



United States Department of the Interior

NATIONAL PARK SERVICE
Geologic Resources Division
P.O. Box 25287
Denver, CO 80225

IN REPLY REFER TO:

2360

March 24, 2005

Memorandum

To: James C. Woods, Chief, Geoscience and Restoration Branch
Geologic Resources Division

From: Mark S. Ziegenbein, Geologist
Geoscience and Restoration Branch
Geologic Resources Division
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Subject: Trip Report October 18-21, 2004 – Craters of the Moon National Monument, Cinder
Extraction and Restoration Recommendations

SUMMARY

In Craters of the Moon National Monument (Monument), land users, the U.S. Bureau of Land Management and the National Park Service have created volcanic cinder pits, material dumpsites, staging areas, maintenance areas and access roads to provide the raw materials for construction or maintenance projects. These disturbances have created modifications to surface topography, visual impacts, and have removed or altered vegetation and habitat. The park no longer uses these sites and some sites have been inactive for 30 years or longer.

In 2004, the Monument submitted a technical assistance request to the National Park Service, Geologic Resources Division (GRD) requesting the following products:

1. issue identification and evaluation of the cinder borrow site as a disturbed mine land;
2. policy and regulatory compliance guidance;
3. evaluation and development of reclamation alternatives including ecological and landscape design, engineering, and restoration techniques to support a reclamation plan and EA; and
4. evaluation of funding, compliance and contract documents.

In addition to providing the above assistance, GRD staff will provide advice and ideas on potential in-park extraction of cinders for NPS maintenance and construction projects, and recommendations for additional research or additional data needed at each site.

In response to the above technical assistance request, Mark Ziegenbein (Geologist, Geologic Resources Division) visited the Monument on October 18 - 21, 2004. While at the Monument, Mark met with the Monument Superintendent, natural resources staff, maintenance staff and the BLM Monument

Manager. This report provides a brief summary of the meetings and fieldwork conducted during this visit, and recommendations for future work.

The tasks or information needed to support future decisions and to resolve the extraction / restoration issues at the Monument fall into six sequential categories (please see the attached task plan):

1. Data Collection
2. Analysis and Decision-Making
3. Project Design
4. Funding
5. Implementation
6. Monitoring and Incidental Mitigation

Future GRD assistance may include:

- Topographic survey of selected sites for detailed extraction or restoration planning,
- Developing restoration site diagrams and cross-sections if needed,
- Providing estimates of time, equipment and materials needed at each site, and
- Drafting contract specifications for work items to be completed by a private contractor.

DISCUSSION

The intent of this field visit was to inspect the various cinder extraction sites within and adjacent to the NPS Monument, assess environmental impacts of these disturbances, develop restoration options, and explore potential for continued extraction at these sites. A secondary goal was to discuss the concept of a combined BLM/NPS Sand, Rock and Gravel Planning effort to help direct the transportation plan that the BLM will be developing soon.

On October 18, Mark Ziegenbein and Monument staff briefly met with Jim Morris (NPS Monument Superintendent) to discuss the goals of the field visit, to review the issues the Superintendent needs the team to address, and to review examples of park wide restoration plans and park wide gravel extraction plans.

On October 19, Mark Ziegenbein and Monument staff met with Rick Vandervoet (BLM Monument Manager) to explore the possibility of developing a cooperative sand, rock, and gravel plan for both the NPS and BLM Monuments. Mr. Vandervoet revealed that the BLM is currently overwhelmed with other priorities and that he does not want to initiate a cooperative gravel planning effort at this time. Mr. Vandervoet did support the monument-wide gravel-planning concept, and expressed interest in developing such a plan in the future. He also expressed interest in obtaining assistance from Mark Ziegenbein in the future to help guide the process.

Since the development of a cooperative NPS/BLM gravel plan is not an option at this time, the Monument has four remaining options regarding the disposition of the cinder extraction sites:

1. No Action – Continue to import needed materials from sources outside of the Monument and leave the disturbed sites as they are.
2. Restoration/Revegetation – Continue to import needed materials from sources outside of the Monument and restore the pits.
3. One-Time Extraction and Restoration – Extract, stockpile, restore and close the site(s) (at one or more sites).

4. Partial Restoration/Continued Mining – Restore the majority of the site(s) and continue to extract small volumes of cinders (at one or more sites).

A core team consisting of John Apel (Monument Integrated Resource Program Manager), Doug Owen (Monument Geologist), Paige Wolken (Monument Ecologist), and Mark Ziegenbein (GRD Geologist) spent the remainder of the field visit (October 19th - 21st) inspecting the cinder extraction sites and discussing extraction/restoration alternatives.

After assessing the various sites, Monument natural resources staff concluded that the No Action Alternative was not desirable at either the BLM Free Use Pit or the Bone Yard Pit for natural resource and aesthetic reasons. Paige Wolken (Monument Ecologist) expressed concern that restoration earthmoving activities in areas containing exotic plant species (especially the BLM Free Use Pit) would probably exacerbate the exotic species problem. In addition, Monument maintenance staff indicated that they would continue to need small amounts of cinders, similar in character to the native rock, for road and campground maintenance in the park headquarters area.

The team concluded that management and staff would need more baseline information before making a decision between option 2 – Restoration, option 3 – One-Time Extraction and Restoration, or option 4 Partial Restoration/Continued Mining. Mark recommended a phased project, proceeding in the following sequence (please see the attached Task Plan):

1. Data Collection
2. Analysis and Decision-Making
3. Project Design
4. Funding
5. Implementation
6. Monitoring and Incidental Mitigation

Extraction Sites – Description, Impacts and Recommendations

The Monument has mapped a large number of small cinder extraction sites. However, most of these sites have naturally recovered, are not causing off-site impacts, and restoration actions are not likely to accelerate site recovery. This report will therefore concentrate on four sites:

- BLM Free Use Pit,
- Bone Yard Pit,
- Inferno Pit, and
- State Material Site Rights-of-Way

BLM Free Use Pit

The BLM Free Use Pit is located approximately 3/4 mile northwest of Highway 20, 26, 93 on the Sunset Cone lava flow (S½ NW¼, N½ SW¼, Section 24, Township 2 North, Range 24 East, Boise B.L. & M., Elevation 5,680'). Please see the BLM Free Use Pit Location Map and Air Photo. The native vegetative community is sagebrush steppe. The soil map unit is Lava Flows – Cinderhurst Complex, 2 to 15% slopes. The BLM operated this site as a community cinder pit until November 9, 2000. The site is a shallow (6' - 8' maximum depth), 22-acre, cinder extraction area, approximately half of which is on NPS-administered National Monument land and the other half on BLM-administered National Monument land. Associated with the extraction site are access roads and working/stockpile

areas (see BLM Free Use Pit Photos 1 through 5). No extraction is currently taking place and the site has apparently not been used since 2000. The thin soil and vegetation have been disturbed or removed and sub-soils have been compacted. Soils are well drained and there is no evidence of rilling or gullying. A fence-line runs North-South through the center of the extraction area, roughly dividing BLM-administered National Monument land (to the west) from NPS-administered National Monument land (to the east).

Access to the site is by 1.5 miles of 8'-10' wide bladed native-surface road. The majority of the road has no cuts or fills and the average grade is less than 2°. The road provides access to lands beyond the extraction site.

Resource Impacts, Conflicts or Issues

The primary resource issues related to this site are soil loss, soil compaction, and loss of vegetation related to the extraction pit and access road. The site is somewhat unsightly, however the NPS-administered portion is only visible from the immediate vicinity and park visitors do not frequently use the area. However, a north-facing hillside on the BLM-administered portion of the site is recovering slowly. This hillside is highly visible from Highway 20, 26, 93. The Goodale's Cutoff Historic Trail runs through the western portion of the site (on BLM Monument land).

Data Needs / Required Actions

1. Monument management will need to decide whether this site should be: A) restored and closed; or B) used for cinder extraction and stockpiling prior to restoration.
2. Coordinate with the BLM to obtain participation in the restoration effort.
3. Site Survey - A survey (Total Station, GPS or tape and compass) sufficient to develop a site map/staking diagram and cross-sections for volume calculation will be needed to develop items #3, #4 and #5.
4. Site Map - Develop a restoration site map/staking map and cross-sections to guide restoration actions at the site.
5. Revegetation - A qualified revegetation specialist will need to assess the site to determine: A) the need for, B) specifications of, and C) estimated cost of revegetation treatments.
6. Time and material estimates - Develop equipment time, labor and material estimate table.
7. Monitoring Baseline Information - Collect baseline data and photos to assist in the determination of restoration success.

Recommendations

This site could benefit from removal of exotic plant species, selective out-sloping and contouring, scarification of compacted soils and revegetation with native species to stabilize soils and to reduce the visual impacts of the site. The following is a chronological list of recommended tasks:

- Perform additional site and resource surveys as needed.
- Establish monitoring photo points and other monitoring networks as needed.
- Eliminate or reduce the presence of exotic species at the site prior to restoration actions.
- Stake site as prescribed in the site-specific restoration diagram.
- Set aside limbs, rocks and vegetative debris that can be used to scatter over the scarified and recontoured site.
- Salvage all soil (3"- 4" if present) native revegetated surface material (1"- 3") and duff from all areas to be disturbed. Windrow salvaged material along edges of proposed disturbance.
- Scarify all compacted soils in the disturbed area if needed.

Extraction Alternative:

If Monument management approves extraction of cinders at this site in conformance with NPS Policies, extraction and stockpiling of cinders could occur in accordance with a site-specific extraction/restoration plan.

- Perform selective out-sloping and contouring as prescribed in the restoration plan.
- Spread salvaged soil and growth medium over the disturbed area.
- Apply revegetation prescription to the site.
- Hand scatter rocks, duff and vegetative debris.
- Monitor restoration success.

Bone Yard Pit

The Bone Yard Pit is located approximately 0.3 miles southeast of Monument Headquarters (NW¼ SW¼, Section 36, Township 2 North, Range 24 East, Boise B.L. & M., Elevation 5,820'). Please see the Bone Yard Pit Location Map and Air Photo. The native vegetative community is sagebrush steppe – Limber Pine/Cinder Garden. The soil map unit is Echo Crater gravelly, loamy sand, 20 to 40% slopes. The NPS operated this site as an administrative-use cinder pit until 1998. No extraction is currently taking place and the Monument has not extracted cinders from this site since 1998. The site is a 4.1-acre, cinder extraction area, maximum depth of approximately 25 feet, with associated access road and working/stockpile area (see Bone Yard Pit Photos 1 through 4). Approximately 1 acre of the site is still in use by the NPS as a maintenance storage area or “boneyard”. The thin soil and vegetation have been disturbed or removed and sub-soils have been compacted. Soils are well drained and there is no evidence of rilling or gullying. The majority of the site (approximately 3 acres) has been inactive for several decades, is naturally recovering, and needs no further restoration.

Access to the site is by 0.25 miles of 8'-10' wide bladed native-surface and graveled road. The majority of the road has less than 1' cuts or fills and the average grade is less than 2°.

Resource Impacts, Conflicts or Issues

The primary resource issues related to this site are soil loss, soil compaction, and loss of vegetation related to the extraction pit and access road. The site is somewhat unsightly and is visible from the main park road looking north from North Crater and Paisley Cone (see Bone Yard Pit Photo 1). However, the extraction site is in the distance from this vantage point, and blends fairly well with the natural volcanic terrain. However, maintenance equipment and stored materials are noticeable.

Data Needs / Required Actions

1. Monument management will need to decide whether this site should be: A) restored and closed; or B) used for cinder extraction and stockpiling prior to restoration.
2. Site Survey - A survey (Total Station, GPS or tape and compass) sufficient to develop a site map/staking diagram and cross-sections for volume calculation will be needed to develop items #2, #3 and #4.
3. Site Map - Develop a restoration site map/staking map and cross-sections to guide restoration actions at the site.

4. Revegetation – The site will need to be assessed by a qualified revegetation specialist to determine: A) the need for, B) specifications of, and C) estimated cost of revegetation treatments.
5. Time and material estimates – Develop equipment time, labor and material estimate table.
6. Monitoring Baseline Information – Collect baseline data and photos to assist in the determination of restoration success.

Recommendations

This site could benefit from removal of exotic plant species, selective out-sloping and contouring, scarification of compacted soils and revegetation with native species to stabilize soils and to reduce the visual impacts of the site. The following is a chronological list of recommended tasks:

- Perform additional site and resource surveys as needed.
- Establish monitoring photo points and other monitoring networks as needed.
- Eliminate or reduce the presence of exotic species at the site prior to restoration actions.
- Stake site as prescribed in the site-specific restoration diagram.
- Set aside limbs, rocks and vegetative debris that can be used to scatter over the scarified and recontoured site.
- Salvage all soil (3”- 4” if present) native revegetated surface material (1”- 3”) and duff from all areas to be disturbed. Windrow salvaged material along edges of proposed disturbance.
- Scarify all compacted soils in the disturbed area if needed.

Extraction Alternative:

If Monument management approves extraction of cinders at this site in conformance with NPS Policies, extraction and stockpiling of cinders could occur in accordance with a site-specific extraction/restoration plan.

- Perform selective out-sloping and contouring as prescribed in the restoration plan.
- Spread salvaged soil and growth medium over the disturbed area.
- Apply revegetation prescription to the site.
- Hand scatter rocks, duff and vegetative debris.
- Monitor restoration success.

Inferno Pit

The Inferno Pit is located approximately 1/2 mile east of Inferno Cone (SE¼, Section 1, Township 1 North, Range 24 East, Boise B.L. & M., Elevation 5,820'). See Inferno Pit Location Map and Air Photo. The NPS operated this site as an administrative-use cinder pit until the late 1960s. The site is a shallow (approximately 18' maximum depth), 2.9-acre, cinder extraction area with associated access road (see Inferno Pit Photos 1 and 2). No extraction is currently taking place and the site has not been used since the late 1960s. The thin soil and vegetation have been disturbed or removed. Soils are well drained and there is no evidence of rilling or gullying. Since the site has been inactive for several decades, it is naturally recovering.

Access to the site is by 0.2 miles of native-surface road. The majority of the road has no cuts or fills and the average grade is less than 2°. The access road is almost completely revegetated with native species and is hard to detect.

Resource Impacts, Conflicts or Issues

The primary resource issues related to this site are soil loss, and loss of vegetation related to the extraction pit and access road. The site has revegetated nicely and has a healthy population of native species.

Data Needs / Required Actions

None recommended.

Recommendations

No remedial measures are needed at this site.

State Material Site Rights-of-Way

Extraction sites opened or operated under Title 23 Material Site Rights-of-Way (23 USC §107)

To my understanding, Title 23 material site rights-of-way constitute a valid existing right that cannot be terminated unilaterally by the NPS or the BLM. However, since Congress has recently designated these lands for special protection, I believe more stringent operating and reclamation standards may now be applied at these sites to assure that natural and cultural resources are protected in accordance with the standards mandated by Congressional designation as a National Monument.

The Geologic Resource Division, Planning, Evaluation and Permits Branch will research the NPS's extent and limitations of authority regarding control of operations on Title 23 rights-of-way. The Planning, Evaluation and Permits Branch will provide guidance on this issue in a forthcoming memo.

Based upon the conclusions of the above clarification, Monument staff should meet with the State of Idaho and/or the Federal Highway Administration to discuss the development of minimum operating standards and site-specific mine/reclamation plans for each of their sites. The goal would be modification of extraction operations to protect Monument resources to the greatest extent possible and the consolidation of extraction operations into a few, well-placed, high-quality, large-volume sites. It may be possible to negotiate phasing-out, closing, or relinquishing unneeded or unused material site rights-of-way. GRD staff may assist in these tasks upon request.

FIELD WORK

October 18, 2004 –

AM – Travel from Denver, Colorado to the Monument.

PM – Meeting with Jim Morris (NPS Monument Superintendent), John Apel (Monument Integrated Resource Program Manager), Paige Wolken (Monument Ecologist) and Mark Ziegenbein (GRD). The group briefly discussed the purpose of Mark's visit, the environmental/restoration/administrative/planning issues facing the Monument and the products the GRD hopes to provide to assist the Monument. Mark provided examples of NPS and BLM National Monument gravel plans and park wide restoration plans. The group then discussed the concept of a NPS-BLM monument combined sand, rock and gravel plan to assess administrative material needs and the most environmentally sound way to provide the needed materials.

October 19, 2004 –

AM – Meeting with Rick Vandervoet (BLM Monument Manager), Sarah Smith (BLM), John Apel (Monument Integrated Resource Program Manager), Doug Owen (Monument Geologist), Paige Wolken (Monument Ecologist) and Mark Ziegenbein (GRD). The group discussed the concept of developing a coordinated BLM/NPS gravel plan. NPS staff proposed integrating the results of such a plan into the results into the BLM transportation plan, which is soon to be developed.

PM – Field overview of extraction sites in and near the NPS Monument.

October 20, 2004 –

Conduct detailed GPS (GeoExplorer 3) mapping of the 7-Acre Pit and the Bone Yard Pit. Discussion of restoration alternatives and potential for limited extraction of cinders without impeding restoration - Doug Owen (Monument Geologist), Paige Wolken (Monument Ecologist), Rachel Zack (SCA Conservation Associate), and Mark Ziegenbein (GRD).

October 21, 2004 –

AM – Rain. Close out. Review draft trip report outline with Monument resources staff. GPS/Soils data file transfer.

PM – Return to Denver

Attachments: Task Plan

Location Maps and Air Photos

Photo Sheets

Table of Contents, Draft Sand, Rock and Gravel Plan – Point Reyes National Seashore

cc:

CRMO: Morris, Apel, Wolken

PWR: Goldsmith, Kolipinski

bcc:

GRD: Shaver, Woods, Higgins, McCoy, Allen / CRMO_Cinder Extraction & Restoration_3.7.05_msz

TASK PLAN
Cinder Extraction and/or Site Restoration
Craters of the Moon National Monument

I DATA COLLECTION

- A. Research methods to control exotic plant species (primarily cheat grass).
 - 1. Identify potential funding sources for research.
 - 2. Develop research design and a proposal appropriate to the proposed funding source
 - Step 1. Literature search - Research the various existing documented methods to control exotic plant species.
 - Step 2. Analysis – and selection or development of exotic species control methods that warrant testing.
 - Step 3. Install test plots.
 - Step 4. Monitor test plots and document results.
 - Step 5. Select method(s) for use in restoration projects.
 - Step 6. Publish results.
- B. Collect information on: 1) the volume of cinders that the Monument needs yearly; and 2) availability of cinders that match the character of Monument cinders within a reasonable shipping distance. Identify potential locations, unit cost, and shipping cost of obtaining cinders from BLM sites or private cinder sources.

II ANALYSIS AND DECISION-MAKING

- A. Cost/Benefit of in-Monument extraction versus importing cinders.
 - 1. Calculate costs of in-Monument extraction and compare to importation costs. In-Monument costs should include the following: planning and environmental costs, equipment costs, labor costs, material costs, any mitigation costs, and restoration costs.
- B. Develop conceptual in-Monument mine plans for use in evaluating environmental consequences.
- C. Decide on direction: import cinders from an external source and restore Monument extraction sites, or continue with analysis of in-Monument extraction.
 - 1. If NPS management decides to continue with analysis of in-Monument extraction, the documentation would be an abbreviated version of the attached Draft Sand, Rock and Gravel Plan – Point Reyes National Seashore.
- D. NEPA and other environmental compliance for either proposed extraction or proposed restoration actions.

III PROJECT DESIGN

- A. Detailed topographic survey (if needed).
- B. Design drawings, cross-sections, and earthmoving/revegetation specifications.
- C. Cost estimates.

IV FUNDING (the process is dependent on the type of funding being sought)

- A. Proposal development
- B. Arranging matching funds

C. Implementation plan development

V IMPLEMENTATION

A. Contract specification development (if work is contracted)

B. Plant material and seed collection (if required)

C. Request for Proposals and selection of contractor (if work is contracted)

D. Conduct pre-construction exotic control measures

E. Earthmoving

F. Soil or growth medium preparation

G. Revegetation

H. Conduct post-construction exotic control measures

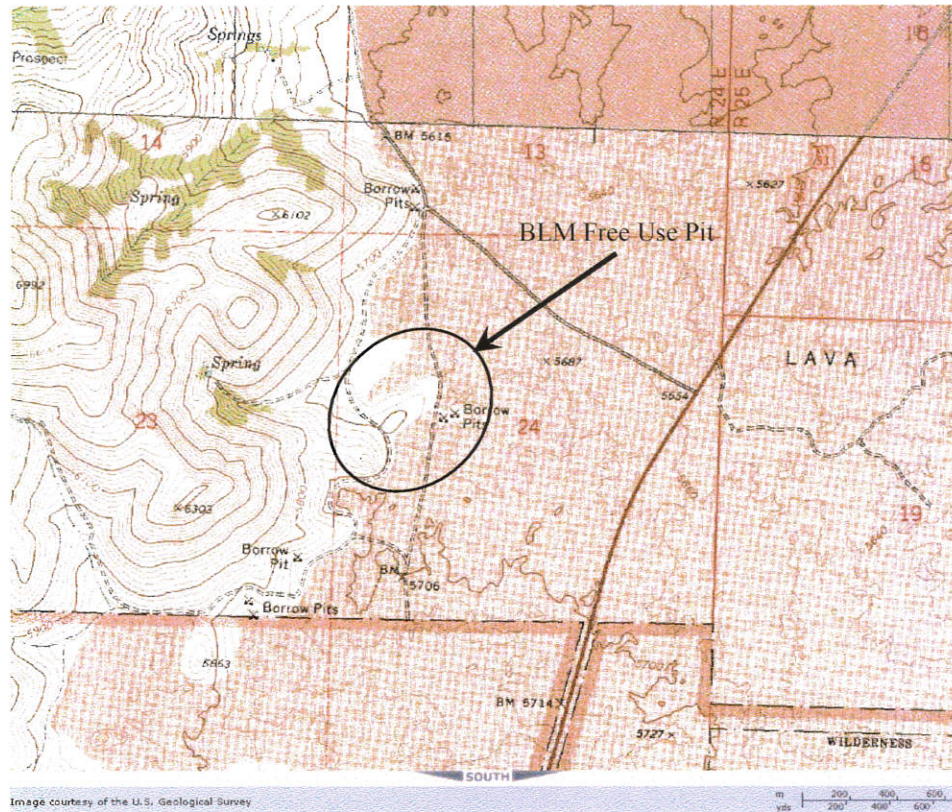
VI MONITORING AND MITIGATION

A. Construction/Operational Monitoring

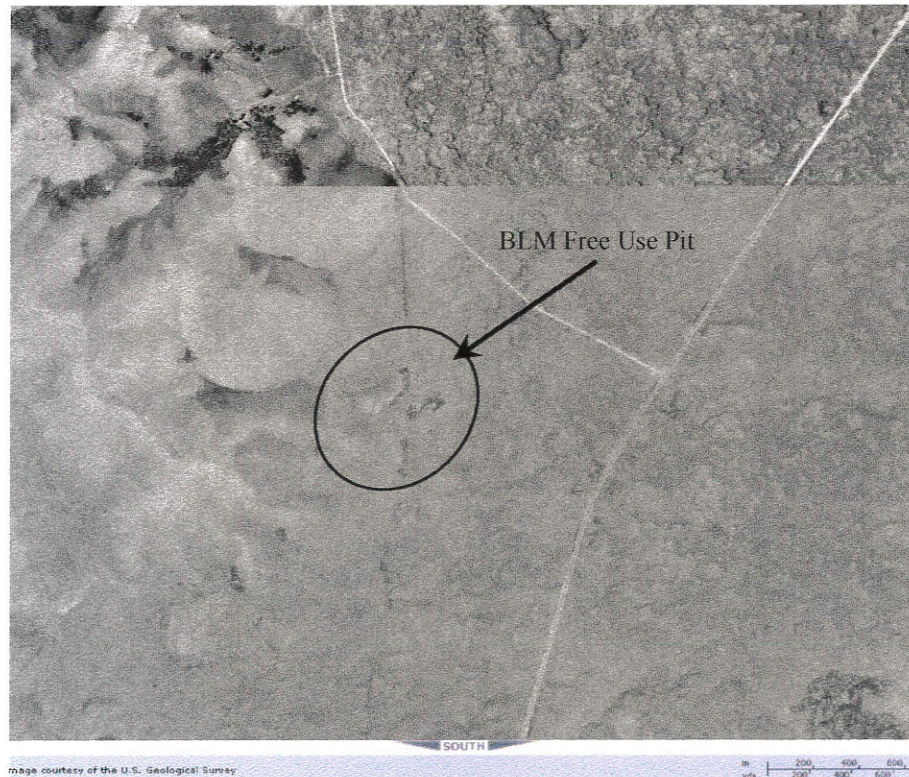
B. Monitoring of Site Stabilization / Restoration Success

C. Monitoring of Site Stabilization / Restoration Success

Location Map and Air Photo BLM Free Use Pit



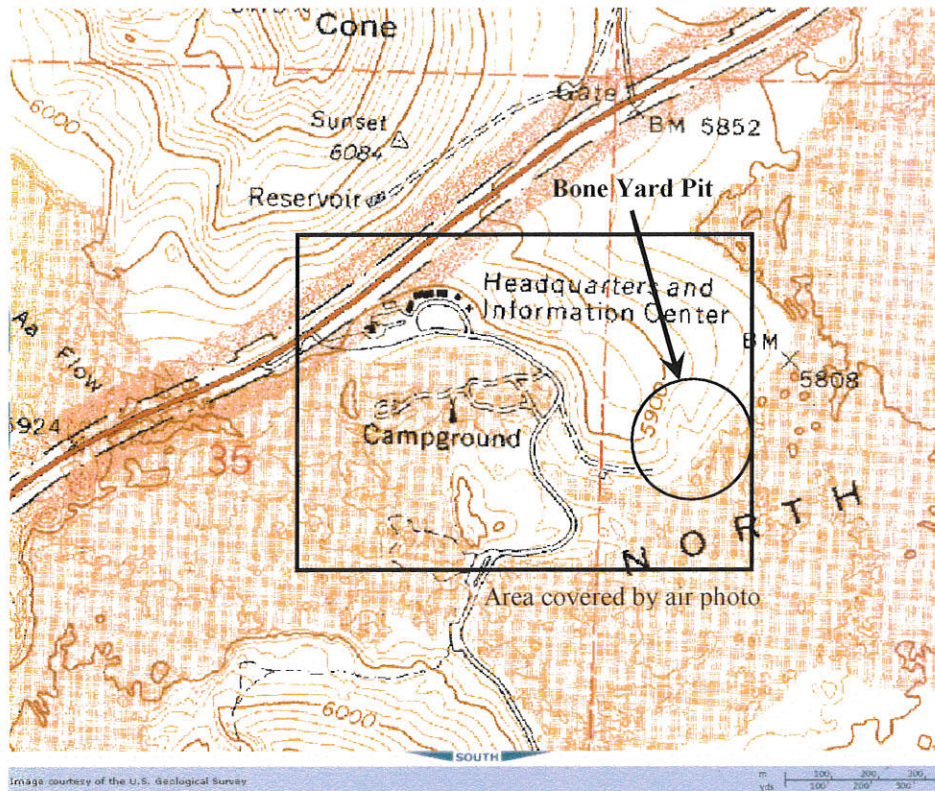
Location Map BLM Free Use Pit



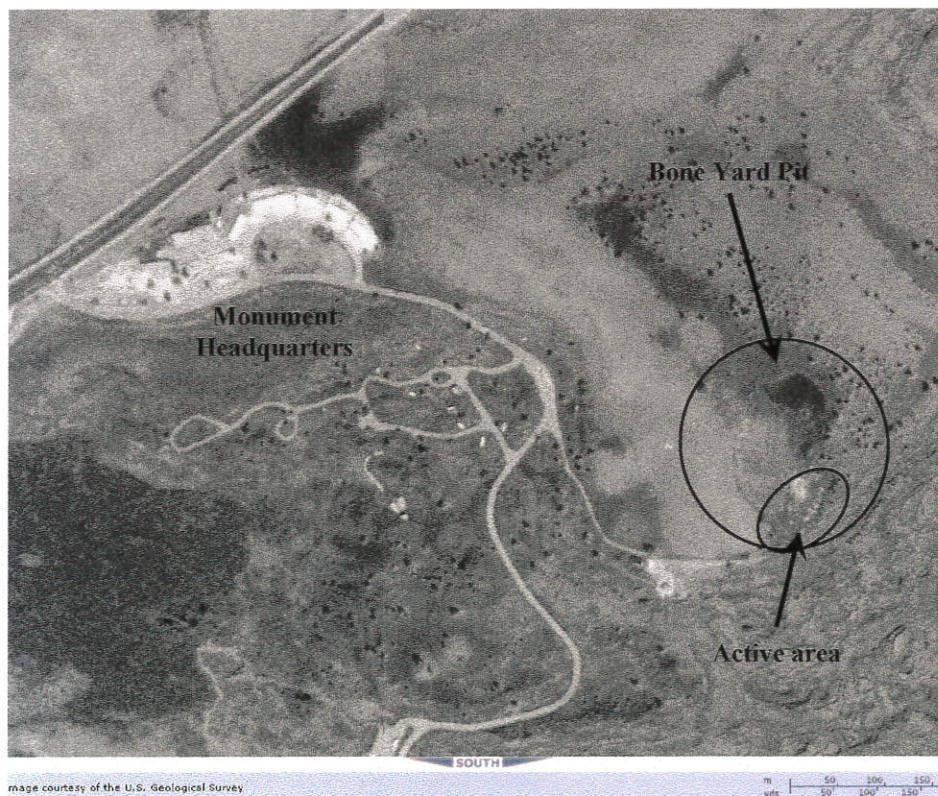
Air Photo BLM Free Use Pit

Images from terraserver-usa.com

Location Map and Air Photo Bone Yard Pit

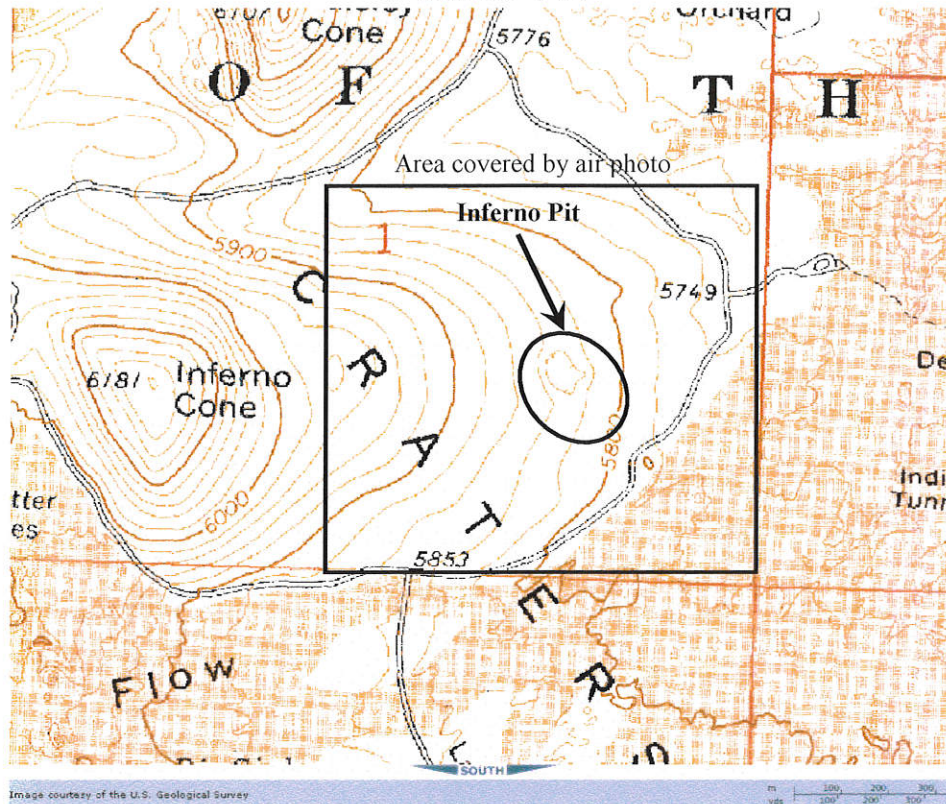


Location Map Bone Yard Pit

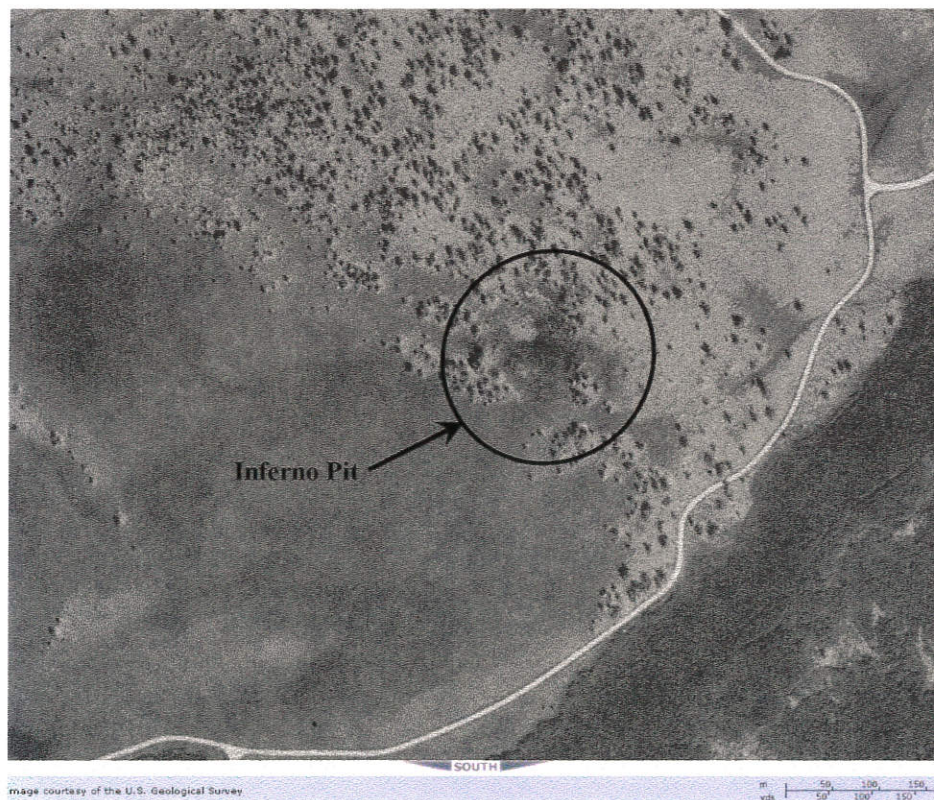


Air Photo Bone Yard Pit

Location Map and Air Photo Inferno Pit



Location Map: Inferno Pit



Air Photo: Inferno Pit

Images from terraserver-usa.com

PHOTOS

BLM Free Use Pit



N

BLM Free Use Pit Photo 1: Panorama north through east to southeast across pit.

SE



SW

BLM Free Use Pit Photo 2: Panorama southwest to north showing the BLM administered portion of the Free Use Permit area.

N

PHOTOS
BLM Free Use Pit

Photo Point 1 & 2



BLM Free Use Pit Photo 3: View north from the southern portion of the pit, showing the deepest extraction area (approx. 6'-8').

PHOTOS
BLM Free Use Pit



BLM Free Use Pit Photo 4: View north of the northeastern portion of the pit.

PHOTOS
BLM Free Use Pit



NW

BLM Free Use Pit Photo 5: Panorama northwest to northeast of the northern portion of the pit.

NE

PHOTOS

Bone Yard Pit



Bone Yard Photo 1: View north of the Bone Yard Pit from the main park road



Bone Yard Photo 2: Panorama southwest to northeast across pit

N

SW

PHOTOS

Bone Yard Pit

Photo Point #2



Bone Yard Photo 3: Panorama southeast to northeast across pit

NE

SE



Bone Yard Photo 4: Panorama southeast to southwest across pit. Dotted line shows the extent of extraction area.

SW

SE

PHOTOS

Inferno Cones Pit



Inferno Cones Photo 1: View north northwest of partially-revegetated access road



Inferno Cones Photo 2: Panorama southwest to north across pit

SW

N

PHOTOS
State Material Site Right-of-Way



Material Site ROW Photo 1: Panorama north to northeast across pit

NE

N

DRAFT SAND, ROCK AND GRAVEL PLAN

POINT REYES NATIONAL SEASHORE

- I. INTRODUCTION**.....Andrea Minor
(The purpose, need and background of this document)
- II. LEGAL AND POLICY FRAMEWORK**..... Andrea Minor [with MZ input]
(enabling legislation, Federal mineral law, NPS policy, Special Directive 91-6, GMP, RMP, traditional use, and other agency requirements)
- III. MATERIAL NEED, AVAILABILITY, CONCERNS AND COST**
- A. History of Sand, Rock and Gravel Use..... Andrea Minor [with park resources input]
(Summary of sites, material types, historical and present users, estimate of annual volumes used for each purpose, past closures/reclamation, etc.)
 - B. Material Needs Andrea Minor [with MZ park maintenance input]
(Quantify material types and volumes required for future NPS and private maintenance and construction. Attempt 20 year prediction)
 - C. Material Sources..... Andrea Minor [with MZ and park maintenance input]
(List internal and external sources of the various material types identified above in B. Needs. Map. Estimate volumes present, overburden, problems.)
 - D. Resource Concerns Andrea Minor [with park resources input]
(Briefly summarize animals, plants and resources of concern for internal and external extraction. Full analysis will be in the EA)
 - E. Cost Comparison Mark Ziegenbein [with park maintenance input]
(Summarize the costs associated with external purchase and trucking of the needed materials vs. internal planning, extraction and restoration. The actual analysis can be an attachment)
- IV. MINE AND RECLAMATION PLANS** (should in-park extraction be part of the preferred alternative)Mark Ziegenbein [with park maintenance and resources consultation]
(Matrix showing status of various sites and recommended future use or action)
- A. Minor Reclamation Sites
(List sites and describe equipment, materials and actions required for these sites. Include site maps and site-specific conditions if needed)
 - B. Restoration Sites
(List sites and describe equipment, materials and actions required for these sites. Include site maps and site-specific conditions if needed)
 - C. Mine to Reclaim - Extract material to aid the reclamation effort
(List sites and describe equipment, method of extraction, methods of processing, equipment storage and fuel storage, surface and groundwater protection measures, noise and visual impact mitigations, topsoil stockpiling, seasons and hours of operation, etc. Include site maps and site-specific conditions.)

- D. 1. Long-Term Extraction Sites
(List sites and describe equipment, method of extraction, methods of processing, equipment storage and fuel storage, surface and groundwater protection measures, noise and visual impact mitigations, topsoil stockpiling, seasons and hours of operation, etc. Include site maps and site-specific conditions.)

V. REVEGETATION METHOD

..... Park Reveg. Specialist [with GOGA, REDW consultation]
(soil preparation, seed mix and application method, cuttings, transplants, predation prevention, exotic control, etc.)

VI. MONITORINGAndrea Minor [with MZ, and reveg. spec. input]
(Establish a process to systematically monitor the success of the mine plans, revegetation plans and mitigations. Provide for modifications of the plan or standard stipulations if needed to achieve the original goals)

VII. ATTACHMENTS

- A. Photos?Andrea Minor
B. Cost ComparisonMark Ziegenbein
C. List of PreparersAndrea Minor
D. Soil and Vegetation Data.....Andrea Minor
E. List of Contacts - Technical AssistanceAndrea Minor
F. NPS Site inventory forms?.....Mark Ziegenbein

