

Appendix D: Road and Trail Assessment –
Saratoga Quarry

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ROAD AND TRAIL ASSESSMENT SARATOGA QUARRY

Santa Clara County, CA

August 15, 2013

Job: DCE-QUARRYPARK-619

Prepared for:

THE PLANNING CENTER | DC&E

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TABLE OF CONTENTS

INTRODUCTION.....	3
BACKGROUND	3
GOALS AND OBJECTIVES	3
PROJECT SETTING.....	5
GEOGRAPHIC SETTING.....	5
Topography.....	5
Drainage	6
GEOLOGY AND SOILS.....	6
Bedrock Geology.....	6
Soils and Surficial Sediments	6
Landsliding.....	8
Regional Faults and Seismicity	8
FACTORS AFFECTING TRAIL SUSTAINABILITY	10
TRAIL GEOMETRY, DESIGN AND LOCATION RELATED FACTORS.....	10
Trail Grade	10
Trail Orientation (Fall-line).....	11
Drainage	11
Stream Crossings.....	11
USE RELATED FACTORS.....	12
Use Intensity	12
Type of Use.....	12
MAINTENANCE FACTORS	12
RESULTS	13
CURRENT TRAIL SYSTEM.....	13
INVENTORY RESULTS	13
APPENDIX 1: ROAD INVENTORY	16
ROAD 1	16
Reach 1A (STN 0 - 420).....	16
Reach 1B (STN 420 - 1020).....	17
Reach 1C (STN 1020 - 2800)	18
Reach 1D.....	19
Reach 1E	20
ROAD 2	21
ROAD 3	23
ROAD 4	24
Reach 4A	25

ROAD 5	26
ROAD 6	29
Reach 6A	30
ROAD 7	32
ROAD 8	33
Reach 8A (STN 0 – 240).....	33
Reach 8B (STN 240 – 1130).....	34
Reach 8C (STN 1130 – 1550).....	36
ROAD 9	37
Reach 9A (STN 0 – 780).....	37
Reach 9B (STN 780 – 1720).....	38
ROAD 10	39
ROAD 11	40
REFERENCES.....	41

INTRODUCTION

This report details the findings of a Road and Trail Assessment (RTA) of the 64 acre Quarry Park area located immediately south of Highway 9 and adjacent to the City of Saratoga in the unincorporated area of Santa Clara County (Figure 1).

BACKGROUND

The property was part of an aggregate quarry that was operational from approximately 1908 until 1967. The quarry was closed in 1967 and the hillside rehabilitated to minimize slope erosion of the graded slopes. The County has since used this site to store road maintenance equipment and materials. There are multiple roads and tractor trails across the property associated with the old quarry operations and subsequent restoration. Some of these roads and trails are drivable, others are overgrown and abandoned.

The long term goal for the property is to develop it for recreational use including a series of sustainable public trail corridors that would ultimately connect to nearby public parks and open space lands.

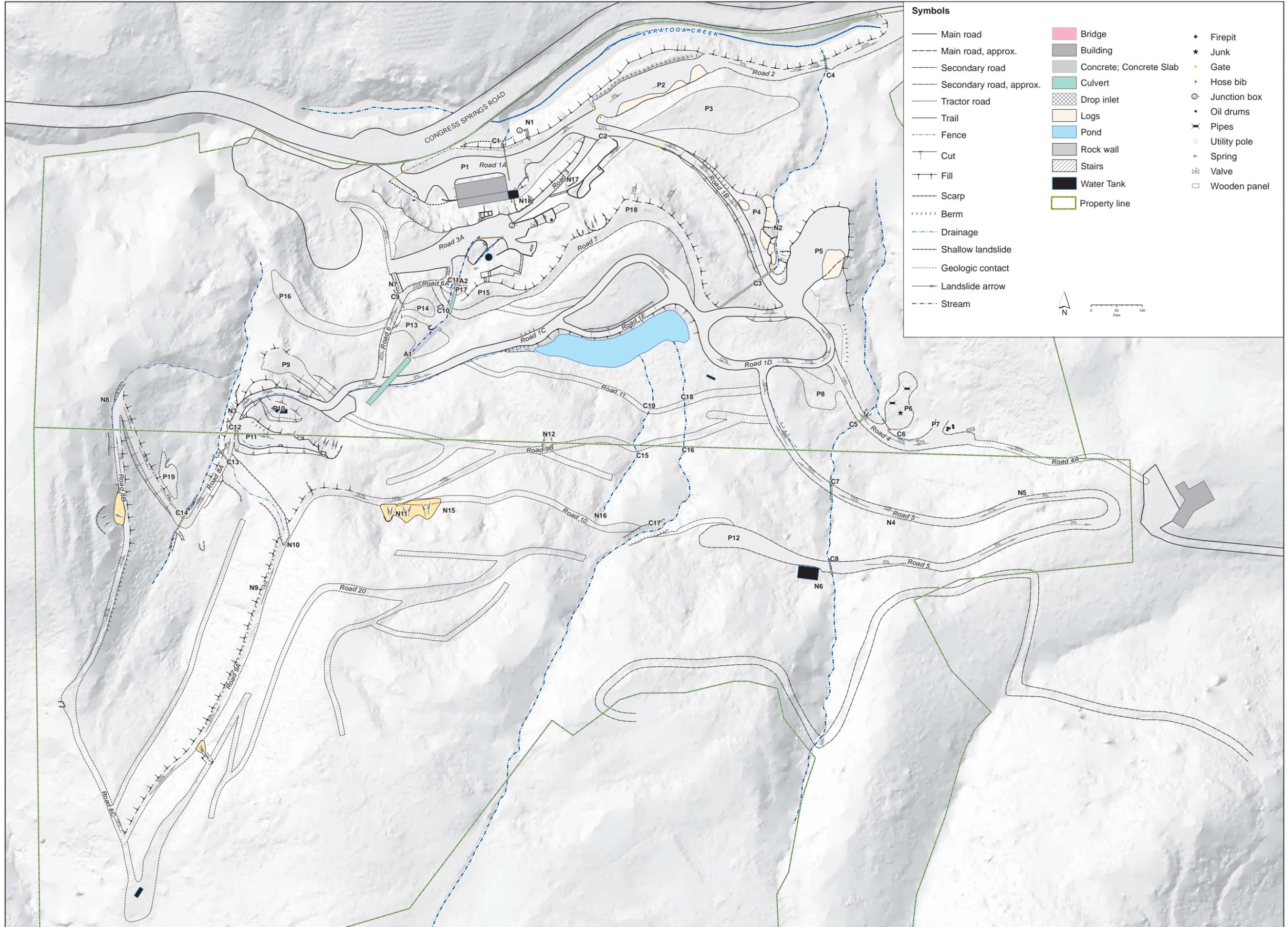
DC+E Planning Group has been retained by the City of Saratoga to develop a master plan for the property. This road and trail assessment was undertaken as part of the master plan to provide baseline information on the current condition of roads and trails on the property and the physical constraints for their inclusion into the final trail network.

GOALS AND OBJECTIVES

This Road and Trail Assessment (RTA) provides a reconnaissance-level assessment of the dominant roads and trails on the property. The objectives of the RTA are to:

- Identify and map existing roads and trails
- Systematically inventory the physical characteristics and condition of roads and trails
- Identify problem areas and physical constraints such as steep gradient trails, fall-line trails, trails with poor drainage and tread condition, and wet areas, that could impact future use and maintenance requirements.

The assessment is based on field observations coupled with observations made from aerial photographs and LiDAR imagery. The inventory is a reconnaissance level effort and therefore the results should be viewed as approximate and general.



Symbols

— Main road	█ Bridge	+ Firepit
- - - Main road, approx.	█ Building	★ Junk
— Secondary road	█ Concrete; Concrete Slab	● Gate
- - - Secondary road, approx.	█ Culvert	● Hose bib
— Tractor road	▨ Drop inlet	⊙ Junction box
— Trail	█ Logs	● Oil drums
- - - Fence	█ Pond	— Pipes
— Cut	█ Rock wall	○ Utility pole
— Fill	▨ Stairs	○ Spring
- - - Scarp	█ Water Tank	○ Valve
⋯ Berm	▭ Property line	□ Wooden panel
— Drainage		
- - - Shallow landslide		
- - - Geologic contact		
— Landslide arrow		
— Stream		

North Arrow and Scale Bar (0, 50, 100 Feet)

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PROJECT
SARATOGA QUARRY PARK PROJECT
 Saratoga, CA

PREPARED FOR
THE PLANNING CENTER / DC&E
 1625 SHATTUCK AVE., SUITE 300
 BERKELEY, CA 94709

SHEET TITLE
SITE MAP

Date	Description	Rev
16 AUG 13	Draft	

PROJECT
DCE-QUARRYPARK-619

SHEET NUMBER
1

PROJECT SETTING

GEOGRAPHIC SETTING

Topography

The Quarry Park property occupies about 64 acres of steep north facing ground above Highway 9 and Saratoga Creek (Figure 1). The project site is bordered to the west by San Jose Water Company property and on the east and the south by low-density rural residential and open space areas.

The majority of the property was part of an open aggregate rock quarry that as previously mentioned was operational from 1908 to 1967. Site topography was extensively modified by the extraction of rock and the subsequent rehabilitation efforts implemented when the quarry closed in 1967. This resulted in multiple graded pads and benches, and a high density of roads and tractor trails. Most of the roads and trails are now overgrown and no longer passable. The 1956 aerial photograph below shows what is roughly the maximum extent of the quarry operations.



1956

0 500 Feet

Drainage

The property is drained by several narrow and steep gradient “V”-shaped ephemeral to intermittent watercourses that are locally deeply incised with steep unstable channel banks. These watercourses were heavily impacted by quarry operations with apparent high rates of channel erosion occurring shortly after quarry closure. As the slopes have become revegetated, these channels appear to have stabilized and the rate of erosion diminished.

GEOLOGY AND SOILS

The project area is located in the central portion of the Coast Range Physiographic Province of California, a series of coastal mountain chains paralleling the pronounced northwest-southeast structural grain of northwest California. The area is geologically active, dominated by the northwest-southeast trending San Andreas Fault Zone located about 1.5 miles southwest of the preserve.

The geology of the project site is complex. The property is mapped as transected by the Berrocal Fault Zone which is a late Quaternary southwest-dipping, reverse fault zone that forms a part of what McLaughlin et al. (1996) refer to as the Southwestern Santa Clara Valley thrust belt. At this location the fault thrusts bedrock of the Mesozoic Franciscan Complex to the south over sediment of the Pliocene-Pleistocene Santa Clara Formation to the north (Brabb et al., 2000; WCA, 1977)(Figure 2). Overlying the bedrock is a large-scale active deep-seated landslide.

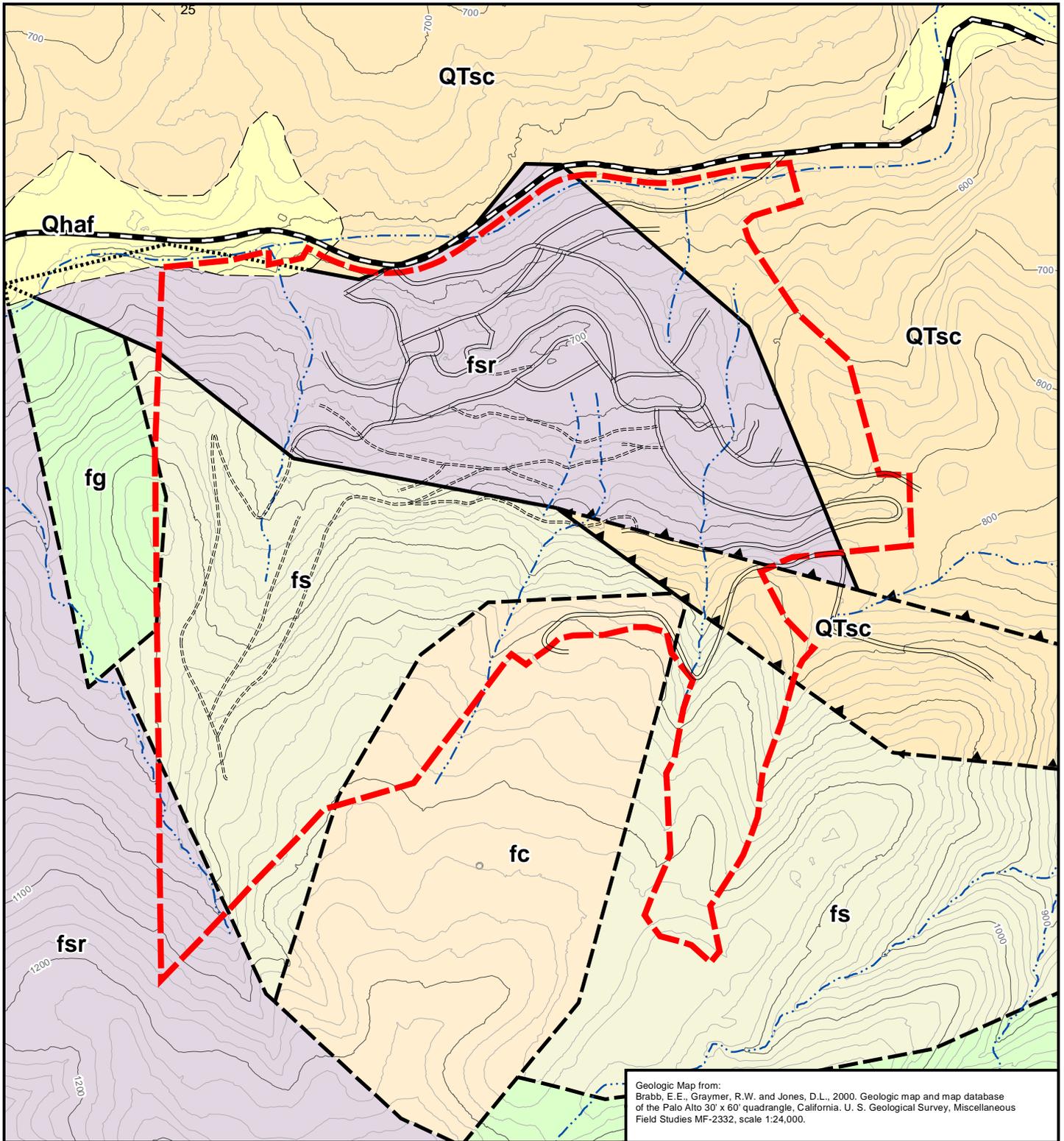
Bedrock Geology

Bedrock of the Franciscan Complex is mapped as underlying the majority of the property and it was this material that was mined for aggregate. Franciscan rocks are described by WCA (1977) and Brabb et al. (2000) as predominantly massive to thick bedded fractured greywacke sandstone with interbedded siltstone and shale, and pervasively sheared *mélange* (a tectonic mixture of sheared shale and sandstone). Blocks of bedrock were locally exposed on the steeper slopes in the upper portion of the property.

The Santa Clara Formation is mapped in the northern downslope portion of the property, though clear exposures of this material were not observed. Regionally this material is described as a poorly indurated mudstone and siltstone with occasional interbeds of sandstone and conglomerate (Brabb et al., 2000; WCA, 1977).

Soils and Surficial Sediments

Bedrock is mapped as overlain by a large-scale deep-seated active landslide. Earth materials that comprise this feature are derived from the underlying bedrock and in places may include relatively intact blocks of Franciscan rock.

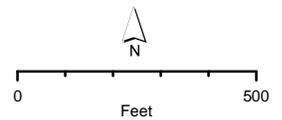


GEOLOGIC UNITS

- Qhaf: Alluvial fan deposits
- QTsc: Santa Clara Formation
- fg: Franciscan greenstone
- fsr: Franciscan sheared rock
- fc: Franciscan chert
- fs: Franciscan sandstone

CONTACTS

- contact, approx. located
- fault, certain
- fault, approx. located
- fault, concealed
- ▲ thrust fault, certain
- ▲ thrust fault, approx. located



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**GEOLOGIC MAP
 SARATOGA QUARRY**

FIGURE: 2
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 Date: August 2013

Natural Resource Conservation Service (NRCS) identifies soils as predominantly gravel loam though nearly all of the native soils have been stripped by quarry operations. Locally mantling the majority of the hillside is fill material derived from quarry operations and site reclamation. This material is variable in thickness and consists mainly of poorly sorted angular sand and gravel. Field observations indicate that surficial earth materials are moderately drained with a moderate erosion potential where runoff is concentrated.

Landsliding

Landslides and slope instability are characterized by the movement of soils and surficial deposits, known as colluvium, and bedrock down steep slopes. This movement results from wet weather, adverse structures, seismic shaking and/or improper grading and drainage.

The property is mapped by CSA (2013) as nearly entirely underlain by a 150+ acre large-scale active deep-seated landslide (Figure 3). Field observations identified multiple small debris slides and debris flows. The majority of these are associated with the failure of oversteepened cuts or fills along roads or are small stream bank failures along watercourses.

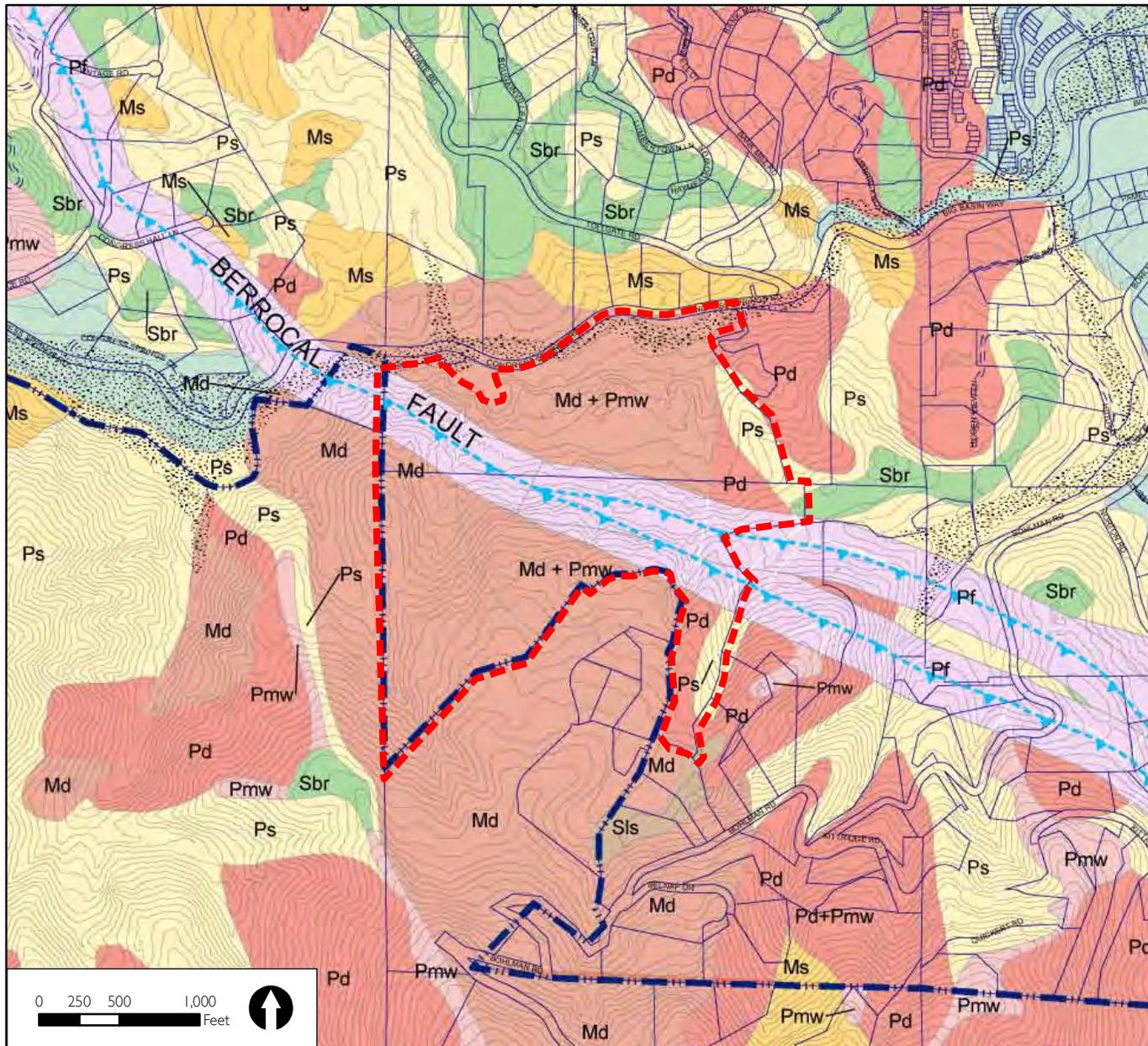
Regional Faults and Seismicity

The subject property is located within a highly seismically-active region of California. A broad system of inter-related northwest-southeast trending strike-slip faults represents a segment of the boundary between the Pacific and North American crustal plates (Figure 3). For approximately the past 15 million years (mid-Miocene) the Pacific plate has been slipping northwestward with respect to the North American plate (Atwater, 1970; Graham and Dickinson, 1978). The majority of movement has been taken up by the San Andreas Fault itself; however, there are other faults within this broad system that have also experienced movement at one time or another. The property is subject to intense seismic shaking during major earthquakes along nearby fault systems.

San Andreas Fault: The San Andreas Fault is an active, northwest-trending right lateral strike slip fault zone and represents the major seismic hazard in northern California. The main trace of the fault trends northeast-southwest and extends over 700 miles from the Gulf of California through the Coast Range to Point Arena, where the fault extends offshore. The San Andreas Fault was responsible for the 1906 San Francisco earthquake (M_w 7.9) and the 1989 Loma Prieta earthquake (M_w 7.0).

The San Andreas Fault is located about 1.5 miles northwest of the project site. This segment of the fault has been assigned a slip rate that results in a M_w 7.3 earthquake with a recurrence interval of 400 years (WGOCEP, 1996).

FIGURE 3



Administrative Boundaries

Plan Area Boundary

City of Saratoga

Areas with Stable Ground

Sbr Level ground to moderately steep slopes underlain by bedrock within approximately 3' of the ground surface or less; relatively thin soil mantle may be subject to shallow landsliding, settlement, and soil creep

Areas with Significant Potential for Ground Movement

Pmw Steep to very steep slopes generally underlain by weathered and fractured bedrock subject to mass-wasting by rockfall, slumping, and raveling

Ps Unstable, unconsolidated material, commonly less than 10 feet in thickness, on gentle to moderately steep slopes subject to shallow landsliding, slumping, settlement, and soil creep

Pd Unstable, unconsolidated material, commonly more than 10 feet in thickness, on moderate to steep slopes; subject to deep landsliding

Liquefaction hazard zones as mapped by the California Geological Survey depicted by stipple

Areas with Potential for Primary Fault Rupture

Pf Zone of potential primary surface fault rupture

Potentially active fault traces

Unstable Ground Characterized by Seasonally Active Downslope Movement

Ms Moving shallow landslides, commonly less than 10 feet in thickness

Md Moving deep landslides, commonly more than 10 feet in thickness

Source: City of Saratoga, 2013; Cotton, Shires and Associates, Inc., Consulting Engineers and Geologists, 2013; The Planning Center DC&E, 2013.

Berrocal Fault Zone: The Berrocal Fault Zone, which transects the property, is a Late Quaternary to possibly Holocene active, poorly constrained reverse to oblique slip fault zone located along the base of the eastern flank of the northeastern Santa Cruz Mountains. It is part of the Southwestern Santa Clara Valley thrust belt that also includes the Sargent, Monte Vista and Shannon Faults (McLaughlin et al., 1996).

Most researchers consider the Santa Clara Valley thrust belt to be potentially active, based upon the geomorphology along the fault zone, as well as loose knit evidence of syntectonic movement during the 1989 Loma Prieta earthquake (Bryant, 2000).

FACTORS AFFECTING TRAIL SUSTAINABILITY

Sustainability can mean different things to different people. In this context the term is used to describe a road or trail that can be maintained for its designated use without off-site impacts and without undue maintenance burdens. Factors influencing road and trail sustainability include 1) trail geometry, design and location, 2) type and extent of use, and 3) maintenance practices. Design and location factors are associated with the layout of the trail and include trail size, gradient, surfacing, orientation, geology and drainage. Use-related factors include type of use, amount of use, and user behavior. Maintenance practices that affect road and trail condition include surface grading, construction and maintenance of drainage structures, and control of use patterns that are impacting the trail.

TRAIL GEOMETRY, DESIGN AND LOCATION RELATED FACTORS

Principal factors that influence trail sustainability from a location and design standpoint include trail geometry (steepness and orientation), drainage provisions, geology and soils, and use. One of the most important considerations for sustainable unpaved roads and trails is maintaining natural drainage patterns to avoid the concentration of runoff, especially down the trail tread, as this leads to erosion and sediment entering streams.

Trail Grade

Numerous studies have documented a strong positive relationship between trail grade and degradation (Best, 2002; Best, 2010; IMBA, 2001; Marion and Olive, 2006; Parker, 2004). The steeper the grade the more likely it is to erode. Most erosion problems tend to occur where the road and trail gradients exceed 15% and it is generally recommended that new trail be constructed with sustained grades less than 15%. Grades steeper than 15% are difficult to adequately drain and as a result, runoff tends to concentrate down the road or trail for long distances. Steep gradient trails also impact recreational access making the trail more difficult to travel and more difficult to use while maintaining control.

Many of the tractor trails on Saratoga Quarry property are quite steep with grades exceeding 15% and up to 35% in some places. Erosion on these trails has been limited, however, probably because of the rocky substrate that comprises the tread material and because many are now overgrown.

Trail Orientation (Fall-line)

Higher rates of erosion occur on fall-line trails (Best, 2002; Best, 2010; Marion and Olive, 2006). These are routes that drop directly down the hillside. Fall-line trails follow the same path that water flows, thereby focusing water down their length. These trails are difficult, if not impossible, to drain and often experience ongoing erosion.

On steep gradient trails with a fall-line orientation, use patterns tend to result in trail widening. This results in greater ground disturbance and higher rates of erosion.

Drainage

One of the most important considerations for sustainable unpaved roads and trails is maintaining natural drainage patterns. Roads and trails should be designed and constructed to minimize disturbance of natural drainage patterns. This avoids the concentration of runoff down the trail tread, which leads to erosion of the tread and sediment entering streams (Best, 2002; Best, 2010; Parker, 2004; PWA, 1994; Webber, 2007). Erosion of the trail tread can result in exposed rocks and plant roots, uneven tread surface and locally muddy conditions. Erosion or instability of the hillslope can also occur where runoff eventually spills over the road embankment.

The most serious problems with drainage tend to occur in areas where the road/trail gradient is steep, typically greater than 15% grade. In these areas constructing effective drainage dips¹, can be difficult and therefore they are often undersized or installed at inadequate intervals. Such drains have a short life expectancy since they tend to break down and/or infill easily with trail use.

Most of the roads and tractor trails on the property were drained by inslope pitch to infrequently spaced cross drains. As a result, runoff was allowed to concentrate for long distances. This does not appear to have resulted in much erosion of the road bed in most instances, but did cause the formation of several larger gullies where runoff was eventually discharged off of the road. Some of this erosion may have occurred shortly after the quarry was closed and prior to the site becoming revegetated. Nonetheless, if roads and trails are to be reopened for trail use it is essential that adequate drainage provisions are incorporated into the design. Where possible these drainage structures should be built to require minimum maintenance.

Stream Crossings

There are a number of stream crossings on the property. The majority of these crossings are culverts that are functioning adequately and are not a significant constraint for future use. The

¹ Drainage Dip: A short dip constructed in the road or trail that forces water off the tread and prevents runoff from concentrating. Drainage dips include rolling dips, reverse grade dips, and as a last option, water bars. Frequent dips are essential elements for sustainable trail design.

most significant issue is found at C19 where a deep ravine has eroded through an old tractor road. Where major washouts occur, extensive reconstruction is usually required which in some cases is cost prohibitive for trail use.

USE RELATED FACTORS

For well-designed and constructed trails, post-construction trail impacts would be minimal in the absence of use. This is the case even on some poorly-designed trails that are not heavily used and are largely covered by vegetation that limits the direct impact of rainfall and runoff. As previously mentioned many of the abandoned roads on the property have inadequate drainage provisions by today's standards but do not show excessive erosion due to the fact the roads are unused and overgrown.

Use Intensity

Most forms of trail degradation on otherwise well-designed trails are related to use intensity, with higher use typically resulting in greater ground disturbance. Leung and Marion (1996) found the majority of post construction changes occur with initial or low levels of use, with changes diminishing, on a per-capita basis, with increasing use. Subsequent degradation on established trails is mostly a function of site durability and other use-related factors such as type of use and use behavior.

Type of Use

Type of use has also been shown to be a determinant of the type and extent of trail impacts (Marion and Olive, 2006; Marion and Wimpey, 2007; Wilson and Seney, 1994). Roads with sustained vehicle use have been shown to have greater degradation than trails where vehicles are not used. Other erosion problems associated with use include hikers and mountain bikes cutting corners and switchbacks resulting in steep, fall-line segments without drainage structures and equestrian use, which can damage the trail tread due to the weight and frequency of use. Because the quarry is not currently being used, this Assessment does not attempt to characterize or differentiate the potential impacts stemming from different types of trail uses.

MAINTENANCE FACTORS

Ideally trails are located and designed to be very low maintenance, but the existing roads and trails were not designed with this in mind. It is likely that the existing steep gradient roads and trails will be utilized in the final park plan. Maintaining drainage structures will be critical, especially prior to the rainy season, in order to prevent damage to the trail tread. Trail upgrades and design specifications will need to include recommendations for maintenance based on planned use, park resources, accessibility, etc.

RESULTS

A reconnaissance level inventory was undertaken on most of the major roads and tractor trails on the property. The purpose of the inventory was to characterize existing conditions and their suitability for recreational trail use. The inventory focused on the principal roads and trails on the property that are most likely to be included in a trail network.

CURRENT TRAIL SYSTEM

The inventory found a high density of roads and tractor trails on the property that were constructed for quarry operations and subsequent reclamation efforts. This includes 0.8 miles of roads that are currently drivable and well over 3 miles of abandoned and overgrown roads and tractor trails. For the purpose of this study, roads are classified as listed in Table 1 below.

TABLE 1: ROAD AND TRAIL CLASSIFICATION	
ROADS	DESCRIPTION
Principal road	Gravel road
Secondary road	Unsurfaced dirt single lane road
Abandoned road	Unused road; typically overgrown.
Tractor road	Unsurfaced steep road constructed for tractor use (>30% grade)
Abandoned tractor road	Unused tractor road; typically overgrown.
Trail	Single track trail

INVENTORY RESULTS

The condition of trails in the park is varied. Most of the roads are in good condition whereas the tractor trails tend to be poor due to their steep grade. Trail grade will be a limiting factor in the future management of the park and will have a direct impact on the type of future use the park can receive.

The condition and constraints of the pertinent trails in the park are summarized in Table 2 below. A detailed description of the roads in found in Appendix 1.

TABLE 2: SUMMARY OF ROADS

ROAD ID	LENGTH (ft)	TYPE	GRADE	DESCRIPTION	CONSTRAINTS FOR TRAIL USE	SUITABILITY FOR TRAIL USE
1A	420	Principal Road	3%	Main gravel road accessing bottom of property off Congress Springs Road	<ul style="list-style-type: none"> None 	Good
1B	600	Principal Road	17%	Main gravel road climbing at moderately steep grade from valley bottom to Pad P5. Tread in good shape. Possible plugged storm drain (C2) at bottom of reach. C3 culvert (30") at top of reach may drain pond. 5 gal buckets incorporated in fill.	<ul style="list-style-type: none"> Drainage 	Good
1C	1700	Principal Road	5% – 20%	Main gravel road contours across hillside at moderate grade to west end of property. Road provides access to pond. Last 250 feet is steep. 30 lf of outer road edge at risk of being undercut at N3. Drainage needs improvement.	<ul style="list-style-type: none"> Drainage Steep 20% grade Undercut road at N3 	Good
1D	200	Principal Road	20%	Short moderately steep gravel road making loop.	<ul style="list-style-type: none"> Steep grade 	Good
1E	250	Secondary Road	10%	Lightly rocked gentle gradient road making loop adjacent to pond	<ul style="list-style-type: none"> Adjacent to pond 	Good
2	750	Secondary Road	5% - 12%	Lightly rocked moderate gradient road accessed off Congress Springs Road from eastern gate. Tread is worn but stable. C3 rusted culvert (36") at stream crossing needs to be replaced. Possible perched fill on outer road edge.	<ul style="list-style-type: none"> Rusted 36" culvert Possible perched fill Drainage 	Good
3	250	Principal Road	16+%	Paved road accessing picnic area. Plugged storm drain at bottom of reach. Past fill failure at N18 reconstructed with low criblog retaining wall.	<ul style="list-style-type: none"> Stability of crib wall at N5 unknown 	Good
4	350	Secondary Road	15%	Secondary road at 15% grade accessing several graded pads used to stockpile old construction material, culverts, and other debris. 30" functional culvert (C5) at old stream crossing. Drainage will need to be upgraded.	<ul style="list-style-type: none"> Drainage 	Good
4A	330	Abandoned Tractor Road	30%	Old overgrown tractor road at steep 30+% grade accessing adjacent parcel.	<ul style="list-style-type: none"> Steep 30% grade Overgrown 	Poor
5	1750	Abandoned Road	5% to 18%	Old overgrown road switch backing up hillside to an old pond and concrete water tank at N6. Tread is intact. Drainage is fair to poor due to lack of cross drains (dips) but this has not caused problems. Two culverted watercourse crossings: C7 is a 48" functional culvert. C8 is a 30" functional put partially plugged culvert. Small sinkhole in road prism at N5 will need to be repaired	<ul style="list-style-type: none"> Steep 18% grade Overgrown 	Good
6	225	Tractor Road	30%	Steep fall-line tractor road dropping down from Road 1 to west end of picnic area. Tread is in good condition. Recently installed wood steps at N7. C9 ditch relief culvert (24") is bypassed. Road accesses Adit A1	<ul style="list-style-type: none"> Steep 30% grade Fall-line orientation Culvert bypassed Stairs 	Fair

ROAD ID	LENGTH (ft)	TYPE	GRADE	DESCRIPTION	CONSTRAINTS FOR TRAIL USE	SUITABILITY FOR TRAIL USE
6A	120	Tractor Road	25%	Short connector road bypassing steps at N7. Lower 40 feet of road is locally wet with 25% grade. Located adjacent to Adit A2.	<ul style="list-style-type: none"> Step 25% grade Locally wet 	Good to Fair
7	750	Abandoned Road	10%	Abandoned road contouring across hillside connecting eastern end of pond to the picnic area. Tread is in good condition but over grown. Wet ford crossing at C10.	<ul style="list-style-type: none"> Overgrown Wet ford crossing 	Good
8A	240	Abandoned Tractor Road	18%	Short tractor road climbing up valley bottom at 18% grade to watercourse crossing. Tread in good condition. Three culverts: C12 functional ditch relief culvert (24") with little flow; C13 partially plugged ditch relief culvert (24"); C14 functional culvert (24") at stream crossing.	<ul style="list-style-type: none"> Partially overgrown 	Good
8B	890	Abandoned Tractor Road	15% - 35%	Steep 15% to 35% gradient abandoned tractor road climbing across steep quarry wall to reach ridgetop. Large outside berm. Tread is intact. Poor drainage resulting in gully at switchback N8. Road narrowed in a few locations from raveling of cutbank. Not feasible to reroute to have lower grade.	<ul style="list-style-type: none"> Steep 25+% grade Large outside berm Steep side slopes Poor drainage Overgrown 	Fair to Poor
8C	430	Abandoned Tractor Road	15% - 25%	Fall-line trail extending up ridgeline at 15% to 25% grade. May be possible to reroute to have lower grade and avoid fall-line orientation.	<ul style="list-style-type: none"> Steep 15% grade Fall-line orientation Overgrown 	Fair to Poor
9A	780	Abandoned Tractor Road	20% - 35%	Steep 20% to 35% gradient tractor road routed across steep rocky quarry wall. Large outside berm. Majority of tread is intact. Poor drainage resulting in entrenched roadbed near N9 and deep gully at N10. This gully narrows the road to less than 3 feet. Not possible to reroute to avoid steep grade.	<ul style="list-style-type: none"> Steep 25+% grade Large outside berm Steep side slopes Poor drainage Gully encroaches into road prism Overgrown 	Fair to Poor
9B	960	Abandoned Tractor Road	15%	Moderate gradient tractor road contours across hillside. Majority of the tread is intact. At N13 an old gully narrows road to about 7 feet. Two wet ford watercourse crossings at C15 and C16. Both crossings will need to be upgraded for trail use.	<ul style="list-style-type: none"> Overgrown Poor drainage Two wet ford crossings 	Good to fair
10	650	Abandoned Tractor Road	5% – 18%	Narrow abandoned tractor road contours across steep rocky hillside at 5% to 18% grade. The road has been narrowed at several locations from cutbank instability depositing debris onto the road surface (N15) and from gully erosion from road drainage (N16). In addition and most significantly, a 60+ foot section of road has completely washed out at a narrow incised ravine (C17) and is no longer passable. It is unknown if the trail can be reconstructed past this site.	<ul style="list-style-type: none"> Cutbank instability Washed out stream crossing 	Poor
11	625	Abandoned Tractor Road	5% to 14%	Old overgrown tractor road contours across moderate gradient slopes above the south side of the pond. There are two wet ford crossings at C18 and C19.	<ul style="list-style-type: none"> None 	Good

APPENDIX 1: ROAD INVENTORY

ROAD 1

Road 1 is the principal road accessing the lower and midslope portions of the property. The road extends 3100+ feet from the gate on Congress Springs Road up the hillside and past the small pond before ending at a small graded pad (P11) near the main old quarry. The road is broken up into 5 reaches, including two small loop roads.

Reach 1A (STN 0 - 420)

Reach 1A is a 420-foot-long, 40-foot-wide gentle gravel road forming a broad graded pad (P1) at the main entrance to the property off Congress Springs Road. The tread has been recently rerocked and is in good condition (Photo 1). There are no signs of erosion or drainage problems. There are two or three storm drain inlets located near the old concrete building that should be checked to see if they are functional.

C1 - culvert: On the downslope side of the road is the outlet of an 18" CMP. The inlet to this pipe was not found. The pipe may be draining a concrete water tank or possibly culverts coming off of the upslope picnic area. Drainage from the concrete water tank and picnic area should be checked.

N1: Stairs: A short set of degraded stairs lead down to a junction box.

Condition and constraints: Overall Reach 1A is in good condition with no significant constraints for future use.



Photo 1: Reach 1A showing good surface condition. Old gravel loading structure in the background

Reach 1B (STN 420 - 1020)

Reach 1B is a 600-foot-long segment of moderately steep, high-use gravel road climbing from the valley bottom to Pad P5 (Photo 3). The road is about 14+ feet wide and climbs at a moderately steep 17% grade (Photo 2). There is one culvert at C3 that appears to drain the nearby pond. Old debris is found locally along the fill embankment below the road at N2.



Photo 2: Grade of 17%. Road tread in good condition.



Photo 3: Large graded pad at P5.

The road tread is gravel that appears recent and in good condition, though slightly worn from use.

The steep 17% grade makes it difficult to drain the road and as a result runoff is conveyed down the road to the inlet of a storm drain (C2) near the bottom of the reach (Photo 4). The inlet to the storm drain appears partially plugged. Though drainage is only fair, there is no evidence of significant erosion of the road surface.



Photo 4: Inlet to storm drain at C2 appears partially plugged.



Photo 5: Outlet to 30-inch diameter CMP.

N2: 5-gallon metal buckets in fill embankment: About halfway up the road are several 5-gallon metal buckets of unknown origin located on the loose fill embankment below a wide segment of road. The fill embankment toes out into an ephemeral watercourse that drains from a 30"

culvert a short distance upslope. The source of the buckets and whether they pose any environmental impact are unknown.

C2: 30" culvert: At the top of the reach is the outlet to a 30" diameter CMP that appears to extend to the pond (Photo 5). The culvert outlet appears in good condition. Presently there is no flow through the pipe suggesting the culvert inlet is blocked. The culvert inlet was not located. The pipe discharges into a dry ephemeral watercourse. The condition of the culvert and its association with the pond requires further review.

Condition and constraints: Overall, the road is in good to fair condition with no significant constraints. As previously mentioned, the steep 17% grade could impact drainage. Drainage will need to be upgraded by maintaining the inboard ditch and cleaning the storm drain inlet at the bottom of the reach. Depending on use the road surface may need to be periodically resurfaced. The fill embankment located at the wide segment of road appears loose and is probably prone to failure but presently does not impact the gravel segment of road.

The 5 gallon buckets should be assessed to determine if they present an environmental hazard.

The 30" diameter culvert presently does not appear to impact the road. The culvert inlet should be identified and assessed to see if it is functioning as designed.

Reach 1C (STN 1020 - 2800)

Reach 1C is a more than 1700-foot-long lightly rocked midslope road that contours across the hillside before ending at a graded pad (P11). The road provides the principal access to the midslope portion of the property including a small pond (Photo 6). There are two adjacent short road segments that form two separate loops in the road.



Photo 6: Photo of western portion of Reach 1C.



Photo 7: Minor rilling on steeper 20% road segment.

The majority of the road has a grade less than 15% with a couple of steeper segments. The last 250 feet of road climb at a steep 20+% grade (Photo 7).

The tread is lightly rocked though locally worn from use. A 40-foot segment of roadway at N3 has been undercut by stream bank erosion at the western end of the reach. Minor rilling is evident on the steeper road segments where the road grade exceeds 15%.

Drainage is fair with most of the road insloped. The most significant drainage issues are along the western portion of road where runoff is collected along 600 lf of road and discharges into the western end of the pond. This runoff has resulted in some shallow rilling of the road surface, especially on the steeper road grades. Road drainage in this area will need to be upgraded by reshaping the road and installing additional cross drains.

N3: Undercut roadway: At the western end of the road segment, approximately 30 lf of roadway have been undercut by stream bank erosion, narrowing the road to about 13 feet. The road at this location appears to have been constructed on a partial bench with fill pushed to the outer edge of the roadway. This fill toes out into a small ephemeral watercourse where some of the material has eroded out from stream bank erosion. Adjacent to the failure is a 30" ditch relief culvert draining a small 1/10 acre graded pad. It is unknown if this culvert played any role in the failure. The outer road edge is currently oversteepened at greater than 80% slope and may be unstable. Continued stream bank erosion is expected which could further undermine the road. For long-term stability, the outer road edge will need to be reconstructed or the road moved inboard slightly. Moving the road inboard will be the most cost-effective solution.

Condition and constraints: Overall, the road is in fair to good condition and suitable for continued road use with upgrades. The principal constraints are the locally steep road grade and undercutting of the road at N3.

Road drainage will need to be upgraded by reshaping the road and installing additional cross drains. The steep 20% grade at the western end of the road will have a higher potential for erosion and therefore require periodic maintenance. At N3 there are 30 lf of road at risk for being undercut by stream bank erosion. In the long term, this section of the road will need to be stabilized or rerouted.

Reach 1D

Reach 1D is a 200-foot segment of rocked road making the first loop with Road 1C. The road is lightly rocked at up to 20% grade. The steeper road segment appears rilled possibly from drainage coming off of Road 4 (Photo 8).

Condition and constraints: Overall the road is in fair to good condition and suitable for continued use with upgrades. The steep 20% grade has a higher potential for erosion and therefore may require periodic maintenance. Drainage coming off of Road 4 will need to be upgraded if this segment is to be reopened.



Photo 8: Steep rilled segment of Reach 1D.



Photo 9: Well-vegetated edge of Reach 1E adjacent to pond.

Reach 1E

Reach 1E is a 250-foot segment of unsurfaced road extending along the north side of the pond and making a second loop with Road 1C. Road fill appears to toe out into the pond but appears well-vegetated (Photo 9). The road tread is lightly rocked and in good shape. No significant erosion observed.

Condition and constraints: Due to its close proximity to the pond, erosion of the road surface will discharge fine sediment into the pond. If this is a significant issue then the road should be rocked if use is to continue or increase.

ROAD 2

Road 2 is a 750-foot-long segment of lightly rocked road extending from the eastern most gate off Congress Springs Road and providing a secondary access to the property. The first 350 feet of road extending from the gate are at 12 % grade (Photo 10); the remaining 400 are at less than 5% grade.

At the western end of the road before its intersection with the main gravel road is a broad graded pad (Photo 11). This pad appears to have been used to stockpile spoils, which partially block the road and form a large outside berm to the road.

The road is lightly rocked and in fair condition, being somewhat rutted from use. Drainage is fair. There are no cross drains in place, though little significant erosion was observed. There is one culverted stream crossing at C4.



Photo 10: Lowered rutted segment of Road 2



Photo 11: Upper wide portion of Road 2. Large berm visible on left



Photo 12: Inlet to rusted 36" culvert

C4: 36" culvert: This is a 36" x 30" diameter CMP draining a small intermittent to perennial stream near its confluence with Saratoga Creek (Photo 13). The culvert is rusted with pin holes

observed in the culvert bottom. There is some sediment backed up behind the culvert inlet suggesting the pipe may be undersized. This culvert will need to be replaced.

Condition and constraints: Overall the road is in fair condition and suitable for continued use with upgrades. The road surface should be regraded and rocked to remove ruts and improve drainage. The large berms found along outer road edge should be removed. For long-term stability, the rusted 36" CMP should be replaced.

ROAD 3

Road 3 is a 250-foot-long paved road accessing picnic grounds. The road is moderately steep at 16%-plus grade (Photo 13). Road is paved with the tread in good condition and drained by inslope to partially plugged storm drain inlet that will need to be cleaned. There are two old road failures at N17 and N18.



Photo 13: Photo of Road 3



Photo 14: Cutbank failure at N17 above Road 3



Photo 15: Crib wall at fill failure N18 on Road 3

N17: Old cutbank failure: This is an old 20-foot-wide cutbank/fillslope failure above the road. Slide appears to have been partially stabilized with an unengineered “chain-link fence” retaining wall (Photo 14).

N18: Old fill failure: This 35-foot-wide old shallow fillslope failure extends to the outer road edge (Photo 15). Slopes below the road are steep at greater than 65%. A couple of stacked crib logs have been placed at the top edge of the slide scarp to stabilize the outer edge of the road. These logs are slightly degraded and their long-term stability is uncertain. A 2” water line crosses the slide scarp. Unknown if the water line is functional.

Condition and constraints: Road is suitable for continued use. Long-term stability of the old fill failure is unknown. Inlet to the storm drain will need to be cleaned.

ROAD 4

Road 4 is a 350-foot-long, infrequently-used, unsurfaced and grassed-over road accessing two graded pads (P6 and P7). These pads are stockpiled with old construction material, culverts, pipes, and other debris (Photos 17 and 18). There is one culverted watercourse crossing at C4 and a small diameter ditch relief culvert at C5. Several oil drums are found at the end of the road (Photo 19)

The road is routed up a graded bench at 15% grade. Much of the tread is grassed over with the lower (northern) portion indistinct (Photo 15). There is no evidence of any drainage dips installed. There is little evidence of erosion, mainly because the road is grassed over.



Photo 15: Looking up overgrown road 4



Photo 16: Inlet to culvert C5

C5: 30" Culvert: 30" x 20' CMP draining small ephemeral watercourse with very little flow (Photo 16). Culvert is intact without problems.

C6: 12" Ditch relief culvert: 12" x 20' ditch relief culvert crossing the entrance of pad P6. Culvert is partially plugged with sediment. Presently the pipe does not appear to receive much flow. Inlet to the culvert is partially brushed over.

Condition and constraints: Overall the road is in good to fair condition and is suitable for future use with drainage upgrades. Culvert inlets should be cleared. If the road is reopened then drainage on the lower road segment will need to be improved to avoid draining onto Road 1D.



Photo 17: Debris on lower pad



Photo 18: End of road 4



Photo 19: Oil drums on Road 4

Reach 4A

This is a ~330-foot-long old overgrown tractor road extending from Pad 7 at the end of Road 4 to an adjoining property.

The road is visible in the 1956 aerial photographs but is overgrown in subsequent photos. The tread is identifiable in the LiDAR imagery at roughly 12 feet wide with greater than 30% grade. A field review of this road was not made.

Condition and constraints: The trail is in poor condition and generally not suitable for future use due to its steep 30% grade.

ROAD 5

This is a 1750-foot-long 15- to 20-foot-wide overgrown road switchbacking up a hillside to an old pond and concrete water tank. The road ends at a large graded pad (P12) at the edge of a deeply incised ravine/watercourse at C6. Crossing this ravine would provide part of what would likely be a popular loop trail, but access may be difficult due to being deeply incised.

The lower 400 feet of road climbs at a 15% to 18% grade (Photos 20 and 21); thereafter the grade drops to a more favorable grade of less than 5% (Photo 25).

The tread is lightly rocked and generally in good condition, though lower portion is slightly rutted. Although drainage is fair to poor due to lack of any cross drains (e.g. dips), there has been only limited erosion due to the rocked and overgrown nature of the road bed.

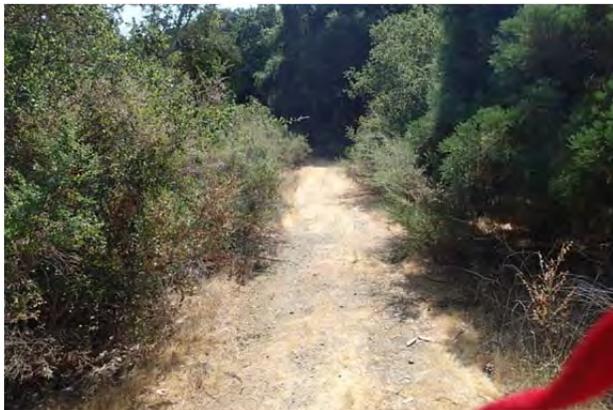


Photo 20: Lower portion of Road 5



Photo 21: Middle portion of Road 5

There are two functional watercourse crossings along the alignment (C7 and C8). A short retaining wall supports a 45-foot-long segment of road cut at N4. At N5 there is a small sinkhole in the road bed.

C7: 48" culvert: 48" x 40' long CMP with concrete sack headwall at an incised ephemeral watercourse (Photo 22). Culvert appears functional and without problems.

N4: Retaining Wall?: At this location the road cut appears to be supported by a 45-foot-long, 8-foot-high concrete retaining wall (Photo 23). The wall appears somewhat degraded.

N5: Sinkhole: 1-foot-diameter by 2-foot-deep sinkhole caused by soil piping has developed in the middle of the old road (Photo 24). Continued erosion is likely. The loose soils around the sinkhole will need to be removed and recompacted.

C8: 30" culvert: 30" x 30' long CMP located on an ephemeral watercourse at the outlet of a small pond (Photo 26). Culvert appears functional though the inlet is overgrown. The pipe does not appear to receive much flow. Adjacent to the culvert is a concrete water tank.

N6: Concrete water tank: This is a 40-foot-long by ~22-foot-wide concrete water tank/reservoir located on the outer road edge (Photo 27). The water tank appears dry.

Condition and constraints: Overall the road is in good to fair condition and suitable for continued use with upgrades. The principal constraint is the moderately steep 18% grade in the initial section of road. For future use, road drainage will need to be upgraded by installing drainage dips. The sinkhole at N5 will need to be excavated and reconstructed.



Photo 22: Inlet to culvert C7



Photo 23: Possible old concrete retaining wall at N4



Photo 24: Small sinkhole at N5



Photo 25: Upper portion of Road 4



Photo 26: Inlet to culvert C8. Concrete water tank to left.



Photo 27: Concrete water tank N6

ROAD 6

Road 6 is a 225-foot-long, steep-gradient fall-line tractor road dropping from Road 1 down to the west end of the picnic area (Photo 28). The road also accesses several small graded pads (P13, P14 and P16) and the entrance to adit A1 (Photo 29). A set of wood steps (N7) has recently been constructed on the lower 40 feet of the trail.

The trail is steep at a 25% grade with a short 35% gradient segment at the wood steps. The tread lightly rocked, partially grassed over and overall in good condition.

The trail is drained by an inslope pitch that was designed to discharge into a 24-inch-diameter ditch relief culvert at C9. The ditch appears to have infilled with sediment and flow currently bypasses the culvert.

C9: 24" culvert: 24" x 40' long CMP draining inboard ditch (Photo 30). The ditch is infilled and flow bypasses the culvert.

N7: Wood Steps: This is a series of recently installed wood steps constructed from railroad ties and anchored into the slope with rebar (Photo 31).



Photo 28: Looking up Road 6



Photo 29: Entrance to Adit A1



Photo 30: Culvert C9 on Road 6



Photo 31: Recently built steps at the bottom of Road 6

Condition and constraints: Overall the trail is in good to fair condition and suitable for continued use with upgrades. The principal constraints are the steep 25% fall-line grade and the steps. Rerouting the trail to have a lower grade would be preferential, though may not be feasible due to topographic constraints in the area.

Fall-line trails are inherently difficult to drain and require a higher level of maintenance to ensure drainage structures are functioning. Presently the trail is not adequately drained, with runoff bypassing the culvert. This problem can easily be remedied by reshaping the road and cleaning the culvert inlet at C9.

The wood steps are functional but would preclude bicycle and equestrian access. Because the steps do not incorporate a side rail they may be prone to shifting over time. The steps can be bypassed by following a gentle gradient tractor trail at 6A.

Reach 6A

Reach 6A is a 120-foot-long tractor road providing an alternative way to connect the top of the stairs on Trail 6 to the Picnic area (Photos 32 and 33). The trail also accesses the western end of Road 7, one of the mine adits at A2 (Photo 34) and a small pad at P17. There is a small diameter plugged culvert (C11) near the entrance of the adit A2

The trail grade is 10% with a short 25% section at the north end. The tread is unsurfaced and grassed over. The lower portion of the trail may be seasonally wet due to runoff coming out of adit A1 and flowing down to the site.



Photo 32: Lower portion of Road 6A



Photo 33: Western end of Road 6A



Photo 34: Entrance to Adit A2

Condition and constraints: Overall, the trail is in fair condition with the principal issue being the steep grade and wet ground near the end. It should be feasible to regrade the lower portion of the trail and apply base rock to remedy this problem. This alignment would provide a lower grade alternative to using the stairs at Road 6.

ROAD 7

Road 7 is a wide 750-foot-long abandoned and overgrown road contouring across the hillside to connect the western end of the picnic area to the west side of the pond. The road is heavily vegetated with brush and grass.

There is a wet ford crossing at C10 where the road crosses a small perennial watercourse draining out of adit A1. A large graded pad is found at P15 (Photo 36) with small a degraded trail with wood steps descending to the picnic area. A second pad or wide section of road is found at P18.

The tread is in good condition with few signs of erosion. The grade is gentle, generally at less than 10%.

C10: Wet Ford Crossing: This is a wet ford crossing located where the old road crosses runoff draining out of the adit at A1. Flow is poorly confined resulting in a roughly 20- to 30-foot-long segment of wet road (Photo 35). It should be feasible to upgrade this crossing by installing a culvert, rock ford, or puncheon.

Condition and constraints: Overall the road is in good condition except for being overgrown. The road could easily be reopened for permanent use by clearing brush and installing drainage dips. Crossing C10 would need to be upgraded by installing a culvert, rock ford, or puncheon.



Photo 35: Wet ford crossing at C10



Photo 36: Wide bench on Road 7

ROAD 8

Road 8 is a 1550-foot-long overgrown tractor road climbing at a steep 30% grade from the end of Road 1 to the ridge top. Use of this road will be essential to establish an upslope loop trail. However, feasibility of this route for trail use is constrained by steep grade, steep side slopes and difficult drainage. The road has been divided into three reaches: 8A, 8B and 8C.

Reach 8A (STN 0 – 240)

The first 250 feet of road climb up the valley bottom from the end of Road 1 to a small ephemeral watercourse at C14 (Photo 37). The road grade is moderately steep at 15% to 18%. The tread appears rocked with minimal past erosion. There are three culverts along this section of road: C12, C13 and C14. Overall, this segment of trail is in good condition, though drainage should be improved by installing a couple of drainage dips.

C12: 24" Culvert: 24" x 40' ditch relief CMP draining inboard edge of Pad P11 (Photo 38). The pipe discharged on the slide area N3 which is undercutting part of Road 1. The culvert presently receives very little flow and is probably not a significant factor in the stability at N3.

C13: 24" Culvert: 24" x 40' culvert draining an upslope gully. The culvert is functional though the inlet is about half plugged with sediment. Upslope of the culvert is a very large and deep gully (N10) that initiates at Road 9A. This gully formed within graded fill material from the reclamation and appears to have been a result of concentrated road runoff coming off of road 9A. Most of the erosion appears old with scarps distinct but weathered. It is quite possible that most of the erosion occurred shortly after the site was regraded and prior to the slope revegetating. Regardless, the gully serves to illustrate the potential for significant erosion to occur when runoff is concentrated. For future use the culvert inlet should be cleaned and drainage on the upper road upgraded if reopened.

C14: 24" Culvert: 24" x 40' culvert at small ephemeral watercourse with little flow (Photo 39). Inlet is partially blocked by a couple of rocks, and the outlet by a wood rat nest. Otherwise the crossing is functional.

Condition and constraints: Overall this segment of trail is in good condition though drainage should be improved by installing a couple of drainage dips.



Photo 37: Inlet to culvert C12



Photo 38: Partially blocked inlet to culvert C14



Photo 39: Looking down Road 8A

Reach 8B (STN 240 – 1130)

This 890 foot long segment of tractor road climbs from the valley bottom at C14 to the ridge top (Photos 40 and 41). The majority of the alignment is located on steep 60% to 90%-plus gradient rocky slopes along the western edge of the old quarry. The road crosses a small pad at P19 and makes a tight switchback at N8.

The road is steep with over half of the alignment with a grade of 15% to 35%. The road appears to have been constructed on cut and fill resulting in a steep, high and rocky cutbank. Portions of the cut have failed, depositing debris on the road tread and narrowing it slightly (Photos 42). The road tread is generally in good shape though heavily vegetated with brush. A large 2-plus-foot-high berm is found along the outer road edge where the road crosses the steepest slopes. This berm was probably built to act as a barrier from the steep slope below.

This segment of road is poorly drained with an insloped pitch that collects water for 600+ feet of roadway. Runoff is discharged off the road at switchback N8 where it has eroded a deep gully on the hillslope below. Most of the erosion appears old and probably occurred when the road was unvegetated and there was a higher rate of runoff. Reopening the road for trail use could

result in renewed erosion unless additional cross drains are installed to prevent excess runoff from concentrating.

Condition and constraints: Road is poorly suited for trail use with the principal constraints being the steep 15% to 35% road grade, steep side slopes, and poor drainage conditions.

Over half of the grade is steeper than 15%, which is the maximum sustained grade generally recommended for trail use. Numerous studies have documented a strong positive relationship between trail grade and degradation (Best, 2002; Best, 2010; IMBA, 2001; Marion and Olive, 2006; Parker, 2004). The steeper the grade the more likely the trail is to erode. Most erosion problems tend to occur where road and trail gradients exceed 15%. Grades steeper than 15% are difficult to adequately drain and as a result runoff tends to concentrate down the road or trail for long distances. Steep gradient trails also impact recreational access making the trail more difficult to travel and more difficult to use while maintaining control. This could be an issue if mountain bikers and hikers are to share the alignment.

The road can be opened for trail use with the understanding that the steep grade will require a high level of maintenance to ensure that drainage dips are functional and to repair degraded segments. It may be possible to reduce the erosion potential narrowing the trail to a 4- to 5-foot width to reduce the amount of ground where runoff can occur. This may be accomplished by pulling back some of the perched fill along the outer edge of road and compacting the material along the inboard edge. Rerouting the trail to have a lower gradient is also a possibility but likely difficult due to the steep surrounding slopes.



Photo 40: Lower portion of Road 8B



Photo 41: Middle portion of Road 8B before it becomes heavily vegetated.



Photo 41: Cutbank instability on Road 8B

Reach 8C (STN 1130 – 1550)

The last 430 feet of road climbs the fall-line of the ridge at a 15% to 25% grade (Photo 42 and 43). The tread is in good condition but at risk for erosion due to steep grade and fall-line orientation. If opened for trail use, drainage dips will need to be installed to control drainage or preferably the trail rerouted to avoid a fall-line orientation.

Condition and constraints: Road is poorly suited for trail use with the principal constraints being the steep 15% to 25% road grade and fall-line orientation.

Higher rates of erosion also occur on fall-line trails (Best, 2002; Best, 2010; Marion and Olive, 2006). They are routes that drop directly down the hillside. Fall-line trails follow the same path that water flows, thereby focusing water down their length. These trails are difficult, if not impossible, to drain, and often experience ongoing erosion.

It may be possible to reroute this trail to have a lower grade and to avoid a fall-line orientation.



Photo 42: Steep fall line segment on Road 8C



Photo 43: Old water truck at end of Road 8C

ROAD 9

Road 9 is a 1720-foot long locally very steep tractor road that connects the ridge near the end of Road 8 to the valley bottom at Road 5. The western portion of this road would be required to be reopened for any upslope loop trail. The road is divided into two reaches 9A and 9B.

Reach 9A (STN 0 – 780)

Reach 9A is a steep gradient tractor road that begins at the ridgetop at the end of Road 8 and extends 780 feet across steep rocky face of the old quarry wall to a deep gully at N10.

The road was constructed across steep 60% to 90+% gradient slopes resulting in a steep and high rocky cut. Portions of the cut have failed or raveled depositing debris on the back edge of the road tread and narrowing the road slightly.

The road grade is very steep with over half of the alignment with a grade between 20% and 35%. Future trail use is constrained by this steep grade which will make it difficult to drain and may hinder access. In general, to be sustainable, trails should have a sustained grade of less than 15%.

The road is poorly drained with an inslope pitch and a large 2 to 3 foot high outside berm along the majority of the alignment. Road runoff is concentrated along the entire reach causing the roadbed to become entrenched near N9 and resulting in a larger and deep gully at N10 where flow eventually discharges off of the road. This gully has encroached most of the way though the road prism narrowing the road to less than 3 feet. Most of the erosion appears old and probably occurred when the road was unvegetated and there was a higher rate of runoff. Reopening the road for trail use could result in renewed erosion unless additional cross drains are installed to prevent excess runoff from concentrating.

N9: Outside road berm: 2 to 3 foot high berm along outer edge of road that concentrated runoff. Road bed has become entrenched.

N10: Gully: 20 foot wide, 8-foot deep gully encroaches most of the way into the road prism. A three-foot wide trail leads around the head of the gully. The gully is the result of poor road drainage. Erosion has diminished as the site revegetated but the potential for renewed erosion exists if the road is to be reopened for trail use. Some road reconstruction will be required to reopen the trail past the gully.

Condition and constraints: Road is in poor condition and generally poorly suited for trail use. The principal constraints are the steep 15% to 35% road grade, steep side slopes, large outside berm, N10 gully and poor drainage.

Over half of the trail has a gradient greater than 20% which is too steep to be sustainable without a high level of maintenance. It may be possible to reduce the erosion potential narrowing the trail to a 4 to 5 foot width to reduce the amount of ground where runoff can occur. Rerouting the trail to have a lower grade is not feasible due to very steep sideslopes.

Road drainage will need to be improved if the trail is to be reopened. This will require removing the large outside berm and installing frequent drainage dips. Repair to the gully at N10 will also be required.

Reach 9B (STN 780 – 1720)

Reach 9B is a 960 foot long old tractor road that contours across the hillside at generally less than 15% grade. The tread is intact and generally in good condition. Drainage is fair and will need to be upgraded if the road is to be reopened. A cutbank failure partially blocking the road is found at N11. A large outside berm and entrenched road prism are at N12. A small gully has encroached partway into the road prism at N13. There are two earth ford watercourse crossings at C15 and C16.

N11: Cutbank failure: Small cutbank failure has deposited a small amount of rocky debris onto the road surface, narrowing the road slightly.

N12: Berm: 2 to 3 foot high berm along outer road edge. Will need to be regraded if road is to be opened for trail use.

N13: Gully: 20-foot wide gully narrows the old road to about 7 feet. Gully is attributed to poor road drainage in past. There appears to be enough of a bench remaining that the trail can be routed around the head of the gully without much problem.

C15: Wet ford crossing: Wet ford crossing where road crosses a small perennial stream and wet area. Stream flow appears to be diverted down the road. Road bed is intact but muddy. It should be feasible to upgrade this crossing by correcting the diversion and installing a culvert, rock ford, or puncheon.

C16: Wet ford crossing: Second wet ford where road crosses a small perennial stream. It should be feasible to upgrade this crossing by correcting the diversion and installing a culvert, rock ford, or puncheon.

Condition and constraints: Road is in fair to poor condition but can be converted to trail use with upgrades. The alignment will need to be regraded and frequent drainage dips installed. The two watercourse crossings will need to be upgraded by installing rock ford, wood puncheon, or culvert.

ROAD 10

Narrow abandoned tractor road extending 650 feet east from Road 9 to a washed out watercourse crossing at C17 before reaching the end of Road 4. The road was constructed at 10 foot width across steep 75+% gradient slopes resulting in steep rocky and unstable cuts. The grade is moderate at 5% to 18%.

The road has been narrowed at several locations from cutbank instability depositing debris onto the road surface (N15) and from gully erosion from road drainage (N16). In addition and most significantly, a 60+ foot section of road has completely washed out at a narrow incised ravine (C17) and is no longer passable. If these issues can be resolved then the road could provide part of a major loop trail when connected to Roads 5 and 9.

N15: Cutbank instability: Raveling of the steep rocky cutbank has deposited talus and rocky debris onto the road surface and in some places narrows the road to less than 3 feet. A multi-use trail can be established by ramping over the failed debris.

N16: Gully: At this location a small gully has eroded into the outer road edge narrowing the road to less than 9 feet. The erosion is mostly likely associated with road drainage. Most of the erosion appears old and probably occurred shortly after the road was abandoned.

C17: Washed out stream crossing: At this location the old tractor road appears to have crossed an ephemeral watercourse before reaching a large graded pad at the end of Road 5. Following the reclamation of the property this watercourse appears to have deeply incised forming a narrow ravine that washed out the crossing. At the crossing this ravine is 20 feet wide and 10 feet deep with steep channel banks. On the right (east) side of the ravine an additional 40+ feet of roadway appears to have failed and down dropped probably from slope instability. This failure occurred at a seep which may have contributed to the failure.

It is unknown if the trail can be reconstructed past this site. Reconstruction is constrained by the steep slopes and unstable nature of the underlying earth materials. Spanning the ravine with a bridge is probably not feasible due to the unstable ground. Likely the best alternative would be to reconstruct the crossing at a narrow width on engineered fill. Additional geologic and geotechnical work will be required to further evaluate the feasibility of reopening this site for trail access.

Condition and constraints: Road is in poor condition. The most significant constraint is at Crossing C16 where a 60 foot long segment of roadway has eroded out and failed. It is unknown if the trail can be reconstructed past this site. Additional geologic and geotechnical work will be required to further evaluate the feasibility of reopening this site for trail access.

ROAD 11

625 foot long abandoned road or tractor trail contouring across moderate gradient slopes above the south side of the pond. The road connects Road 5 with Road 1. The tread appears intact but overgrown with brush. Grade is gentle to moderate at mostly less than 10%. Old rilling of the road surface is found on the eastern portion of the roadway. There are two wet ford crossings at C18 and C19.

C18: Wet ford crossing: Wet ford crossing where road crosses a small perennial stream and wet area. It should be feasible to upgrade this crossing by correcting the diversion and installing a culvert, rock ford, or puncheon.

C19: Wet ford crossing: Second wet ford where road crosses a small perennial stream. It should be feasible to upgrade this crossing by correcting the diversion and installing a culvert, rock ford, or puncheon.

Condition and constraints: Overall, the road is suitable for continued road use with upgrades.

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