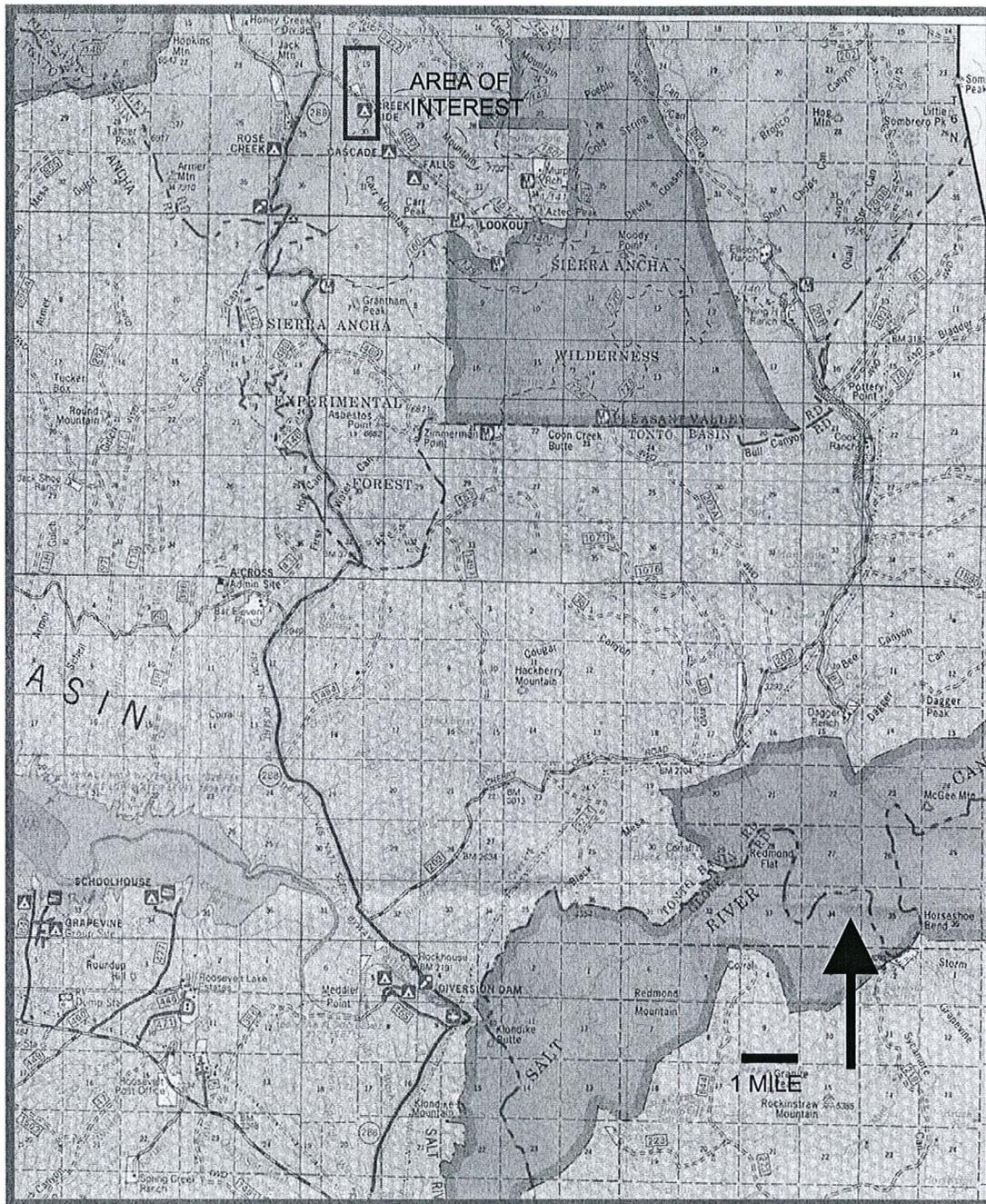


FIGURE 5-1 - ACCESS MAP

( IN PART, COMPLETE REPORT AS PDF FILE  
ON SERVER )

REPORT  
ON  
WORKMAN CREEK URANIUM PROJECT  
GILA COUNTY, ARIZONA

on behalf of

RODINIA MINERALS INC.  
VANCOUVER, B.C.

by

J.H. Montgomery, Ph.D., P.Eng.

October 15, 2004

(Revised February 11, 2005)

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## **1.0 SUMMARY AND CONCLUSIONS**

### **1.1 Summary**

1. Rodinia Minerals Inc. a Vancouver corporation, holds title to 33 unpatented lode claims under agreement with the owners, Mr. Steve van Ert, Mr. Noel Cousins and Cooper Minerals Inc..
2. The claim groups known as Workman North (17 claims) and Workman South (16 claims) are located in Gila County, Arizona. They are located about 30 miles (48km.) north of Miami, Arizona and 85 miles (136 km) ENE from Phoenix, Arizona.
3. The areas of interest lie within the Sierra Ancha Experimental Forest in the Sierra Ancha Mountains with elevations ranging from 6000 feet (1830 meters) to 6400 feet (1950 meters). The Experimental Forest is designated open for use by motorized vehicles.
4. The property is accessible by road from Globe, AZ a distance of about 42 miles (67km.). An extensive network of FWD roads, which were previously for drill access, provide access to most parts of the claims.
5. The Workman Creek property is located within the Transition Zone between the Colorado Plateau to the northeast and the Basin and Range terrain to the southwest. In the general area, elevations range from 5,400 feet (1647 meters) in valley bottoms to 6,400 feet (1950 meters) on the peaks.

The area of interest lies within Zones 1 and 2 of the Arizona Plant Climate Zones. Zone1, the Cold Mountainous Region, has annual

precipitation of 20 to 25 inches (50.8 to 63.5 cm) part of which is snowfall during the winter. Temperatures range between 30°F to 50 F°.

6. Infrastructure - the nearest communities of size are Globe, Claypool, Miami and Superior about 30 miles (48km.) to the south of Workman Creek. Globe is capable of supplying most mining personnel, equipment and supplies.

7. The Dripping Spring uranium deposits were first noted in 1950 but were ignored because of rugged topography, inaccessibility and the difficult forest terrain of Sierra Ancha Mountains. A good network of access roads is now present throughout the project area.

A staking rush took place in 1954 following an airborne radiometric survey conducted by the Federal government.

Major work, including a feasibility study, was done for Wyoming Mineral Corporation by Dravo Engineers and Contractors during 1978-1980. All work ceased and the project was abandoned when the uranium price dropped drastically. The data from this study is still available and may be used along with some confirmation drill holes to recast the reserve estimate to conform with National Instrument 43-101.

8. The Workman Creek uranium deposits are defined as a stratiform accumulation of uraninite and coffinite in the Dripping Spring quartzite. The later intrusion of basalt resulted in low-grade thermal metamorphism and consequent re-crystallization and remobilization of secondary uranium minerals. These occur in sub-horizontal bedding planes and sub-vertical cross-cutting veins.

9. A positive feasibility study was completed in 1980 by Dravo Engineers and Contractors. Their geostatistical estimate of reserves in a preliminary mining plan encompassing both open pit and underground

mining was 4.408 million tons containing 9.8 million pounds of  $U_3O_8$  with an average grade of 0.111%  $U_3O_8$  and a cutoff of 0.05%  $U_3O_8$ . Their calculated recovery of 93% would recover 9.114 million lbs. of  $U_3O_8$ . They proposed a conventional acid leach, solvent extraction and ammonia precipitation process. This estimate was made prior to the implementation of NI #43 -101 and is not compliant with those regulations. ***“None of the historical estimates of tonnage and grade of the Workman Creek uranium deposit comply with NI 43-101 regulations, since they were made long before the implementation of the instrument. The estimates are relevant only for their historical interest and as an indication of uranium mineralization of interest in place. These calculations although believed to be reliable, are historical and do not comply with NI 43-101 standards because they do not meet CIM definitions or use CIM terminology. It is likely that the estimates would fall into the category of indicated mineral resource as set out in NI 43-101.”***

10. A regional geochemical program and an airborne radiometric survey have indicated additional mineralized areas. Some of the drilled areas of mineralization are open ground.

## 1.2 Conclusions

1. The work done on the Workman Creek claims in 1978-80 has shown the presence of a uranium ore-body under the conditions which prevailed at that time.

2. The North Workman Creek and South Workman Creek deposits appear to be parts of the same deposit which was eroded down the centre.
3. The mineralization outcrops on the sides of steep canyon walls thus creating a possibility for some open pit mining.
4. The Workman Creek deposits form the largest uranium source in the general area. From this preliminary study of the huge WMR database, it appears certain that there is a large body of low grade uranium mineralization present and that additional exploration is warranted and will probably increase the resource and provide additional data which will be of benefit in designing mining methods and refining grade estimate.
5. Many of the drill holes are vertical in spite of the observation that mineralization occurs in both subvertical veins and subhorizontal bedding planes. However, angled drill holes, when compared with vertical holes did not result in an improvement in grade.
6. A two phase program of continued exploration and development is recommended. The first phase consists of a compilation and evaluation of the immense Wyoming Mineral Corporation database; twinning of several holes to confirm grade and nature of mineralization; a comparison of radiometric and chemical analyses; and staking of additional claims. The second phase, which is dependent on the results of the first, consists of a detailed geological study to determine more precisely the extent and quality of uranium mineralization. Ore reserve estimates should be recast to conform to 43-101 standards; additional metallurgical tests should be made with some consideration given to solution mining in situ; a feasibility assessment should also be made.

The first phase of the program is estimated to cost US\$250,000 and to take about three months to complete while the second phase will cost US\$550,000 and take about six months to complete.

## **2.0 INTRODUCTION AND TERMS OF REFERENCE**

Rodinia Minerals Inc. of Vancouver, B.C. has retained me to make a study and evaluation of the Workman Creek Uranium Project and, if warranted, to prepare a technical report for them which meets the requirements of National Instrument 43-101. The property, which consists of 33 contiguous mineral claims, is located in Dripping Springs district within Gila County, Arizona. The property lies about 30 miles (48Km) north of Miami, AZ and 85 miles (136Km) ENE from Phoenix, AZ. The total area of the claim block is about 630 acres (255 hectares).

The property has numerous test pits, several short tunnels and more than 400 drill holes. A great deal of work was done on the property during the period 1977 to 1980 by Wyoming Mineral Corporation, a subsidiary of Westinghouse. Preliminary feasibility studies were made but, apparently because of a serious drop in the price of uranium, all operations shut down and the property was later abandoned.

# ARIZONA

## Arizona 1 mine

Size: 385 tonnes U  
Ore grade: 0.55% U

(on standby)

- International Uranium Corp.

## Canyon mine

Size: 770 tonnes U  
Ore grade: 0.76% U

(partially developed)

- International Uranium Corp.

## Pinenut mine

Size: 347 tonnes U  
Ore grade: 0.35% U

(on standby)

- International Uranium Corp.

## Wate property

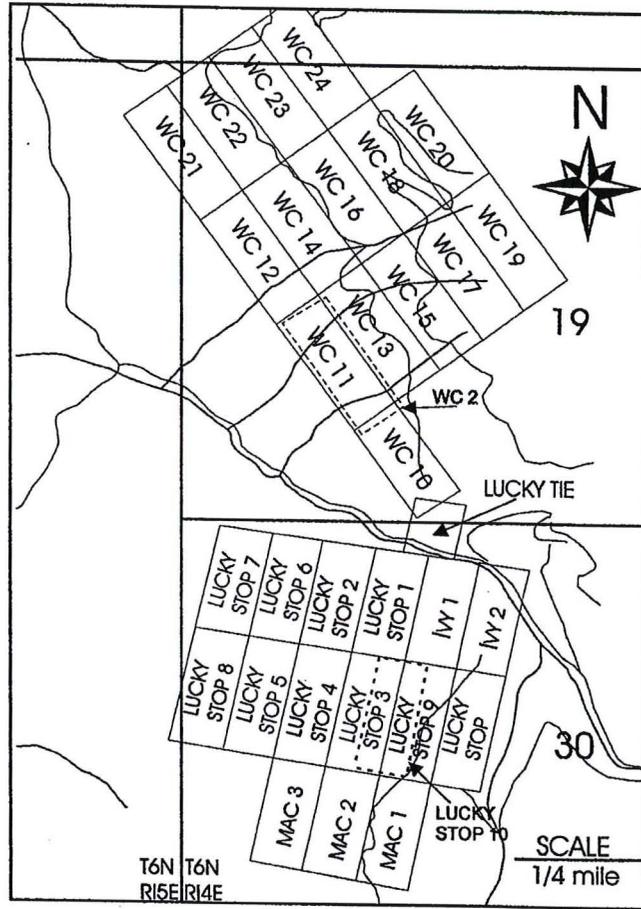
Size: 431 tonnes U  
Ore grade: 0.68% U

- 100% - Clan Resources

## Workman Creek deposit, Gila County

Size: 3773 tonnes U  
Ore grade: 0.093% U

- 100% - Cooper Minerals Inc. (property to be acquired by Rodinia Minerals Inc.)



RODINIA MINERALS INC.

WORKMAN CREEK PROJECT

CLAIM MAP



MCL

PROJECT #: O4CA-2

MARCH 17, 2004

FIGURE 4-4

WORKMAN GROUP

GILA COUNTY  
SIERRA ANCHA DIST.  
T6N, R14E, sec 19

REFERENCES:

See: AEC 172-480, p. 65. In AEC files.  $eU_{308}O_{13}$   
See: Open File Report of PP 595, pp. 36, 85, 86, 140-144.  
In AEC files. *Supplement*

See: PP 595, pp. 2, 3, 20, 31, 35, 37, 38, 65, 71, 76, 80, 86  
87, 88, 91, 102.

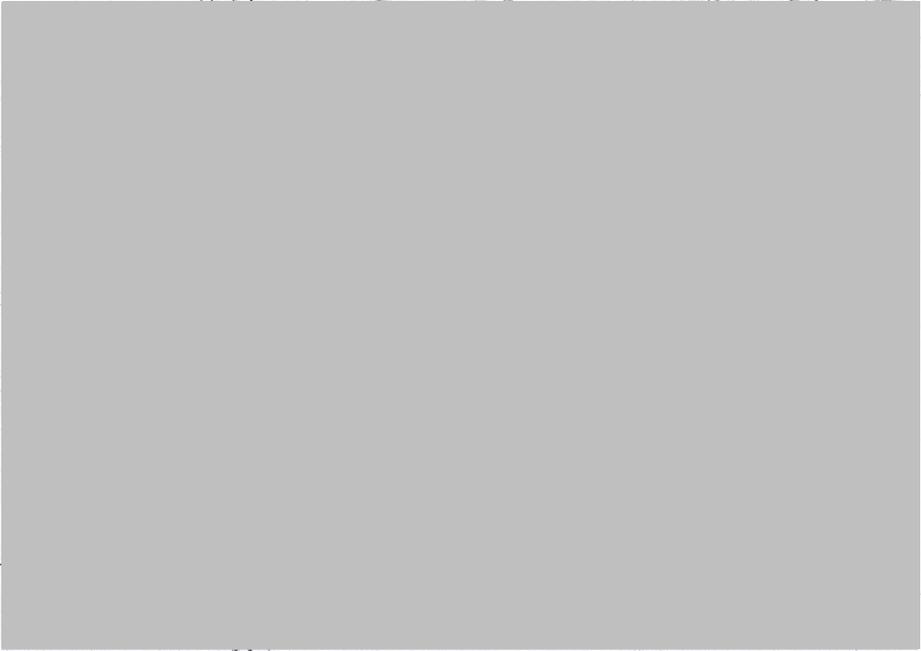
See: USGS Bull. 1046, pp. 417, 440, 441, 445, 446, 470--472.

*Wyoming Minerals (file)*

USGS MF 1162-H

planned from about Wednesday

Wohman Creek Mine Gila County <sup>MS</sup> K.



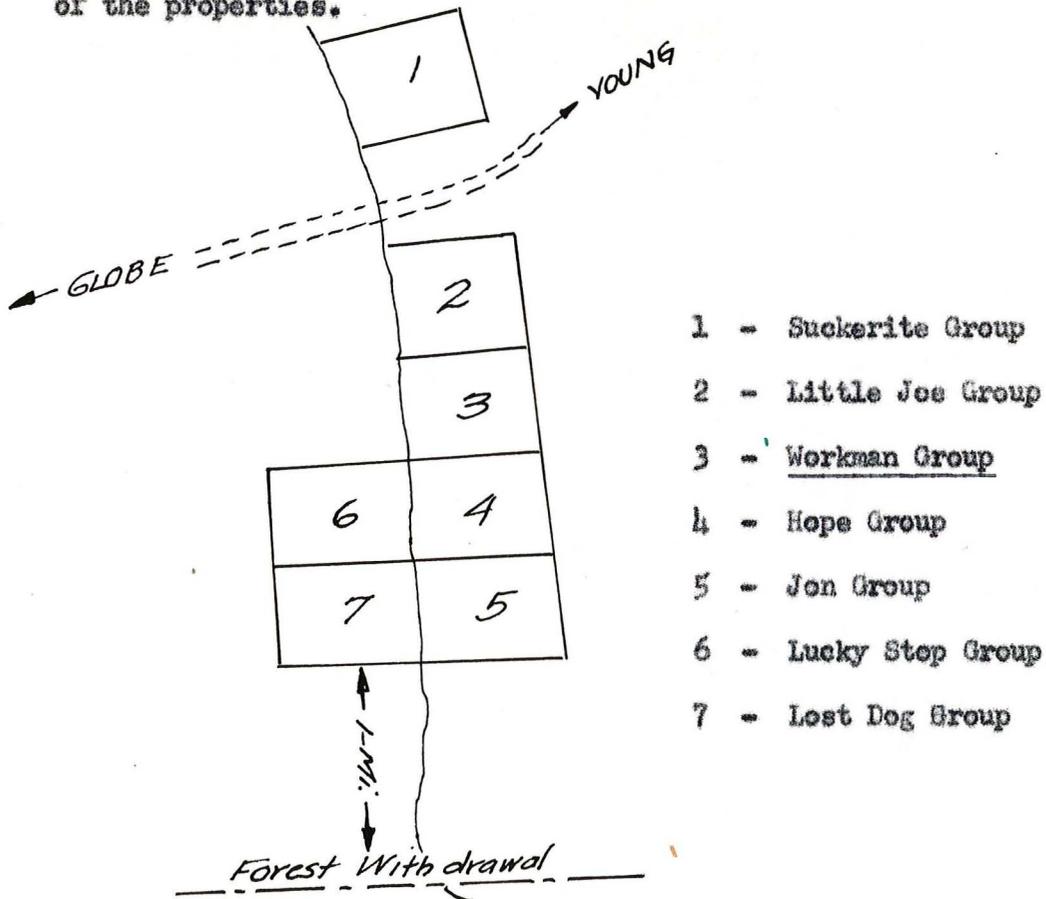
Arizona Silver Belt

3-5-81

May 23, 1957

WORKMAN CREEK URANIUM

B. J. Squire and Lewis A. Smith visited the Workman Creek Area, Thursday, May 23, 1957. The following sketch shows the distribution of the properties.



16 claims

Sec. 19, T. 6 N., R. 14 E.

located in 1954 by Charles and Burnelle Nichols  
Box 752  
Globe, Ariz

DEPARTMENT OF MINERAL RESOURCES

STATE OF ARIZONA

FIELD ENGINEERS REPORT

Mine WORKMAN GROUP ✓ Date May 23, 1957  
District Workman Creek Dist., Gila County ✓ Engineer Lewis A. Smith  
Subject: Workman Creek Uranium ✓ B. J. Squire

Location: T6N, R14E.

Owners: Arizona Continental Uranium Company, Phoenix, Arizona.

Operator: Rusty Moore, Globe, Arizona

The Workman Group was being operated by "Rusty" Moore. He now is uncovering a "hot" spot, with a cat, preparatory to development. The spot appears to be along a fault. Two older workings are being exploited to a limited extent.

According to Moore the recent shipments were about average in grade.