California Native Species Field Survey Form

Mail to:
Natural Diversity Database
California Dept. of Fish & Game
1416 Ninth Street, 12th Floor
Sacramento, CA 95814

For office use only
Source Code _____ Quad Code _____
Elm Code _____ Occ # _____
Copy to _____ Map Index # _____

Date of Field Work (*Month – Day – Year*) *April 30 2007*

Scientific Name : *Castilleja cinerea*
Common Name :

Species Found?	Yes	No	*If not, why?*	*Total Number of Individuals:*
	xx			Occasional on pebble plain and open forest, with Eriogonum wrightii subscaposum

Is this an existing NDDB occurrence?	Yes	*Occurrence #*	No		**Is this a Subsequent Visit?**	Yes	No	*#s of individuals since last visit*		
	xx	24			Also noted in 02	xx		*More ?*	*Fewer ?*	*Same ?* xx

Collected?	Yes	*Coll. #,Museum/Herbarium:*
	xx	11657 / RSA

Reporter:	Scott D. White
Address:	Scott White Biological Consulting 201 North First Ave., No. 102 Upland, Calif. 91786
Phone: **E-mail:**	(909) 949-2686 / scottbioservices@earthlink.net

Plant Phenology Information

dormant %	*sterile* %	*senescent* %
budding %	*flowering* %	*fruiting* %

Animal Information

Age Structure:	*# of adults*	*# of juveniles*	*# of unknown*		
Wintering	*Foraging*	*Breeding*	*Roosting*	*Burrow site*	*Other*

Location: (*please attach map*)
San Bernardino Mtns., just north of Big Bear Lake near community of Fawnskin at former "Moon Camp" site

County:	**Quad Name:**	**Landowner:**	
San Bernardino Co.	Fawnskin	private	
Elevation:	*Township*	*Range*	*Section (s)*
6800-6900 ft	2N	1W	13 (N half)
Latitude:	*Longitude:*		
Ca. 34°16' N	Ca. 116°56' W		

UTM Data	*Zone*	*Datum*	*Source*	*Accuracy*	*X coordinate (E)*	*Y coordinate (N)*

Habitat Description: (*plant communities, dominants, associates, substrates/soils, aspects/slope*)
Pebble plain surrounded by arid Jeffrey pine forest.
Other rare species? Arabis parishii, Astragalus leucolobus, Ivesia argyrocoma, Castilleja cinerea, "C. montigena,"

Site Information

Current/surrounding land use: Vacant, short distance S of residential development, short distance N of well-used highway
Visible Disturbances; possible threats: Significant vehicle damage to habitat; site proposed for development

Overall site quality: ??	*Excellent*	*Good*	*Fair*	*Poor*

Comments:

Determination method:	*Photographs:*	Slides	Prints	Digital
[x] *Keyed in a site reference:*	*Organism*			
[x] *Compared with other specimen*	*Habitat*			
[] *Compared with photo/sketch*	*Diagnostic Features*			
[x] *By knowledgeable individual*	*Other*			
[] *Other method:*	*Permission to duplicate*	yes []	no []	

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For office use only
Source Code _____ Quad Code _____
Elm Code _____ Occ # _____
Copy to _____ Map Index # _____

Date of Field Work (Month – Day – Year) April 30 2007

Scientific Name : *Castilleja "montigena"*
Common Name :

Species Found?	Yes	No	If not, why?	Total Number of Individuals:
	xx			Occasional in forest

Is this an existing NDDB occurrence?	Yes	Occurrence #	No		Is this a Subsequent Visit?	Yes	No	#s of individuals since last visit: More ?	Fewer ?	Same ?
			xx		Also seen in 02	xx				xx

Collected?	Yes / No	Coll. #,Museum/Herbarium:

Reporter: Scott D. White
Address: Scott White Biological Consulting
201 North First Ave., No. 102
Upland, Calif. 91786
Phone / E-mail: (909) 949-2686 / scottbioservices@earthlink.net

Plant Phenology Information

dormant	sterile	senescent
%	%	%
budding	flowering	fruiting
%	%	%

Animal Information

Age Structure:	# of adults	# of juveniles	# of unknown

Wintering	Foraging	Breeding	Roosting	Burrow site	Other

Location: (please attach map)
San Bernardino Mtns., just north of Big Bear Lake near community of Fawnskin at former "Moon Camp" site

County:	Quad Name:	Landowner:
San Bernardino Co.	Fawnskin	private

Elevation:	Township	Range	Section (s)	Latitude:	Longitude:
6800-6900 ft	2N	1W	13 (N half)	Ca. 34°16' N	Ca. 116°56' W

UTM Data	Zone	Datum	Source	Accuracy	X coordinate (E)	Y coordinate (N)

Habitat Description: (plant communities, dominants, associates, substrates/soils, aspects/slope)
Arid Jeffrey pine forest; generally in relatively shaded places
Other rare species? Arabis parishii, Astragalus leucolobus, Ivesia argyrocoma, Castilleja cinerea, "C. montigena,"

Site Information

Current/surrounding land use: Vacant, short distance S of residential development, short distance N of well-used highway
Visible Disturbances; possible threats: Significant vehicle damage to habitat; site proposed for development

Overall site quality: ??	Excellent	Good	Fair	Poor
Comments:				

Determination method:	Photographs:	Slides	Prints	Digital
[] Keyed in a site reference:	Organism			
[] Compared with other specimen	Habitat			
[] Compared with photo/sketch	Diagnostic Features			
[x] By knowledgeable individual	Other			
[] Other method:	Permission to duplicate	yes []	no []	

B.9 - Supplemental Focused Rare Plant Survey (Tim Krantz, June 2008

MOON CAMP TENTATIVE TRACT 16136

SUPPLEMENTAL FOCUSED RARE PLANT SURVEY

Prepared for:
Michael Brandman Associates
621 E. Carnegie Dr., Suite 100
San Bernardino, CA 92408

Prepared by:
Dr. Timothy P. Krantz
Timothy Krantz Environmental Consulting
(a division of Pangaea Nova LLC)
P.O. Box 33
Angelus Oaks, CA 92305

June 29, 2008

Project site location:	USGS Fawnskin 7½-minute topographic map, Township 2 North, Range 1 West, portion of Section 13.
Assessors Parcel Nos.:	0304-082-04 and 0304-091-12, 13 and 21
Owner /Applicant:	Tim Wood, P.O. Box 6820, Big Bear Lake, CA 92315
Principal Investigator:	Dr. Timothy P. Krantz, (909)748-8590

MOON CAMP TENTATIVE TRACT
SUPPLEMENTAL FOCUSED RARE PLANT SURVEY

TABLE OF CONTENTS

MAPS, APPENDICES, AND ATTACHMENTS

MOON CAMP TENTATIVE TRACT 16136
SUPPLEMENTAL RARE PLANT SURVEY

I. EXECUTIVE SUMMARY

A focused rare plant survey of the Moon Camp Tentative Tract 16136 was completed for the property. This survey supplements a general botanical survey of the property conducted by Scott White Biological Consulting, dated August 2007 (White 2007, henceforth, "White survey"). The White survey positively identified one federally-listed plant species—ashy-gray Indian paintbrush (*Castilleja cinerea)*—and four special-status species: Parish's rock-cress (*Arabis parishii*), Big Bear Valley woollypod (*Astragalus* leucolobus), Heckard's paintbrush (*Castilleja montigena*) and silver-haired rattails (*Ivesia argyrocoma*) (Table 1).

This supplemental survey affirmed the presence of these species, and added two additional special-status species: purple monkeyflower (*Mimulus purpureus*) and Sugarloaf phlox (*Phlox dolichantha*); and disaffirmed presence of a list of other special-status and federally-listed plant species deemed to potentially occur on the property, according to White (Table 2).

The White survey had identified 13.81 acres of ashy-gray paintbrush habitat, distributed among four occurrences (Figure 1). This supplemental survey found the two easternmost occurrences to be erroneous. No ashy-gray Indian paintbrush plants occur at those two sites. In addition, the occupied habitat of the middle occurrence was found to cover less than one-third the estimated acreage reported by White, and the western occurrence exhibited a somewhat smaller occupied habitat footprint, but was deemed to generally conform to White's estimated acreage. Altogether, the occupied habitat of ashy-gray Indian paintbrush has been recalculated to approximately 7.71 acres.

II. PROJECT AND PROPERTY DESCRIPTION

The San Bernardino County Planning Department is reviewing an application for Moon Camp Tentative Tract 16136—a proposed 50-lot residential development on the former Moon Camp site in Fawnskin. The project site is on the north shore of Big Bear Lake, in the eastern part of the community of Fawnskin, in unincorporated San Bernardino County. The project site is comprised of about 62 acres, situated on both sides of State Highway 38, between Oriole Lane and Polique Canyon Road (on the Fawnskin USGS 7½' quadrangle map, in the north half of Section 13, Township 2N and Range 1W). The project site slopes from north to south. Elevation ranges from 6,960 feet in the northeastern portion of the site to 6,750 feet near the lakeshore (see Figures 1 and 2).

The project site occurs within an area that is described by the Open Space element of San Bernardino County's General Plan as, "This area includes the entire watershed area of Big Bear Lake, and contains a number of specialized habitat areas, which support a large number of endangered plants and animals (as well as commonly occurring mountain species). Habitat values

here should be maintained, potentially by controlling development to prevent damage to important habitat areas."

III. FOCUSED STUDY / SPECIES OF CONCERN

The White survey was conducted on three dates, April 30, June 7, and August 8, during the 2007 season. The 2007 precipitation season (measured from July 1 to June 30 annually) was a record drought year for the San Bernardino Mountains, with only 11.66 inches of precipitation recorded at Big Bear Dam, compared to an average annual precipitation of 36.00 inches. For this reason, White recommended that additional surveys be accomplished to determine presence or absence of four federally-listed endangered plant species known to occur in montane meadow habitats; and that a subsequent survey should be accomplished on site to determine presence or absence of three federally-listed species known to occur on pebble plain habitat. In addition, there are numerous other special-status plant species potentially occurring in the area , particularly annual species, that would not be identifiable during extreme drought years.

The 2008 precipitation year was average, with 35.29 inches through May this year, and flowering of both annual and perennial species exhibited good anthesis.

This report focuses on determining presence or absence of the following plant species:

Montane Meadow Species:

- San Bernardino bluegrass (*Poa atropurpurea*) (federally endangered);
- Bird-foot checkerbloom (*Sidalcea pedata*) (federal- and state-endangered);
- California dandelion (*Taraxacum californicum*) (federal-endangered); and
- Slender-petaled thelypodium (*Thelypodium stenopetalum*) (federal-endangered).

Pebble Plain Species:

- Bear Valley sandwort (*Arenaria ursina*) (federally threatened);
- Ash-gray Indian paintbrush (*Castilleja cinerea*) (federal-threatened); and
- Southern mountain buckwheat (*Eriogonum kennedyi* var. *austromontanum*) (federal-threatened).

IV. METHODOLOGY

California Department of Fish and Game field survey protocols were followed for each of the target federal-listed species considered to potentially occur on site (CDFG 2000). These protocols basically require that surveys are conducted following these guidelines: (1) conducted during flowering seasons for the special status plants known from the area, (b) were floristic in nature, (c) were consistent with conservation ethics, (d) systematically covered all habitat types on the site, and (e) are well documented by this report.

A walkover of the Moon Camp property was conducted on May 5, 12 and June 6, 2008. The May 5 and 12th surveys focused on the "meadow" habitat along the lakeshore of the Big Bear Lake reservoir; and on identification of any special-status early-blooming annual plant species. The June 6 survey focused on delineation of the ashy-gray Indian paintbrush occurrences; and on identification of late-blooming annuals and perennials.

May surveys for other projects elsewhere in Big Bear Valley (North Baldwin Lake, Pan Hot Springs, Sawmill/Sugarloaf pebble plains, Eagle Point) had indicated that all seven federal-listed species considered to potentially occur on site, according to the White survey, were observed and reliably identifiable at the time of the early May surveys; and the ashy-gray paintbrush and other potential pebble plain species were readily visible, with fully-mature inflorescences, at the time of the June survey.

Positive findings (only pebble plain-associated species, including ashy-gray paintbrush) were precisely located using a Garmin GPS; and GPS data was downloaded and displayed at the Redlands Institute GIS laboratory, and transferred to the EIR consultant, Michael Brandman Associates, to their Palm Springs office; and to the project engineer, Hicks and Hartwick Engineering, in Redlands.

The meadow habitat was carefully walked throughout its narrow distribution along the lakeshore, and any other vernal springs or areas of persistent surface soil moisture were closely examined for potential endangered meadow species; and for the presence of special-status vernal annual species, such as eye-strain monkey-flower (*Mimulus exiguus*) or yellow owl's-clover (*Castilleja lasiorhyncha*).

The White survey reported four ashy-gray paintbrush occurrences, and these were the focus of the June 6 field survey—to confirm those locations and obtain an accurate GPS delineation of the ashy-gray paintbrush distribution and pebble plain habitat on the property.

V. RARE, ENDANGERED OR SENSITIVE SPECIES AND HABITATS (RESULTS)

Endangered Meadow Species

Of the four federally-listed endangered meadow species (Section 3, above), none were identified on site; and they are not considered likely to occur on site. The lakeshore habitat is not indigenous meadow habitat, such as supports the endemic meadow flora elsewhere in Big Bear Valley (Krantz 1979, 1980, 1981a, et alus); rather, it is what this author calls "ruderal" reservoir habitat. Ruderal means, "growing where the natural vegetational cover has been disturbed by man." (Webster's 9th Collegiate Dictionary) In this case, the ruderal reservoir habitat is comprised of a mix of native and non-native, aquatic and semi-aquatic plant species, existing in the zone between the high water level of the reservoir and the draw-down area. Native meadow species sometime occur along the narrow margin just above the high water level, but in the case of the Moon Camp property, this is very limited to a strand of willows (*Salix scouleriana)* and a non-diverse assemblage of common wetland species, such as wiregrass (*Juncus balticus*), yarrow (*Achillea millefolium*) and silver-leaved cinquefoil (*Potentilla anserina*).

No endangered, threatened, or special-status meadow plant species were identified on the Moon Camp property, and the potential for any occurrence of such species is considered to be extremely low.

Pebble Plain Species

The White survey had previously mapped a known pebble plain occurrence on the western portion of the property. This pebble plain contains many of the characteristic species occurring on other pebble plains in Big Bear and Holcomb Valleys, but for the Kennedy's southern mountain buckwheat (*Eriogonum kennedyi* var. *austromontanum*), which is replaced by the closely-related taxon, Wright's matting buckwheat (*Eriogonum wrightii* var. *subscaposum*), and absence of Bear Valley sandwort (*Arenaria ursina*). Kennedy's southern mountain buckwheat and Bear Valley sandwort were used as indicator species of pebble plains by the author, during his original systematic surveys of this endemic plant community (Krantz 1981b, 1983). The lack of both indicator species on the Moon Camp property resulted in this area not being indicated as pebble plain habitat during those initial surveys. However, the area indicated as "pebble plain" within Open Space Lot A has many other species commonly associated with true pebble plain habitat, and has been mapped as such on Figure 3.

Ashy-gray paintbrush (*Castilleja cinerea*) had been mapped as four distinct occurrences by White, but the author, in conjunction with this survey, found that the two eastern occurrences, indicated as occurring behind (north of) Lots 22, and 29-30-31 of the adjacent existing residential tract, do not support any ashy-gray paintbrush plants. There were openings of Wright's matting buckwheat at these locations, with silver rat-tails (*Ivesia argyrocoma*), which is sometimes associated with pebble plains, and Heckard's paintbrush (*Castilleja montigena*) was found on the perimeter of the openings, but no ashy-gray paintbrush exists at those locations. To verify that the author was, indeed, at the proper locations, the areas considered to be concurrent with those areas indicated by White were delineated with GPS data points to confirm the negative findings.

Similarly, the GPS delineation of the middle ashy-gray paintbrush occurrence was found to be less than one-third the size of the occupied habitat indicated in the White survey (0.11-acre actual occupied habitat, consisting of approximately 50 plants). This occurrence corresponds to the

southernmost portions of proposed Lots 47 and 48, adjoining Highway 18. In this case, it appeared that White had mapped the Wright's matting buckwheat distribution, without regard to association with the ashy-gray paintbrush.

Another very small ashy-gray paintbrush occurrence was located at the rear of Lot 49, comprised of 0.01-acre, and consisting of 10 plants.

A single point, representing three ashy-gray paintbrush plants, was located at the vernal spring on the rear portion of Lot 50; and the easternmost portion of the primary pebble plain occurrence on Lot A extends into Lot 50 on its southwestern quarter, comprising about 0.11-acre of occupied habitat.

The primary pebble plain (the westernmost occurrence according to White) was found to be more restricted than indicated by White at the eastern portion of the occurrence on Lots 49 and 50, but generally conformed to the area indicated by White in the area of the central pebble plain (within the proposed rare plant preserve) and toward the western portion of the pebble plain and ashy-gray paintbrush area. The actual occupied habitat of ashy-gray paintbrush on Lots 1 through 5 was calculated to comprise 2.07 acres.

The most exemplary pebble plain habitat on the Moon Camp property was found to conform to the area indicated by White, and would be entirely included within the proposed 4.2 acre conservation easement area. Fencing of the highway frontage has stopped the unauthorized off highway vehicle use that was evidenced on the pebble plain habitat from years past.

To summarize the results of the survey of ashy-gray paintbrush occupied habitat, it is distributed among four occurrences: Lot 47—0.11 acre, Lot 49—0.01 acre, Lot 50—0.11 acre, and the pebble plain and more extensive western occurrence, comprising 4.91 acres within Lot A, 2.07 acres within Lots 1-5, and 0.5 acre within Road A, for a total of 7.7 acres of occupied ashy-gray paintbrush.

Other Special Status Species

Two new special status species were added to the project list: purple monkeyflower (*Mimulus purpureus*) and Sugarloaf phlox (*Phlox dolichantha*). Purple monkeyflower was found to be rather widely distributed on the pebble plain and extending down into the draw to the east, corresponding to the southern half of proposed Lot 50. This draw exhibited vernal spring habitat characteristics; that is, an association of very tiny, ephemeral annuals, such as moss juncus (*Juncus bryoides*), hispid popcorn flower (*Plagiobothrys hispidulus*) and other minute monkeyflower species, such as *Mimulus androsaceus* and *M. suksdorfii*. Most of the purple monkeyflower distribution is included within the proposed 4.2 acre conservation easement area.

Sugarloaf phlox was found to be rather widely distributed on the Moon Camp property in open black oak woodland and under Jeffrey pines. Although restricted to Big Bear and Holcomb Valleys, its regional distribution extends up to the summit of Sugarloaf Mountain south of Big Bear Valley, and as far north as White Mountain, northwest of Holcomb Valley; the taxon is fairly common within its range, and is not considered to be a high priority candidate for listing or more formal protection (Krantz 1983).

Table 1: Special Status Species Occurring on the Moon Camp Property

Arabis parishii	Parish's rock-cress	Fed.: none; S2.1; List 1B.2
Astragalus leucolobus	Bear Valley woollypod	Fed.: none; S2.2; List 1B.2
Castilleja cinerea	Ashy-gray Indian paintbrush	Fed.Threatened; S2.2; List 1B.21B, 2-2-3;
Castilleja applegateii Ssp. *martinii*	Mountain paintbrush	Fed: none; S3.3; List 4.3
Ivesia argyrocoma	Fuzzy rat-tails	Fed: none; S2.2; List 1B.2
Mimulus purpureus	Purple Monkeyflower	Fed: none; S2.2; List 1B.2
Phlox dolichantha	Sugarloaf phlox	Fed: none; S2.2; List 1B.2

Fed. (Federal Rank)
State Rank (S), California Natural Diversity Database
- **S1**: Fewer than six occurrences or fewer than 1000 individuals or less than 2000 acres
- **S1.1**: Very threatened
- **S1.2**: Threatened
- **S1.3**: No current threats known
- **S2**: 6-20 occurrences or 1000-3000 individuals or 2000-10000
- **S3**: 21-100 occurrences or 3000-10000 individuals or 10000-50000 acres
- **S4**: Apparently secure in California; this rank is clearly lower than S3, but factors exist to cause some concern, *i.e.*, there is some threat or somewhat narrow habitat. No threat rank.
- **S5**: Demonstrably secure or ineradicable in California. No threat rank.

Table 2: Threatened or Endangered Species Determined Not to Occur On Site

Federal Threatened—FT
Federal Endangered—FE

Arenaria ursina	Bear Valley sandwort	FT
Eriogonum kennedyi var. *austromontanum*	Southern mountain buckwheat	FT
Poa atropurpurea	San Bernardino bluegrass	FE
Sidalcea pedata	Bird-foot checkerbloom	FE
Taraxacum californicum	California dandelion	FE
Thelypodium stenopetalum	Slender-petaled thelypodium	FE

VI. RECOMMENDATIONS

A. Establishment of a Conservation Easement and Rare Plant Habitat Preserve

A 4.91-acre rare plant preserve is proposed to be established over the pebble plain habitat. As indicated on the Tentative Tract map, this preserve will protect the most exemplary and best quality of the pebble plain habitat on site, including all seven of the special status species observed on site. A detailed management plan for the preserve area shall be adopted and recorded with the conservation easement, specifying the terms and conditions for allowed and disallowed uses within the preserve area.

The conservation easement shall be conveyed to the San Bernardino Mountains Land Trust or other land stewardship entity, together with a management endowment to cover annual costs of maintenance (replacing signs, mending fences). Interpretive literature, signs, and trails shall be developed for homeowners and visitors to provide an understanding of the sensitive resources occurring in the preserve area.

B. Building Envelopes for Paintbrush Habitat

Construction to the rear portions of Lots 47, 48, 49 and 50 shall be restricted by means of building envelopes or building setback lines, to prevent construction in the occupied ashy-gray paintbrush habitat. The rear portions of these lots abut the Highway 38 frontage, in any case, and are thus largely within the Caltrans right of way and required rear lot setbacks. Lot 50 is constrained by a drainage easement along the eastern length of the parcel, by the Caltrans right-of-way along the highway, and by pebble plain resources.

C. Offsite Compensation for Paintbrush Habitat

Off-site compensation for direct and indirect impacts to ashy-gray Indian paintbrush and pebble plain habitat outside of the 4.91-acre Conservation Easement and not protected by building setbacks (2.57 acres) may be accomplished by acquisition and protection of similar or better habitat resources elsewhere in the valley.

There is a limited amount of privately-held ashy-gray paintbrush and pebble plain habitat available for off-site mitigation. One of the best remaining examples of pebble plain habitat in private ownership that may be used to off-set impacts on the Moon Camp property is the "Sugarloaf pebble plain", situated at the northern terminus of Dixie Lee Lane in the unincorporated community of Sugarloaf. This is a 10-acre, high-quality pebble plain. It was fenced and has been protected from off-highway vehicles since the mid-1980s as a mitigation for construction of the Big Bear High School, the intention being to set aside a 2-acre portion of the 10-acre parcel as mitigation for impacts to pebble plains resources for the High School site, and use the remaining eight acres for mitigation of other projects. The parcel was surveyed by Hicks & Hartwick, but was never formally recorded.

The proposal for off-site mitigation of direct and indirect impacts to ashy-gray paintbrush and pebble plains resources on the Moon Camp property is to acquire fee title interest of the entire Sugarloaf Pebble Plain parcel (less a proposed road easement to accommodate the County's

westerly extension of Baldwin Lane); record the parcel, and convey a Conservation Easement to a responsible stewardship entity, such as the San Bernardino Mountains Land Trust (SBMLT). The conveyance of the easement shall be accompanied by a habitat management and monitoring endowment to be deposited into an escrow account for that purpose. In addition to the initial deposit to establish the habitat management account, Homeowner's Association fees shall be collected annually to provide funding in the long-term. Management guidelines, terms and conditions of the conservation easement shall be clearly defined in a Habitat Management Plan, to be recorded with the easement. These management conditions shall include maintenance of fencing and signs, maintenance of the trail across the pebble plain, and development of interpretive materials for the pebble plains resources.

D. Onsite Management

Impacts to the pebble plains habitat and sensitive plants will be minimized by the project's design, which will place the pebble plain area, including ashy-gray Indian paintbrush habitat and all six special-status species, into a permanently protected Conservation Easement. The long-term conservation value of the proposed open space requires active onsite land management to prevent "edge effects" from existing and proposed adjacent land uses.

A habitat management plan (HMP) should be developed for the Conservation Easement area. The HMP shall address management of the rare plant preserve with respect to the following indirect impacts:

- Removal and control of invasive non-native plants;
- Trampling or soil damage caused by foot traffic, vehicles, bicycles, or other recreation;
- Alteration of surface hydrological conditions caused by irrigation on adjacent lots, road runoff, or water diversions installed for erosion control;
- Vegetation clearing, especially for fuel modification to reduce fire hazards to adjacent homes; and

The HMP shall be administered by the SBMLT or other land stewardship entity. Funding for implementation of habitat management measures shall be derived from interest earned from the habitat management endowment and from annual Homeowner's Association fees.

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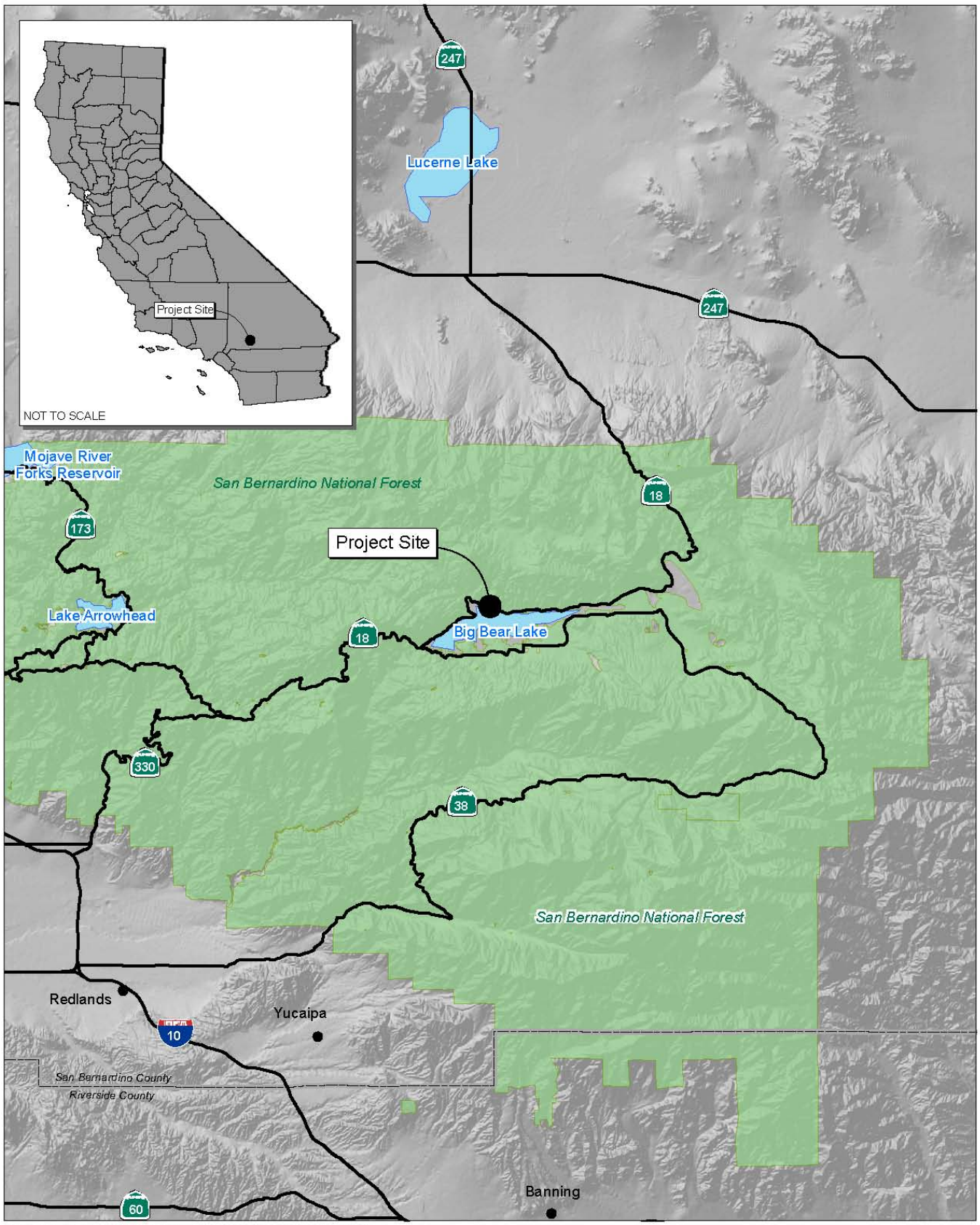
VIII. CERTIFICATION

I hereby certify that the statements furnished above and in the attached exhibits present the data and information required for this supplemental rare plant survey, and that the facts, statements, and information presented are true and correct to the best of my knowledge and belief. Field work conducted for this assessment was performed by me. I certify that I have not signed a nondisclosure or consultant confidentiality agreement with the project applicant or applicant's representative and that I have no financial interest in the project.

DATE: June 29, 2008 SIGNED: _____



Source: Census 2000 Data, The CaSIL, MBA GIS 2007.

NORTH

5 2.5 0 5 Miles

Michael Brandman Associates

00520089 • 07/2009 | 1_Krantz_regional.ai

Figure 1
Regional Location Map

MOON CAMP TENTATIVE TRACT 16136
FOCUSED RARE PLANT SURVEY

Source: Hicks & Hartwick, Inc. (July, 2009).

NORTH

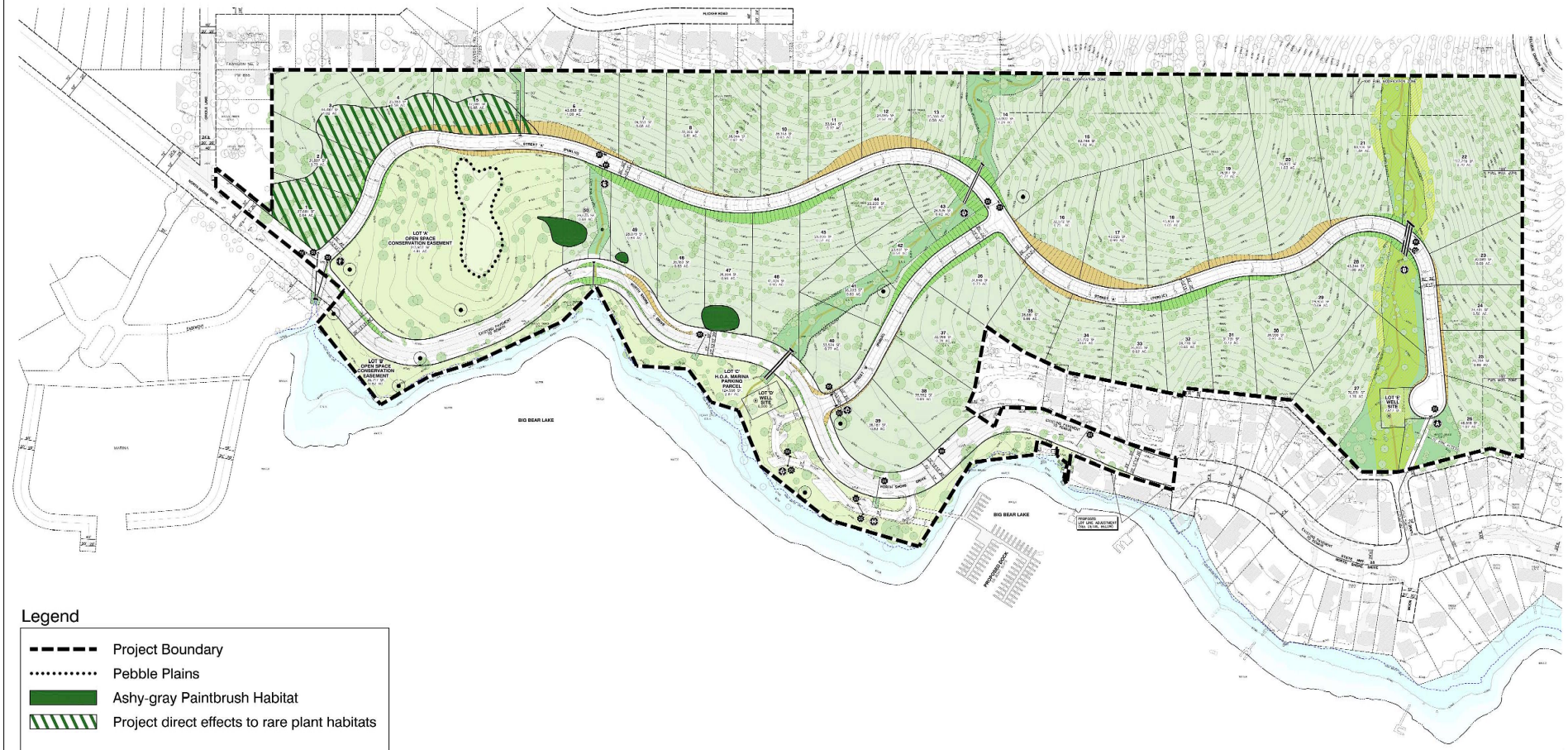
260 130 0 260 Feet

Michael Brandman Associates

00520089 • 07/2009 | 2_Krants_ttm16136.ai

Figure 2
Project Map

MOON CAMP TENTATIVE TRACT 16136
FOCUSED RARE PLANT SURVEY



Source: Hicks & Hartwick, Inc. (July, 2009) & Tim Krantz, Ph.D (July, 2009).

Michael Brandman Associates

00520089 • 07/2009 | 3_Krants_Pebble_Plain.ai

Figure 3
Map of Pebble Plain and Ash-gray Paintbrush Habitat

B.10 - Southern Rubber Boa Letter Report (Glen Stewart, February 2007)

CALIFORNIA STATE POLYTECHNIC UNIVERSITY, POMONA

Biological Sciences
College of Science

February 18, 2007

Mr. Michael Perry
California Collaborative Solutions
P. O. Box 706
Big Bear City, CA 92314

Dear Mr. Perry,

This letter reports my observations and evaluation of potential habitat for the Southern Rubber Boa (SRB, *Charina bottae umbratica*), a State of California Threatened Species, on two properties in the Big Bear Lake area on February 9, 2007. Accompanied by you, Lisa Kegarice, and Marni McKernan, I walked the 62 acre "Moon Camp Tract" in Fawnskin between about 11:20 AM and 12:20 PM. After lunch, you and I walked about half of the 160 acre "High Timber Ranch" tract in the Moonridge area, also driving to briefly view two other parts of the tract, between approximately 1:45 PM and 3:15 PM. Lisa and Marni accompanied us for a few minutes at the beginning of our walk there.

The Moon Camp Tract in Fawnskin is immediately adjacent to the north shore of Big Bear Lake and has a south-facing exposure at an elevation of about 6,800 feet. Roughly the western third of the tract is bounded by developed property while the eastern two thirds is bounded by Forest Service land on the north and, I believe, undeveloped private property on the east. The tract is quite dry, sloping unevenly upward to the north and east with a couple of shallow, dry ravines in the eastern portion. In the western portion, the vegetation is composed of an open stand of Jeffrey Pine, with a sparse understory of Great Basin Sagebrush and herbaceous plants. Here, there also is an open "pebble plain" habitat. The stands of pine become somewhat more dense in the eastern part of the tract with larger sagebrush shrubs. Throughout the tract, litter and duff are very thin, but there are a few moderately weathered, medium-sized logs scattered around. Significantly, there are no rock outcrops, which generally are used by SRBs for hibernation sites.

My assessment of the Moon Camp Tract is that it is poor SRB habitat. Further, it is outside of the area mapped as potential SRB habitat in the 1985 Forest Service habitat management guide for the SRB, and there have been no sightings of SRBs reported in the area. My recommendations for mitigating development of the tract are that trees and downed logs be allowed to remain in place, to the extent that clearing is not required by the development process, and that a 50 foot setback be maintained along the deepest ravine at the eastern edge of the property. These measures will serve to protect a limited amount of habitat for native wildlife, such as lizards, snakes, salamanders, chipmunks, mice and wood rats, as well as incidental SRBs.

The High Timber Ranch tract is located on Moonridge, immediately west of Sawmill Canyon and Sugarloaf, with developed property existing along the southwestern boundary. It has a north-facing exposure with several shallow ravines draining to the north-northwest and alternating with gently sloping ridges oriented in the same direction. The crowns of the ridges

are rather flat with small "pebble plain" habitats. Elevation at the upper levels of the property is about 7,200 feet. The vegetation is dominated by fairly open stands of Jeffrey Pine, mixed with small Black Oaks in much of the area. A shrubby understory is present in places, but with little sagebrush. Toward the eastern portion of the property there are occasional Pinyon Pines. Leaf litter and duff are moderately thick where there are Black Oaks, and well weathered medium-sized to large logs are common throughout the site. Significantly, again, no rock outcrops were observed.

My assessment of the High timber Ranch tract is that it is marginally suitable as SRB habitat. The northern exposure, denser vegetation, thicker layers of litter and duff, and greater abundance of large logs provide potential cover for SRBs and other forest floor wildlife. However, the site is outside of the area of potential habitat mapped in the 1985 SRB habitat guide, and no SRBs have been reported in the area. Still, I recommend that the portion of the site that I was not able to survey on foot be surveyed for rock outcrops by an experience field biologist, specifically Lisa Kegarice. Mitigations for development should be similar to those recommended for the Fawnskin site, with 50 foot setbacks along the ravines. If any rock outcrops 10 feet or greater in diameter are discovered in future surveys, they also should be protected by 50 foot setbacks.

I hope that the information and assessments I have provided above are sufficient for your purposes. Please find my invoice enclosed. If you have any questions or concerns, however, please do not hesitate to contact me by e-mail (grstewart@csupomon.edu) or phone (909-869-4093).

Sincerely yours,

Glenn R. Stewart, Ph.D.
Professor Emeritus of Zoology
and Environmental Science

TOM DODSON & ASSOCIATES
2150 N. ARROWHEAD AVENUE
SAN BERNARDINO, CA 92405
TEL (909) 882-3612 • FAX (909) 882-7015
E-MAIL tda@tdaenv.com

May 1, 2007

Michael Perry
California Collaborative Solutions
P.O. Box 706
Big Bear City, CA 92314

RE: High Timber Ranch Survey

Dear Mr. Perry,

On February 9, 2007 I accompanied you and Dr. Glenn Stewart on a walking survey of the High Timber Ranch Property in the upper Moonridge area of Big Bear Lake. Dr. Stewart was able to survey approximately one half of the High Timber Ranch site that day and provided a February 18, 2007 letter report (attached) detailing his findings.

In his February 18, 2007 letter report, Dr. Stewart recommended that I survey the remainder of the High Timber site on foot to verify the absence of any rock outcrops.

On March 9, 2007, I surveyed the remainder of the site on foot with you and verified that there are no rock crops within the area of the site that Dr. Stewart did not survey on February 9, 2007.

If you need any additional information, please do not hesitate to contact me.

Sincerely,

Lisa Kegarice
Ecologist / Regulatory Specialist

Csp07/0501LK1 (CCS-193)

Appendix C:
Hydrology Study/Water Quality Management Plan

C.1 - Post Construction Water Findings (AEI CASC, October 2007)

AEI CASC CONSULTING

October 5, 2007

Nancy Ferguson
Michael Brandman Associates
220 Commerce, Suite 200
Irvine, CA 92602

Subject: Tentative Tract 16136, Moon Camp – Post Construction Water Quality Findings

Dear Ms. Fergueson,

We have reviewed the proposed Tentative Tract 16136 Moon Camp Project for Post Construction Best Management Practices (BMPs) which will address Pollutants of Concern for this project while being in compliance with the standards set forth in the document, "San Bernardino County Stormwater Program - Model Water Quality Management Plan Guidance". The purpose of this letter is to provide the results of that review.

PROJECT DESCRIPTION

The Moon Camp Project is a 62.4 acre site proposing 50 subdivided lots for individual home sale. The project also proposes a portion of the project's total acreage, approximately 8.6 acres, for dedication as open space. This project is located on the North Shore of Big Bear Lake, in the City of Big Bear, nestled in the San Bernardino Mountains.

HYDROLOGIC CONDITIONS OF CONCERN

Post-project runoff flows are proposed to generally remain in the existing natural drainage pattern, with culvert crossings occurring at low points along the highway and under interior roads, with ultimate discharge into Big Bear Lake. The Moon Camp Project development will have a minor impact on the overall existing hydrology, effecting primarily minor redirection of natural flows, with the outfall into the lake remaining largely unchanged in both location and quantity.1 Project runoff flows will be carried to the lake via six proposed storm culverts which drain directly into the lake itself; thus, runoff from the project becomes a small part of the vast storage volume in Big Bear Lake.

The Moon Camp Project is proposing minor grading and minimal increases of impervious surfaces on each lot by utilizing stemwall construction and a reduced overall construction footprint. Each lot will further reduce project runoff with the implementation of bioretention BMPs, while roads constructed as part of the project will have runoff directed to bioretention areas. Big Bear Lake has a storage capacity of approximately 73,000 Ac-ft. The project site is estimated to produce runoff equivalent to 0.04 percent of lake volume before development and 0.09 percent of lake volume after development. Thus, project runoff is a miniscule fraction of lake storage.

[1] Tract 16136 - Moon Camp Hydrology & Hydraulic Preliminary Report, July 2007, Hicks & Hartwick, Inc.

Big Bear Lake possesses a controlled release point for project runoff flows at Big Bear Dam, which is controlled by Big Bear Municipal Water District (BBMWD). The primary goal of the BBMWD is maintaining the water level of Big Bear Lake as level as possible given the availability of water and finances. The belief is that a constant water level increases recreational use, stabilizes property value, improves water quality and supports a healthier fish and wildlife environment. BBMWD accomplishes their goal by implementing a water management plan that includes the following: [2]

- Stabilization of Big Bear Lake by managing the amount of water released to the downstream water rights holder
- Watershed/water quality management
- Recreation management
- Bear Valley Dam and Reservoir Maintenance

In many seasons, BBMWD will elect to keep water in the lake and then purchase "in-lieu" water to meet demands of the downstream water rights holder. This "in-lieu" water is purchased from the San Bernardino Valley Municipal Water District and consists of water supplied via the State Water Project.

Releases from Big Bear Dam encounter another controlled release point further downstream at the Seven Oaks Dam, which is controlled by the United States Army Corps of Engineers (USACE). The USACE operates Seven Oaks Dam in tandem with the Prado Dam, located 40.3 miles downstream on the Santa Ana River, by implementing the following strategies: [3]

- Runoff during the early flood season is stored behind Seven Oaks Dam to build a debris pool to protect outlet works;
- Small releases from Seven Oaks Dam are made on continual basis to maintain downstream water supply;
- During a flood, Seven Oaks Dam will store runoff for as long as the reservoir pool at Prado Dam is rising;
- After the flood threat has passed, Seven Oaks Dam will release stored water at a rate which does not exceed the downstream channel capacity; and
- After the flood season, Seven Oaks Dam will be gradually drained and the Santa Ana River will flow through unhindered.

BBMWD and the USACE's regulation of their structures is a function of irrigation demand, availability of water from other sources, and flood control purposes. Because these two organizations and their structures regulate and control discharges to downstream waters, and because runoff from the project is miniscule compared to the volume stored in Big Bear Lake, Hydrologic Conditions of Concern (HCOC) for the Moon Camp Project development are independently minimal and not expected to directly and significantly impact down stream receiving waters.

[2] http://www.bbmwd.org/, Accessed Oct 1, 2007
[3] http://www.spl.usace.army.mil/resreg/htdocs/7oaks.html, Accessed Oct 1,2007

PROJECT RECEIVING WATERS

Big Bear Lake is the primary downstream receiving water for the Moon Camp project. As project runoff flows continue westerly, further downstream receiving waters are the Santa Ana River, Reaches 6 through 1, which ultimately drain to the Pacific Ocean. As Table 1 indicates, one or more of these receiving waters are impaired.

Table 1 – Project Receiving Waters and Impairments

Storm Drains and Receiving Waters	Receiving Water Classification		Primary Hydro Unit Basin No.	303(d) Listing		TMDL Pollutants
	Proximate	Downstream		Listed?	Pollutant Causing Impairment	
Big Bear Lake	Yes	Yes	801.71	Yes	Copper, Mercury & Metals – Source: **Resource Extraction** Noxious Aquatic Plants, Nutrients & Sedimentation/siltation – Source: **Construction/Land Developement** PCBs (Polychlorinated biphenyls) – Source: **Unknown**	Adopted Phosphorus
Santa Ana River (Reach 6)	No	Yes	801.72	No	None	None
Santa Ana River (Reach 5)	No	Yes	801.52	No	None	None
Santa Ana River (Reach 4)	No	Yes	801.25	Yes	Pathogens – Non Point Source	Not Adopted
Santa Ana River (Reach 3)	No	Yes	801.21	Yes	Pathogens – "Dairies"	Not Adopted
Prado Basin Management Zone	No	Yes	802.21	No	None	None
Santa Ana River (Reach 2)	No	Yes	801.11	No	None	None
Santa Ana River (Reach 1)	No	Yes	801.11	No	None	None
Pacific Ocean	No	Yes	801.11	No	None	None

PROJECT POLLUTANTS AND POLLUTANTS OF CONCERN

Table 2 lists the pollutants likely to be associated with the development of the Moon Camp Project and compares these pollutants to pollutants causing stress in local receiving waters. When a project pollutant is the same as a pollutant causing stress in the receiving waters, the San Bernardino County Model Water Quality Management Plan Guidance requires that project runoff be treated for said pollutants utilizing BMPs that are medium to high effectiveness. Pollutants of concern for the Moon Camp project are bacteria/virus, heavy metals, nutrients, and sediments, see Table 2.

Nutrients are of particular concern because a TMDL for phosphorus has been adopted for Big Bear Lake. The current TMDL assigned to Big Bear Lake is 475 lbs per year for Urban Waste Load Allocation for phosphorus. For urban areas, compliance with this TMDL requires compliance with the Municipal separate storm sewer system (MS4) Permit which, in turn, requires implementation of Best Management Practices (BMPs) which treat pollutants of concern at a medium to high level of effectiveness.

Table 2 – List of Project Pollutants [5]

Land Use	Associated Project Pollutants		Is Pollutant 303(d) Listed and / or TMDL for Receiving Water[4]
	Pollutants	Status	
Home Subdivisions of 10 units or more & Streets/Highways/Freeways	Bacteria/Virus	Expected	Yes
	Heavy Metals	Expected	Yes
	Nutrients	Expected	Yes
	Pesticides	Expected	No
	Organic Compounds	Expected	No
	Sediments	Expected	Yes
	Trash and Debris	Expected	No
	O_2 Demanding Substances	Expected	No
	Oil and Grease	Expected	No

PERMIT REGULATIONS

WQMP Requirements

The Santa Ana Regional Water Quality Control Board Order Number R8-2002-0012, NPDES Permit No. CAS618036 (Permit) requires post-construction BMPs to be implemented for new development and significant redevelopment projects, for both private and public agencies. A Water Quality Management Plan (WQMP) is then used to guide the development and implementation of a program to minimize the detrimental effects of urbanization on the beneficial uses of receiving waters, including effects caused by increased pollutants loads and changes in hydrology. [5] Under the permit's requirements, Moon Camp will be required to comply with the WQMP guidance document by implementing the following:

- Incorporate and implement site design BMPs
- Incorporate and implement all applicable source control BMPs

[4] California Regional Water Quality Control Board, 2006 CWA Section Proposed 303(d) List of Water Quality Limited Segments, approved by the USEPA October 25, 2006.

[5] San Bernardino Stormwater Program – Model Water Quality Management Plan Guidance Document, June 2005

- Incorporate or implement Treatment Control BMPs
- Utilize a combination of site design, source control and/or treatment control that addresses all identified pollutants and hydrologic conditions of concern.

TMDL Requirements

The Santa Ana Regional Water Quality Control Board Resolution No. R8-2006-0023, amending the Water Quality Control Plan for the Santa Ana River Basin to Incorporate a Nutrient Total Maximum Daily Load (TMDL) for Dry Hydrological Conditions for Big Bear Lake, was approved by the Office of Administrative Law (OAL) on August 21, 2007. Under this resolution, it appears that the only TMDL implementation provision applicable to the Moon Camp project is the item referring to the MS4 Stormwater Permit:

> **Implementation Task 3.1** – "Waste Discharge Requirements for the San Bernardino County Flood Control and Transportation District, the County of San Bernardino and the Incorporated Cities of San Bernardino County within the Santa Ana Region, Areawide Urban Runoff, NPDES No. CAS 618036 (Regional Board Order No. R8-2002- 0012). The current Order has provisions to address TMDL issues. In light of these provisions, revision of the Order may not be necessary to address TMDL requirements."

The deadline for the Regional Board's update to the MS4 permit is February 29, 2008; however, as noted in Implementation Task 3.1, changes to the MS4 permit may not be necessary to address TMDL issues.

The County of San Bernardino, in compliance with its MS4 permit, has adopted a program that requires new development projects, such as the Moon Camp project, to prepare and implement a Water Quality Management Plan (WQMP) that includes a combination of site design, source control, and treatment control BMPs to reduce the discharge of pollutants and hydrologic conditions of concern resulting from the development. This letter report outlines the site design BMPs, source control BMPs, and treatment control BMPs to be implemented by the Moon Camp project, with said controls to ultimately be documented in a project-specific WQMP. Therefore, by preparing and implementing a WQMP including the prescribed BMPs, the Moon Camp project will be compliant with the County's requirements, and by extension, the MS4 permit and TMDL implementation plan.

PROJECT BMPs

In order to address the project POCs and to reduce the chance of pollutants entering Big Bear Lake, the project will implement a treatment BMP that is effective for all POCs and also prepare a Water Quality Management Plan (WQMP) which shall incorporate the following:

Site Design

Lots in the Moon Camp Project are proposed to be low density with stem wall construction, thereby reducing the area of construction. This criteria in planning reduces the overall footprint of construction and minimizes the imperviousness of each lot.

Source Control

Activity restrictions and property owners' education are crucial to the project's success at preserving water quality. The more informed each property owner is the more likely they are to participate in compliance with imposed water quality standards. Conditions, covenants & restrictions (CC&R) shall be utilized in this project to clearly spell out activities that are not beneficial to water quality and shall not be

allowed on the project site. The CC&Rs will be implemented and maintained by the project's Property Owner's Association (POA).

Treatment Control

Assuming a generous average house footprint of 3,500 sf on a 43,560 sf lot, with an estimated driveway surface of 3,000 sf, produces and impervious percentage of 15. Using this average 15% yields a water quality volume (V_0) of 1.56 Ac-ft for all project lots. Calculating the water quality volume of street runoff at 90% yields a V_0 of 0.37 Ac-ft. Therefore the individual lot treatment BMPs shall be designed to address 1.56 Ac-ft of total water quality volume, approximately 0.03 Ac-ft per lot, while the street treatment BMPS shall address the remaining 0.37 Ac-ft of the water quality volume.

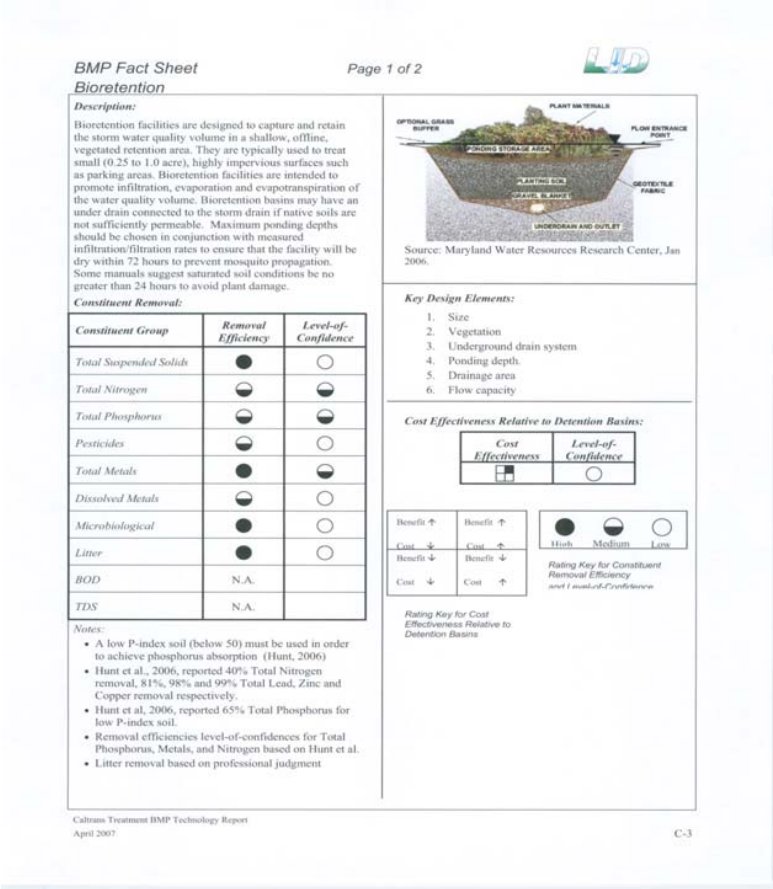
Table 3 –BMPs Level of Treatment [6]

Pollutant of Concern	Treatment Control BMP Categories	
	Biofilter	Filtration
Sediment/Turbidity	H/M	H/M
Nutrients	L	L/M
Organic Compounds	U	H/M
Trash & Debris	L	H/M
Oxygen Demanding Substances	L	H/M
Bacteria & Viruses	U	H/M
Oils & Grease	H/M	H/M
Pesticides (non-soil bound)	U	U
Metals	H/M	H

Bioretention is the selected treatment BMP for the Moon Camp Project and operates similar to that of a biofilter and filtration. The individual lots will each treat their water quality volume prior to discharging from the site, with maintenance provided from the site, with maintenance provided by individual owners. The street runoff will also be treated with bioretention that is located in common areas or on open space lots, with maintenance by the POA.

As shown on Table 3, the combination of a biofilter and filtration will treat the project pollutants of concern at medium to high level of effectiveness. The Caltrans Treatment BMP Technology Report (April 2007) provides results of their full-scale pilot studies performed on various BMPs. The report shows that bioretention will effectively treat nutrients from the project, including nitrogen and phosphorus, at a medium level of effectiveness, see attached fact sheet.

[6] San Bernardino Stormwater Program – Model Water Quality Management Plan Guidance Document, June 2005



BMP Fact Sheet Page 1 of 2

Bioretention

Description:

Bioretention facilities are designed to capture and retain the storm water quality volume in a shallow, offline, vegetated retention area. They are typically used to treat small (0.25 to 1.0 acre), highly impervious surfaces such as parking areas. Bioretention facilities are intended to promote infiltration, evaporation and evapotranspiration of the water quality volume. Bioretention basins may have an under drain connected to the storm drain if native soils are not sufficiently permeable. Maximum ponding depths should be chosen in conjunction with measured infiltration/filtration rates to ensure that the facility will be dry within 72 hours to prevent mosquito propagation. Some manuals suggest saturated soil conditions be no greater than 24 hours to avoid plant damage.

Constituent Removal:

Constituent Group	Removal Efficiency	Level-of-Confidence
Total Suspended Solids	●	○
Total Nitrogen	◒	◒
Total Phosphorus	◒	◒
Pesticides	◒	○
Total Metals	●	◒
Dissolved Metals	◒	○
Microbiological	●	○
Litter	●	○
BOD	N.A.	
TDS	N.A.	

Notes:
- A low P-index soil (below 50) must be used in order to achieve phosphorus absorption (Hunt, 2006)
- Hunt et al., 2006, reported 40% Total Nitrogen removal, 81%, 98% and 99% Total Lead, Zinc and Copper removal respectively.
- Hunt et al, 2006, reported 65% Total Phosphorus for low P-index soil.
- Removal efficiencies level-of-confidences for Total Phosphorus, Metals, and Nitrogen based on Hunt et al.
- Litter removal based on professional judgment

Source: Maryland Water Resources Research Center, Jan 2006.

Key Design Elements:

1. Size
2. Vegetation
3. Underground drain system
4. Ponding depth
5. Drainage area
6. Flow capacity

Cost Effectiveness Relative to Detention Basins:

Cost Effectiveness	Level-of-Confidence
■	○

Benefit ↑ Cost ↓ | Benefit ↑ Cost ↑
Benefit ↓ Cost ↓ | Benefit ↓ Cost ↑

Rating Key for Cost Effectiveness Relative to Detention Basins

● High ◒ Medium ○ Low

Rating Key for Constituent Removal Efficiency and Level-of-Confidence

Caltrans Treatment BMP Technology Report
April 2007

C-3

The key factor in bioretention success is utilizing soils that have an initial low phosphorus index (P-Index) rating existing in the soil. The P-Index of the soil is the measurement of how much phosphorus already exists in the soil media. The lower the P-Index, the greater the amount of phosphorus the media can capture. The success of this BMP to properly address phosphorous is based on the appropriate fill media being used.

RECOMMENDATION

Therefore, it is our recommendation that the Moon Camp Project development include site design, source control and appropriate treatment control BMPs, such as bioretention, that meet the requirements of the MS4 Permit, TMDL requirements and the requirements of the San Bernardino County Water Quality Management Plan Guidance. The bioretention areas must be situated to capture runoff from the project and must be constructed utilizing an engineered planting and filtering media with a low P-Index.

Best regards,

AEI-CASC Consulting

Melanie E. Sotelo
Design Engineer

Jeffrey D. Endicott, P.E., DEE
Engineering Director
R.C.E. 40658
Expiration 3-31-2009

C.2 - Drainage Study Review for "Hydrology and Hydraulics Preliminary Report" in Conjunction with Development of Tentative Tract 16136 (AEI CASC, May 2007)

AEI-CASC ENGINEERING

May 7, 2007

Ms. Nancy M. Ferguson
Regional Manager
Michael Brandman Associates
340 S. Farrell Drive, A210
Palm Springs, CA 92262

Re: Drainage Study Review for "Hydrology and Hydraulics Preliminary Report" in conjunction with the development of Tract 16136 in the County of San Bernardino

Dear Ms. Ferguson:

INTRODUCTION:

Michael Brandman Associates (MBA) in conjunction with the County of San Bernardino requested AEI-CASC Consulting Inc. to provide technical services in order to assist the County in the review of the study "Hydrology and Hydraulics Preliminary Report" for Tract 16136. The study was prepared by Hicks& Hartwick, Inc. and was prepared October 2006.

DRAINAGE REVIEW AND EVALUATION COMMENTS

In general the report performed an existing and proposed hydrology analysis based on the San Bernardino County Flood Control Hydrology Manual. The rational method hydrology was performed for the 100-yr and 10-yr storm events for a drainage area of approximately 181-acres. The drainage area~~consistence~~ of several natural streams that cross the State Highway 18 at various locations along the project limits. The drainage area and project are tributary to Big Bear Lake. The hydrology calculations performed are complete and in accordance with the San Bernardino County Flood Control Hydrology Manual.

Upon completing the review of the Study, we offer the following comments and recommendations:

- The Study included section in the report for "Surface Hydraulics" and "Storm Hydraulics", but calculations were not included. Calculations for these sections should be provided or the sections removed from the report.
- The Proposed hydrology map showed the proposed lot lines and street alignments, but elevations and proposed grading was not shown. To verify the proposed boundaries and conveyance of storm flows a copy of the TTM should be included in the report. Additionally, to assist in the verification of the proposed routing and drainage boundaries, the proposed TTM grading should be added to the proposed hydrology map and the scale increased to show the requested detail.

- Tract 16136 drains to Big Bear Lake, an impaired water body based on the San Bernardino County WQMP manual. The report should include a description of the proposed water quality treatment methods, calculation of treatment volumes and flows, and locations where treatment facilities are proposed. If a Preliminary WQMP report was prepared for Tract 16136 a copy of the report could be included as an appendices to the report.
- It appears that the proposed development will increase the nuisance flows ("Urban Slobber") to two or three of the existing downstream residences. Please describe how this will be mitigated and or minimized with the development.
- The proposed condition hydrology calculations show the developed flows increase the peak flow rate downstream of the project and into Big Bear Lake. Per the San Bernardino County Flood Control District Hydrology manual and guidelines, the increased flow rates should be decreased via detention basins to 90% of the existing condition flow rates or demonstrate that the increase in flow will not impact any downstream facilities. Based on the calculations provided the project does not meet this condition. The exemption of this condition should be discussed and approved by San Bernardino County Flood Control District.
- The proposed condition hydrology map shows that drainage areas "A" and "F" will be conveyed via roadway culverts and natural stream sections through project site. Due to the high flow rates and steep terrain it is recommended that a storm drain system be extended to intercept these drainage flows. The flows should include debris and bulking factor in the analysis. San Bernardino County Flood Control typically requires a bulking factor of 2.0 when a debris analysis is not performed.
- It is recommended that a flood plain analysis and review be performed for Drainage "A". The drainage flows for this stream are shown as 323.0 cfs for the 100-yr storm event (646 cfs for bulked flow condition). Additionally, a debris basin should be considered prior to discharge of flows into an underground storm drain. This recommendation could also be applied to drainage area "F".
- The proposed condition map shows that a storm drain will be extended from the project site (drainage area "A") to Big Bear Lake. The proposed alignment appears to require the acquisition of a drainage easement and/or right-of-way. Please demonstrate the size of required storm drain and that the proposed facility could be constructed through this area. Also, coordination with the affected property owner to provide the above mentioned rights should be demonstrated to the County of San Bernardino. This issue should be discussed in detail since it appears that the development will impact these existing residents.

If there are any questions or clarifications needed please feel free to call me at 951-342-7990 ext. 105

Sincerely,
AEI-CASC CONSULTING, INC.

Aric M. Torreyson, P.E.
Project Manager
AMT/bc

C.3 - Drainage Study Review for "Hydrology and Hydraulics Preliminary Report" in Conjunction with Development of Tentative Tract 16136 (AEI CASC, October 2007)

AEI CASC ENGINEERING

October 12, 2007

Ms. Nancy M. Ferguson
Regional Manager
Michael Brandman Associates
340 S. Farrell Drive, A210
Palm Springs, CA 92262

Re: Drainage Study Review for "Hydrology and Hydraulics Preliminary Report" in conjunction with the development of Tract 16136 in the County of San Bernardino

Dear Ms. Ferguson:

INTRODUCTION:

Michael Brandman Associates (MBA) in conjunction with the County of San Bernardino requested AEI-CASC Consulting Inc. to provide technical services in order to assist the County in the review of the study "Hydrology and Hydraulics Preliminary Report" for Tract 16136. The study was prepared by Hicks& Hartwick, Inc. and was revised July 2007.

DRAINAGE REVIEW AND EVALUATION COMMENTS

In general the report performed an existing and proposed hydrology analysis based on the San Bernardino County Flood Control Hydrology Manual. The rational method hydrology was performed for the 100-yr and 10-yr storm events for a drainage area of approximately 181-acres. The drainage area consists of several natural streams that cross the State Highway 18 at various locations along the project limits. The drainage area and project are tributary to Big Bear Lake. The hydrology calculations performed are complete and in accordance with the San Bernardino County Flood Control Hydrology Manual. Based upon the last review by AEI-CASC Consulting, the drainage report has been partially revised. Please note that no response letter addressing the comments and recommendations by AEI-CASC Consulting (May 7, 2007 letter) has been provided by Hicks& Hartwick, Inc.

Upon completing the review of the Study, we offer the following comments and recommendations:

- The Proposed hydrology map showed the proposed lot lines and street alignments, but elevations and proposed grading was not shown. To verify the proposed boundaries and conveyance of storm flows a copy of the TTM should be included in the report. Additionally, to assist in the verification of the proposed routing and drainage boundaries, the proposed TTM grading should be added to the proposed hydrology map and the scale increased to show the requested detail. *A response to this issue has not been obtained. Clarification should be provided in the report.*

CIVIL ENGINEERING PLANNING SUVEYING ENVIRONMENTAL ENGINEERING
5053 La Mart Drive, Suite 205 ♦ Riverside, CA 92517 ♦ 951.342.-7990♦ 951.275.01 FAX
www.aei-casc.com

- The proposed condition hydrology calculations show the developed flows increase the peak flow rate downstream of the project and into Big Bear Lake. Per the San Bernardino County Flood Control District Hydrology manual and guidelines, the increased flow rates should be decreased via detention basins to 90% of the existing condition flow rates or demonstrate that the increase in flow will not impact any downstream facilities. Based on the calculations provided the project does not meet this condition. The exemption of this condition should be discussed and approved by San Bernardino County Flood Control District. *A response to this issue has not been obtained. Clarification should be provided in the report or response letter format.*
- The proposed condition hydrology map shows that drainage areas "A" and "F" will be conveyed via roadway culverts and natural stream sections through the project site. Due to the high flow rates and steep terrain it is recommended that a storm drain system be extended to intercept these drainage flows. The flows should include debris and bulking factors in the analysis. San Bernardino County Flood Control District typically requires a bulking factor of 2.0 when a debris analysis is not performed. *A response to this issue has not been obtained. Clarification should be provided in the report.*
- A flood plain analysis was performed for the project. The calculations could not be review since a flood plain map showing the cross sections and floodplain widths was not provided. It is recommended that a map showing the above information be included to support the calculations.
- The proposed condition map shows that a storm drain will be extended from the project site (drainage area "A") to Big Bear Lake. The proposed alignment appears to require the acquisition of a drainage easement and/or right-of-way. Please demonstrate the size of required storm drain and that the proposed facility could be constructed through this area. Also, coordination with the affected property owner to provide the above mentioned rights should be demonstrated to the County of San Bernardino. This issue should be discussed in detail since it appears that the development will impact these existing residents. *A response to this issue has not been obtained. Clarification should be provided in the report.*

It should be noted that some of these comments and recommendations could be addressed in the final design stage of the project. It is at the discretion of San Bernardino County to postpone of eliminate any of the comments and recommendations. If there are any questions or clarifications needed please feel free to call me at 951-342-7990 ext. 105

Sincerely,
AEI-CASC CONSULTING, INC.

Aric M. Torreyson, P.E.
Project Manager
AMT/bc

C.4 - Peer Review Memorandum (AEI CASC, March 2007)

AEI-CASC CONSULTING

Memorandum

To: Ms. Nancy Ferguson
MICHAEL BRANDMAN ASSOCIATES

From: Aric Torreyson, P.E.
AEI-CASC Consulting

Date: March 23, 2007

Re: Moon Camp, Tentative Tract Map 1616

Cc: Ceazar Aguilar, **AEI-CASC Consulting**

Comments to the Engineer:

1st PLAN CHECK COMMENTS

HYDROLOGY AND WATER QUALITY TECHNICAL APPENDIX

AEI-CASC Engineering, Inc. has performed a review of the report entitled, "Moon Camp Tentative Tract 16136, Hydrology and Water Quality Technical Appendix", prepared by R.B.F. Consulting and we offer the following comments:

I. Hydrology Study

- In the narrative, please indicate the rainfall values, slope of intensity duration curve, and antecedent moisture condition values used in the analysis.
- Provide a hydrologic soils map and rainfall charts in the report. Show and

label the general location of the project on all maps and charts.

- For the proposed condition rational method calculations, please verify area "J". (The calculations do not match the tables shown in the narrative)
- Consider creating a large scale land use map – figure 6. (i.e. the information is difficult to read)
- Consider replacing the pictures provided for figure 5 with pictures that are more presentable.
- Please provide a FIRM map showing that there will be no existing flood hazards within the project site.
- For consistency in the narrative, please provide the pipe lengths in the tables.
- Please re-format the rational method output files to display all of the input parameters used. (i.e. slope of intensity duration curves and rainfall values)
- Please provide an R.C.E. stamp. (With signature)
- Please see the report for additional comments.
- It is mentioned in the report that the project will increase the run off to Big bear Lake. It should be noted that San Bernardino County Flood Control Hydrology Manual states that developed flows should be mitigated to 90% of existing flow rates. This project may need to provide this mitigation. Coordination with the district may be a required.

II. Hydrology Map

For the existing condition hydrology map it is recommended that the following information be provided:

- Consider creating a large scale map. (The information is difficult to read)
- Existing drainage facilities, in and around the project site, as appropriate. (and label them).
- Contour elevations.
- Add soil type "D" to the hydrologic data table.
- Label the flow path lengths.
- A vicinity map.
- Provide a leader line for all nodal points.
- Node elevations.
- Street names.
- Delete one of the north arrows.

For the proposed condition hydrology map it is recommended that the

following information be provided:

- Consider creating a large scale map. (The information is difficult to read)
- Existing drainage facilities, in and around the project site, as appropriate. (and label them).
- Contour elevations.
- Add a hydrologic data table. (See the existing hydrology map)
- A vicinity map.
- Street names.

III. Hydraulics Study

1. Please provide preliminary pipe sizes for the cross culverts.

Please include a response to comments letter with the next plan check. Failure to do so may result in the return of submittal without plan check.

Sincerely,

AEI-CASC Consulting, Inc.

Aric M. Torreyson, P.E.
Project Manager

C.5 - Water Supply Analysis (California Collaborative Solutions, February 2009)

Nancy @ NBA

California Collaborative Solutions

Water Supply Analysis

Tentative Tract No. 16136

Moon Camp Tract

Fawnskin, Ca

February 11, 2009

P.O. Box 706 Big Bear City, CA 92314 909 586-5819 calcolsol@gmail.com

Tentative Tract No. 16136 --- Moon Camp

Water Supply Analysis

February 11, 2009

Background:

The Moon Camp Tract was originally proposed as a 92 lot subdivision. An existing, onsite domestic water well, FP2, was proposed to provide the water supply for the subdivision. Well FP2 extracts its groundwater from Sub Area "A" of the North Shore Groundwater Basin. During the evaluation of the Water Supply, it was determined that the Perennial Yield of Sub Area "A" is between 14 and 44 acre-feet per year (Geoscience Support Services, December 2, 2003 Focused Geohydrologic Evaluation, Summary of North Shore Subareas, Page 3, copy attached). The Geoscience Focused Evaluation and the DWP's Master Plan (November, 2006, Table 4-2, copy attached) uses the mid-point of this range, 29 acre-feet per year, as Sub Area A's annual yield. However, County Planning Staff stated that they would only support a project that utilized the most conservative 14 acre-feet per year. ALDA Engineering completed a Final Feasibility Study that determined that 50 lots (occupied full-time) could be served by the 14 acre-feet per year (DWP report dated March 6, 2007, Page 2, copy attached). As a result, the Proposed Subdivision was redesigned as 50, one-half acre minimum lots.

During the preparation of the Draft EIR by MBA, it was discovered that the existing Private Well production within Sub Area "A" is 5 acre-feet per year (Table 4-2, DWP Water Master Plan, November, 2006, copy attached). In order to provide 5 acre-feet per year of groundwater yield to the subdivision from a groundwater basin other than Sub Area "A", the developer has drilled Well FP4 in the adjoining Grout Creek Groundwater Basin. The Grout Creek Basin has a Perennial Yield of 280 acre-feet per year; existing private well production of 7 acre-feet per year; and DWP domestic well production of 121 acre-feet per year (Tables 4-1 and 4-2, DWP Water Master Plan, November, 2006, copies attached). Based on this data, the Grout Creek Basin has 152 acre-feet per year of Perennial Yield available.

Water Well FP2:

In order to produce 9 - 14 acre-feet per year from Sub Area "A", Well FP2 would need to pump at a rate of 5.6 – 8.7 gpm. In June, 2008, Well FP2 was cleaned, pump tested and a Title 22 Water Quality Analysis was performed (Geoscience Support Services Report, August 7, 2008, copy attached). Geoscience concluded:

- Well FP2 can be pumped at a rate of 35 gpm on a long-term basis with less than 10 feet of drawdown in the well (Well FP2 is 380' deep and the static water level is 2 feet below ground surface)
- At the 35 gpm discharge rate, pumping interference with the closest private well is expected to be less than 0.3 feet (the nearest private well is approximately 1,000 feet to the east of Well FP2)

- Title 22 Ground water quality data from Well FP2 indicates the water from the well is suitable for municipal supply

The 35 gpm rate from Well FP2 can produce 56 acre-feet per year and supports Geoscience's Focused Evaluation and the DWP Master Plan's conclusion that Sub Area A can produce 29 acre-feet per year.

Water Well FP4:

In December of 2008, Harich Enterprises drilled Well FP4 to a depth of 240 feet. Well FP4 is located in the north-west corner of the proposed subdivision, within the Grout Creek Groundwater Basin. In order to produce 5 acre-feet per year from the Grout Creek Basin, Well FP4 would need to pump at a rate of 3.1 gpm. Harich pump tested Well FP4 at 3.4 gpm (Harich Driller's Report, February, 2009, copy attached) and the County's Special Districts Department obtained Title 22 Water Quality samples for analysis. The results concluded:

- Well FP4 can be pumped at a rate of 3.4 gpm on a long-term basis with 87 feet of drawdown in the well (Well FP4 is 240 feet deep and the static water level is 22 feet below ground surface)

The 3.4 gpm pumping rate from Well FP4 will produce 5.5 acre-feet per year from the Grout Creek Basin.

Water Service Provider:

Based upon the January 24, 2008 letter from LAFCO Executive Officer Kathleen Rollings-McDonald (copy attached), County Service Area 53C can own and operate the Moon Camp Subdivision Water System, including Water Wells FP2 and FP4. Special Districts staff has stated that they would operate the water system with their existing staff. Currently, Special Districts staff operate the Fawnskin Sewer System through CSA 53B.

Conclusion:

The combined pumping capacity of FP2 and FP4 is more than adequate to meet the long term water supply needs of the proposed 50 lot subdivision without adverse impacts to either Sub-Area "A" of the North Shore Basin, or the Grout Creek groundwater basin.

References:

GEOSCIENCE Support Services Inc., 2003. Focused Geohydrologic Evaluation of the Maximum Perennial Yield of the North Shore and Grout Creek Hydrologic Subunit Tributary Subareas. Prepared for the City of Big Bear Lake, Department of Water and Power. December 2, 2003.

ALDA Engineering, Inc., 2007. Final Feasibility Study to Serve the Proposed Moon Camp Residential Development (Tentative Tract No. 16136). Prepared for the City of Big Bear Lake, Department of Water and Power. March 6, 2007.

Camp, Dresser & McKee, Inc., 2006. Water Master Plan. Prepared for the City of Big Bear Lake, Department of Water and Power. November, 2006.

GEOSCIENCE Support Services Inc., 2008. Results of Rehabilitation and Aquifer Testing Moon Camp Well FP-2. Prepared for California Collaborative Solutions. August 7, 2008.

HARICH Enterprises, 2009. Well FP4 Driller's Report. February, 2009.

Local Agency Formation Commission. 2008. Memorandum, Water Service to Tentative Tract 16136; Moon Camp Residential Subdivision. Prepared by Kathleen Rollings-McDonald, Executive Officer. January 24, 2008.

Focused Geohydrologic Evaluation of the Maximum Perennial Yield of the North Shore and Grout Creek Hydrologic Subunit Tributary Subareas

Prepared for: City of Big Bear Lake Department of Water and Power

December 2, 2003

GEOSCIENCE Support Services, Inc.
Tel: (909) 920-0707
Fax: (909) 920-0403
Mailing: P. O. Box 220, Claremont, CA 91711
1326 Monte Vista Ave., Suite 3, Upland, CA 91786
email: email@geoscience-water.com

- Long-term precipitation records from weather stations within the Big Bear Lake watershed,
- Evapotranspiration data from evaporation pans and weather stations within the watershed,
- Ground water levels, and
- Ground water production.

However, most of the input parameters that are required for a detailed evaluation of the average annual ground water recharge had to be estimated or assumed from data collected outside the Grout Creek and North Shore subunits or outside the Big Bear Lake Watershed due to lack of measured data in the area. Although the assumed values are published and are from reliable sources (i.e. the U.S. Environmental Protection Agency, United States Geological Survey, etc.), they are not specific to the area of interest. Numerous additional monitoring features can be developed to collect the data necessary to refine the ground water recharge estimates. However, priority should be given to the construction of monitoring wells and the development of a reliable ground water level baseline for the tributary subareas.

The results of the ground water recharge analysis for the North Shore Subunit are as follows:

Summary of Ground Water Recharge Results
North Shore Tributary Subareas

Tributary Subarea	Area [acres]	Annual Precipitation [inches]	Average Annual Ground Water Recharge - Low Estimate [acre-ft/yr]	Average Annual Ground Water Recharge - High Estimate [acre-ft/yr]	Average of Ground Water Recharge Estimate Range [acre-ft/yr]
A	247	27.87	14	44	29
B	720	25.45	36	110	73
C	828	23.01	37	107	72
D	558	21.45	22	63	43
E	392	20.01	15	39	27
F	814	18.27	23	66	44

WATER MASTER PLAN

Mission

The mission of the DWP is to manage our limited water resources through responsible planning in order to assure quality water and essential services in the most cost-effective manner for our current and future customers.

November 2006

Department of Water and Power

Big Bear Lake, California

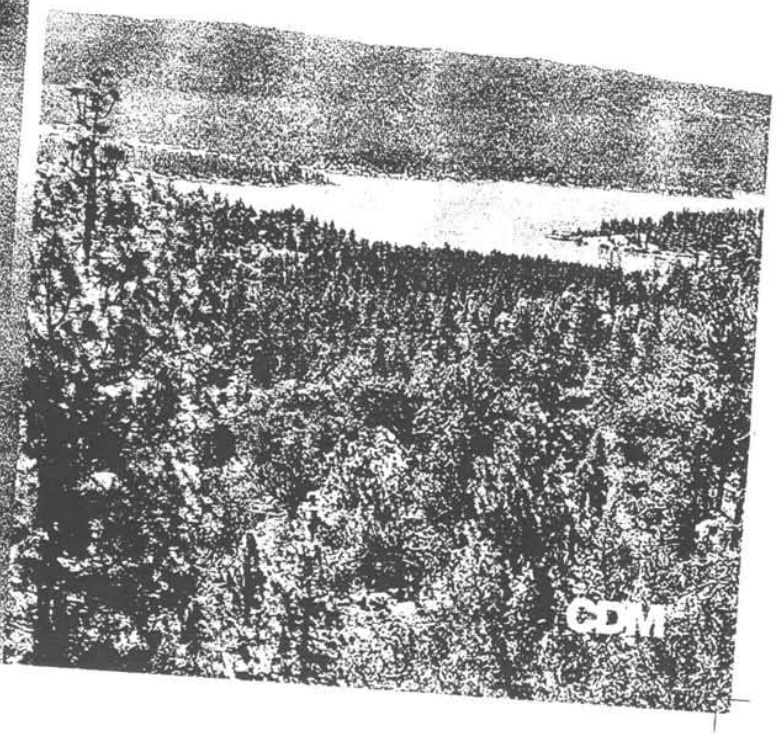


Table 4-1
Current and Projected Annual Demand and Supply Requirements by Pressure Zone

Current and Projected Annual Demand and Supply Requirements by Pressure Zone

Pressure Zone	Current		Full Development			
			25% Full-Time Equivalent		50% Full-Time Equivalent	
	Consumption (ac-ft/yr)	Supply (ac-ft/yr)	Consumption (ac-ft/yr)	Supply (ac-ft/yr)	Consumption (ac-ft/yr)	MDD (gpm)
Erwin Lake / Sugarloaf/ Lake William						
Erwin Lake	87	93	144	154	194	208
Lower Sugarloaf	173	186	225	241	339	363
Upper Sugarloaf	86	92	120	129	201	215
Lake William	28	29	45	48	57	61
Sub-total	374	400	535	572	791	846
Moonridge						
Wolf Booster	31	33	53	56	84	90
Wolf Tank	117	125	162	173	284	303
Lassen	54	58	70	75	104	111
Minton	11	12	17	18	30	32
Traventine	4	5	8	9	14	15
Lower Moonridge	162	173	207	221	286	306
High Timber Ranch	-	-	45	48	64	68
Sub-total	378	405	562	601	865	926
Big Bear Lake						
Town [1]	1,585	1,696	2,370	2,536	2,847	3,046
Conklin Booster	14	15	26	27	41	44
Ironwood Booster	18	19	35	37	48	51
Sub-total	1,617	1,730	2,431	2,601	2,935	3,141
Unmatched	61	65	--	--	--	--
"BIG FOUR" TOTAL:	2,431	2,601	3,527	3,774	4,591	4,913
Fawnskin						
Lower Fawnskin	102	109	172	184	224	240
Upper Fawnskin	19	20	32	35	51	54
Sub-total	121	129	204	219	275	294
Rim Forest	47	50	47	50	47	50
OVERALL TOTAL	2,598	2,780	3,778	4,043	4,913	5,257

(1) Includes Knickerbocker and Ponte pressure zones.

Table 4-2
Maximum Perennial Yield Estimate by Subunit (ac-ft/yr)

Maximum Perennial Yield Estimates by Hydrologic Subunit (ac-ft/yr)			
Subunit	*Perennial Yield Estimate*	*Private Wells Production*	*Available to DWP (ac-ft/yr)*
Grout Creek [1]	280	7	273
Mill Creek	100-175	3	147
Village	250	3	247
Rathbone	1,100	135	965
Division	496	2	494
North Shore			
Sub-Area A [1]	29	5	24
Sub-Area B	71		71
Sub-Area C	70		70
Sub-Area D	43		43
Sub-Area E	27		27
Sub-Area F	44		44
Erwin [2]	890	14	576
TOTAL:	3,400 - 3,475	169	2,981

(1) Assumed to be available to the Fawnskin system only.

(2) Only 576 ac-ft/yr are available to DWP from the Erwin Lake Subunit as an estimated 300 ac-ft/yr are produced by CSD. An additional 14 ac-ft/yr are produced by private wells.

The Perennial Yield from the Grout Creek subunit (280 ac-ft per year) and from Sub A of the North Shore subunit (29 ac-ft per year) is only available to the Fawnskin area. However, only 297 ac-ft per year are available to the DWP as an estimated 12 ac-ft per year are pumped by private wells. Therefore, an estimated 2,684 ac-ft per year are available to DWP to meet the water needs of the "Big Four" system on the south side of the lake. This number assumes that DWP would be able to develop all water sources in the remaining sub-areas in the North Shore subunit given that they are located in United States Forest Service (USFS) lands.

A comparison of supply requirements from Table 4-1 with available local supplies from Table 4-2 indicates that local supplies are capable of meeting current and projected water demands in the Fawnskin system. Local groundwater supplies available to the "Big Four" system are sufficient to meet current water demand of 2,601 ac-ft per year in that system; however, there would be a need to either reduce projected demands through conservation, secure additional supplies, or a combination of both options to meet demands at full development or resulting from conversion to full-time equivalent use. The supply deficit in the "Big Four" is estimated at approximately 1,090 ac-ft per year to meet projected demands at full development assuming the current distribution of full-time equivalent use is maintained; an additional 1,139 ac-ft per year of new supplies would be required to address the impact from demographics.

ALDA Engineering Inc.
9996 Orange Street
Alta Loma, CA 91737
Tel: 909-297-3741
Fax: 909-498-0423

March 6, 2007

Mr. Scott Heule, C.E.G./C.H.G., Assistant General Manager
City of Big Bear Lake
Department of Water & Power
41972 Garstin Drive
Big Bear Lake, CA 92315

Subject: **Final Feasibility Study to Serve the Proposed Moon Camp Residential Development** (Tentative Tract No. 16136)

Dear Mr. Heule:

Pursuant to your request, ALDA Engineering Inc. (ALDA) has conducted a feasibility study to determine the necessary system facilities to serve the above referenced development. This report summarizes the results of our investigation and recommendations. This report presents the project background, an assessment of demand and supply issues, the results of the system analysis, and the recommended improvements.

Project Background

The proposed Moon Camp development consists of 50 residential lots to be developed over approximately 62 acres of land. The proposed development is located along North Shore Drive, in the community of Fawnskin on the north side of Big Bear Lake, and ranges in elevation from approximately 6,750 ft. near the lake to approximately 6,950 ft. in the northeasterly quadrant. Individual lots range in size from approximately half an acre to well over two acres depending on location and are anticipated to be developed as single family residential units; average lot size is approximately one and a quarter acres. Because of its location and lot size, some of the residential units are anticipated to be fairly large and potentially exceed 4,000 square feet in size.

Water service to the proposed development will be provided off the Upper Fawnskin pressure zone as the Lower Fawnskin zone would not provide enough static head to provide the development adequate fire flow. DWP's closest pipeline off the Upper Fawnskin system is a single 6-inch diameter pipeline located near the intersection of Flicker Road and Chinook Road, approximately 2,000 ft away from the westerly boundary of the proposed development. Significant transmission improvements in the Fawnskin system are needed to provide fire flow to the proposed tract.

Currently, there are two groundwater production wells within the proposed residential tract. These wells are located in subarea A of the North Shore hydrologic subunit. It is our understanding that these wells will be deeded to the DWP at the time the tract map is recorded. The developer plans to equip the FP-2 well initially to meet the development projected water demands. The DWP will use excess capacity from this well to help reduce reliance on the leased North Shore Well No. 1. Groundwater production capacity from this well is estimated at approximately 100 gallons per minute. The second well (FP-3), located to the east of the FP-2 well, will not be initially equipped by DWP.

Pressure Zone Service Area

Based on the elevation range of the proposed development, 6,750 ft. to 6,950 ft., the development can be served off the Upper Fawnskin pressure zone. This pressure zone has an operating hydraulic grade of 7,113 ft. set by the high water level of the existing 0.25-million gallon Racoon Reservoir. Based on this hydraulic elevation, static pressures would range from a low of 71 psi at the highest point in Lot 18 to 157 psi near the lake. Individual pressure regulators would be required for all lots with static pressures exceeding 80 psi.

Water supply in the Fawnskin area is provided by two groundwater wells in the Lower Fawnskin pressure zone and by slant wells in the vicinity of the Racoon Reservoir. Excess groundwater production from the Lower Fawnskin pressure zone is conveyed to the Upper Fawnskin pressure zone through a booster station located at the Cline Miller Reservoir.

Water Demand

Projected water demand for the proposed development is based on the average consumption rate of 250 gallons per day per connection. Maximum day demand is estimated based on information provided in the recently completed water master plan and it is equivalent to 1.76 times the average day demand. Therefore, the average and maximum day demands for the proposed 50-lot subdivision are estimated as follows:

- Average Day Demand (ADD) = 12,500 gpd or 8.68 gpm
- Maximum Day Demand (MDD) = 15.27 gpm

Based on an estimated average day demand of 12,500 gallons, the annual water demand for the development is estimated at 4.56 million gallons or 14.00 ac-ft per year.

LOCAL AGENCY FORMATION COMMISSION
COUNTY OF SAN BERNARDINO

215 North "D" Street, Suite 204
San Bernardino, CA 92415-0490 • (909) 383-9900 • Fax (909) 383-9901
E-mail: lafco@lafco.sbcounty.gov
www.sbclafco.org

DATE: **JANUARY 24, 2008**

FROM: **KATHLEEN ROLLINGS-McDONALD, Executive Officer**

TO: **MATTHEW SLOWIK, Senior Planner**
Advance Planning Division – Land Use Services Department

SUBJECT: **WATER SERVICE TO TENTATIVE TRACT 16136; MOONCAMP RESIDENTIAL SUBDIVISION**

In response to your memorandum, dated January 15, 2008, I would like to provide a description of the three options for water service to this tract and the implications of Government Code Section 56133 to them from the LAFCO staff perspective.

First, Option #1, as previously identified to LAFCO staff, would be for the City of Big Bear Lake Department of Water and Power (hereafter DWP) to extend its infrastructure to serve the entirety of the residential subdivision. As I understand it, a portion of the tract is within the boundaries of the former SoCal Water Company which was condemned and acquired by the City of Big Lake and now operates under the DWP. Pursuant to the provisions of Government Code Section 56133 and LAFCO policies, the DWP has been authorized to continue to expand its services within the former boundaries of the SoCal system without the need for review and approval of LAFCO pursuant to Govt. Code Section 56133, but not beyond. Therefore, a review of the current project with our Special Counsel indicated that Option #1, to extend services by the DWP, was not viable since it would require consideration under §56133 which precludes service outside an agency's sphere of influence. None of the Fawnskin community is within the City of Big Bear Lake sphere of influence.

Please note that there is an area outside the existing DWP boundary defined as the former certificated service area of the SoCal Water Company that is receiving water service from DWP. The agreement between the DWP and Big

Bear Shores Homeowners Association was entered into in 1993, prior to the 1994 enactment of §56133. A copy of this agreement is included as an attachment to this memorandum.

Option #2, as presented to LAFCO staff, was the creation of a Joint Powers Authority (JPA) between the City of Big Bear Lake and County Service Area 53 Improvement Zone C (hereafter CSA 53C) to provide for domestic water service to the area outside the DWP system. CSA 53C was created with water powers to encompass the whole of the North Shore of Big Bear Lake including the entirety of the community of Fawnskin. This option is viable for the provision of domestic water service should it be the choice of the developers of the project.

Option #3, identified by LAFCO staff, would be for CSA 53C to own and/or install the domestic water system required by the project including development of wells and infrastructure and contract with the DWP to operate the system. CSA 53C, as noted above, includes the whole of the Fawnskin community, including areas inside and outside the service area of DWP, and is authorized water service as its only function. In the LAFCO staff view, such a management contract would be exempt from review by LAFCO under provisions of Government Code Section 56133 Subsection (e) which reads as follows:

> *"(e) This section does not apply to contracts or agreements solely involving two or more public agencies where the public service to be provided is an alternative to, or substitute for, public services already being provided by an existing public service provider and where the level of service to be provided is consistent with the level of service contemplated by the existing service provider..."*

The determination of exemption is made by the Commission following the receipt of a written request for consideration. The request shall include a copy of the contract for service, a map delineating the area to be served and a description of the manner in which the service is to be provided. Precedent for this procedure includes the contracts for service between the County (for law enforcement) and County Service Area 38 (Fire protection) and the City of Redlands related to service delivery to the "Donut Hole". A copy of these exemptions is included as an attachment to this memorandum.

Please contact me if you have any questions at (909) 383-9900.

/KRM

Attachments (3)

HARICH ENTERPRISES INC

Michael Perry
California Collaborative Solutions
P.O. Box 706
Big Bear City, Ca 92314

February 12, 2009

RE: Driller's Report and Pump Test for Moon Camp Well FP4

Dear Mr. Perry:

Enclosed please find the Well Completion Report and the results of the 48 hour constant rate pumping test for your Moon Camp Well FP4.

Harich Enterprises drilled Well FP4 at a 12" diameter to a total depth of 240 feet, with the screened interval from 100 to 240 feet and a 60' sanitary seal. Well FP4 is permitted through the County of San Bernardino as a municipal well. The well screen is a 6" diameter Roscoe Moss "Ful-Flo Louver" steel pipe. An Aquarium Sand filter pack was installed per the Special Districts Department specifications.

Static water level in the well was 22 feet measured on 2/4/09. The well was pumped at 3.4 gpm for 48 hours with the drawdown stabilizing at 87 feet (see enclosed Constant Rate Test Drawdown Chart).

Well FP4 was drilled in the northwest corner of the Moon Camp Tract as shown on the enclosed map.

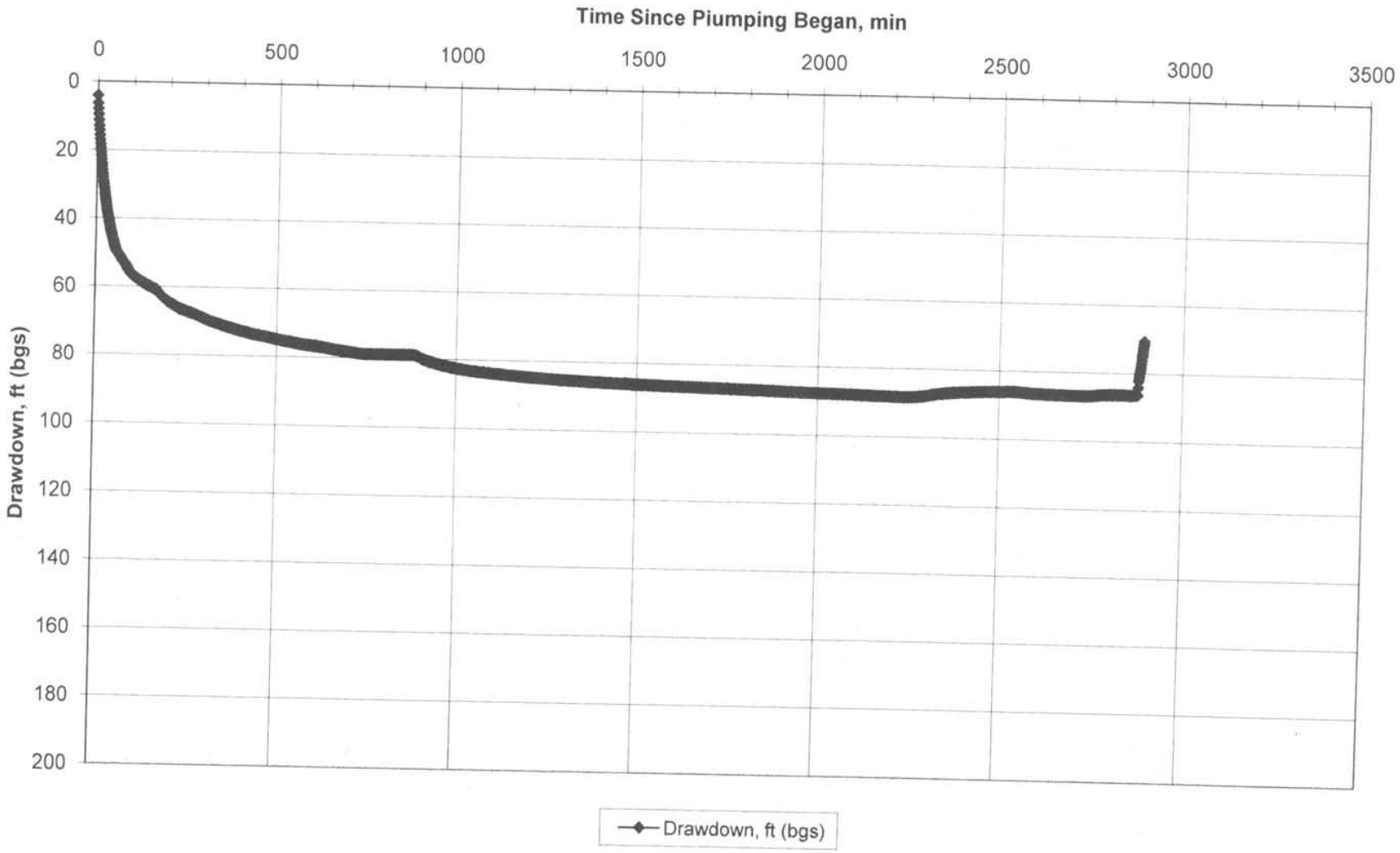
Please call me if you need any additional information.

Sincerely,

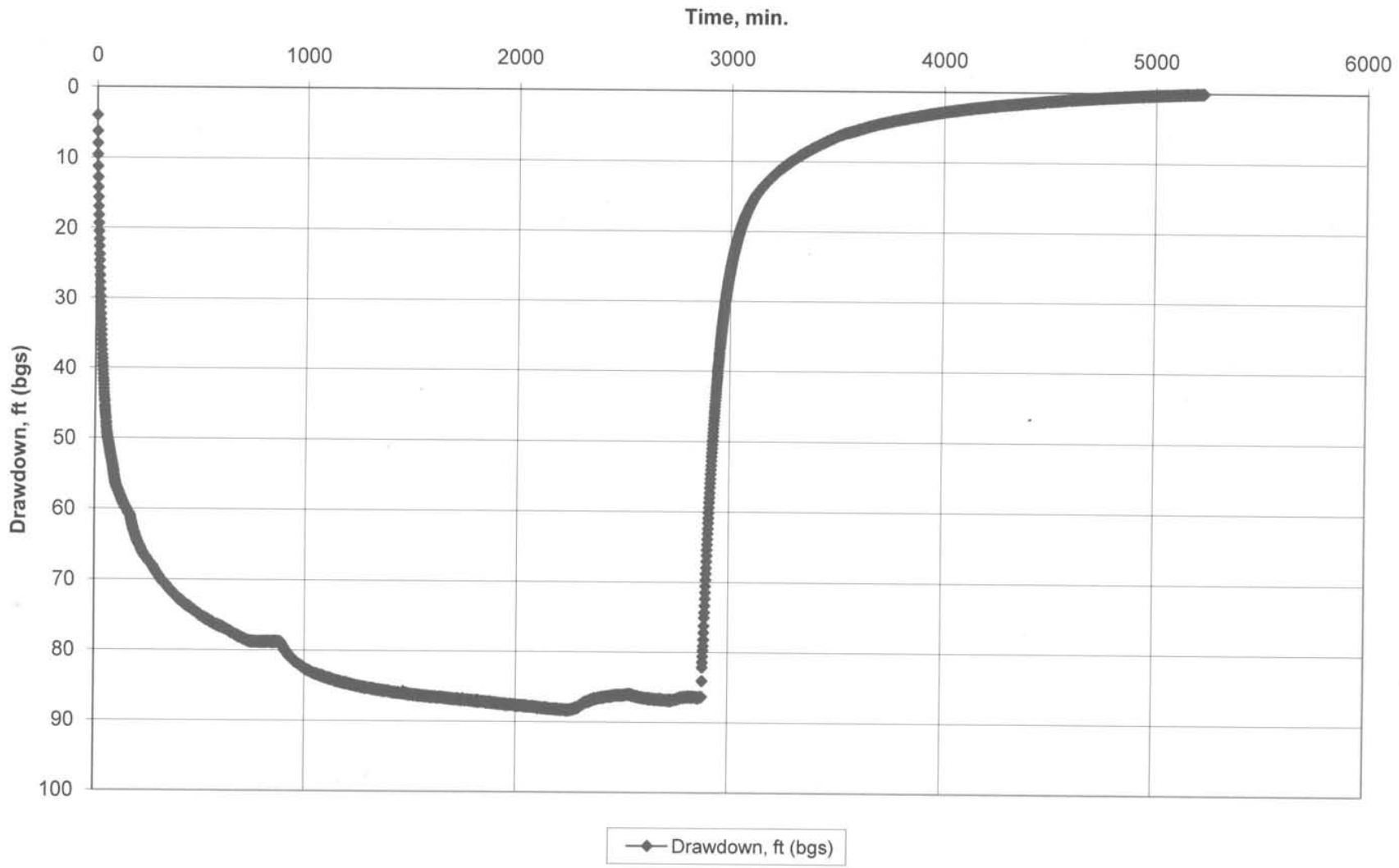
David Harich
Harich Enterprises Inc.

WATER RESOURCES DEVELOPMENT
POST OFFICE BOX 2233 RUNNING SPRINGS, CA. 92382
FAX (909)867-7759 / OFFICE (909) 867-2483

Constant Rate Test Moon Camp Well FP4
Constant Flow Rate at 3.4 GPM



Moon Camp Well FP4 Constant Rate Test at 3.4 GPM



TRIPLICATE
Owner's Copy
Page 1 of 1

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. e0085096

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO / STATION NO
LATITUDE LONGITUDE
APN/TRS/OTHER

Owner's Well No. WELL FP4
Date Work Began 12/17/2009 Ended 2/6/2009
Local Permit Agency SAN BERNARDINO
Permit No. 2008100582 Permit Date 9/26/2008

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL — HORIZONTAL — ANGLE — (SPECIFY)
DRILLING METHOD ROTARY FLUID AIR

DEPTH FROM SURFACE Ft. to Ft.	DESCRIPTION Describe material, grain, size, color, etc.
0 10	BROWN/RED/COBBLES/CLAY
10 20	BROWN/CLAY
20 40	BROWN/CLAY/GRAVELS
40 75	BROWN CLAY/PINK QUARTZITE
75 85	TAN/SANDS/GRAVELS/COBBLES/ 1st WATER
85 110	TAN/PINK/BLACK/COBBLES/SAND
110 120	BROWN/CLAY/GRAVELS
120 140	TAN/SAND (ADDITIONAL WATER)
140 150	TAN/GREY/BROKEN GRANITE(SMALL WATER)
150 240	GREY/SOLID GRANITE

TOTAL DEPTH OF BORING 240 (Feet)
TOTAL DEPTH OF COMPLETED WELL 240 (Feet)

WELL OWNER

Name TIM WOOD MOON CAMP
Mailing Address P.O. BOX 6820
BIG BEAR LAKE CA 92315
CITY STATE ZIP

WELL LOCATION

Address HWY 18 & CANYON RD
City FAWNSKIN, CA CA 92333
County SAN BERNARDINO
APN Book 0304 Page 091 Parcel 22
Township 2 N Range 1 W Section 13
Latitude 34 15 56 N 116 56 15 W
DEG MIN SEC DEG MIN SEC

LOCATION SKETCH

NORTH
WEST
EAST
SOUTH
See Attached
Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers etc. Add Attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

✓ NEW WELL
MODIFICATION/REPAIR
Deepen
Other (Specify)
DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USES (✓)

WATER SUPPLY
— Domestic ✓ Public
— Irrigation — Industrial
MONITORING
TEST WELL
CATHODIC PROTECTION
HEAT EXCHANGE
DIRECT PUSH
INJECTION
VAPOR EXTRACTION
SPARGING
REMEDIATION
OTHER (SPECIFY)

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 80 (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 22 (Ft.) & DATE MEASURED 2/4/2009
ESTIMATED YIELD 3.4 (GPM) & TEST TYPE PUMP
TEST LENGTH 48 (Hrs.) TOTAL DRAWDOWN 87 (Ft.)
May not be representative of a well's long-term yield

CASING (S)

DEPTH FROM SURFACE Ft. to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0 60	12"			✓		STEEL	6"	.188	
60 100	12"				✓	STEEL	6"	.188	
100 240	12"		✓			STEEL	6"	.188	.093
						(Roscoe Mo	Ful-flo	Louvered	Pipe)

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft. to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0 60	✓			
60 240				AQUARIUM SAND

ATTACHMENTS (✓)

— Geologic Log
— Well Construction Diagram
— Geophysical Log(s)
— Soil/Water Chemical Analysis
— Other
ATTACH ADDITIONAL INFORMATION, IF IT EXISTS

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.
NAME HARICH ENTERPRISES, INC.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
ADDRESS P.O. BOX 2233
CITY RUNNING SPRING STATE CA ZIP 92382
Signed [signature]
WELL DRILLER/AUTHORIZED REPRESENTATIVE
DATE SIGNED 02/10/09
C-57 LICENSE NUMBER 618447

DWR 188 REV 11-97
IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

California Collaborative Solutions
Results of Rehabilitation and Aquifer Testing
Moon Camp Well FP-2

August 7, 2008

GEOSCIENCE Support Services, Inc.
P.O. Box 220, Claremont, CA 91711
Tel: (909) 920-0707 Fax: (909) 920-0403
email: email@geoscience-water.com

THIS REPORT IS RENDERED TO CALIFORNIA COLLABORATIVE SOLUTIONS AS OF THE DATE HEREOF, SOLELY FOR THEIR BENEFIT IN CONNECTION WITH ITS STATED PURPOSE AND MAY NOT BE RELIED ON BY ANY OTHER PERSON OR ENTITY OR BY THEM IN ANY OTHER CONTEXT. ALL CALCULATIONS WERE PERFORMED USING ACCEPTED PROFESSIONAL STANDARDS.

AS DATA IS UPDATED FROM TIME TO TIME, ANY RELIANCE ON THIS REPORT AT A FUTURE DATE SHOULD TAKE INTO ACCOUNT UPDATED DATA.

CALIFORNIA COLLABORATIVE SOLUTIONS
RESULTS OF REHABILITATION AND AQUIFER TESTING
MOON CAMP WELL FP-2

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B	Water Quality Data
C	Microscopic Particulate Analysis

CALIFORNIA COLLABORATIVE SOLUTIONS
RESULTS OF REHABILITATION AND AQUIFER TESTING
MOON CAMP WELL FP-2

1.0 INTRODUCTION

This report summarizes the results of rehabilitation and testing of Well FP-2, located in the vicinity of the proposed Moon Camp development, east of Fawnskin, California (see Figures 1 and 2). Well FP-2 is a potential water source for the development, however, prior to recent activities, it had not been pumped since its construction in 1987. In order to assess the suitability of the well for water supply, GEOSCIENCE developed and implemented a well rehabilitation and testing program.

1.1 Purpose and Scope

The purpose of rehabilitation and testing of Moon Camp Well FP-2 was to:

1) Assess the current condition of the well;

2) Develop a rehabilitation program adequate to restore the specific capacity of the well so that its potential yield and water quality could be evaluated;

3) Implement the rehabilitation and testing program; and

4) Collect and analyze the data necessary for evaluating aquifer characteristics including water quality, potential interference to nearby wells, and possible hydraulic continuity with Big Bear Lake.

The scope of work to address the objectives included:

1) Conducting a downhole video survey of the well;

2) Developing a rehabilitation and testing program and coordinating implementation of the program with a rehabilitation contractor;

3) Implementing the rehabilitation program;

4) Conducting a 72-hour aquifer pumping test;

5) Collecting ground water quality samples from the well and having them analyzed for full Title 22 suite and microscopic particulate analysis (MPA); and

6) Analysis of the data and preparation of the report.

1.2 Background

The Moon Camp Well FP-2 was drilled in 1987 by Howard Pump Company of Barstow, California, using the mud rotary drilling method. A 17-inch borehole was drilled to a depth of 50 ft below ground surface (bgs), below which a 15-inch borehole was drilled to the total depth of 385 ft bgs. Well casing and screen, consisting of 8 1/8-inch inside diameter (ID) mild steel with a 1/4-inch wall thickness was installed to a total depth of 380 ft bgs. The screened portion of the well consists of Johnson Hi-Cap, a type of wire-wrap, located at depths of 60 to 120, 156 to 176, 216 to 278, and 310 to 370 ft bgs. The well was equipped with a 2-inch sounding tube that attaches to the well casing just below the ground surface. The well was filter packed using an 8 x 16 Monterey Sand from the total borehole depth to 53 ft bgs. A 2-foot bentonite layer was placed above the filter pack from 51 to 53 ft bgs and a cement annular seal was placed above the bentonite layer from 51 ft bgs to the ground surface.

Following well construction, the well was developed by bailing and pumping. Following development, an 8-hour variable rate (step drawdown) test was performed. During this test, a maximum discharge rate of 100 gallons per minute (gpm) was achieved with a pumping water level of 26 ft bgs. The specific capacity calculated from data collected during this test was approximately 5 gpm per foot of drawdown.

2.0 DOWNHOLE VIDEO SURVEY

On May 2, 2008, Pacific Surveys, LLC, conducted a downhole video survey of Well FP-2. GEOSCIENCE personnel were on site to note observations made during the survey and to direct the operation of the camera as necessary.

At the time of the video survey, the depth to static ground water level was approximately 2 ft bgs. The camera reached a depth of approximately 376 ft bgs before visibility within the water column became so reduced (i.e. blackout conditions) as to warrant the removal of the camera.

The video survey showed that the blank well casing and screen was locally scaled and corroded although no obvious structural damage was observed. The blank well casing was coated with moderate to heavy scale, with encrustants occurring in localized patches, particularly along welded casing joints. Large mounds of encrustants became more frequent and larger with depth. The wire-wrapped screen sections showed minor to complete clogging with some localized patches of encrustants and tubercles. Where screens were open, no filter pack could be seen through the screen apertures. Some of the encrusting material was observed to be relatively fragile and brittle and became dislodged from contact with the video camera.

3.0 WELL REHABILITATION PROCEDURE

Based on review of the video log, GEOSCIENCE developed a chemical and mechanical rehabilitation program for Well FP-2[1]. Rehabilitation was performed by Roadrunner Drilling & Pump Company of Winnemucca, Nevada (Contractor). The rehabilitation program was initiated on June 27, 2008.

Initial rehabilitation of Well FP-2 included mechanical dislodging of encrusted material throughout the wetted portion of the well casing and screen using a spirally-wound nylon brush. Scale and debris were dislodged by gently raising and lowering the brush throughout the specified area. The Contractor brushed each wetted foot of blank well casing for one minute and each wetted foot of screen for two minutes, for a total of 10 hours brushing time. Following brushing, a bailer was used to remove material that had accumulated at the bottom of the well.

The well was disinfected through a combination of acidification and chlorination. Using a tremie pipe, acid was introduced throughout the length of the well. The acid was mixed into the screened portion by gently lifting and lowering a bailer tool. Once the pH of the well water had been lowered to approximately 4.5 pH units, a chlorine solution was added through the tremie pipe and worked into the screened portion of the well by lifting and lowering the bailer. Once the chlorine concentration of the water in the well exceeded 200 milligrams per liter (mg/L), the well was allowed to sit idle for 24 hours.

Following chlorination, the Contractor continued rehabilitation of Well FP-2 using a combination swab and airlift tool. Swabbing was accomplished by gently lifting and lowering the double-packer tool opposite 10-foot sections of the well screen, effectively dislodging any remaining biofilm and/or fine-grained sediment from the gravel pack and near well zone. Following several passes with the swab tool through a 10-foot screened interval, the interval was

[1] Letter to Michael Perry dated May 9, 2008

pumped (air lifted) using the tool until the discharged water was clear and free of sediment. The screened portion of the well was swabbed and airlifted for a total of 20 hours.

Following swabbing and airlifting, a submersible test pump was installed within the well for final development and testing. The test pump intake was installed at a depth of approximately 130 ft bgs. Initial pumping was performed at a relatively low flow rate (approximately 30 gpm) and was gradually increased as water clarity improved and sand production decreased. Pumping was periodically interrupted to surge the well, a process where water in the pump column is allowed to flow back into the screened section of the well. This process was repeated until the discharge water was clear and the sand content was less than 0.1 parts per million (ppm). The well was developed by pumping for approximately 11 hours. The maximum discharge rate during development was approximately 150 gpm with approximately 25 feet of drawdown.

4.0 AQUIFER PUMPING TEST

A 72-hour variable rate (step-drawdown) pumping test was conducted at Well FP-2 during the period from July 1 to 4, 2008. The well was pumped in 24-hour "steps" at average discharge rates of 35 gpm, 60 gpm and 105 gpm (see Figure 3). During the pumping test, the pumping water level, discharge rate, and sand content were closely monitored (see Appendix A). Ground water levels in a nearby private well, referred to as the Fujimoto Well (see Figure 2), were also monitored during the pumping test. The pumping test was followed by 4 hours of recovery measurements in both the pumping well and the observation well. The field procedure for the pumping test followed the American Society for Testing and Materials (ASTM, 1994), Standard Test Method D4050.

4.1 Pumping Test Methodology

4.1.1 Basic Assumptions Used in Analysis of Pumping Test Data

The purpose of a pumping test is to obtain field data, which when substituted into an equation or set of equations, will yield estimates of well and aquifer properties. As certain assumptions have been used to derive these equations, it is important to consider or control these factors during the test. These assumptions are:

- The aquifer material is assumed to consist of porous media, with flow velocities being laminar and obeying Darcy's law.
- The aquifer is considered to be homogeneous, isotropic, of infinite aerial extent, and of constant thickness throughout.
- Water is released from (or added to) internal aquifer storage instantaneously upon change in water level.

- No storage occurs in the semi-confining layers of leaky aquifers.
- The storage in the well is negligible.
- The pumping well penetrates the entire aquifer and receives water from the entire thickness by horizontal flow.
- The slope of the water table or piezometric surface is assumed to be flat during the test with no natural (or other) recharge occurring, which would affect test results.
- The pumping rate is assumed constant during the entire time period of pumping during a constant-rate test, and constant during each discharge step in a variable-rate test.

4.1.2 Theis Equation

Estimation of aquifer parameters from pumping test data is based on analytical solutions of the basic differential equation of ground water flow that can be derived from fundamental laws of physics. One of the most widely used solutions of this equation for non-steady radial flow to wells is the "Theis Equation":

$$s(r,t) = \frac{114.6Q}{T} W(u) \qquad \text{"Theis Equation"} \qquad (1)$$

where:

s(r,t) = Drawdown in the vicinity of an artesian well, [ft]
r = Distance from pumping well, [ft]
Q = Discharge rate of pumping well, [gpm]
T = Transmissivity of aquifer, [gpd/ft]
W(u) = "Well function of Theis"

$$u = \frac{1.87r^2S}{Tt}$$

where:

S = Storativity, [fraction]

t = Time after pumping started, [days]

4.1.3 Jacob's Straight-Line (Modified Theis Non-Equilibrium) Method

According to Jacob (1950), for small values of "u" ($u < 0.05$), the Theis equation may be approximated by Jacob's equation:

$$s(r,t) = \frac{264Q}{T}\log\left(\frac{0.3\,Tt}{r^2 S}\right) \qquad \text{"Jacob's Equation"} \qquad (2)$$

Jacob's equation is valid for use for most hydrogeologic problems of practical interest, is easier to use than the Theis equation, and involves a simple graphical procedure to estimate transmissivity and storativity. This method (D 4105) is summarized by ASTM (1994).

Transmissivity (T, in gpd/ft) can be estimated as:

$$T = \frac{264Q}{\Delta s} \qquad (3)$$

where:

Q = Pumping rate, [gpm]

Δs = Change in drawdown over one log cycle of time, [ft]

4.2 Pumping Well

Well FP-2 served as the pumping well for the 72-hour constant rate pumping test. The static ground water level in the well was measured to be approximately 6 ft bgs prior to the start of pumping. Ground water levels were measured during the pumping test and recovery phase using a downhole pressure transducer programmed to collect measurements at one-minute intervals. Additionally, an electric wireline sounder was used to manually collect ground water levels in FP-2 during the pumping and recovery phases.

The discharge rate was monitored with a flowmeter equipped with a totalizer and instantaneous rate gauge. During the course of the 72-hour pumping test, Well FP-2 pumped at average discharge rates of 35, 60, and 105 gpm (Steps 1, 2, and 3, respectively). The total volume of ground water pumped during testing was 289,350 gallons.

Ground water samples were collected during the 72-hour step test after approximately 44 hours of pumping (July 2, 2008). The samples were submitted to E.S. Babcock & Sons, Inc. of Riverside, California for analysis of constituents required by the State of California Code of Regulations Title 22 Rule as well as other selected constituents. A complete list of the constituents tested and their detection limits are provided in Table 1. Laboratory results of the water quality testing are presented in Appendix B.

A microscopic particulate analysis (MPA) was performed during the first 24 hours of the step drawdown test. After approximately 1,000 gallons of discharge water were run through a filtering apparatus, the filter was submitted to BioVir laboratories, Inc. of Benicia, California. The sample was analyzed according to EPA Method 910/9-92-029 including *Giardia* species and *Cryptosporidium*. Results of the MPA are presented in Appendix C.

4.3 Observation Well

Ground water levels were monitored before, during and after the pumping test in an observation well (a private well referred to as the Fujimoto Well) located approximately 910 ft east of Well FP-2. Water level measurements were collected and recorded in this well using a pressure transducer.

5.0 PUMPING TEST RESULTS

5.1 Production Well (FP-2)

As shown on Figure 3, Well FP-2 can be pumped at a rate of 35 gpm on a long-term basis with less than 10 ft of drawdown in the well. The well can also sustain a pumping rate of 105 gpm on a long-term basis although the rate of ground water level decline is greater. Analysis of the 105 gpm step using Jacob's straight-line interpretation shows an aquifer transmissivity of approximately 14,600 gallons per day per foot of drawdown (gpd/ft; see Figure 4). At a pumping rate of 105 gpm, the specific capacity of FP-2 is approximately 4.7 gpm/ft.

The specific capacity (the inverse of specific drawdown), of the well during Step 1 was less than the specific capacity measured during Steps 2 and 3. This results in a negative trendline when plotting specific drawdown with discharge rate, and thus, well efficiency cannot be calculated (see Figure 5).

Calculated recovery is a method of analysis whereby extrapolated drawdown data is compared to actual recovery data from the pumping well. It can be used to calculate transmissivity using Jacob's straight line interpretation in a similar manner as used with the pumping drawdown data. Results of the calculated recovery analysis for well FP-2 shows an aquifer transmissivity of approximately 8,900 gpd/ft (see Figure 6). Residual drawdown analysis, a method whereby residual drawdown (the difference between the static and recovering water level) is plotted with respect to the ratio between the time since pumping stopped and the time since pumping started, can also be used for calculating aquifer transmissivity using Jacob's straight line interpretation. Results of the residual drawdown analysis for Well FP-2 shows an aquifer transmissivity of approximately 9,600 gpd/ft (see Figure 7).

5.2 Observation Well

Ground water level data collected from the observation (Fujimoto) well, located approximately 910 ft east of Well FP-2, during the pumping test shows minor ground water pumping interference that can be attributed to pumping of Well FP-2. Given that the Fujimoto well was an actively pumping well that cycled on and off periodically during the pumping test, it was necessary to interpret pumping interference from Well FP-2 through the ground water level "noise" of the pumping observation well. To account for this, static ground water levels were used to interpret interference trends (see Figure 8). Interpretation of static ground water trends during the pumping test shows a decline of approximately 0.3 ft that can be attributed to interference from pumping Well FP-2 at a rate of 35 gpm.

5.3 Ground Water Quality

Ground water quality data from Well FP-2 indicate that water produced from the well is suitable for municipal supply. The water is of calcium-bicarbonate type (see Figure 9). The total dissolved solids (TDS) concentration was reported to be 300 mg/L, below the recommended California Department of Public Health (CDPH) secondary maximum contaminant level (MCL) of 500 mg/L. Toluene was detected at a concentration of 1.2 micrograms per liter (µg/L), below the CDPH primary MCL of 150 µg/L, and is likely from materials used during installation of the test pump. Chloroform was detected at a concentration of 0.98 µg/L, below the USEPA MCL of 80 µg/L for trihalomethanes, and is likely a by-product of the chlorine used during rehabilitation of the well casing and screen. All other detected constituents were below their respective MCLs or notification levels.

The results of the water quality analyses are summarized in the following table:

Water Quality Analytical Data – Moon Camp Well FP-2

		Analysis Result	Drinking Water Regulatory Standards
Aluminum	[µg/L]	< 50	200[2]/1,000[1]
Arsenic	[µg/L]	< 2.0	10[1]
Boron	[µg/L]	< 100	1,000[3]
Chloride	[mg/L]	2.7	250-500[2]
Chromium, Hexavalent	[µg/L]	< 1.0	50[1,4]
Chromium, Total	[µg/L]	1.1	50[1]
Color	[Color Units]	< 3.0	15[2]
Fluoride	[mg/L]	< 1.0	2.0[1]
Iron	[µg/L]	< 100	300[2]
Manganese	[µg/L]	< 20	50[2]
Nitrate (as NO_3)	[mg/L]	< 1.0	45[1]
Odor	[TON]	< 1.0	3[2]
Perchlorate	[µg/L]	< 4.0	6[1]
pH	[pH Units]	7.5	6.5 - 8.5[5]
Silica, Total	[mg/L]	25	NA[6]
Specific Conductance	[µmhos/cm]	510	900-1,600[2]
Sulfate (as SO_4)	[mg/L]	5.2	250-500[2]
Surfactants (MBAS)	[mg/L]	< 0.05	0.5[2]
Total Dissolved Solids (TDS)	[mg/L]	300	500 - 1,000[2]
Total Hardness	[mg/L]	270	NA[6]
Turbidity	[NTU]	0.39	5[2]
Vanadium	[µg/L]	< 3.0	50[1]
1,2,3-Trichloropropane	[µg/L]	< 0.005	0.005[1]
Gross Alpha	[pCi/L]	1.74 +/- 1.33	15[1]
Radon	[pCi/L]	447 +/- 43.1	300-4,000[7]
Volatile Organic Compounds (EPA Method 524.2) except as noted below:	[µg/L]	ND	Varies with Chemical[1]
Chloroform	[µg/L]	0.98	80[8]
Toluene	[µg/L]	1.2	150[1]

1 California Department of Public Health (CDPH) primary maximum contaminant level (MCL).
2 CDPH secondary MCL.
3 CDPH notification level for unregulated chemicals.
4 Chromium-6 (hexavalent chromium) is regulated by CDPH under the 50 µg/L total chromium MCL.
5 United States Environmental Protection Agency (USEPA) secondary standard for pH.
6 Not Applicable – no current MCL.
7 USEPA proposed MCL and alternative MCL.
8 Chloroform is regulated under the 80 µg/L USEPA MCL for total trihalomethanes.
ND Not detected above laboratory detection limit.
BOLD Equal to or above current CDPH MCL or notification level.

5.4 Microscopic Particulate Analysis

Microscopic particulate analysis (MPA) did not show any primary or secondary particulates in the well discharge, with the exception of plant pollen. The plant pollen identified was determined to be pine pollen, and is likely an airborne contaminant that contacted the sampling apparatus during field set-up. Given this, there is no evidence from the MPA that the ground water produced by Well FP-2 is under the direct influence of surface water in Big Bear Lake. A copy of the complete MPA report is presented in Appendix C.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the data collected during this investigation, we have developed the following conclusions:

- Well FP-2 has successfully been rehabilitated and its specific capacity restored to near original levels;
- Extreme care should be exercised when equipping or redeveloping the well in the future to avoid damaging the wire-wrap screen. Although no clear damage was visible from the video survey, the screen design is fragile and can easily be damaged;
- Well FP-2 can yield up to 35 gpm on a long-term basis with less than 10 ft of drawdown;
- At the 35 gpm discharge rate, pumping interference with the closest private well is expected to be less than 0.3 ft;
- Ground water quality data from Well FP-2 indicates the water from the well is suitable for municipal supply;
- Microscopic particulate analysis of discharge water detected pine pollen on the sampling filter. However, the detection was likely the result of an airborne contaminant and not from ground water under the direct influence of surface water. Confirmation sampling and analysis may be necessary to verify this conclusion prior to permitting the well with the CDPH.

7.0 REFERENCES

American Society for Testing and Materials, 1994. ASTM Standards on Ground Water and Vadose Zone Investigations. 2nd Edition.

Jacob, C.E., 1950. Engineering Hydraulics. J. Wiley and Sons, New York.

Driscoll, Fletcher G., 1986. Groundwater and Wells. Second Edition. U.S. Filter/Johnson Screens, St Paul Minnesota.

C.6 - Water Supply Analysis (California Collaborative Solutions, May 2009)

California Collaborative Solutions

Water Supply Report

Tentative Tract No. 16136

Moon Camp Tract

Fawnskin, Ca

May 14, 2009

P.O. Box 706 Big Bear City, CA 92314 909 586-5819 calcolsol@gmail.com

performed above indicates that new estimates of this planning number may be lower in the future. Please feel free to contact me if you have any questions.

Thank you for your interest,

William S. La Haye
Water Resource Manager
Big Bear Lake DWP