

**APPENDIX I**

**COST ESTIMATE FOR ROADWAY IMPROVEMENTS**



Local Interchange Improvements CONT...		
2.	Reconstruct Existing Interchange	
	Realign and widen existing ramps (to 2 lanes)	\$750,000/Each Ramp
	Construct Loop on – ramps (Does not include realigning existing ramp)	\$700,000/Each Ramp
	Upgrade existing Diamond IC to Partial – Cloverleaf	\$6,000,000
3.	Improve Existing Interchange	
	Widen ramps (From one to two lanes)	\$350,000/Each Ramp
	Widen existing OC structure	\$110/Sq. Ft.
	Signalize ramp Intersection	\$90,000/Location
	Upgrade existing signal at ramp terminal	\$75,000/Intersection
	Upgrade existing signal at ramp terminal (Add lights only)	\$25,000/Each
4.	Ramp Metering System	\$60,000/Each location
Intersection Improvements		
1.	Signalization of local Intersection (with some roadwork)	\$250,000
2.	Upgrade existing Intersection signalization	\$75,000
3.	Upgrade existing Traffic Controller/Assembles	\$40,000/Each
4.	Install new signal	\$90,000/location
5.	Add signal heads	\$25,000/Intersection
6.	Construct left – turn lane (240' long)	\$50,000/Each Location
7.	Street widening (12' wide) (Pavement only)	\$180,000/Mile
8.	Curb and gutter (Type A2-8)	\$15/LF

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## **Appendix F: Applicable Fire Code Requirements**



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## CHAPTER 82.13 FIRE SAFETY (FS) OVERLAY

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### Sections:

- 82.13.010 Purpose
- 82.13.020 Location Requirements
- 82.13.030 Fire Safety Areas
- 82.13.040 Application Requirements
- 82.13.050 General Development Standards
- 82.13.060 FS1, FS2, and FS3 Development Standards
- 82.13.070 FS1 Additional Development Standards
- 82.13.080 Soil Erosion and Sediment Control Plans/Permits
- 82.13.090 Alternate Hazard Protection Measures

### 82.13.010 Purpose

The Fire Safety (FS) Overlay established by Sections 82.01.020 (Land Use Plan and Land Use Zoning Districts) and 82.01.030 (Overlays) is created to provide greater public safety in areas prone to wildland brush fires, by establishing additional development standards for these areas.

Adopted 4011 (2007)

### 82.13.020 Location Requirements

The FS Overlay shall be designated in high fire hazard areas as mapped on the General Plan Hazards Maps with the locations derived from the California Department of Forestry, U.S. Forest Service, and the County Fire Department.

Adopted 4011 (2007)

### 82.13.030 Fire Safety Areas

The FS Overlay is divided into three fire safety areas to correspond to distinct geographic areas and the associated wildland fire hazard. The requirements applicable to each fire safety area are found in Section 82.13.050 (General Development Standards), Section 82.13.060 (FS1, FS2, and FS3 Development Standards), and 82.13.070 (FS1 Additional Development Standards).

- (a) **Fire Safety Area 1 (FS1).** Fire Safety Area 1 (FS1) includes areas within the mountains and valley foothills. It includes all the land generally within the San Bernardino National Forest boundary and is characterized by areas with moderate and steep terrain and moderate to heavy fuel loading contributing to high fire hazard conditions.
- (b) **Fire Safety Area 2 (FS2).** Fire Safety Area 2 (FS2) includes those lands just to the north and east of the mountain FS1 area in the mountain-desert interface. These areas have gentle to moderate sloping terrain and contain light to moderate fuel loading. These areas

are periodically subject to high wind conditions that have the potential of dramatically spreading wildland fires.

- (c) **Fire Safety Area 3 (FS3).** Fire Safety Area 3 (FS3) includes lands just to the south of the mountain FS1 area. These lands are primarily within the wildland-urban interface of the Valley Region and consist of varying terrain from relatively flat to steeply sloping hillside areas. Present and future development within FS3 is exposed to the impacts of wildland fires and other natural hazards primarily due to its proximity to FS1. These areas are subject to Santa Ana wind conditions that have the potential of dramatically spreading wildland fires during extreme fire behavior conditions.

Adopted 4011 (2007)

#### 82.13.040 Application Requirements

- (a) **Notice of application or permit.** A notice of each land use application and/or development permit that would lead to the construction of one or more structures or the subdivision of land within the FS Overlay shall be filed with the responsible Fire Authority by the Department.
- (b) **Review authorities.** Each proposed land use application that would lead to the construction or expansion of a structure or the subdivision of land shall be submitted to the responsible fire authority and the appropriate Natural Resource Conservation Service Office for review and recommendation. Any recommendations received shall be indicated in any staff report and/or presentation for the proposed development and shall be incorporated into project conditions of approval where possible.
- (c) **Pre-application conference.** Every development project application submitted to the Department shall be reviewed by Department staff through a pre-application conference with the project proponent before the acceptance of the application for filing.
- (d) **Density bonus.** A residential density bonus, if any, shall only be allowed through the approval of a Planned Development Permit in compliance with Chapter 85.10 (Planned Development Permits).
- (e) **Subdivisions.** When 25 percent or more of a subdivision project site involving five or more lots is located on natural slopes greater than 30 percent, the subdivision application shall be submitted concurrently with a Planned Development application to evaluate appropriate project design in consideration of topographic limitations of the site. This provision shall not apply if all of the areas on the site with natural ungraded slopes over 30 percent are permanently restricted from structural development.
- (f) **Application requirements.** Each land use and other project application shall include the following information and materials, in addition to what is required by Section 85.03.060 (Application Forms and Information Packets).



- (1) **Slope analysis.** Each project application shall include a slope analysis. The slope analysis shall include the following information:
  - (A) A topographic map of the proposed project area and all adjoining properties within 150 feet at a scale of not less than one-inch to 200 feet. The contour interval shall not be more than two feet except that the contour interval may be five feet if the general natural ungraded slope is more than 10 percent. Contour lines shall be obtained by aerial or field survey, done under the supervision of a licensed Land Surveyor or Registered Engineer.
  - (B) The natural, ungraded, slope categories to be computed are zero percent to less than 15 percent, 15 percent to less than 30 percent, and 30 percent or greater. The minimum area (polygon) used for slope calculation shall be 5,000 square feet.
  - (C) The area, in acres, shall be tabulated for each category.
- (2) **Preliminary grading plan.** Each project application shall include a preliminary grading plan, except that preliminary grading plan requirements may be waived by the Director if it is determined through the required preapplication conference that this requirement is unnecessary due to site specific soils, topographic or other physical conditions, or due to the specific design of the project. The preliminary grading plan shall include the following information.
  - (A) A topographic map of the proposed project area and all adjoining properties within 150 feet at a scale of not less than one inch to 200 feet. The contour interval shall not be more than two feet except that the contour interval may be five feet if the natural ungraded slope is more than 10 percent. Contour lines shall be obtained by aerial or field survey, done under the supervision of a licensed Land Surveyor or Registered Engineer.
  - (B) Contours of the finished graded slope shown at intervals similar to that on the topographic base map.
  - (C) Street grades, slope ratios, flow lines, pad elevations, maximum elevation of top and minimum elevation of toe of finished slopes over five feet in vertical height, the maximum heights of those slopes and approximate total cubic yards of cut and fill shown on the preliminary grading plan.
  - (D) Compliance with the current edition of the California Building Code, as adopted by the County, is required.
  - (E) In the event no grading is proposed, a statement to that effect shall be placed on the required topographic map described in Subsection (f)1.a, above, and the map shall delineate the boundary of an adequately sized building pad, driveway and septic system (if proposed) for each proposed parcel.

- (3) **Fuel modification plan.** Each project application shall include a fuel modification plan describing the fuel modification area required in Subsection 82.15.060.(b) 6, below. The plan may be submitted as a preliminary and final plan. A preliminary and/or final plan shall be submitted concurrently with the development application to the Department for review in conjunction with the project design review. Final plans shall be reviewed and approved by the responsible Fire Authority in conjunction with the County Fire Marshall. The fuel modification plan shall address the standards in Subsection 82.15.060.(b) 6, below, and the following factors:
- (A) The natural ungraded slope of the land within the project and in the areas adjacent to the project;
  - (B) Fuel loading;
  - (C) Access to the project and access directly to the fuel modified area;
  - (D) The on-site availability of water that can be used for fire fighting purposes;
  - (E) The continual maintenance of the fuel modified areas;
  - (F) The soil erosion and sediment control measures to alleviate permanent scarring and accelerated erosion; and
  - (G) A list of recommended landscape plant materials that are fire resistant.

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**82.13.050 General Development Standards**

Each proposed development shall comply with all applicable requirements of this Chapter, as follows.

- (a) **All phases.** The requirements of this Chapter shall apply to all phases of a development project.
- (b) **Fire Authority standards.** All proposed development shall comply with all other applicable standards required by the responsible Fire Authority.
- (c) **Applicability of land use zoning district standards and overlay standards.** The development standards established by a land use zoning district and any applicable overlay shall apply, except as modified by this Chapter.

- (d) **Additions, alterations, enlargements, or reconstructions.** Any addition, alteration, enlargement or reconstruction of a structure shall comply with the provisions of this Chapter. When an addition, alteration, enlargement or reconstruction of a structure equals or exceeds 50 percent of the existing structure, or 25 percent of the roof for roofing requirements only, the provisions of Section 82.13.060(c) (FS1, FS2, and FS3 Development Standards - Building separation standards), Section 82.13.060(d) (FS1, FS2, and FS3 Development Standards - Building construction requirements), and Section 82.13.070 (FS1 Additional Development Standards) regarding construction requirements shall apply to the entire structure and/or the whole roof as applicable. The structures and/or roofs shall be entirely retrofitted to comply with the requirements of this Chapter.

Adopted 4011 (2007)

**82.13.060 FS1, FS2, and FS3 Development Standards**

Development proposed in the FS1, FS2, or FS3 Overlays shall comply with all applicable requirements of this Section. Development proposed in the FS1 Overlay shall also comply with the requirements of Section 82.13.070 (FS1 Additional Development Standards).

- (a) **Residential density.** In order to reduce fire hazards, prevent erosion, and to preserve the existing vegetation and visual quality, the density of development for any Tentative Parcel Map or Tentative Tract Map in sloping hillside areas shall be in compliance with the following criteria:
- (1) One to four dwelling units per gross acre on slopes of zero to less than fifteen percent (0-<15%);
  - (2) Two dwelling units per gross acre on slopes of 15 to less than 30 percent (15-<30%);
  - (3) One dwelling unit per three gross acres on slopes of greater than 30 percent gradient;
  - (4) In the Rancho Cucamonga Sphere of Influence, zero density is allowed for any portion of a proposed Tentative Parcel Map or Tentative Tract Map on slopes of greater than 30 percent gradient.
- (b) **Site development requirements.**
- (1) **Site and emergency access.** Each development project and each development project phase, except for a development project located exclusively on a cul-de-sac, shall have a minimum of two points of vehicular ingress and egress, designed to County road standards, with a minimum width of 26 feet of all-weather surface as defined in the Uniform Fire Code, from existing and surrounding streets. The Department may authorize one point of vehicular access to be an emergency access route with an all-weather surface if the Department first makes each of the following findings:

- (A) Two points of nonemergency access are physically infeasible;
  - (B) Provisions have been made to reasonably ensure that the emergency access will be maintained; and
  - (C) Based on the review and consideration of the Fire Authority's recommendation, the emergency access route will provide adequate vehicular ingress and egress during emergencies.
- (2) **Private driveways or access roadways.** Private driveways or access roadways for residential units shall not exceed 150 feet in length, unless approved by the Fire Authority in compliance with Section 10.207 of the Uniform Fire Code.
- (3) **Fences.**
- (A) Where wood or vinyl fencing is used, there shall be a minimum five-foot separation between the wood or vinyl fencing and the wall of the nearest structure except on those properties where previous construction occurred in compliance with a previous code. Fencing within the five-foot separation area shall be of noncombustible material or modified one-hour fire-resistance-rated construction.
  - (B) Fences or walls required adjacent to fuel modification areas or wildland areas as conditions of approval for a development project shall be constructed of noncombustible materials as defined in the California Building Code. All other fences, including those on the interior of a development project, are not subject to this requirement, except as required in subparagraph a, above.
- (4) **Water supply.** Each development project shall provide six-inch or larger circulating (loop) water mains as required by the Uniform Fire Code, proper hydrant location and spacing, and have sufficient water storage capacity to provide the minimum fire flow duration requirements [gallons per minute (GPM) for a minimum number of hours or portions thereof] as specified by the minimum system standards established by the Fire Authority. Circulating (loop) mains are not required for cul-de-sacs and are not required for subdivisions that exclusively take all access from cul-de-sacs. In areas not served by water purveyors, on-site fire flow and water storage requirements shall be as specified by the Uniform Fire Code.
- (5) **Access to water supplies.** There shall be vehicular access, at least 12 feet in width, to within at least 10 feet of each static water source, including ponds, lakes, swimming pools, reservoirs and water storage tanks. Access shall be either to a plumbed outlet with two-and-one-half-inch National Hose Thread Fitting, or directly to the source. This requirement shall be waived if the Fire Authority determines that the water source is sufficiently below the elevation of existing or proposed roads or driveways to make drafting of water from the source through a plumbed outlet

infeasible, and that direct vehicular access to the water source would require an impractical extension of a road or driveway.

**(6) Fuel modification areas.**

(A) A permanent fuel modification area shall be required around a development project or portions thereof that are adjacent or exposed to hazardous fire areas for the purpose of fire protection. In no case shall this area be less than 100 feet in width as measured from the development perimeter. Where feasible, the area shall be designated as common open space rather than private open space. The recommended width of the fuel modification area shall be determined based on a fuel modification plan filed in compliance with Subsection 82.13.040.(f)3 (Application Requirements Fuel modification plans), above.

(B) When a development project is phased, individual phases may be required to provide temporary fuel modification areas, where the development perimeter of a phase is contiguous to a subsequent phase of a project, which in its undeveloped state is a hazardous fire area. The need for a temporary fuel modification area shall be determined by the responsible Fire Authority in conjunction with the County Fire Marshall and shall be based upon the same considerations described in Subparagraph a, above, for permanent fuel modification areas and the factors addressed in the required fuel modification plan.

**(7) Setback requirements.** Each proposed structure shall comply with the following setback requirements as applicable, in addition to the setbacks required by the applicable primary land use zoning district, and the building separation requirements in Subsection C. (Building separation), below.

(A) **Firewood or flammable materials storage.** Each area used for the storage of firewood, or other flammable materials, shall either be located at least 30 feet away from all structures, or wholly enclosed within a structure.

(B) **Fuel tanks.** Fuel tanks (e.g., liquefied petroleum tanks) shall be located at least 10 feet away from any structure and shall be in compliance with the standards in the Uniform Fire Code, Section 83.02.080 (Allowed Projections into Setbacks), and Section 83.01.060 (Fire Hazards). The tanks shall be secured to the ground.

(C) **National Forest boundary.** Each structure on a lot that was created after April 12, 2007 and abuts a boundary of the San Bernardino National Forest shall be set back at least 100 feet from the boundary.

(D) **Sloping site setbacks or fuel modification.** Each structure proposed in an area with slopes exceeding 30 percent and 30 feet in height shall comply with the following requirements:

- (I) Where a structure is proposed or within 200 feet of a slope that is greater than 30 percent before grading and where the slope is at least 30 feet in height, the vegetation on the slopes shall be treated in a manner so that it becomes a fuel modified area. The fuel-modified area shall be maintained for either the entire slope, or 100 feet, or to the property line, whichever distance is less for existing parcels or the distance prescribed by a fuel modification plan for new development.
  - (II) Where grading is utilized that does not conform to the natural slope and the graded area is adjacent to natural ungraded slopes that are greater than 30 percent in gradient and greater than 30 feet in height, each structure shall be set back at least 30 feet from the edges of the graded area adjacent to the natural ungraded slopes.
- (8) **Street name signs.** All public or private streets within or bordering a development project shall have noncombustible and reflective street name signs designed to County standards and visible at all street intersections.
- (9) **Fire hydrant identification.** Each fire hydrant shall be identified by a method specified by the Fire Authority.
- (10) **Erosion and sediment control.** Each development project, building permit, grading and any other significant land disturbing activity shall include the installation of erosion control measures in compliance with this Development Code.
- (c) **Building separation standards.** The intent of the following exterior wall separation standards is to reduce the exposure and risk from adjacent structural fires and to reduce the potential spread of fire from structure to structure.
- (1) Building separation standards in FS1 and FS2 areas. In FS1 and FS2 areas, the following shall apply:
    - (A) Each building on a parcel shall have exterior wall separations of at least 30 feet.
    - (B) Residential structures shall have interior side yard setbacks of 20 percent of the lot width, provided that these interior side yards shall not be less than five feet and need not exceed 15 feet. In no case shall exterior wall separations be less than 10 feet for all buildings, including those on adjoining parcels. Eaves shall be permitted to project into the required setback no more than two feet. No other projections shall be allowed in the required setbacks unless a variance is obtained.
    - (C) When the exterior walls of residential and accessory buildings or portions thereof are within 15 feet of interior side or rear lot lines, or the exterior wall separation is less than 30 feet, the outside of each exterior wall or portion

thereof shall be constructed with the modified one-hour construction. Modified one-hour construction shall be defined by the Building Official. Where building separations are less than 10 feet, additional mitigation measures may be required by the responsible Fire Authority;

(D) In compliance with Section 82.13.090 (Alternate Hazard Protection Measures), and dependent upon site specific conditions, the following measures or combinations of measures may be substituted for the exterior wall separation requirements for all structures in FS1 and FS2 areas:

(I) The expansion of fuel modified areas around the perimeter of the development project beyond that required by this Section or other requirement of the County Code.

(II) A substantial transfer of density from steeper slopes, including areas with slopes less than 30 percent if they exist on-site, to less steep areas within the development project.

(III) Clustering of structures away from the development perimeter and away from fire hazard areas.

(IV) Other alternate measures (e.g., sprinklers, etc.) if approved by the Department in compliance with Section 82.13.090 (Alternate Hazard Protection Measures).

(2) **Building separation standards in FS3 areas.** In FS3 areas, exterior walls shall be constructed of noncombustible materials or shall provide the equivalent one-hour fire-resistance-rated construction on the exterior side. Interior side yards shall not be less than five feet in width. Within the Mountain Region, building separation and side yard setbacks shall be as described in Paragraph 1, above.

**(d) Building construction requirements.**

**(1) Eaves.**

(A) In FS 1 and FS2 areas, eaves shall be boxed in perpendicular to the adjoining wall and shall be one-hour protected.

(B) In FS3 areas, eaves shall be enclosed with a minimum seven-eighth inch stucco or equivalent protection.

(2) **Exterior doors.** All exterior doors made of wood or wood portions shall be solid core wood. For exterior doors with inset windows, refer to Subparagraph 3.(A), below.

(3) **Exterior glazing.** Exterior glazing shall comply with the provisions of the California Building Code and with the following additional requirements:

- (A) Exterior windows, window walls and glazed doors, and windows within exterior doors, shall be multi-layered glass panels (dual- or triple-paned), tempered glass, or other assemblies approved by the Building Official.
- (B) Vinyl window frame assemblies shall be prohibited, except when they have all of the following characteristics:
  - (I) Frame and sash are comprised of vinyl material with welded corners;
  - (II) Metal reinforcement in the interlock area;
  - (III) Glazed with insulated glass or tempered;
  - (IV) Frame and sash profiles are certified in American Architectural Manufacturing Association (AAMA) Lineal Certification Program (verified with either an AAMA product label or Certified Products Directory); and
  - (V) Certified and labeled in compliance with American National Standards Institute (ANSI)/AAMA/National Wood Window and Door Association (NWWDA) structural requirements.
- (4) **Insulation.** Paper-faced insulation shall be allowed in attics or ventilated spaces only if the paper is not exposed to the attic open space. Cellulose insulation is required to be fire retardant.
- (5) **Roof coverings.** Roof coverings shall be either noncombustible or shall be fire retardant material not composed of organic fiber with a minimum Class A rating, as defined in the California Building Code. The tile shall be tight-fitting and the open ends of high-profile tile shall be capped with non-ignitable material to prevent birds' nests or other combustible material from accumulating. Gutters and downspouts shall be constructed of noncombustible material.
- (6) **Spark arresters.** Each chimney used in conjunction with a fireplace, or other heating appliance in which solid or liquid fuel is used, shall be maintained with a spark arrester. An approved spark arrester shall mean a device constructed of stainless steel, copper or brass, woven galvanized wire mesh, 12 gauge minimum of three-eighths inch minimum to one-half inch maximum openings, mounted in or over all outside flue openings in a vertical and near vertical position, adequately supported to prevent movement and visible from the ground.
- (7) **Street address numbers.** Each non-accessory building shall have internally illuminated non-combustible building address numbers legible from the street in compliance with the Uniform Fire Code.



- (8) **Vents and openings.** Louvers, ventilators, or openings in walls, roofs, attics, and underfloor areas having headroom less than four feet in height that are not fitted with sash or doors, shall be covered with wire screen. The screen covering the openings shall be corrosion-resistant metal or other approved material that offers equivalent protection and shall have a maximum mesh of one-eighth inch. Eave-type attic ventilators and roof-mounted turbine vents are prohibited.
- (9) **Water faucets.** A minimum of two, three-quarter-inch faucets with hose connections each served by a three-quarter-inch waterline and installed before any pressure-reducing device shall be available per habitable structure separated by at least one-third of the perimeter of the structure. The faucets shall be on the sides of a structure facing fire hazardous areas whenever possible.
- (e) **Perimeter access to fuel modified and fire hazard areas.** Fire fighting vehicles shall have adequate access into areas between fire hazardous areas or fuel modified areas and the development perimeter, so that a wildland fire can be contained at the development perimeter and prevented from spreading to structures. Each development project shall provide adequate vehicular access for fire fighting vehicles to the development perimeter of the project along the portion of the development perimeter that is adjacent to either an existing or proposed fuel modified area, or a fire hazard area. Provisions shall be made and shall be required, where necessary, through conditions of approval for the development project for the continual maintenance of the areas intended to provide the access. Perimeter access shall be provided, through either of the following measures or through alternate measures in compliance with Section 82.13.090 (Alternate Hazard Protection Measures).

  - (1) The provision of an existing or proposed road along the development perimeter, or portion thereof that is exposed to a fire hazard or fuel modified area, and which is accessible to fire fighting equipment. The road shall be capable of supporting fire-fighting equipment, shall be at least 20 feet in width, and shall not exceed a grade of 14 percent. The conditions of approval for the development project shall require provisions to ensure that the roadway will be maintained, if it is not within the publicly maintained road system.
  - (2) Development projects shall provide access ways, at least 12 feet in width, with a grade not to exceed 14 percent, and capable of supporting fire fighting vehicles, between the development perimeter and proposed or existing streets. Access ways shall be spaced at intervals of no more than an average of 350 feet along each street. The conditions of approval for the development project shall require specific provisions to ensure that access ways will remain unobstructed and will be maintained. Where feasible, access ways may not be paved and shall be designed so as not to detract from the visual quality of the project.
- (f) **Length of cul-de-sacs.** Cul-de-sacs shall not exceed 350 feet in length, except that they may be extended as allowed by this Subsection.

- (1) **Exception for parcels of less than five acres.** A cul-de-sac may exceed 350 feet in length but shall not exceed 600 feet in length, if parcels that take access from the cul-de-sac are less than five acres, and:
  - (A) Alternate measures are utilized in compliance with Section 82.13.090 (Alternate Hazard Protection Measures); or
  - (B) Based upon consideration of the recommendation of the Fire Authority, the Department determines that the cul-de-sac is situated and designed so that each parcel taking access from it is not contiguous to or exposed to either undeveloped fuel modified areas along the development perimeter of the project or to fire hazard areas, and that the extension of the cul-de-sac will not increase the exposure of buildings to wildland fires.
  
- (2) **Exception for parcels larger than five acres.** A cul-de-sac may exceed 600 feet in length if all parcels that take access from the cul-de-sac are five acres or greater in area and:
  - (A) The proposed cul-de-sac is not within or adjacent to areas that are zoned for or subdivided to parcels of five acres or less.
  - (B) Alternate measures are utilized in compliance with Section 82.13.090 (Alternate Hazard Protection Measures).
  
- (3) **Alternate measures.** In compliance with Section 82.13.090 (Alternate Hazard Protection Measures) and dependent upon site specific conditions, one of the following measures or combination of measures may be used to mitigate the effect of creating cul-de-sacs up to 600 feet in length with parcels less than five acres in area:
  - (A) Limitation of the total number of dwelling units with access to the cul-de-sac to no more than 15, and restriction of further subdivision of parcels and construction of additional independent residential units which have access to the cul-de-sac. These restrictions shall be imposed through conditions of approval of the development project.
  - (B) A continuous perimeter access road at least 20 feet in width is provided along the portion of the cul-de-sac exposed to fire hazard or fuel modified areas such that it is drivable under normal conditions by fire fighting vehicles, provides adequate maneuvering space for the vehicles, and is designed so that at least one point of access to the perimeter access road is taken from roads other than the subject cul-de-sac.

- (C) The cul-de-sac road will have a paved width of at least 40 feet with posted no parking for its entire length, and there is at least one area approximately at the midpoint of the cul-de-sac that serves the same function of a cul-de-sac bulb in allowing fire fighting vehicles adequate room to turn around. This measure may only be utilized if the expansion of the road width will not contribute to slope stability hazards either on-site or off-site.
- (D) Other alternate measures approved by the Department in compliance with Section 82.13.090 (Alternate Hazard Protection Measures).
- (g) **Additional requirements.** Dependent upon specific site conditions (e.g., building separation, fire flow, road conditions, slope, vegetation, etc.) or a combination of conditions, the responsible Fire Authority may require structures to meet more stringent construction standards (e.g., full perimeter exterior walls to be constructed to the modified or full one-hour construction standards, sprinklers, soffitted eaves, etc.) as additional mitigation to the fire threat.

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**82.13.070 FS1 Additional Development Standards**

The requirements of this Section apply only to the FS1 Overlay and are in addition to the requirements in Section 82.13.060 (FS1, FS2, and FS3 Development Standards).

- (a) **Concealed spaces.** Unenclosed or projecting assemblies (e.g., cantilevered floors, bay windows, etc.) that contain concealed space shall be protected on the exposed surface with materials approved for the modified one-hour construction.
- (b) **Decks.** Cantilevered or standard type decks shall be:
  - (1) Constructed with a minimum of at least one-and-one-half-inch wood decking; and/or
  - (2) Protected on the underside with materials approved for one hour fire resistive construction; and/or
  - (3) Composed of noncombustible materials, as defined in the California Building Code.
- (c) **Exposed piping.** Exposed piping, except for plumbing vents above the roof, shall be noncombustible as defined in the California Building Code.
- (d) **Patio covers.** Patio covers attached or within 10 feet of a residential structure with plastic, bamboo, straw or fiberglass or wood lathe lattice made of materials that are one-half-inch or less in width shall be prohibited.

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**82.13.080 Soil Erosion and Sediment Control Plans/Permits**

This Section provides regulations and procedures for project planning, preparation of Soil Erosion and Sediment Control Plans, runoff control, land clearing, and winter operations in order to control existing and potential conditions of human induced accelerated erosion.

- (a) **Applicability.** The regulations in this Section apply to all areas within Fire Safety (FS) Overlays, except for ministerial projects within the FS2 and FS3 Areas that are located on parcels that are less than one acre and have a slope of less than 10 percent.
  
- (b) **Soil Erosion and Sediment Control Plans/Permits.**
  - (1) **Compliance of land clearing or grading activities with approved Plan.** Land clearing or grading activities in Fire Safety (FS) Overlays shall comply with the provisions of an approved Soil Erosion and Sediment Control Plan, unless exempt as follows:
    - (A) Exempt in compliance with Section 88.02.030 (Exempt Activities); or
    - (B) Exempt as determined by the Building Official.
  
  - (2) **Approval of Plan before issuance of permits.** A Soil Erosion and Sediment Control Plan shall be submitted and approved before the issuance of the following:
    - (A) Building Permits.
    - (B) Grading Permits.
    - (C) Soil Erosion and Sediment Control Permits.
    - (D) Other permits where, in the opinion of the Building Official, erosion can reasonably be expected to occur.
  
  - (3) **Plan contents.** A Soil Erosion and Sediment Control Plan shall:
    - (A) Include the applicable measures required by this Chapter and other measures or modifications of proposed measures required by the Building Official.
    - (B) Identify building and access construction envelopes and identify areas that will not be disturbed by construction activity in order to minimize disturbance of erodible areas of a proposed development site.
    - (C) Preserve existing streams and drainage courses in their natural condition in order to retain their ability to accommodate runoff and water drainage with a minimum of erosion.
  
  - (4) **Permit application requirements.** The Building Official shall specify the following application requirements for Soil Erosion and Sediment Control Permits:

- (A) Requirements for the submittal of plans and supporting data to accompany applications for Soil Erosion and Sediment Control Plans and Soil Erosion and Sediment Control Permits.
  - (B) Licensing and/or certification requirements for those preparing Soil Erosion and Sediment Control Plan and Permit submittals.
  - (C) The incorporation and coordination of Soil Erosion Control Plans and Permits with other plan requirements.
  - (D) Other data/materials identified by the Building Official.
- (5) **Additional permit requirements.** For additional permit requirements, see Subsection 88.02.050(f)(2) (Winter operation measures Additional permit requirements).
- (c) **General erosion control requirements.**
- (1) **Conditions causing accelerated erosion prohibited.** No person shall cause, or allow the continued existence of, a condition on a site that is causing or is likely to cause accelerated erosion as determined by the Building Official.
  - (2) **Notification to control erosion.** Upon notification by the Building Official, the responsible person shall take appropriate measures to control erosion on the site within a reasonable period of time as determined by the Building Official.
  - (3) **Plan/Permit approval.** The Building Official may require that a property owner, whose property has been cited in compliance with Subsection (2) (Notification to control erosion), above, file and obtain approval of a Soil Erosion and Sediment Control Plan and Soil Erosion and Sediment Control Permit in compliance with Subsection (b) (Soil Erosion and Sediment Control Plans/Permits), above.
  - (4) **Cessation of activities due to inclement weather.** The Building Official may direct that a particular operation, process, or construction be stopped during periods of inclement weather if the Building Official determines that erosion problems are not adequately being controlled.
  - (5) **Applicable laws and regulations.** Land clearing and grading activities that comply with this Section shall also comply with all other applicable local, state, and Federal laws and regulations. Where there is a conflict with other preexisting County regulations, the conflict shall be resolved by using the least restrictive standard and shall be accomplished before the project is allowed to proceed.
  - (6) **Appeals.** A property owner, an aggrieved person, or a person whose interests are adversely affected by an action or determination of the Building Official may appeal the action or determination in compliance with Chapter 86.08 (Appeals).

- (7) **Variances.** The Director may approve, conditionally approve, or deny a variance from the provisions of this Section, the permit conditions, or the plan specifications in compliance with Chapter 85.17 (Minor Variances). The Director may refer a variance request to the Commission in compliance with Section 85.17 (Variances).
- (d) **Runoff control measures.** Activities subject to a development permit (e.g. Conditional Use Permit, Grading Permit, Planned Development Permit, Site Plan Permit, Temporary Use Permit, etc.) shall implement measures to control runoff in order to prevent erosion. Measures shall be adequate to control runoff from a 10-year storm.
- (1) **Prevention of sediment discharge.** Erosion control and surface flow containment facilities shall be constructed and maintained to prevent discharge of sediment to surface waters or storm drainage systems.
- (2) **Permeability rate.**
- (A) **More than two inches per hour.** Where soils have a permeability rate of more than two inches per hour, runoff in excess of predevelopment levels shall be retained on the site by methods and in quantities approved by the Building Official. This may be accomplished through the use of infiltration basins, percolation pits or trenches, or other suitable means. This requirement may be waived where the Building Official determines that high groundwater, slope stability problems, etc., would inhibit or be aggravated by onsite retention, or where retention will provide no benefits for groundwater recharge or erosion control.
- (B) **Two inches per hour or less.** Where soils have a permeability rate of two inches per hour or less and onsite percolation is not feasible, runoff shall be detained or dispersed over nonerodible vegetated surfaces so that the runoff rate does not exceed the predevelopment level. When the runoff rate must exceed the predevelopment level, the runoff water shall be discharged over nonerodible surfaces or at a velocity that will not erode. The Building Official shall require onsite detention unless the applicant shows that the runoff will not contribute to downstream erosion, flooding, or sedimentation.
- (3) **Onsite percolation devices.** Concentrated runoff that cannot be effectively dispersed over nonerodible channels or conduits to the nearest drainage course shall be contained within onsite percolation devices.
- (4) **Energy dissipaters at point of discharge.** Where water will be discharged to natural ground or channels, appropriate energy dissipaters shall be installed to prevent erosion at the point of discharge.
- (5) **Detention or filtration mechanisms.** Runoff from disturbed areas shall be detained or filtered by berms, vegetated filter strips, catch basins, or other means necessary to prevent the escape of sediment from the disturbed area.

- (6) **Deposition of earth or materials prohibited.** No earth, organic, or construction material shall be deposited in or placed where it may be directly carried into a stream, lake, marsh, slough, lagoon, or body of water.
  - (7) **Buffer zone along land/water margin.** Where land disturbing activities are in proximity to lakes or natural watercourses, a buffer zone shall be required along the land/water margin of sufficient width to confine visible siltation within 25 percent of the buffer zone nearest the land disturbing activities.
- (e) **Land clearing measures.** Activities subject to a development permit (e.g. Conditional Use Permit, Grading Permit, Planned Development Permit, Site Plan Permit, Temporary Use Permit, etc.) shall provide the following land clearing measures:
- (1) **Approval of Plan/Permit required before commencement of activities.** No land clearing activities, except as otherwise allowed by this Section, shall take place before approval of the Soil Erosion and Sediment Control Plan and/or Permit.
  - (2) **Limitations on land clearing and vegetation removal.** Land clearing shall be kept to a minimum. Vegetation removal shall be limited to that amount necessary for building, access, fire protection and construction as shown on the approved Soil Erosion and Sediment Control Plan or as allowed by the Building Official through a Soil Erosion and Sediment Control Permit.
  - (3) **Establishment of vegetation.** Disturbed surfaces shall be prepared and maintained to control erosion and to establish vegetative growth compatible with the area. This control shall consist of any one or a combination of the following:
    1. Effective temporary planting (e.g., rye grass, fast germinating native seed, etc.) and/or mulching with straw, pine needles, chippings, or other slope stabilization material.
    2. Permanent planting of compatible drought resistant species of ground cover, shrubs, trees, or other vegetation.
    3. Mulching, fertilizing, watering, or other methods necessary to establish new vegetation.
  - (4) **Installation and maintenance of protection.** The protection required by this Section shall be installed before calling for final approval of the project and at all times between October 15 and April 15. The protection shall be maintained for at least one year or until permanent protection is established.
  - (5) **Vegetation removal between October 15 and April 15.** Vegetation removal between October 15 and April 15 shall not precede subsequent grading or construction activities by more than 15 days. During this period, erosion and sediment control measures shall be in place.

**(f) Winter operation measures.**

**(1) Winter operation erosion control measures.** Land clearing and grading activities during the winter months (i.e., activities between October 15 and April 15) that are subject to a development permit (e.g. Conditional Use Permit, Grading Permit, Planned Development Permit, Site Plan Permit, Temporary Use Permit, etc.) shall implement the following winter operation measures to prevent accelerated erosion. The Building Official may require additional measures when determined to be necessary by field inspection.

(A) The Building Official shall authorize the following activities between October 15 and April 15 only if the Building Official determines that the activities comply with the provisions of, and are consistent with the purposes of, this Section:

(I) Contiguous land clearing operations involving greater than one acre in a one-year period of time.

(II) Major grading operations (greater than 100 cubic yards).

(B) Between October 15 and April 15, disturbed surfaces not involved in the immediate operation shall be protected by mulching or other effective means of soil protection.

(C) Roads and driveways shall have drainage facilities sufficient to prevent erosion on or adjacent to the roadway or on downhill properties. Erosion-resistant surfacing may include, but is not limited to, slag, crushed rock or natural soil when compacted to 90 percent of maximum density.

(D) Runoff from a site shall be detained or filtered by berms, vegetated filter strips, or catch basins to prevent the escape of sediment from the site. These drainage controls shall be maintained by the permittee or property owner as necessary to achieve their purpose throughout the life of the project.

(E) Erosion control measures shall be in place at the end of each day's work.

**(2) Additional permit requirements.** In addition to the requirements in Section 82.13.080, the following shall also apply:

(A) When construction will be delayed due to the limitation on winter operations, the date for expiration of the permit shall be extended by that amount of time that work is delayed by the requirements of this Section.

(B) The Building Official shall stamp or attach the following statement to all development permits and plans issued for projects subject to the provisions of this Section.



NOTICE: IF THE CONSTRUCTION ACTIVITY WILL EXTEND INTO THE WINTER OPERATIONS PERIOD (OCTOBER 15 THROUGH APRIL 15), ADDITIONAL SOIL EROSION AND SEDIMENT CONTROL MEASURES MAY BE REQUIRED.

ANY DEVELOPMENT PROJECT WHICH IS REQUIRED TO IMPLEMENT AN APPROVED SOIL EROSION AND SEDIMENT CONTROL PLAN SHALL HAVE THE APPROVED PLAN AMENDED IF IT DOES NOT COMPLY WITH SUBSECTION 82.13.080 (f) (Winter Operation Measures) OF THE SAN BERNARDINO COUNTY DEVELOPMENT CODE. ALL REQUIRED WINTER OPERATION EROSION CONTROL DEVICES SHALL BE INSTALLED BEFORE OCTOBER 15 FOR ONGOING CONSTRUCTION PROJECTS AND BEFORE ANY CONSTRUCTION ACTIVITY FOR THOSE DEVELOPMENT PROJECTS COMMENCING BETWEEN OCTOBER 15 AND APRIL 15.

**(g) Inspections.**

**(1) Types of inspections.** The Building Official may perform the following inspections to ensure compliance with this Section:

**(A) Pre-construction inspection.** A pre-construction inspection to determine the potential for erosion resulting from the proposed project.

**(B). Progress inspections.** Periodic progress inspections to determine ongoing compliance with the Soil Erosion and Sediment Control Plan.

**(C) Final inspection.** A final inspection to determine compliance with the Soil Erosion and Sediment Control Plan and with other approved plans and specifications.

**(2) Notification.** The permittee shall provide the Building Official at least:

**(A) Commencement of work.** Twenty-four hours' advance notice before the commencement of authorized work.

**(B) Inspection request.** Nine business hours' advance notice of an inspection request.

**(3) Right of entry.** Filing an application for a development permit (e.g. Conditional Use Permit, Grading Permit, Planned Development Permit, Site Plan Permit, Temporary Use Permit, etc.) constitutes a grant of permission for the County to enter the permit area for the purpose of administering this Section from the date of the application filing to the termination of the erosion control maintenance period.

**(h) Continued responsibility.** The property owner and the permittee shall be responsible for ensuring that accelerated erosion does not occur from an activity during and after project construction. Additional measures, beyond those specified in an approved Soil Erosion and Sediment Control Plan, may be required by the Building Official as deemed necessary to control erosion after project completion.

- (i) **Post-approval procedures.** The procedures and requirements in Division 6 (Development Code Administration), related to permit implementation, time limits, extensions, appeals, and revocations, shall apply following the decisions on Soil Erosion and Sediment Control Plans and Soil Erosion and Sediment Control Permits.

Adopted 4011 (2007)

**82.13.090      Alternate Hazard Protection Measures**

- (a) **Purpose.** This Section allows greater design flexibility than would otherwise be permitted to more efficiently and effectively achieve the purposes of the FS Overlay. Design flexibility is provided by allowing the substitution of alternate measures for otherwise applicable requirements if it is found that they provide the same or a greater level of protection from wildland fires and other natural hazards, and that they will fulfill the same purpose as the established standard or requirement.

- (b) **Applicability.**

- (1) The provisions of this Section following shall apply only to the standards and requirements of:
  - (A) Subsection 82.13.060(c)2. (Building separation standards in FS1 and FS1 areas);
  - (B) Subsection 82.13.060(e) (Perimeter access to fuel modified and fire hazard areas); and
  - (C) Subsection 82.13.060(f) (Length of cul-de-sacs).
- (2) Since these alternative measures apply to the standards and requirements that pertain to these three specific design elements, they are intended to be applied to development projects only and not to individual parcel conditions. Therefore, they do not apply to the determination of setbacks for residential construction on individual lots.

- (c) Substitution of alternative measures for standards and requirements.

- (1) If alternative measures are proposed, the Fire Authority shall determine, with specific consideration of the effect of the proposed alternative measures, whether the proposed development project has adequate provisions for fuel modification and management, including the ongoing maintenance of fuel modified areas.
- (2) If the Fire Authority makes a positive determination in compliance with Paragraph 1, above, alternate measures may be substituted for the established standards and requirements if the Department, with consideration of the recommendation of the Fire Authority, finds and justifies all of the following:

- (A) The approved alternative measures meet the intent of, and serve the same purpose as, the established standard or requirement.
- (B) The approved alternative measures provide the same or a greater level of protection or are as effective as the established standard or requirement.
- (C) There are clear and substantial reasons for utilizing the alternative measures because they provide for a more efficient and economic use of the site, or provide for a superior physical design, and are consistent with the intent of the FS Overlay.

Adopted 4011 (2007)



## **Appendix G: Water and Sewer Feasibility Studies**



**G.1 - Sewer Feasibility Study for Mooncamp Project  
(San Bernardino County, April 2007)**





# SPECIAL DISTRICTS DEPARTMENT



COUNTY OF SAN BERNARDINO  
PUBLIC AND SUPPORT  
SERVICES GROUP

WATER AND SANITATION DIVISION  
12402 Industrial Blvd., Building D, Suite 6  
Victorville, CA 92395  
PO Box 5004 • Victorville, CA 92393  
(760) 955-9885 • (800) 554-0565  
Fax (760) 955-9685

CRESTLINE SANITATION DISTRICT  
24516 Lake Drive  
Crestline, CA 92325  
PO Box 3395 • Crestline, CA 92325  
(909) 338-1751  
Fax (909) 338-5306

THOMAS L. SUTTON  
Director

MANUEL M. BENITEZ  
Deputy Chief

April 17, 2007

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

Subject: Updated Sewer Feasibility Study  
APN: 0304-091-12, 13, 21 & 0304-082-04 TTM 16136  
RCK Properties, Inc./Moon Camp  
County Service Area 53, Improvement Zone B

Dear Mr. Perry:

The District Engineer has completed the Updated Sewer Feasibility Study. The purpose of the study was to determine the equivalent dwelling unit (EDU) assignment, costs/fees and evaluate sewer service alternatives. The study indicates County Service Area 53, Improvement Zone B can serve the above referenced project.

The study is valid for one-year from the date of issue.

If you decide to move forward with the project or have questions, please contact this office.

Sincerely,

*For:* James A. Oravets  
Division Chief, Engineering

JAO:ce

cc: Kathy Whalen, District Manager

Enclosure: Updated Sewer Feasibility Study

MARK H. UFFER  
County Administrative Officer  
NORMAN A. KANOLD  
Assistant County Administrator  
Public and Support  
Services Group

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Board of Supervisors  
BRAD MITZELFELT ..... First District      DENNIS HANSBERGER ..... Third District  
PAUL BIANE ..... Second District      GARY C. OVITT ..... Fourth District  
JOSIE GONZALES ..... Fifth District



# So & Associates Engineers Inc.

16209 KAMANA RD., SUITE 200 • P.O. BOX 1712 • APPLE VALLEY, CA 92307 • PHONE (760) 242-2365 FAX (760) 242-3083

April 11, 2007

101.0110-359

County of San Bernardino  
Special District Department  
Water & Sanitation Division  
12402 Industrial Blvd., Bldg. D, Suite 6  
Victorville, CA 92392

Attention: Mr. Gary Martin  
Interim Division Engineer

**Reference: County Service Area 53, Improvement Zone B (CSA 53-B) Updated Sewer Feasibility Study for APN's 0304-091-12,13, 21 and 0304-082-04, TTM 16136 (RCK Properties, Inc./Moon Camp)**

Dear Mr. Martin:

In accordance with CSA 53-B (District) authorization, we have completed the subject feasibility study for APN's 0304-091-12, 13 & 21 and 0304-082-04, TTM 16136 for connection to CSA 53-B sewer system. We are pleased to submit the FINAL feasibility study report for District's review and consideration.

## **A. Wastewater Flow From the Proposed Development**

The proposed development is a housing development located within the portion of Northeast 1/4 of Section 13, Township 2 North and Range 1 West. The proposed project will consist of 50 single family housing as shown in Figure 1. The sewer capacity requirement of the proposed project will be calculated based on one equivalent dwelling unit (EDU's). For this study, average wastewater flow per EDU in the CSA 53 (Fawnskin) is typically estimated at 215 gpd (gallon per day). In this case, proposed project will be assigned a maximum occupancy of 50 EDU's with an average flow at  $215 \text{ gpd/EDU} \times 50 = 10,750 \text{ gpd}$ . For preliminary design purpose, a peaking factor of four will be used. The estimated peak wastewater flow for the proposed development will be 43,000 gpd (29.86 gallons per minute).

## **B. Existing Sewer System Capacity and Review and Buy-In Cost**

The existing sewer system located to the southeast and southeast side of the project site should be capable of handling the wastewater flow from the proposed development based on estimated flows



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as discussed above. The internal collection sewer system design has been presented in Figure 1 based on the grading plans. The project developer (through its civil engineer) will be required to submit the proposed internal collection system to CSA 53B for review and approval.

County Service Area 53-B Local Sewer Cost: On September 15, 2005 the County Board of Supervisors adopted an Ordinance authorizing the Special Districts Department to implement increases in fees and charges. The study included recommendations on capital funds required to construct infrastructure to ensure adequate capacity in the District's respective water and sewer systems. The local connection fee approved for County Service Area 53-B (Fawnskin) is \$ 1,358.72.

$$\begin{aligned} \text{Local Connection Fee} &= \$1,358.72/\text{EDU} \times 50 \text{ EDU} \\ &= \$ 67,936.00 \end{aligned}$$

### C. Estimate Cost of System Improvements

On-Site Facilities: The proposed development will be entirely responsible for all costs of internal plumbing and sewer facilities including manholes and re-connection to the CSA 53-B system at location(s) approved by CSA 53B. All on-site gravity facilities must be minimum 8-inch diameter. The proposed project will be required to construct the onsite collector sewer as shown in Figure 1. All on-site facilities must meet CSA 53-B standards and specifications, and construction plans must be submitted for plan check and approval by District Engineer.

Off-Site Facilities: Based on the grading plan and sewer layout plan of the proposed development, the developer of TTM 16136 will be responsible for an offsite sewer extension of about 1,200 LF along North Shore Drive to connect to the existing 8-inch collector sewer to the southwest of the property. This improvement will be able to serve some of the lots of the project as shown in Figure 1. The proposed development will be able to convey part of the wastewater flow via gravity sewer to the existing Pump Station "B"(to the southeast of the property, refer Figure 1); and some of the subdivided lots may require additional on-site sewage lift stations(s). CSA 53-B staff and engineer will continue to monitor and upgrade the collection sewer system to ensure adequate capacity and reliable service to its customers.

### D. Regional Connection Fee

Regional connection fees imposed by BBARWA (Big Bear Area Regional Wastewater Authority) for sewage treatment and disposal are presently assessed at \$2,704.99 per equivalent dwelling unit



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(EDU) and an additional \$ 100 fee for the Fawnskin area (CSA 53-B). The above connection fees are subject to adjustment each year. The exact connection fees for the proposed project will be reviewed at the time when application is made to connect to the District's sewer system, based on the most current project information. An estimate of the fee at this time would be as follows:

Regional Connection Fee                 = \$2,704.99/EDU x 50 EDU  
    = \$135,249.50

### **E. Plan Check/Inspection Fee**

The sewer line design and connection details must be submitted through the Special Districts Department for plan check and approval. The District's current plan check fee is set per Board Resolution 97-95 and will be determined at a later date. Prior to start of construction, the property owner or the contractor must also deposit with the Special District's Department an inspection fee, again per District rules and regulations.

### **F. Monthly User Fee**

The monthly user fee will be determined by the District's staff at the time the sewer connection application is made. Based on District's rules, regulations and the estimated number of EDUs. The current monthly user fee is \$ 40.91/EDU.

### **G. Summary of Estimated Costs**

Based on limited information provided by the developer's engineer, the following briefly summarizes the various sewerage costs and connection fees:

- On-site collector sewer and lift stations(s)    =    Developer to pay for the costs
- Off-site sewer extensions                         =    Developer to pay for the costs
- Local sewer connection fees                     =    \$ 67,936.00
- Regional connection fee                           =    \$135,249.50




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We trust that the information provided in this report will be helpful to the property owner and the Special District Department. Information provided in this letter report is valid for a period of one year from date of final report.

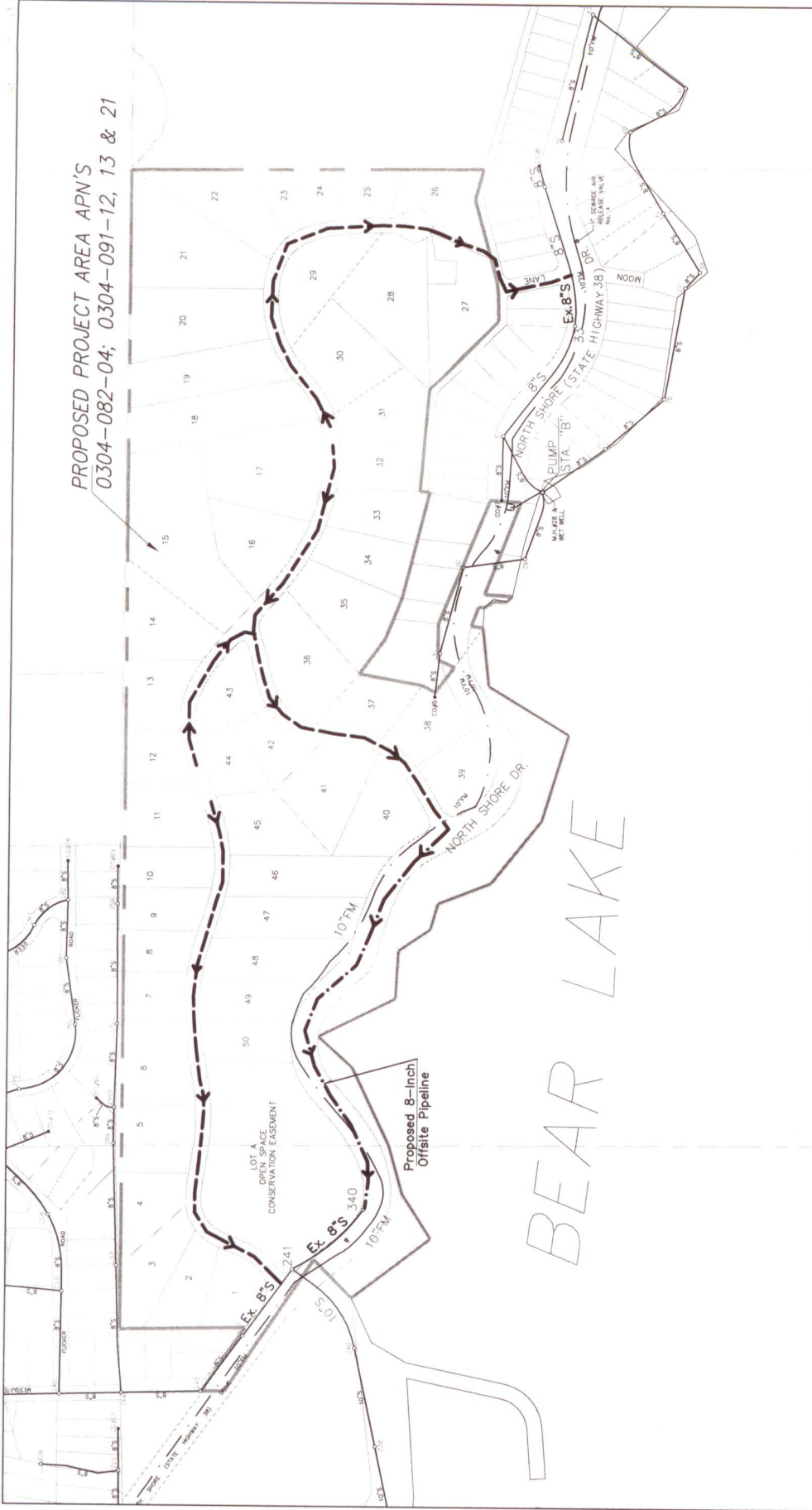
Very truly yours,

  
Wilson F. So, P.E.  
District Engineer

Prepared By:

  
Kanchan Joshi

PROPOSED PROJECT AREA APN'S  
0304-082-04; 0304-091-12, 13 & 21



**LEGEND**

- EXISTING SEWER LINES
- PROPOSED OFFSITE SEWER (L=± 1,200 LF)
- MANHOLE
- PROPOSED ONSITE SEWER
- CLEANOUT



SCALE: 1" = 400'

**FIGURE 1**  
**COUNTY SERVICE AREA 53B**  
**SEWER FEASIBILITY STUDY**  
**(APN'S 0304-091-12, 13 & 21**  
**AND 0304-082-04, TTM 16136)**

PREPARED BY  
**So & Associates**  
**Engineers Inc.**



**G.2 - Final Water Feasibility Study  
(Alda Engineering, Inc. March 2007)**





# **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.

Mr. Scott Heule, C.E.G./C.H.G., Assistant General Manager

March 6, 2007

Page 2 of 8

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.

Mr. Scott Heule, C.E.G./C.H.G., Assistant General Manager

March 6, 2007

Page 3 of 8

## **Water Supply**

Water supply sources for this development must meet projected maximum day demands during the summer as well as annual demands. The existing on-site FP-2 well, when equipped by the developer, would be capable of meeting the projected maximum day demand for the proposed Tract 16136.

To meet the projected annual demand, the developer would have to participate in the Water Demand Offset Plan currently being implemented by DWP. This plan requires that any development that creates new lots must pay for the necessary facilities to reduce water demand somewhere else in the service area. The demand to be reduced is equivalent to one half of the average water demand for residential parcels in the service area, estimated at 250 gallons per day, for each new lot developed. Therefore, in the case of the proposed tract, a demand equivalent to 6,250 gallons per day (50 EDUs times 250 gallons per day per EDU times 50 percent) would need to be offset.

## **Fire Flow Requirements**

Fire flow protection in the Fawnskin area is provided by the County of San Bernardino Fire Department. Information obtained from the Office of the Fire Marshall for the county indicates the following fire flow requirements for residential structures in the Fawnskin area:

- Structures less than 3,600 ft<sup>2</sup> - 1,000 gpm @ 20 psi with a two-hour duration
- Structures between 3,601 to 4,800 ft<sup>2</sup> - 1,750 gpm @ 20 psi with a two-hour duration
- Structures between 4,801 to 6,200 ft<sup>2</sup> - 2,000 gpm @ 20 psi with a two-hour duration

Additional information provided by the Office of the Fire Marshall indicates that fire flow requirements could be lowered if fire sprinklers are installed; however, actual requirements are determined individually based on the construction plans for individual residences.

For the purpose of this analysis and based on discussions held with DWP staff, a fire flow of 1,750 gpm @ 20 psi with a two-hour duration was used to size transmission, pumping, and storage facilities that would be needed to serve the proposed development.

## **Storage Requirements**

Storage capacity for this development was sized to meet the operational, emergency and fire flow storage requirements. Operational storage is used to meet the hourly fluctuations in demand during maximum day conditions and has been established as 30 percent of maximum day. Emergency storage is used to meet demands during a power outage or other emergency situation when supply sources and boosting pumps may not be available; DWP requirements for emergency storage are equivalent to one day of maximum day demand.

Mr. Scott Heule, C.E.G./C.H.G., Assistant General Manager

March 6, 2007

Page 4 of 8

Fire flow storage is equal to the fire flow capacity (1,750 gpm) times its duration (two-hours). Storage requirements for the proposed development are as follows:

■ Operational Storage = 30% of MDD (15.27 gpm):	6,600 gallons
■ Emergency Storage = 100% of MDD (15.27 gpm):	22,000 gallons
■ Fire Flow Storage for 1,750 gpm (based on 120 min):	<u>210,000 gallons</u>
Total storage requirement for indoor use:	238,600 gallons

According to the recently completed water master plan, DWP has sized its storage facilities to provide a maximum fire flow of 1,500 gpm with a two-hour duration for residential development. Additional storage to provide incremental fire flow requirements would be the responsibility of individual developers in each of the pressure zones impacted. In the case of Tract 16136, the incremental fire flow of 250 gpm (1,750 gpm – 1,500 gpm) results in an additional storage requirement of 30,000 gallons. Storage requirements for operational and emergency storage are provided by the DWP as part of the meter connection charges.

Existing storage facilities in the Upper Fawnskin pressure zone consist of a single 0.25 million gallon reservoir that is fed by a combination of slant wells, located in the vicinity of the reservoir site, and the Cline Miller booster station that supplies water from the Lower Fawnskin pressure zone. The existing reservoir capacity is adequately sized to meet current storage requirements of existing users while providing fire flow protection for a flow rate of 1,500 gpm over a two-hour duration. Current storage requirements in this zone are estimated at approximately 225,000 gallons; this value is approximately 10 percent below existing storage capacity.

An additional storage of 30,000 gallons would be required in the Upper Fawnskin pressure zone to supply the recommended 1,750 gpm fire flow over a two-hour duration. This additional storage could be provided by either constructing a second reservoir adjacent to the existing Racoon Reservoir or conveying surplus storage capacity in the Lower Fawnskin pressure zone through the existing Cline Miller booster station. This booster station consists of two booster units with a combined capacity of approximately 190 gpm. To make surplus storage from the Lower Fawnskin pressure zone available during power outages, a backup generator at the Cline Miller booster station would be needed. In addition, the capacity of the existing booster station would need to be increased to pump 303 gpm. This flow rate represents a combination of a) estimated maximum day demand at full development in the Upper Fawnskin pressure zone of 38 gpm, b) estimated maximum day demand of 15 gpm from tract 16136, and c) 250 gpm of incremental fire flow into the Upper pressure zone.

Mr. Scott Heule, C.E.G./C.H.G., Assistant General Manager

March 6, 2007

Page 5 of 8

## **Alternatives to Serve Proposed Tract 16136**

Under average and peak summer demands, the proposed development could be served by simply extending existing facilities in the Upper Fawnskin pressure zone. The closest facility in this pressure zone that the development can be connected to consist of a 6-inch pipeline in the vicinity of Flicker Road and Chinook Road. However, existing distribution facilities would not be able to provide the required fire flow capacity needed to protect future residential development in the area. Existing system facilities consist of pipelines ranging in size from 2 to 8 inches in diameter with limited fire flow carrying capacity.

To provide the fire flow requirements indicated by the Office of the Fire Marshall, transmission improvements will be required in the Upper Fawnskin pressure zone. Two alternatives were evaluated to serve the proposed development; a brief description of these alternatives and the required facilities is presented below. Figure 1 illustrates the alignment of proposed transmission facilities for each alternative and the recommended pipelines within the proposed residential tract.

**Facilities Common to Both Alternatives.** Transmission facilities south of the intersection of Flicker Road and Mesquite Drive to the westerly boundary of the proposed tract are common to both alternatives and consist of approximately 700 ft of 12-inch diameter pipeline. The alignment of this pipeline is shown in Figure 1.

**Alternative A.** This alternative consists of serving the proposed tract by constructing a dedicated 12-inch transmission pipeline from the vicinity of the Cline Miller Reservoir to the proposed development site. This alternative would also require the construction of a fire booster station at the Cline Miller Reservoir site to augment the capacity of the existing booster units as they are not adequate to provide the recommended fire flow capacity into the Upper Fawnskin pressure zone. To assure that the fire booster unit is operational during power outages, the installation of a 200 kilowatt on-site electric generator is recommended.

The alignment of the recommended transmission pipeline between the Cline Miller Reservoir and the intersection of Flicker Road and Mesquite Drive is depicted in Figure 1. The estimated length of this pipeline is approximately 2,450 ft.

**Alternative B.** This alternative consists of serving the proposed development by gravity off the existing Racoon Reservoir. Transmission improvements in the Upper Fawnskin pressure zone would be required as existing distribution facilities have limited fire flow carrying capacity; they consist primarily of small pipelines ranging in size from 2 to 8 inches in diameter. Recommended improvements consist of a series of 12-inch segments between the reservoir site and the intersection of Flicker Road and Mesquite Drive as illustrated in Figure 1. The estimated combined length of proposed facilities is approximately 2,800 ft.

Mr. Scott Heule, C.E.G./C.H.G., Assistant General Manager

March 6, 2007

Page 6 of 8

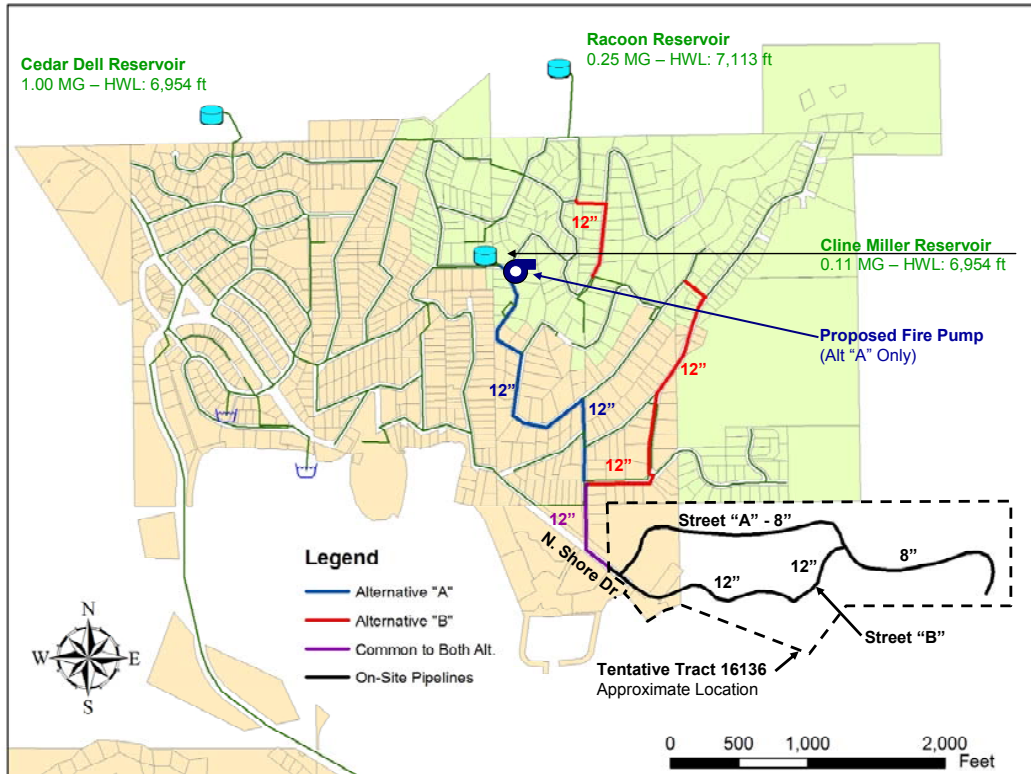


Figure 1

### Tentative Tract 16136 - Recommended Facilities Both Alternatives

Alternative "B" would not require the construction of a fire pump at the Cline Miller Reservoir to pump from the Lower to the Upper Fawnskin pressure zone as the majority of the fire flow would be provided by gravity off the existing Racoon Reservoir. However, the existing Cline Miller booster station would have to be refurbished to increase its capacity to convey surplus storage from the Lower Fawnskin pressure zone during a fire flow event. The capacity of this booster station would be increased from its current capacity of 190 gpm to 303 gpm. In addition, an on-site generator would be required to operate the station during power outages. The enhancement of this booster station would eliminate the need to construct additional storage facilities in USFS lands, which are difficult to obtain approval for.

**On-Site Facilities.** The sizing of pipelines within the proposed tract is the same for both alternatives. Recommended pipeline diameters for the various street segments shown in Figure 1 are described as follows:

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March 6, 2007

Page 7 of 8

- North Shore Dr. from tract boundary to Street "A": 150 ft of 12-inch pipeline
- North Shore Dr. from Street "A" to Street "B": 1,600 ft of 12-inch pipeline
- Street "B" from North Shore Dr. to Street "A": 700 ft of 12-inch pipeline
- Street "A" from North Shore Dr. to Street "B": 2,000 ft of 8-inch pipeline
- Street "A" from Street "B" to end of Cul-de-sac: 1,500 ft of 8-inch pipeline

## **Estimated Cost of Improvements**

The capital cost of proposed improvements was based on construction information provided by DWP and from other construction cost information available. The estimated cost of construction for pipelines is estimated at \$15 per diameter inch; the cost for pump stations is estimated at \$2,500 per horsepower. Construction contingencies are estimated at 20 percent while engineering cost is estimated at 15 percent.

It should be noted that estimated capital cost of proposed improvements shown here is for planning purposes only; actual cost of improvements may vary significantly depending on materials and labor cost at the time of construction.

### ***Alternative "A" – Dedicated line from the Cline Miller Reservoir***

■ 2,450 ft of 12-inch diameter off-site pipeline	\$ 440,000
■ 700 ft of 12-inch diameter off-site – Common to both Alt.	\$ 130,000
■ 175 Hp Cline Miller booster fire pump	\$ 440,000
■ 200 KW on-site emergency generator <sup>(1)</sup>	<u>\$ 65,000</u>
Sub-total:	\$ 1,075,000
Contingency during construction – 20 percent	\$ 215,000
Engineering, administration, inspection – 15 percent	<u>\$ 165,000</u>
Overall construction cost for off-site improvements	\$ 1,455,000

(1) Capital cost estimate includes cost of generator and transfer switch.

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March 6, 2007

Page 8 of 8

## **Alternative "B" – Gravity flow from the Racoon Reservoir**

■ 2,800 ft of 12-inch diameter off-site pipeline	\$ 505,000
■ 700 ft of 12-inch diameter off-site – Common to both Alt.	\$ 130,000
■ Refurbishing of existing Cline Miller booster station	\$ 100,000
■ 50 KW on-site emergency generator <sup>(1)</sup>	<u>\$ 35,000</u>
Sub-total:	\$ 770,000
Contingency during construction – 20 percent	\$ 155,000
Engineering, administration, inspection – 15 percent	<u>\$ 115,000</u>
Overall construction cost for off-site improvements	\$ 1,030,000

(2) Capital cost estimate includes cost of generator and transfer switch.

## **Recommendations**

The implementation of either alternative should provide the proposed development with the necessary facilities to meet the recommended fire flow protection of 1,750 gpm during maximum day demand conditions. However, Alternative "B" is preferred because it also enhances the distribution and fire flow capacity of the existing system in the Upper Fawskin pressure zone. In addition, the implementation of this alternative is approximately 29 percent less expensive than Alternative "A".

## **Disclaimer**

This feasibility study is based on current system conditions and it is valid for a period of 12 months from the date of this letter. The feasibility of developing the Tract 16136 subdivision may need to be revised and/or reassessed if the project is delayed for a significant period of time. Revisions may result from changes in future water demands, system conditions, and construction cost of recommended facilities.

Should you have any questions, please contact us at 909-587-9916 during normal business hours.

Very truly yours

ALDA Engineering Inc.



F. Anibal Blandon, P.E.  
Principal



**G.3 - Results of Rehabilitation and  
Aquifer Testing Well FP-Z  
(California Collaborative Solutions, August 2008)**



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

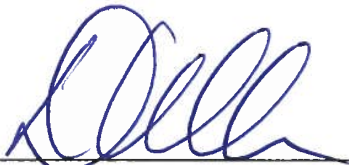
**August 7, 2008**

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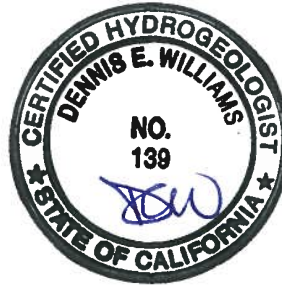


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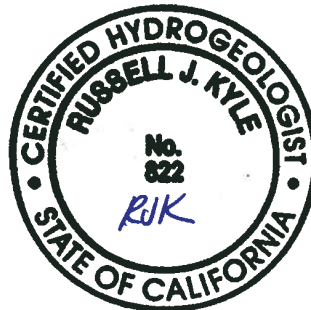
**AS DATA IS UPDATED FROM TIME TO TIME, ANY RELIANCE ON THIS REPORT AT A FUTURE DATE SHOULD TAKE INTO ACCOUNT UPDATED DATA.**



Dennis E. Williams, Ph.D., PG, CHG



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

**CONTENTS**

<b>1.0</b>	<b>INTRODUCTION .....</b>	<b>1</b>
1.1	Purpose and Scope .....	1
1.2	Background .....	2
<b>2.0</b>	<b>DOWNHOLE VIDEO SURVEY .....</b>	<b>4</b>
<b>3.0</b>	<b>WELL REHABILITATION PROCEDURE .....</b>	<b>5</b>
<b>4.0</b>	<b>AQUIFER PUMPING TEST .....</b>	<b>7</b>
4.1	Pumping Test Methodology.....	7
4.1.1	Basic Assumptions Used in Analysis of Pumping Test Data .....	7
4.1.2	Theis Equation .....	8
4.1.3	Jacob's Straight-Line (Modified Theis Non-Equilibrium) Method .....	9
4.2	Pumping Well .....	10
4.3	Observation Well .....	11
<b>5.0</b>	<b>PUMPING TEST RESULTS .....</b>	<b>12</b>
5.1	Production Well (FP-2).....	12
5.2	Observation Well .....	13
5.3	Ground Water Quality.....	13
5.4	Microscopic Particulate Analysis .....	15

**6.0 CONCLUSIONS AND RECOMMENDATIONS.....16**

**7.0 REFERENCES.....17**

**FIGURES, TABLE, APPENDICES**

**FIGURES**

<b>No.</b>	<b>Description</b>
1	General Location
2	Detailed Location
3	Step Drawdown Test – Moon Camp Well FP-2
4	Step Drawdown Test – Step 3 (105 gpm) – Moon Camp Well FP-2
5	Specific Drawdown – Moon Camp Well FP-2
6	Calculated Recovery – Moon Camp Well FP-2
7	Residual Drawdown – Moon Camp Well FP-2
8	Observation Well Interference – Fujimoto Well
9	Trilinear Diagram – Moon Camp Well FP-2

**TABLE**

<b>No.</b>	<b>Description</b>
1	Summary of Required Water Quality Analyses



**APPENDICES**

<b>Ltr.</b>	<b>Description</b>
A	Pumping Test Data
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<sup>1</sup>. 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

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<sup>1</sup> 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”:

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

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”

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

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:

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

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:

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

where:

- Q = Pumping rate, [gpm]  
 $\Delta s$  = 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 ( $\mu\text{g/L}$ ), below the CDPH primary MCL of 150  $\mu\text{g/L}$ , and is likely from materials used during installation of the test pump. Chloroform was detected at a concentration of 0.98  $\mu\text{g/L}$ , below the USEPA MCL of 80  $\mu\text{g/L}$  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
<b>Aluminum</b>	[µg/L]	< 50	200 <sup>2</sup> /1,000 <sup>1</sup>
<b>Arsenic</b>	[µg/L]	< 2.0	10 <sup>1</sup>
<b>Boron</b>	[µg/L]	< 100	1,000 <sup>3</sup>
<b>Chloride</b>	[mg/L]	2.7	250-500 <sup>2</sup>
<b>Chromium, Hexavalent</b>	[µg/L]	< 1.0	50 <sup>1,4</sup>
<b>Chromium, Total</b>	[µg/L]	1.1	50 <sup>1</sup>
<b>Color</b>	[Color Units]	< 3.0	15 <sup>2</sup>
<b>Fluoride</b>	[mg/L]	< 1.0	2.0 <sup>1</sup>
<b>Iron</b>	[µg/L]	< 100	300 <sup>2</sup>
<b>Manganese</b>	[µg/L]	< 20	50 <sup>2</sup>
<b>Nitrate (as NO<sub>3</sub>)</b>	[mg/L]	< 1.0	45 <sup>1</sup>
<b>Odor</b>	[TON]	< 1.0	3 <sup>2</sup>
<b>Perchlorate</b>	[µg/L]	< 4.0	6.0 <sup>1</sup>
<b>pH</b>	[pH Units]	7.5	6.5 - 8.5 <sup>5</sup>
<b>Silica, Total</b>	[mg/L]	25	NA <sup>6</sup>
<b>Specific Conductance</b>	[µmhos/cm]	510	900-1,600 <sup>2</sup>
<b>Sulfate (as SO<sub>4</sub>)</b>	[mg/L]	5.2	250-500 <sup>2</sup>
<b>Surfactants (MBAS)</b>	[mg/L]	< 0.05	0.5 <sup>2</sup>
<b>Total Dissolved Solids (TDS)</b>	[mg/L]	300	500 - 1,000 <sup>2</sup>
<b>Total Hardness</b>	[mg/L]	270	NA <sup>6</sup>
<b>Turbidity</b>	[NTU]	0.39	5 <sup>2</sup>
<b>Vanadium</b>	[µg/L]	< 3.0	50 <sup>3</sup>
<b>1,2,3-Trichloropropane</b>	[µg/L]	< 0.005	0.005 <sup>3</sup>
<b>Gross Alpha</b>	[pCi/L]	1.74 +/- 1.33	15 <sup>1</sup>
<b>Radon</b>	[pCi/L]	447 +/- 43.1	300-4,000 <sup>7</sup>
<b>Volatile Organic Compounds (EPA Method 524.2) except as noted below:</b>	[µg/L]	ND	Varies with Chemical <sup>1</sup>
<b>Chloroform</b>	[µg/L]	0.98	80 <sup>8</sup>
<b>Toluene</b>	[µg/L]	1.2	150 <sup>1</sup>

<sup>1</sup> California Department of Public Health (CDPH) primary maximum contaminant level (MCL).

<sup>2</sup> CDPH secondary MCL.

<sup>3</sup> CDPH notification level for unregulated chemicals.

<sup>4</sup> Chromium-6 (hexavalent chromium) is regulated by CDPH under the 50 µg/L total chromium MCL.

<sup>5</sup> United States Environmental Protection Agency (USEPA) secondary standard for pH.

<sup>6</sup> Not Applicable – no current MCL.

<sup>7</sup> USEPA proposed MCL and alternative MCL

<sup>8</sup> 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.

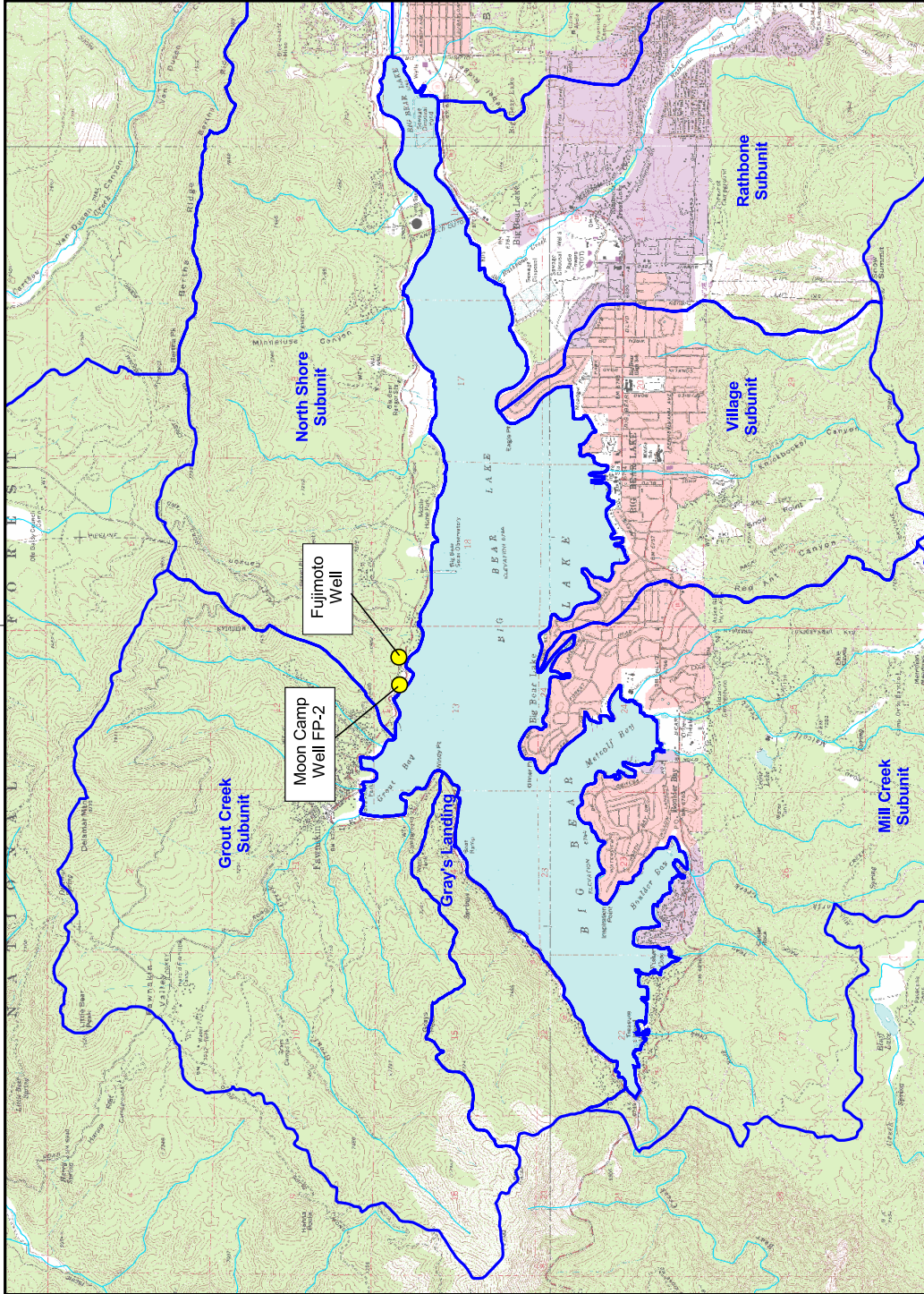
**FIGURES**

*GEOSCIENCE Support Services, Inc.*



CALIFORNIA COLLABORATIVE SOLUTIONS

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

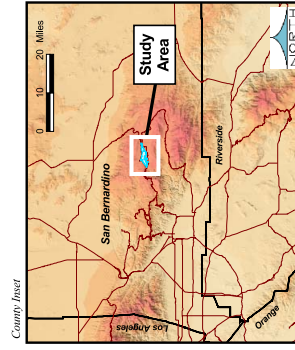


GENERAL LOCATION

EXPLANATION

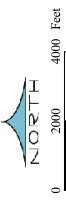
● Well Location

~ Hydrologic Subunit Boundary



7-Aug-08

R.I.W. R.I.E.

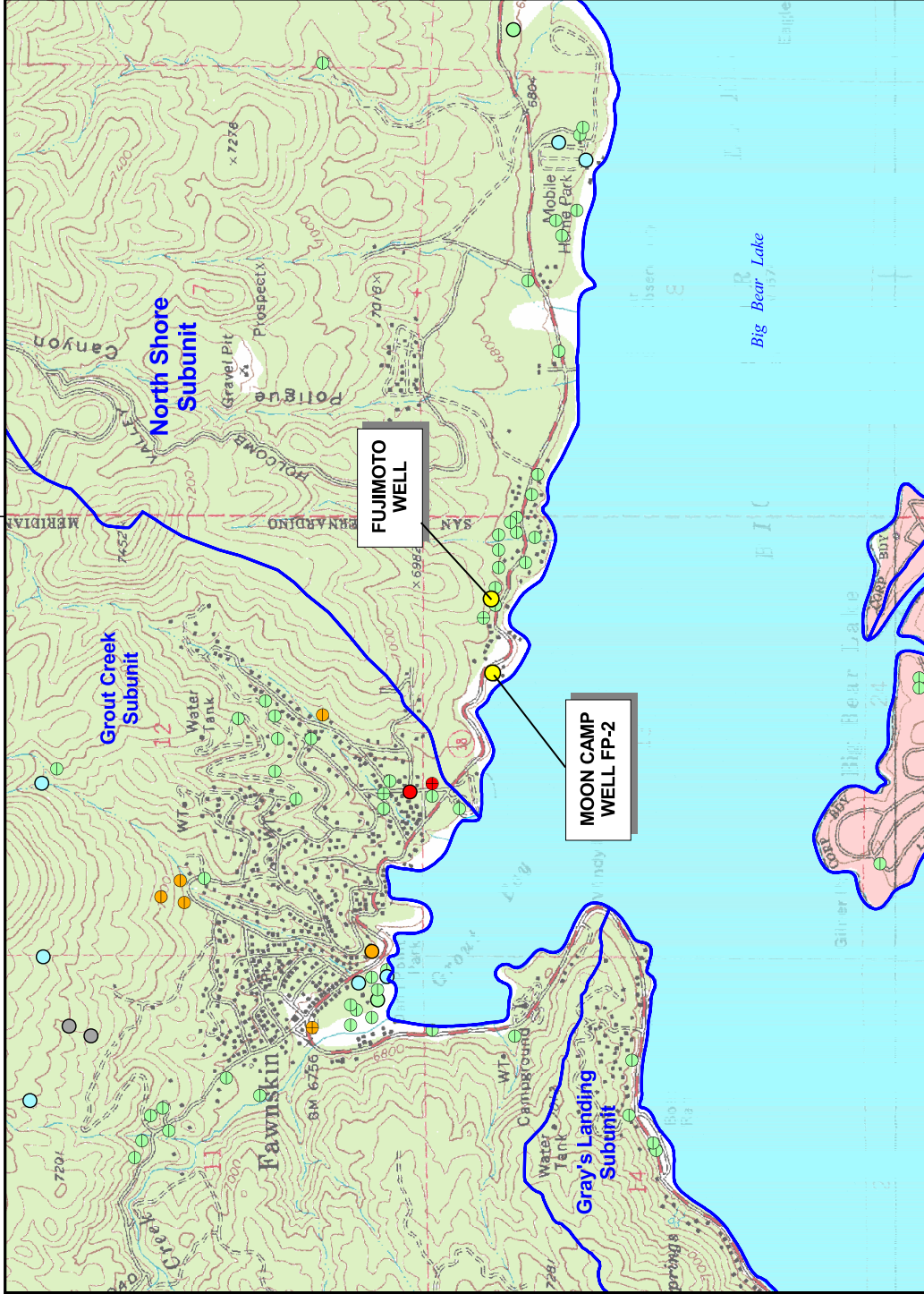


Prepared by: DWB  
Map Projection:  
UTM Zone 11, NAD27  
Central Meridian: -117 degrees

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www.gswwater.com

Figure 1

G:\proj\col\_collab\_mooncamp\_data\54801\_mooncamp\_data\_5480.apr



**DETAILED LOCATION**

**EXPLANATION**

● Moon Camp Well FP-2 and Fujimoto Well Locations

○ Well Classification

○ Municipal

⊖ Private

⊕ Test Well

Well Status

■ Abandoned

■ Destroyed

■ Non-Pumping

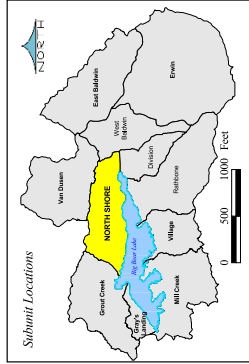
■ Pumping

■ Unknown

○ = Pumping Municipal Well

— Hydrologic Subunit Boundary

--- Creek or Drainage Channel



7-Aug-08

0 1000 2000 Feet

R.I.W. | R.I.E.

Prepared by: DWB  
Map Projection: USGS 7 1/2 minute Big Bear City (1994) and Moonridge (1994) Quadrangles.  
Central Meridian: -117 degrees

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**Figure 2**

G:\2008\col\_collab\_mooncamp\_data\_5480\mooncamp\_data\_5480.apr

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

Step Drawdown Test  
 Moon Camp Well FP-2

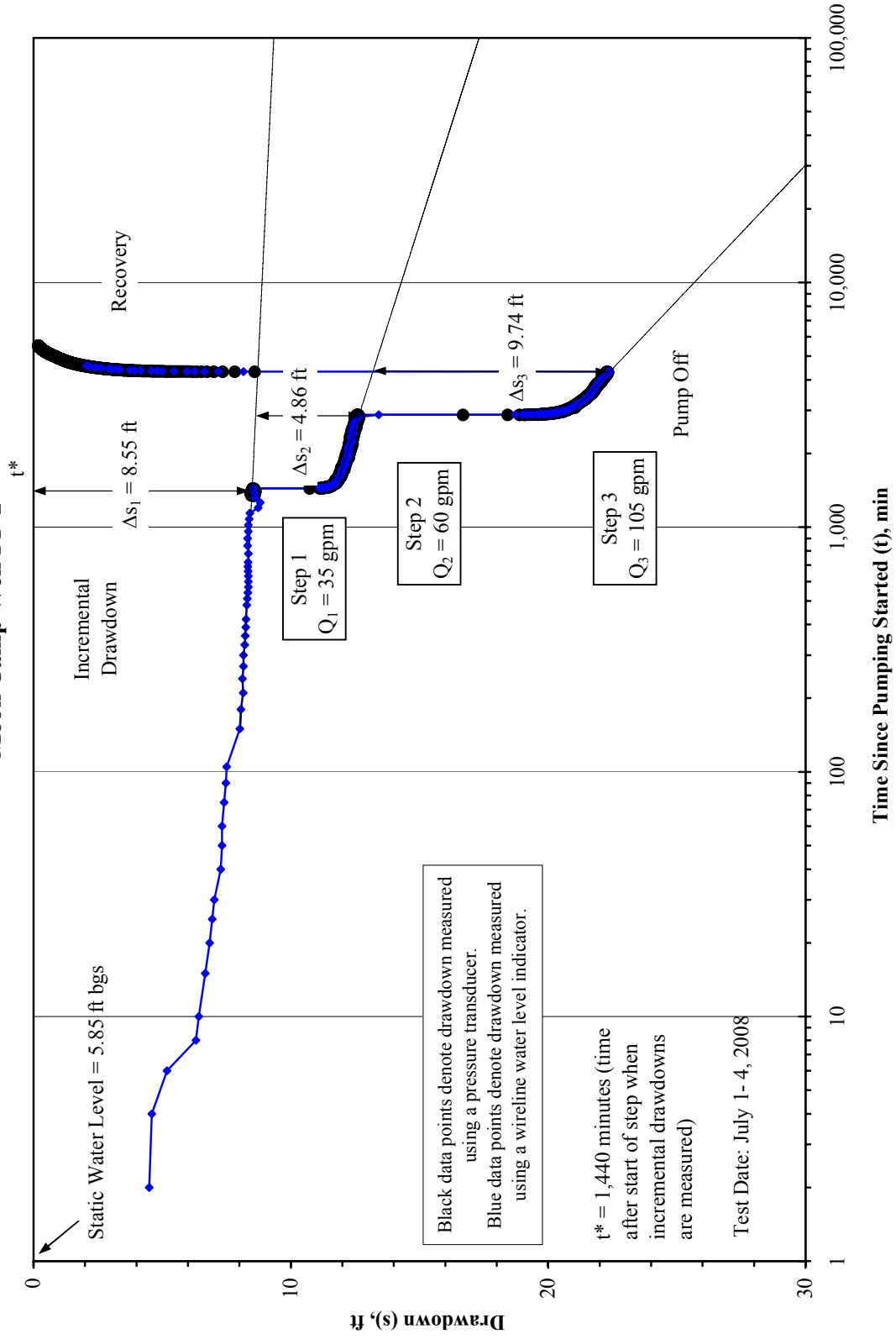


Figure 3

Step Drawdown Test - Step 3 (105 gpm)  
 Moon Camp Well FP-2

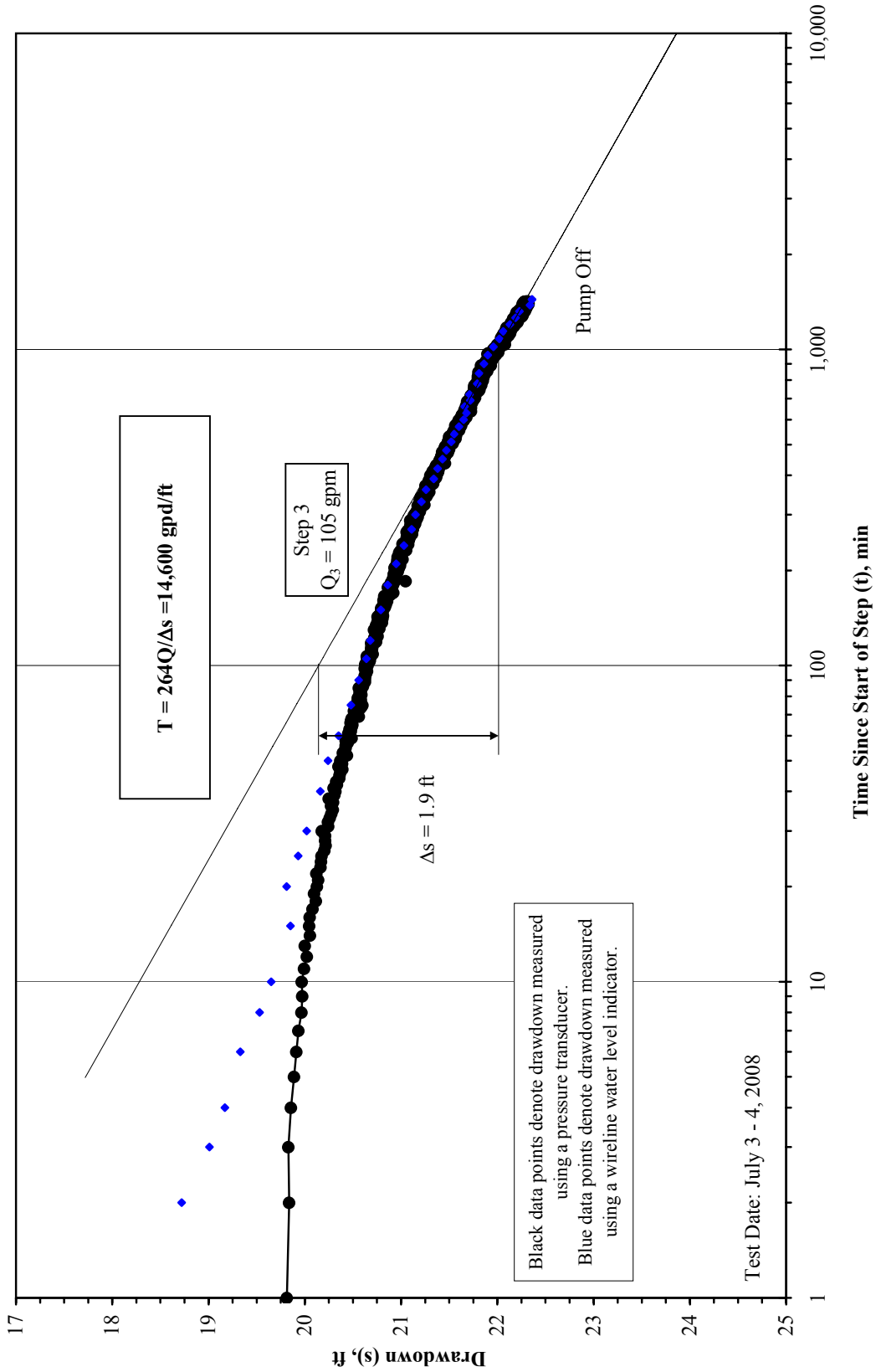


Figure 4

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

Specific Drawdown  
Moon Camp Well FP-2

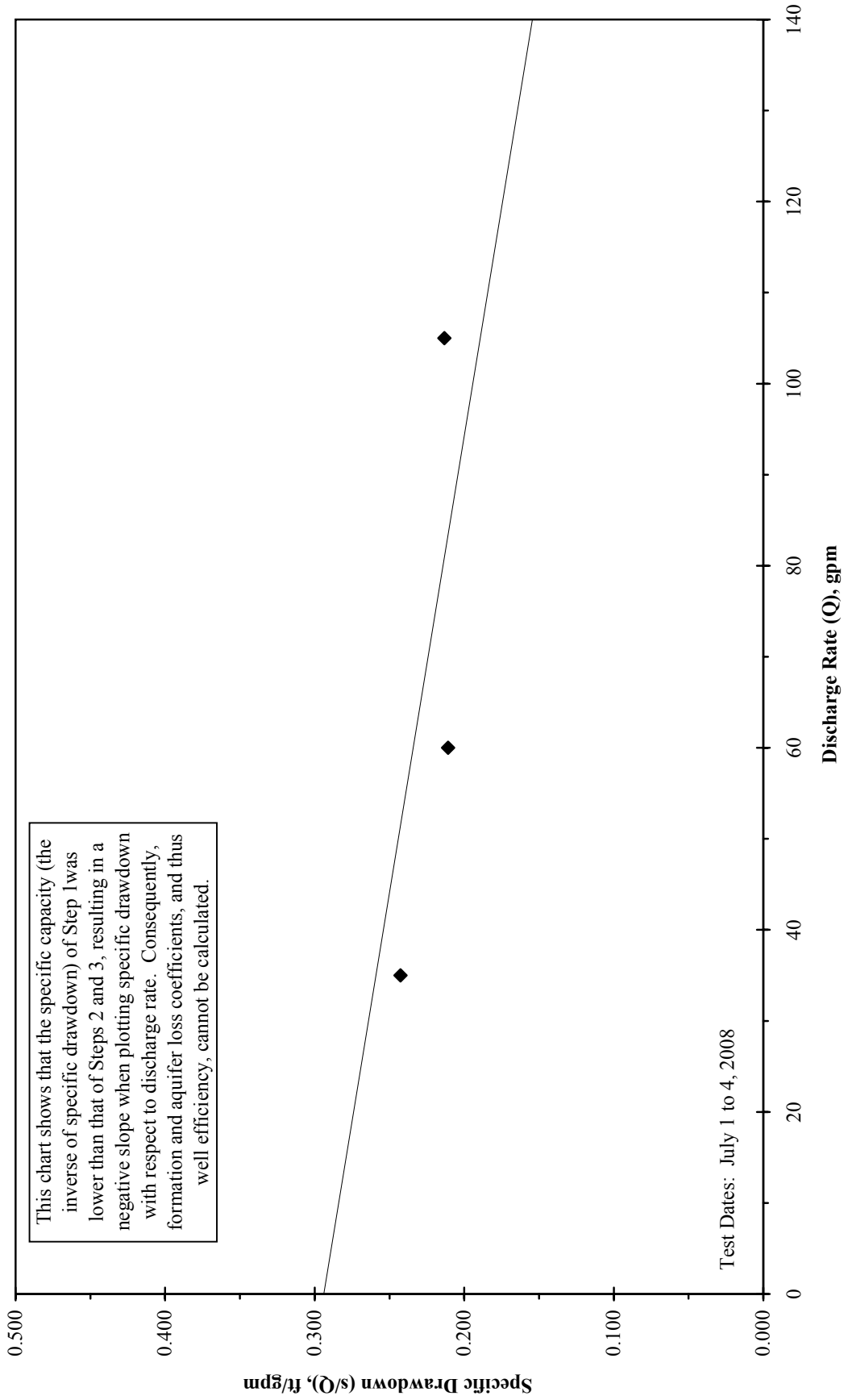


Figure 5



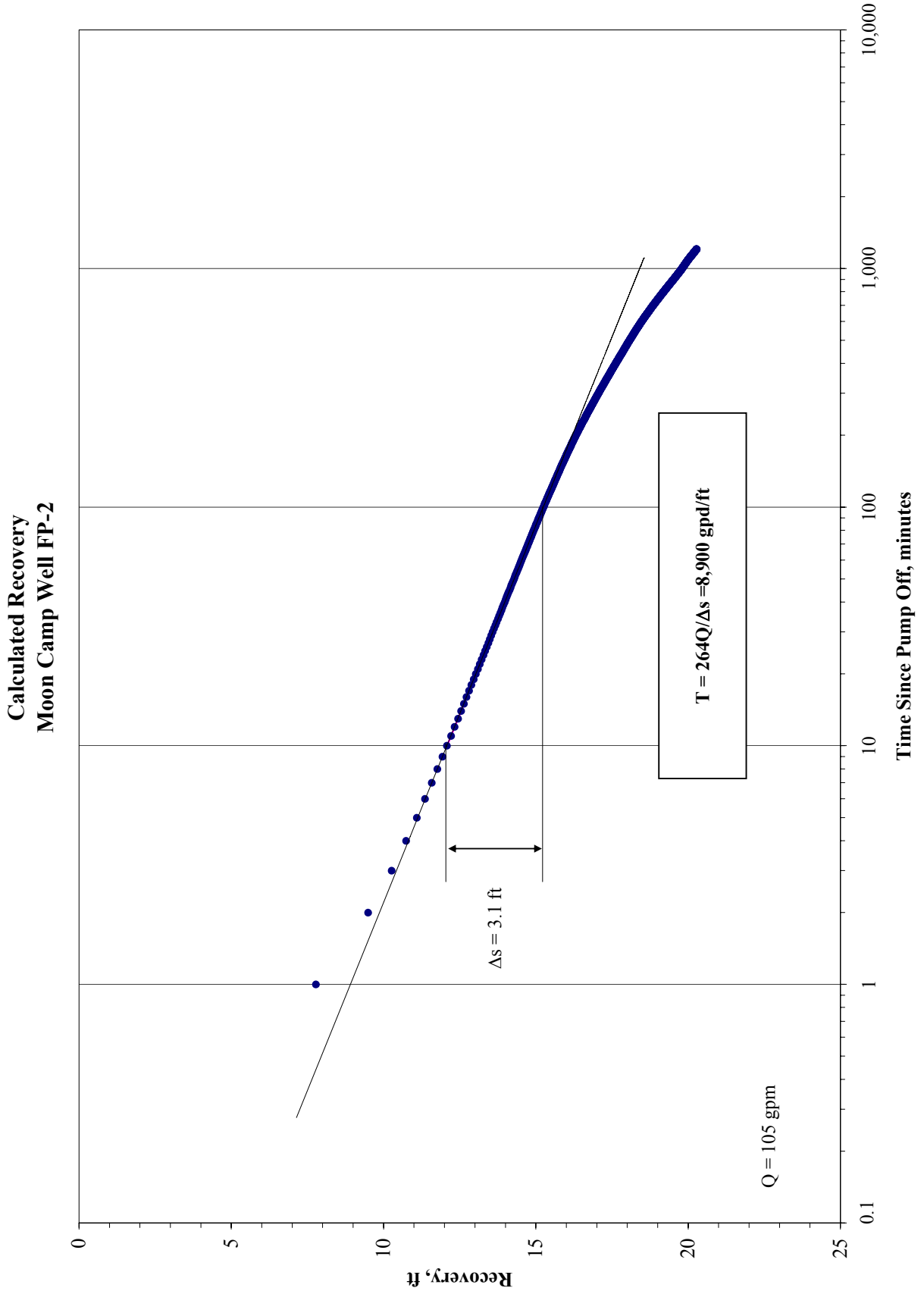


Figure 6

Residual Drawdown  
 Mooncamp Well FP-2

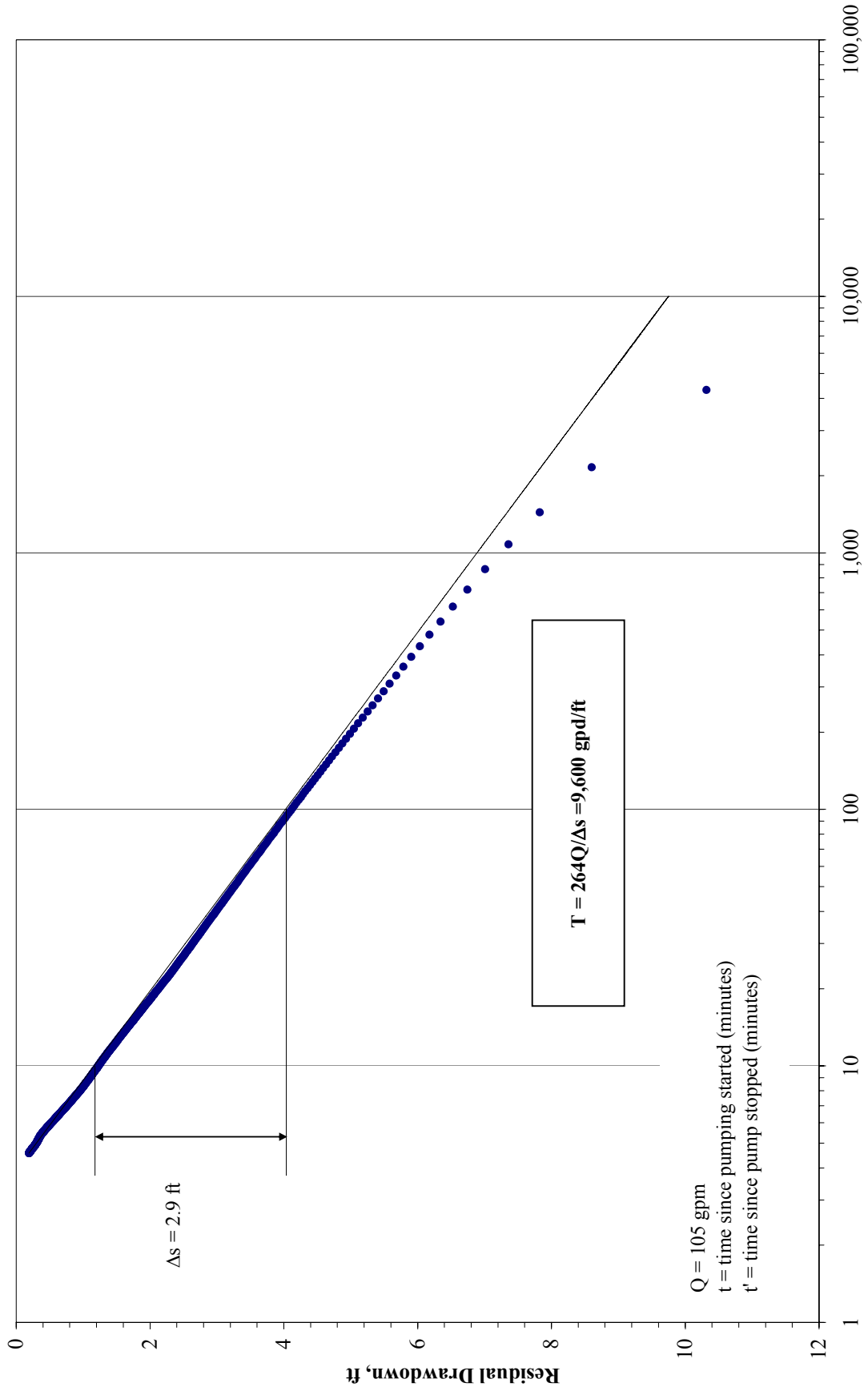


Figure 7

Observation (Fujimoto) Well  
 Interference Chart

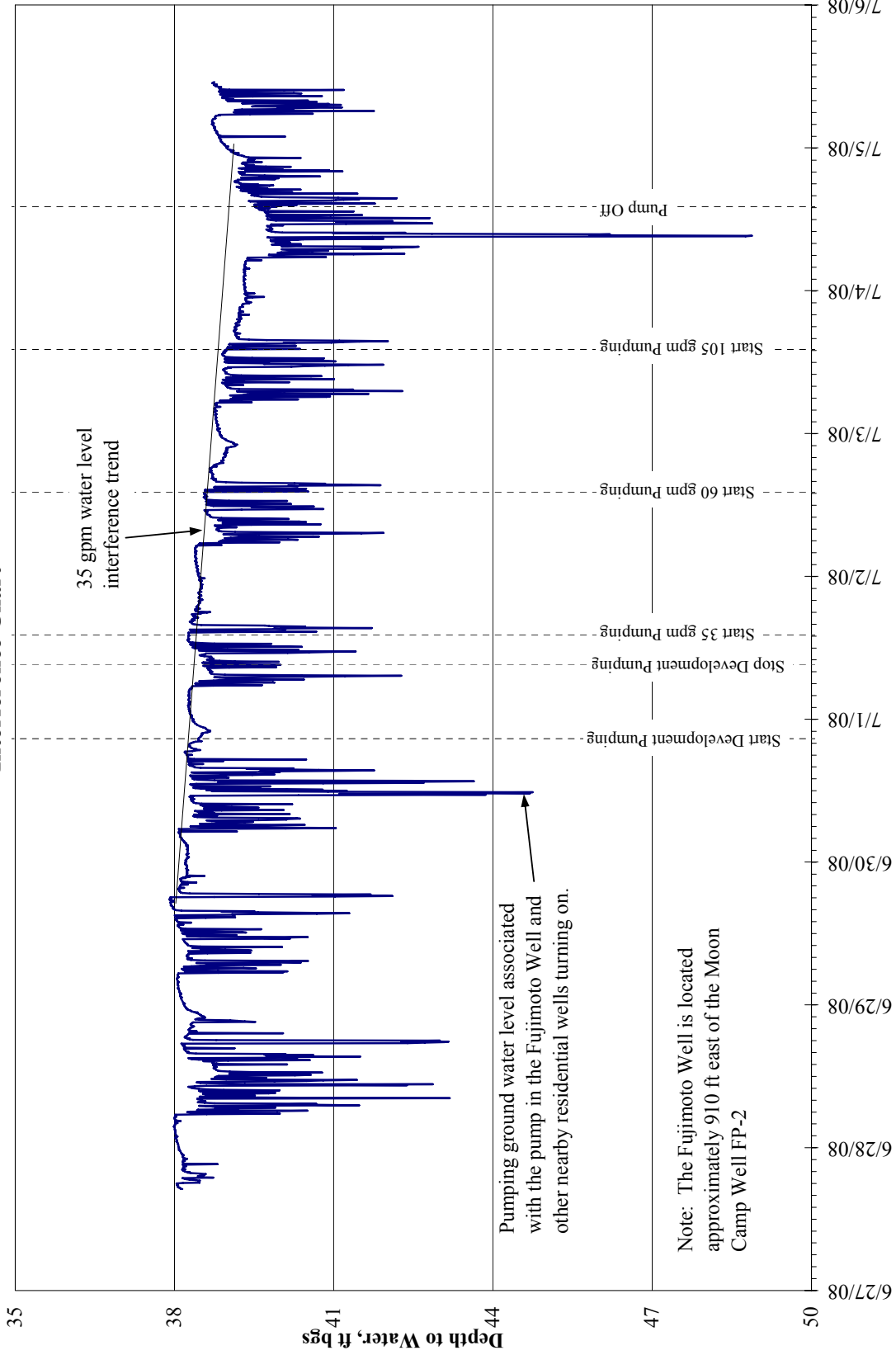
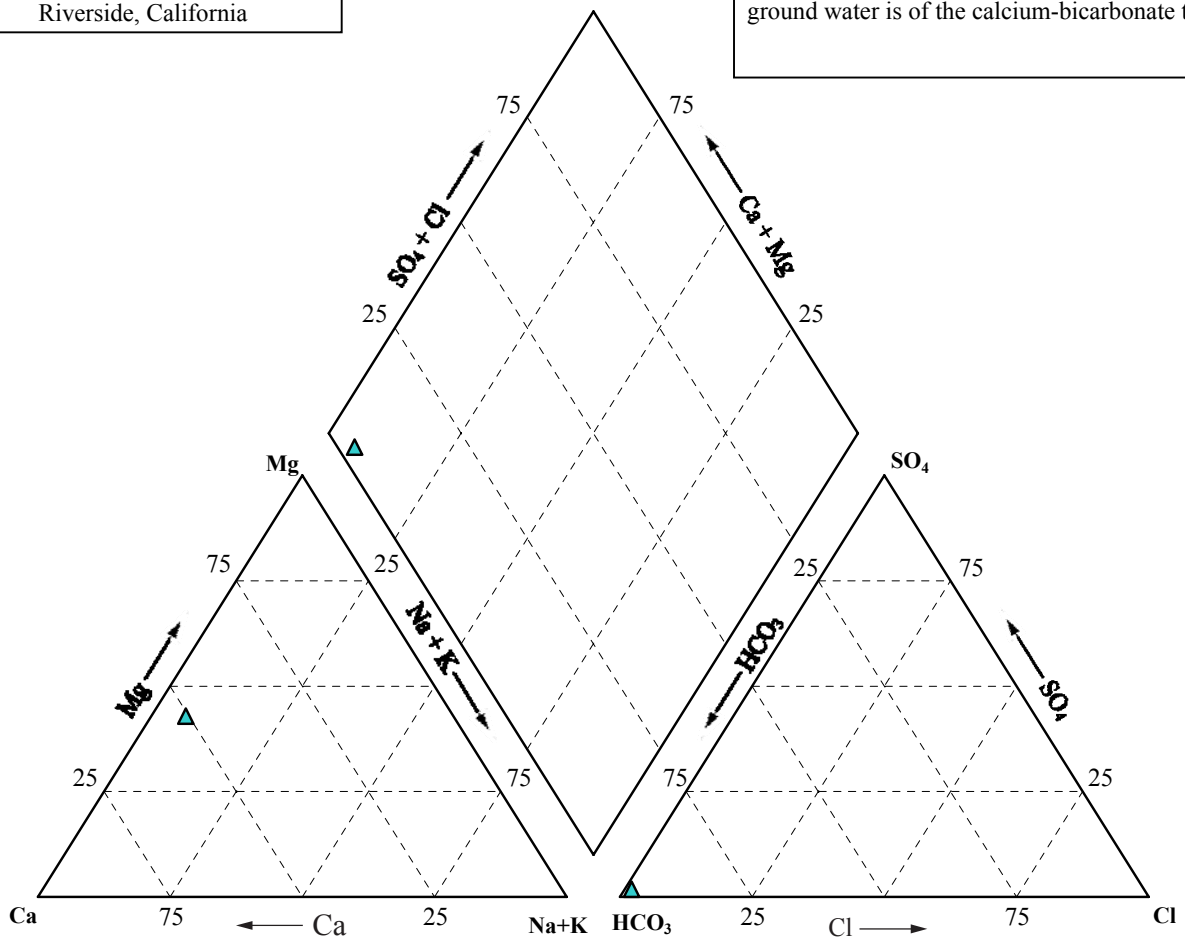


Figure 8

**Trilinear Diagram  
 Water Quality Data  
 Moon Camp Well FP-2**

Water Quality Results from  
 E.S. Babcock & Sons, Inc. of  
 Riverside, California

Water Quality samples collected from the Moon  
 Camp Well FP-2 on July 2, 2008 indicate that  
 ground water is of the calcium-bicarbonate type.



**TABLE**

*GEOSCIENCE Support Services, Inc.*



Summary of Required Water Quality Analyses

Constituent	Units	Detection Limit
<b>General Physical Properties</b>		
Color	Color unit	3
Odor	Odor unit	1
Turbidity	NTU <sup>1</sup>	0.2
MBAS	mg/L <sup>2</sup>	0.05
<b>General Minerals</b>		
Total Hardness	mg/L	3
Calcium	mg/L	1
Magnesium	mg/L	1
Sodium	mg/L	1
Potassium	mg/L	1
Total Alkalinity, as CaCO <sub>3</sub>	mg/L	3
Hydroxide	mg/L	3
Carbonate	mg/L	3
Bicarbonate	mg/L	3
Sulfate	mg/L	0.5
Chloride	mg/L	1
pH	pH unit	1
Iron	µg/L	20.0
Zinc	µg/L	10.0
Manganese	µg/L	10.0
Copper	µg/L	10.0
Specific Conductance	umhos/cm <sup>3</sup>	1
Total Dissolved Solids (TDS)	mg/L	20
Aggressive Index	-	-
Langlier Index	-	-
<b>Inorganic Chemicals</b>		
Aluminum	µg/L <sup>4</sup>	50.0
Antimony	µg/L	6.0
Arsenic	µg/L	2.0
Barium	µg/L	100.0
Beryllium	µg/L	1.0
Cadmium	µg/L	1.0
Chromium (Total)	µg/L	1.0
Chromium, hexavalent (CrVI)	µg/L	1.0
Cyanide	mg/L	0.1
Fluoride	mg/L	0.1
Lead	µg/L	5.0
Mercury	µg/L	1.0
Nickel	µg/L	10.0
Nitrate, as NO <sub>3</sub>	mg/L	1.0
Nitrate, as N	mg/L	0.2
Nitrite, as N	mg/L	0.1
Selenium	µg/L	5.0
Silver	µg/L	10.0
Thallium	µg/L	1.0

Constituent	Units	Detection Limit
<b><i>EPA Organic Methods</i></b>		
Volatiles (EPA 524.2) - includes MTBE	µg/L	various
EDB and DBCP (EPA 504.1)	µg/L	various
Nitrogen & Phosphorus Pesticides (EPA 507)	µg/L	various
Chlorinated Pesticides & PCB's as DCP (EPA 508)	µg/L	various
Chlorinated Acid Herbicides (EPA 515.3)	µg/L	various
DEHP, DEHA, Benzo(EPA a)Pyrene (EPA 525.2)	µg/L	various
Carbamates (EPA 531.1)	µg/L	various
Glyphosate (EPA 547)	µg/L	25.0
Endothall (EPA 548.1)	µg/L	45.0
Diquat (EPA 549.1)	µg/L	4.0
Dioxin (2,3,7,8 TCDD) (EPA 1613)	µg/L	0.000005
Perchlorate (EPA 314.0)	µg/L	4.0
<b><i>Unregulated Contaminant Monitoring Rule (State and Federal) not Covered Under EPA Organic Methods</i></b>		
Vanadium	µg/L	3.0
Boron	µg/L	100.0
1,2,3-Trichloropropane (1,2,3-TCP)	µg/L	0.005
<b><i>Additional Analysis</i></b>		
Radioactivity (Gross Alpha)	pCi/L <sup>5</sup>	3
Uranium*	µg/L	1
Radium-226*	pCi/L	1
Radium-228**	pCi/L	1
Radon	pCi/L	10
Asbestos	MFL <sup>6</sup>	0.2
Silica (Total)	mg/L	1.0

<sup>1</sup> nephelometric turbidity units

<sup>2</sup> milligrams per liter

<sup>3</sup> micromhos per centimeter

<sup>4</sup> micrograms per liter

<sup>5</sup> picocuries per liter

<sup>6</sup> million fibers per liter

\*Analysis for Uranium and Radium-226 should occur only if Gross Alpha is detected above 5 pCi/L


\*\* Analysis for Radium 228 should occur only if Radium 226 is detected above 3 pCi/L


**APPENDIX A**  
**Pumping Test Data**


*GEOSCIENCE Support Services, Inc.*








 GEOSCIENCE Support Services, Inc. P.O. Box 220, Claremont, CA 91786 Tel: (909) 920-0707 Fax: (909) 920-0403 www.gssiwater.com								<b>PUMPING TEST DATA</b>	
Test Date: July 1 - 4, 2008									
Well Name/Number: Mooncamp Well FP-2									
Circle Well Type: <u>Pumping</u>			Observation (r =                      ft)						
Circle Test Type: <u>Step Drawdown</u>			Constant Rate		Recovery		Development		
Static Water Level Depth: 5.85 ft bgs			Reference Point Elevation: + 1.64 ft above ground surface						
Time of Day	Time Step [min]	Time Total [min]	Depth to Water [ft]	Draw-down [ft]	Pumping Rate [gpm]	Sand Content [ppm]	Totalizer [gal x 10]	Remarks and Other Data	
14:05	0	0	7.49	-	-	-	115,464.0	Pump on.	
14:07	2	2	11.98	4.49	38	tr	115,471.5		
14:09	4	4	12.09	4.60	18	0	115,475.0		
14:11	6	6	12.68	5.19	20	0	115,479.0		
14:13	8	8	13.80	6.31	33	0	115,485.5		
14:15	10	10	13.91	6.42	33	0	115,492.0		
14:20	15	15	14.16	6.67	30	0	115,507.0		
14:25	20	20	14.33	6.84	31	0	115,522.5		
14:30	25	25	14.43	6.94	30	0	115,537.5		
14:35	30	30	14.51	7.02	31	0	115,553.0		
14:45	40	40	14.76	7.27	30	0	115,582.5		
14:55	50	50	14.81	7.32	29	0	115,611.5		
15:05	60	60	14.81	7.32	30	0	115,641.0		
15:20	75	75	14.89	7.40	29	-	115,684.5		
15:35	90	90	14.96	7.47	27	0	115,725.5	Totalizer briefly not spinning freely	
15:45	100	100	-	-	28	0	115,753.0		
15:50	105	105	14.99	7.50	19	0	115,762.5		
16:05	120	120	16.45	8.96	42	0	115,825.0		
16:15	130	130	-	-	36	0	115,861.0		
16:35	150	150	15.51	8.02	33	0	115,926.5		
17:05	180	180	15.55	8.06	36	0	116,033.5		
17:35	210	210	15.64	8.15	35	0	116,139.0		
18:05	240	240	15.61	8.12	35	0	116,244.0		
18:35	270	270	15.65	8.16	36	0	116,352.0		
19:05	300	300	15.65	8.16	36	0	116,460.0		
19:35	330	330	15.70	8.21	36	0	116,568.0		
20:05	360	360	15.72	8.23	35	0	116,672.0		
20:35	390	390	15.74	8.25	36	0	116,779.0		
21:05	420	420	15.75	8.26	36	0	116,886.0		
22:05	480	480	15.78	8.29	36	0	117,100.5		
22:35	510	510	15.80	8.31	37	0	117,210.0		

								PUMPING TEST DATA	
GEOSCIENCE Support Services, Inc. P.O. Box 220, Claremont, CA 91786 Tel: (909) 920-0707 Fax: (909) 920-0403 www.gssiwater.com									
Test Date: July 1 - 4, 2008									
Well Name/Number: Mooncamp Well FP-2									
Circle Well Type:		Pumping		Observation (r =		ft)			
Circle Test Type:		Step Drawdown		Constant Rate		Recovery		Development	
Static Water Level Depth: 5.85 ft bgs				Reference Point Elevation: + 1.64 ft above ground surface					
Time of Day	Time Step [min]	Time Total [min]	Depth to Water [ft]	Draw-down [ft]	Pumping Rate [gpm]	Sand Content [ppm]	Totalizer [gal x 10]	Remarks and Other Data	
23:05	540	540	15.82	8.33	36	0	117,317.0		
23:35	570	570	15.84	8.35	34	0	117,420.0		
0:05	600	600	15.84	8.35	38	0	117,533.0		
0:35	630	630	15.84	8.35	35	0	117,639.0		
1:05	660	660	15.83	8.34	36	0	117,746.0		
1:35	690	690	15.82	8.33	37	0	117,856.0		
2:05	720	720	15.83	8.34	42	0	117,981.0		
3:05	780	780	15.84	8.35	31	0	118,169.0		
4:05	840	840	15.81	8.32	37	0	118,389.0		
5:05	900	900	15.81	8.32	36	0	118,604.0		
6:05	960	960	15.84	8.35	36	0	118,822.0		
7:05	1020	1020	15.84	8.35	36	0	119,037.0		
8:05	1080	1080	15.87	8.38	39	0	119,272.0		
9:05	1140	1140	15.90	8.41	35	0	119,480.0		
10:05	1200	1200	16.22	8.73	34	0	119,682.0		
11:05	1260	1260	16.30	8.81	36	0	119,896.0		
12:05	1320	1320	16.08	8.59	36	0	120,114.0		
13:05	1380	1380	16.06	8.57	34	0	120,319.0	Q <sub>1</sub> = 35 gpm, SC <sub>1</sub> = 4.1 gpm/ft	
14:05	1440	1440	16.04	8.55	35	0	120,526.0	Adjust Q up.	
14:07	2	1442	18.66	11.17	55	0	120,537.0		
14:09	4	1444	18.60	11.11	65	0	120,550.0		
14:11	6	1446	18.67	11.18	60	0	120,562.0		
14:13	8	1448	18.73	11.24	60	0	120,574.0		
14:15	10	1450	18.79	11.30	60	0	120,586.0		
14:20	15	1455	18.91	11.42	62	0	120,617.0		
14:25	20	1460	18.93	11.44	60	0	120,647.0		
14:30	25	1465	19.01	11.52	62	0	120,678.0		
14:35	30	1470	19.03	11.54	60	0	120,708.0		
14:45	40	1480	19.09	11.60	61	0	120,769.0		
14:50	45	1485	19.09	11.60	60	0	120,799.0		
14:55	50	1490	19.10	11.61	62	0	120,830.0		

 GEOSCIENCE Support Services, Inc. P.O. Box 220, Claremont, CA 91786 Tel: (909) 920-0707 Fax: (909) 920-0403 www.gssiwater.com								<b>PUMPING TEST DATA</b>	
Test Date: July 1 - 4, 2008									
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Time of Day	Time Step [min]	Time Total [min]	Depth to Water [ft]	Draw-down [ft]	Pumping Rate [gpm]	Sand Content [ppm]	Totalizer [gal x 10]	Remarks and Other Data	
15:05	60	1500	19.21	11.72	61	0	120,890.5		
15:20	75	1515	19.21	11.72	60	0	120,980.0		
15:35	90	1530	19.24	11.75	60	0	121,070.5		
15:50	105	1545	19.26	11.77	61	0	121,162.5		
16:05	120	1560	19.30	11.81	59	0	121,251.5		
16:35	150	1590	19.36	11.87	60	0	121,432.0		
17:05	180	1620	19.38	11.89	61	0	121,614.0		
17:35	210	1650	19.43	11.94	61	0	121,798.0		
18:05	240	1680	19.46	11.97	60	0	121,978.0		
18:35	270	1710	19.48	11.99	61	0	122,160.0		
19:05	300	1740	19.48	11.99	61	0	122,343.0		
19:35	330	1770	19.54	12.05	61	0	122,526.0		
20:05	360	1800	19.62	12.13	61	0	122,709.0		
20:35	390	1830	19.59	12.10	61	0	122,892.0		
21:05	420	1860	19.61	12.12	61	0	123,074.0		
21:35	450	1890	19.63	12.14	61	0	123,256.0		
22:05	480	1920	19.66	12.17	61	0	123,438.0		
22:35	510	1950	19.68	12.19	60	0	123,619.0		
23:05	540	1980	19.72	12.23	61	0	123,801.0		
23:35	570	2010	19.72	12.23	60	0	123,982.0		
0:05	600	2040	19.75	12.26	60	0	124,163.0		
0:35	630	2070	19.70	12.21	53	0	124,322.0		
1:05	660	2100	19.73	12.24	61	0	124,506.0		
1:35	690	2130	19.71	12.22	61	0	124,689.0		
2:05	720	2160	19.76	12.27	57	0	124,860.0		
3:05	780	2220	19.84	12.35	64	0	125,245.0		
4:05	840	2280	19.84	12.35	59	0	125,598.0		
5:05	900	2340	19.82	12.33	59	0	125,950.0		
6:05	960	2400	19.90	12.41	61	0	126,318.0		
7:05	1020	2460	19.86	12.37	59	0	126,671.0		
8:05	1080	2520	19.89	12.40	61	0	127,035.0		

 GEOSCIENCE Support Services, Inc. P.O. Box 220, Claremont, CA 91786 Tel: (909) 920-0707 Fax: (909) 920-0403 www.gssiwater.com								PUMPING TEST DATA	
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Time of Day	Time Step [min]	Time Total [min]	Depth to Water [ft]	Draw-down [ft]	Pumping Rate [gpm]	Sand Content [ppm]	Totalizer [gal x 10]	Remarks and Other Data	
9:05	1140	2580	19.94	12.45	61	0	127,399.0		
10:05	1200	2640	19.94	12.45	62	0	127,771.0		
11:05	1260	2700	19.98	12.49	61	0	128,135.0		
12:05	1320	2760	20.05	12.56	62	0	128,504.5		
13:05	1380	2820	20.12	12.63	60	0	128,865.0	Q <sub>2</sub> = 60 gpm, SC <sub>2</sub> = 4.5 gpm/ft	
14:05	1440	2880	20.90	13.41	60	0	129,226.0	Adjust Q up.	
14:07	2	2882	26.21	18.72	100	0	129,246.0		
14:08	3	2883	26.50	19.01	105	0	129,256.5		
14:09	4	2884	26.66	19.17	110	0	129,267.5		
14:11	6	2886	26.82	19.33	108	0	129,289.0		
14:13	8	2888	27.02	19.53	105	0	129,310.0		
14:15	10	2890	27.14	19.65	108	0	129,331.5		
14:20	15	2895	27.34	19.85	105	0	129,384.0		
14:25	20	2900	27.30	19.81	104	0	129,436.0		
14:30	25	2905	27.42	19.93	106	0	129,489.0		
14:35	30	2910	27.51	20.02	105	0	129,541.5		
14:45	40	2920	27.65	20.16	104	0	129,645.5		
14:55	50	2930	27.73	20.24	105	0	129,750.5		
15:05	60	2940	27.84	20.35	105	0	129,855.0		
15:20	75	2955	27.97	20.48	100	0	130,005.0		
15:35	90	2970	28.05	20.56	110	0	130,170.0		
15:50	105	2985	28.13	20.64	104	0	130,326.5		
16:05	120	3000	28.17	20.68	106	0	130,485.0		
16:35	150	3030	28.28	20.79	105	0	130,799.0		
17:05	180	3060	28.35	20.86	105	0	131,112.5		
17:35	210	3090	28.44	20.95	105	0	131,426.0		
18:05	240	3120	28.52	21.03	101	0	131,730.0		
18:35	270	3150	28.60	21.11	108	0	132,054.0		
19:05	300	3180	28.64	21.15	104	0	132,367.0		
19:35	330	3210	28.70	21.21	104	0	132,680.0		
20:05	360	3240	28.75	21.26	105	0	132,994.0		

 GEO SCIENCE Support Services, Inc. P.O. Box 220, Claremont, CA 91786 Tel: (909) 920-0707 Fax: (909) 920-0403 www.gssiwater.com								PUMPING TEST DATA	
Test Date: July 1 - 4, 2008									
Well Name/Number: Mooncamp Well FP-2									
Circle Well Type:		Pumping		Observation (r =		ft)			
Circle Test Type:		Step Drawdown		Constant Rate		Recovery		Development	
Static Water Level Depth: 5.85 ft bgs				Reference Point Elevation: + 1.64 ft above ground surface					
Time of Day	Time Step [min]	Time Total [min]	Depth to Water [ft]	Draw-down [ft]	Pumping Rate [gpm]	Sand Content [ppm]	Totalizer [gal x 10]	Remarks and Other Data	
20:35	390	3270	28.83	21.34	104	0	133,307.0		
21:05	420	3300	28.87	21.38	104	0	133,620.0		
21:35	450	3330	28.92	21.43	105	0	133,934.0		
22:05	480	3360	28.96	21.47	104	0	134,247.0		
22:35	510	3390	29.01	21.52	104	0	134,560.0		
23:05	540	3420	29.04	21.55	105	0	134,873.5		
23:35	570	3450	29.09	21.60	105	0	135,187.0		
0:05	600	3480	29.14	21.65	104	0	135,500.0		
0:35	630	3510	29.17	21.68	105	0	135,814.0		
1:05	660	3540	29.15	21.66	109	0	136,140.0		
1:35	690	3570	29.21	21.72	105	0	136,455.0		
2:05	720	3600	29.20	21.71	103	0	136,764.0		
3:05	780	3660	29.28	21.79	107	0	137,405.0		
4:05	840	3720	29.30	21.81	105	0	138,037.0		
5:05	900	3780	29.35	21.86	107	0	138,678.0		
6:05	960	3840	29.39	21.90	106	0	139,312.0		
7:05	1020	3900	29.45	21.96	104	0	139,938.0		
8:05	1080	3960	29.51	22.02	105	0	140,567.0		
9:05	1140	4020	29.55	22.06	108	0	141,215.0		
10:05	1200	4080	29.62	22.13	104	0	141,838.0		
11:05	1260	4140	29.68	22.19	107	0	142,480.0		
12:05	1320	4200	29.72	22.23	109	0	143,132.0		
13:05	1380	4260	29.83	22.34	105	0	143,762.5	Q <sub>3</sub> = 105 gpm, SC <sub>3</sub> = 4.7 gpm/ft	
14:05	1440	4320	29.85	22.36	106	0	144,399.5	Pump off.	

 <span style="float: right;"><b>PUMPING TEST DATA</b></span>								
GEOSCIENCE Support Services, Inc. P.O. Box 220, Claremont, CA 91786 Tel: (909) 920-0707 Fax: (909) 920-0403 www.gssiwater.com								
Test Date: July 4, 2008								
Well Name/Number: Mooncamp Well FP-2								
Circle Well Type: <u>Pumping</u>			Observation (r =    ft)					
Circle Test Type: Step Drawdown			Constant Rate <u>Recovery</u>			Development		
Static Water Level Depth: 5.85 ft bgs				Reference Point Elevation: + 1.64 ft above ground surface				
Time of Day	Time Step [min]	Time Total [min]	Depth to Water [ft]	Draw-down [ft]	Pumping Rate [gpm]	Sand Content [ppm]	Totalizer [kgal]	Remarks and Other Data
2:05 PM	0	4,320	29.85	22.36	-	-	144,399.5	Pump off.
2:07 PM	2	4,322	15.65	8.16	-	-	-	
2:09 PM	4	4,324	14.67	7.18	-	-	-	
2:11 PM	6	4,326	14.13	6.64	-	-	-	
2:13 PM	8	4,328	13.75	6.26	-	-	-	
2:15 PM	10	4,330	13.45	5.96	-	-	-	
2:20 PM	15	4,335	12.95	5.46	-	-	-	
2:25 PM	20	4,340	12.50	5.01	-	-	-	
2:30 PM	25	4,345	12.30	4.81	-	-	-	
2:35 PM	30	4,350	12.08	4.59	-	-	-	
2:45 PM	40	4,360	11.65	4.16	-	-	-	
2:55 PM	50	4,370	11.41	3.92	-	-	-	
3:05 PM	60	4,380	11.24	3.75	-	-	-	
3:26 PM	81	4,401	10.85	3.36	-	-	-	
3:36 PM	91	4,411	10.73	3.24	-	-	-	
3:50 PM	105	4,425	10.54	3.05	-	-	-	
4:05 PM	120	4,440	10.40	2.91	-	-	-	
4:35 PM	150	4,470	10.10	2.61	-	-	-	
5:05 PM	180	4,500	9.90	2.41	-	-	-	
5:35 PM	210	4,530	9.68	2.19	-	-	-	
6:05 PM	240	4,560	9.55	2.06	-	-	-	

**APPENDIX B**  
**Water Quality Data**

*GEOSCIENCE Support Services, Inc.*





**E.S.BABCOCK**&Sons, Inc.  
Environmental Laboratories *est. 1906*

Client Name: Geoscience Support Services Inc.  
Contact: Diane Smith  
Address: P.O. Box 220  
Claremont, CA 91711

Analytical Report: Page 1 of 9  
Project Name: Geo - Well Testing  
Project Number: [none]

**Work Order Number: A8G0246**

Report Date: 16-Jul-2008

Received on Ice (Y/N): Yes Temp: 6 °C

Attached is the analytical report for the sample(s) received for your project. Below is a list of the individual sample descriptions with the corresponding laboratory number(s). Also, enclosed is a copy of the Chain of Custody document (if received with your sample(s)). Please note any unused portion of the sample(s) may be responsibly discarded after 30 days from the above report date, unless you have requested otherwise.

Thank you for the opportunity to serve your analytical needs. If you have any questions or concerns regarding this report please contact our client service department.

**Sample Identification**

<u>Lab Sample #</u>	<u>Client Sample ID</u>	<u>Matrix</u>	<u>Date Sampled</u>	<u>By</u>	<u>Date Submitted</u>	<u>By</u>
A8G0246-01	Moon Camp Well FP2, Fawnskin CA	Water	07/02/08 10:00	Christofer Coppinger	07/02/08 14:50	Nathan Reynolds

<i>mailing</i> P.O. Box 432 Riverside, CA 92502-0432	<i>location</i> 6100 Quail Valley Court Riverside, CA 92507-0704	P 951 653 3351 F 951 653 1662 www.babcocklabs.com	NELAP no. 02101CA CA ELAP no. 1156 EPA no. CA00102
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**E.S.BABCOCK & Sons, Inc.**  
Environmental Laboratories *est. 1906*

Client Name: Geoscience Support Services Inc.  
Contact: Diane Smith  
Address: P.O. Box 220  
Claremont, CA 91711

Analytical Report: Page 2 of 9  
Project Name: Geo - Well Testing  
Project Number: [none]

Report Date: 16-Jul-2008

**Work Order Number: A8G0246**  
Received on Ice (Y/N): Yes Temp: 6 °C

Laboratory Reference Number  
**A8G0246-01**

<u>Sample Description</u>	<u>Matrix</u>	<u>Sampled Date/Time</u>	<u>Received Date/Time</u>
Moon Camp Well FP2, Fawnskin CA	Water	07/02/08 10:00	07/02/08 14:50

<u>Analyte(s)</u>	<u>Result</u>	<u>RDL</u>	<u>Units</u>	<u>Method</u>	<u>Analysis Date</u>	<u>Analyst</u>	<u>Flag</u>
<b>Cations</b>							
Total Hardness	270	3.0	mg/L	SM 3120B	07/08/08 15:17	lmt	
Calcium	58	1.0	mg/L	EPA 200.7	07/08/08 15:17	lmt	
Magnesium	30	1.0	mg/L	EPA 200.7	07/08/08 15:17	lmt	
Sodium	7.6	1.0	mg/L	EPA 200.7	07/08/08 15:17	lmt	
Potassium	1.6	1.0	mg/L	EPA 200.7	07/08/08 15:17	lmt	
Total Cations	5.8	0.05	me/L	Calculation			
<b>Anions</b>							
Total Alkalinity	280	3.0	mg/L	SM 2320B	07/11/08 13:38	ctl	
Hydroxide	ND	3.0	mg/L	SM 2320B	07/11/08 13:38	ctl	
Carbonate	ND	3.0	mg/L	SM 2320B	07/11/08 13:38	ctl	
Bicarbonate	340	3.0	mg/L	SM 2320B	07/11/08 13:38	ctl	
Chloride	2.7	1.0	mg/L	EPA 300.0	07/02/08 23:44	JC	
Sulfate	5.2	0.50	mg/L	EPA 300.0	07/02/08 23:44	JC	
Nitrate as N	0.20	0.20	mg/L	EPA 300.0	07/02/08 23:44	JC	
Fluoride	ND	0.1	mg/L	SM 4500F C	07/11/08 14:20	hga	
Nitrate	ND	1.0	mg/L	EPA 300.0	07/02/08 23:44	JC	
Total Anions	5.80	0.05	me/L	Calculation			
<b>Aggregate Properties</b>							
pH	7.5	1.0	pH Units	SM 4500H+ B	07/02/08 20:08	sbd	
Specific Conductance	510	1.0	umhos/cm	SM 2510 B	07/02/08 20:08	sbd	
Aggressive Index	12.2	1.0	N/A	Calculation			
Langlier Index @ Site Temp.	0.30		N/A	SM 2330 B	07/03/08 12:37	saf	

*mailing*  
P.O. Box 432  
Riverside, CA 92502-0432

*location*  
6100 Quail Valley Court  
Riverside, CA 92507-0704

P 951 653 3351  
F 951 653 1662  
www.babcocklabs.com

NELAP no. 02101CA  
CA ELAP no. 1156  
EPA no. CA00102

## Appendix B



**E.S.BABCOCK & Sons, Inc.**  
Environmental Laboratories *est. 1906*

Client Name: Geoscience Support Services Inc.  
Contact: Diane Smith  
Address: P.O. Box 220  
Claremont, CA 91711

Analytical Report: Page 3 of 9  
Project Name: Geo - Well Testing  
Project Number: [none]

Report Date: 16-Jul-2008

**Work Order Number: A8G0246**  
Received on Ice (Y/N): Yes      Temp: 6 °C

Laboratory Reference Number  
**A8G0246-01**

<u>Sample Description</u>	<u>Matrix</u>	<u>Sampled Date/Time</u>	<u>Received Date/Time</u>
Moon Camp Well FP2, Fawnskin CA	Water	07/02/08 10:00	07/02/08 14:50

Analyte(s)	Result	RDL	Units	Method	Analysis Date	Analyst	Flag
<b>Solids</b>							
Total Dissolved Solids	300	20	mg/L	SM 2540C	07/08/08 14:45	hga	
<b>General Physical</b>							
Color	ND	3.0	Color Units	SM 2120B	07/03/08 19:17	sbd	
Odor	ND	1.0	T.O.N.*	SM 2150	07/03/08 19:17	sbd	
Turbidity	0.39	0.20	NTU	SM 2130 B	07/03/08 19:17	sbd	
<b>Surfactants</b>							
MBAS	ND	0.05	mg/L	SM 5540C	07/03/08 11:28	ctl	
<b>General Inorganics</b>							
Cyanide	ND	100	ug/L	SM 4500CN E	07/09/08 14:19	mds	N_pScr
Perchlorate	ND	4.0	ug/L	EPA 314.0	07/11/08 19:32	cth	
<b>Nutrients</b>							
Nitrite as N	ND	100	ug/L	SM 4500NO2 B	07/03/08 17:00	adb	
<b>Metals and Metalloids</b>							
Aluminum	ND	50	ug/L	EPA 200.7	07/08/08 15:17	lmt	
Antimony	ND	6.0	ug/L	EPA 200.8	07/09/08 17:17	ap	
Arsenic	ND	2.0	ug/L	EPA 200.8	07/09/08 17:17	ap	
Barium	ND	100	ug/L	EPA 200.8	07/09/08 17:17	ap	
Beryllium	ND	1.0	ug/L	EPA 200.8	07/09/08 17:17	ap	
Boron	ND	100	ug/L	EPA 200.7	07/08/08 15:17	lmt	
Cadmium	ND	1.0	ug/L	EPA 200.8	07/09/08 17:17	ap	
Total Chromium	1.1	1.0	ug/L	EPA 200.8	07/08/08 10:15	krv	
Hexavalent Chromium	ND	1.0	ug/L	EPA 218.6	07/08/08 18:42	jc	N_pFilt
Copper	ND	50	ug/L	EPA 200.8	07/09/08 17:17	ap	
Iron	ND	100	ug/L	EPA 200.7	07/08/08 15:17	lmt	
Lead	ND	5.0	ug/L	EPA 200.8	07/09/08 17:17	ap	
Manganese	ND	20	ug/L	EPA 200.8	07/09/08 17:17	ap	

<i>mailing</i> P.O. Box 432 Riverside, CA 92502-0432	<i>location</i> 6100 Quail Valley Court Riverside, CA 92507-0704	P 951 653 3351 F 951 653 1662 www.babcocklabs.com	NELAP no. 02101CA CA ELAP no. 1156 EPA no. CA00102
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# Appendix B



**E.S.BABCOCK & Sons, Inc.**  
 Environmental Laboratories *est. 1906*

Client Name: Geoscience Support Services Inc.  
 Contact: Diane Smith  
 Address: P.O. Box 220  
 Claremont, CA 91711

Analytical Report: Page 4 of 9  
 Project Name: Geo - Well Testing  
 Project Number: [none]

**Work Order Number: A8G0246**

Report Date: 16-Jul-2008

Received on Ice (Y/N): Yes Temp: 6 °C

Laboratory Reference Number  
**A8G0246-01**

<u>Sample Description</u>	<u>Matrix</u>	<u>Sampled Date/Time</u>	<u>Received Date/Time</u>
Moon Camp Well FP2, Fawnskin CA	Water	07/02/08 10:00	07/02/08 14:50

Analyte(s)	Result	RDL	Units	Method	Analysis Date	Analyst	Flag
<b>Metals and Metalloids</b>							
Mercury	ND	1.0	ug/L	EPA 200.8	07/09/08 17:17	ap	
Nickel	ND	10	ug/L	EPA 200.8	07/09/08 17:17	ap	
Selenium	ND	5.0	ug/L	EPA 200.8	07/09/08 17:17	ap	
Total Silica	25	5.0	mg/L	EPA 200.7	07/08/08 15:17	lmt	
Silver	ND	10	ug/L	EPA 200.8	07/09/08 17:17	ap	
Sodium	ND	1.0	ug/L	EPA 200.8	07/09/08 17:17	ap	
Vanadium	ND	3.0	ug/L	EPA 200.8	07/08/08 10:15	krv	
Zinc	ND	50	ug/L	EPA 200.8	07/09/08 17:17	ap	
<b>EDB and DBCP by EPA 504</b>							
Ethylene dibromide	ND	0.020	ug/L	EPA 504.1	07/03/08 18:23	cya	
Dibromochloropropane	ND	0.010	ug/L	EPA 504.1	07/03/08 18:23	cya	
<b>Nitrogen-Phosphorus Pesticides by EPA 507</b>							
Alachlor	ND	1.0	ug/L	EPA 507	07/07/08 20:52	kos	
Atrazine	ND	0.50	ug/L	EPA 507	07/07/08 20:52	kos	
Butachlor	ND	0.38	ug/L	EPA 507	07/07/08 20:52	kos	
Diazinon	ND	0.25	ug/L	EPA 507	07/07/08 20:52	kos	
Metolachlor	ND	1.0	ug/L	EPA 507	07/07/08 20:52	kos	
Metribuzin	ND	1.0	ug/L	EPA 507	07/07/08 20:52	kos	
Molinate	ND	0.90	ug/L	EPA 507	07/07/08 20:52	kos	
Prometryn	ND	2.0	ug/L	EPA 507	07/07/08 20:52	kos	
Simazine	ND	1.0	ug/L	EPA 507	07/07/08 20:52	kos	
Thiobencarb	ND	1.0	ug/L	EPA 507	07/07/08 20:52	kos	
Surrogate: 1,3-Dimethyl-2-Nitrobenzene	96.5	% 70-130		EPA 507	07/07/08 20:52	kos	

<i>mailing</i> P.O. Box 432 Riverside, CA 92502-0432	<i>location</i> 6100 Quail Valley Court Riverside, CA 92507-0704	P 951 653 3351 F 951 653 1662 <a href="http://www.babcocklabs.com">www.babcocklabs.com</a>	NELAP no. 02101CA CA ELAP no. 1156 EPA no. CA00102
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# Appendix B



**E.S.B.**  
E.S.BABCOCK & Sons, Inc.  
 Environmental Laboratories *est. 1906*

Client Name: Geoscience Support Services Inc.  
 Contact: Diane Smith  
 Address: P.O. Box 220  
 Claremont, CA 91711

Analytical Report: Page 5 of 9  
 Project Name: Geo - Well Testing  
 Project Number: [none]

Report Date: 16-Jul-2008

**Work Order Number: A8G0246**  
 Received on Ice (Y/N): Yes Temp: 6 °C

Laboratory Reference Number  
**A8G0246-01**

<u>Sample Description</u>	<u>Matrix</u>	<u>Sampled Date/Time</u>	<u>Received Date/Time</u>
Moon Camp Well FP2, Fawnskin CA	Water	07/02/08 10:00	07/02/08 14:50

Analyte(s)	Result	RDL	Units	Method	Analysis Date	Analyst	Flag
<b>Organochlorine Pesticides and PCBs by EPA 508</b>							
Aldrin	ND	0.075	ug/L	EPA 508	07/07/08 17:46	DF	
Chlordane	ND	0.10	ug/L	EPA 508	07/07/08 17:46	DF	
Dieldrin	ND	0.020	ug/L	EPA 508	07/07/08 17:46	DF	
Endrin	ND	0.10	ug/L	EPA 508	07/07/08 17:46	DF	
Heptachlor	ND	0.010	ug/L	EPA 508	07/07/08 17:46	DF	
Heptachlor Epoxide	ND	0.010	ug/L	EPA 508	07/07/08 17:46	DF	
Hexachlorobenzene	ND	0.50	ug/L	EPA 508	07/07/08 17:46	DF	
Hexachlorocyclopentadiene	ND	1.0	ug/L	EPA 508	07/07/08 17:46	DF	
Lindane	ND	0.20	ug/L	EPA 508	07/07/08 17:46	DF	
Methoxychlor	ND	10	ug/L	EPA 508	07/07/08 17:46	DF	
Polychlorinated Biphenyls (Total PCB's)	ND	0.50	ug/L	EPA 508	07/07/08 17:46	DF	
Propachlor	ND	0.50	ug/L	EPA 508	07/07/08 17:46	DF	
Toxaphene	ND	1.0	ug/L	EPA 508	07/07/08 17:46	DF	
Surrogate: Decachlorobiphenyl	95.5	% 70-130		EPA 508	07/07/08 17:46	DF	
<b>Chlorinated Herbicides by EPA 515.3</b>							
2,4,5-TP Silvex	ND	1.0	ug/L	EPA 515.3	07/09/08 07:05	DF	
2,4-D	ND	10	ug/L	EPA 515.3	07/09/08 07:05	DF	
Bentazon	ND	2.0	ug/L	EPA 515.3	07/09/08 07:05	DF	
Dalapon	ND	10	ug/L	EPA 515.3	07/09/08 07:05	DF	
Dicamba	ND	1.5	ug/L	EPA 515.3	07/09/08 07:05	DF	
Dinoseb	ND	2.0	ug/L	EPA 515.3	07/09/08 07:05	DF	
Pentachlorophenol	ND	0.20	ug/L	EPA 515.3	07/09/08 07:05	DF	
Pichloram	ND	1.0	ug/L	EPA 515.3	07/09/08 07:05	DF	
Surrogate: DCAA	96.3	% 70-130		EPA 515.3	07/09/08 07:05	DF	

*mailing*  
 P.O. Box 432  
 Riverside, CA 92502-0432

*location*  
 6100 Quail Valley Court  
 Riverside, CA 92507-0704

P 951 653 3351  
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NELAP no. 02101CA  
 CA ELAP no. 1156  
 EPA no. CA00102