JOSHUA TREE SOLAR SITE
PRELIMINARY HYDROLOGY STUDY

Prepared for

Joshua Tree Solar Farm, LLC
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Houston, TX 77002

WG Project Number: 1100.0002
December 2014

Prepared by

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CERTIFICATION
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INTRODUCTION AND BACKGROUND

The purpose of this preliminary hydrology study is to determine and document the potential drainage impacts of the proposed Joshua Tree Solar Farm project in San Bernardino County, California. This study documents existing conditions at the site, presents our hydrologic analysis of the project watershed, reviews the potential impacts of the proposed site development, and provides recommendations for mitigating potential impacts. This report has been prepared to comply with the San Bernardino County Hydrology Manual (SBCHM).

Joshua Tree Solar Farm, LLC proposes to construct, own, and operate a 20 megawatt (MW) solar photovoltaic (PV) generating facility located on approximately 115 acres of previously developed land, 3.5 miles east of the city of Joshua Tree and 1.3 miles north of Twentynine Palms Highway in unincorporated San Bernardino County, in the high desert region of the Mojave Desert.

The proposed project would consist of solar module arrays installed on driven piers, skid mounted inverter equipment also supported by piers, and a small switchyard. The front (south, lower) side of the arrays will maintain a 24-inch clearance from ground level. The highest point of the array (north, upper side) will be approximately 6'-6" but no higher than 8' from ground level.

The site is a recently deactivated private airport, chosen to help fulfill project objectives of strong solar resource, proximity to the utility distribution grid, ecological stewardship and overall project viability. The project site has gone through significant development, so the entire 115 acre site can be classified as "previously disturbed" and "previously developed."

EXISTING STUDIES

The following studies were reviewed and are referenced in this report:

- Jurisdictional Delineation of Wetlands/Waters Subject to Regulatory Authority, Unnamed Drainage, Assessor Parcel Numbers 0607-231-04,-07,-09,-10, -11, -12, -13, -14, -15, -18 and 0607-364-06, San Bernardino County, California. Prepared by Tetra Tech Inc., May 2012.
- County of San Bernardino 2007 General Plan – Prepared by URS Corporation, Effective April 12, 2007, Amended May 22, 2012.
- San Bernardino County Operational Area Multi-Jurisdictional Hazard Mitigation Plan – Prepared by the San Bernardino County Fire Department Office of Emergency Services, April 2005.
- A History of Significant Weather Events in Southern California – Prepared by the National Oceanic and Atmospheric Administration (NOAA), February 2010

SITE DESCRIPTION AND LOCATION

The site is located east of the community of Joshua Tree and north of Twentynine Palms highway. The project is bordered by Coyote Valley Road to the east, unpaved Fourth Street to the north, and unmaintained vacant land to the south and west. The majority of land surrounding the site is undeveloped. There are a few scattered commercial and residential developments to the east, a concrete plant adjacent to the southwest corner of the site, and some residential development to the north. The general site location is shown in Figure 1. The property is a recently deactivated private airport. The existing paved surfaces will remain in place and the existing building structures will either be demolished or repurposed. The solar arrays and ancillary equipment will occupy the majority of the site. The proposed site plan layout is shown in Figure 2.

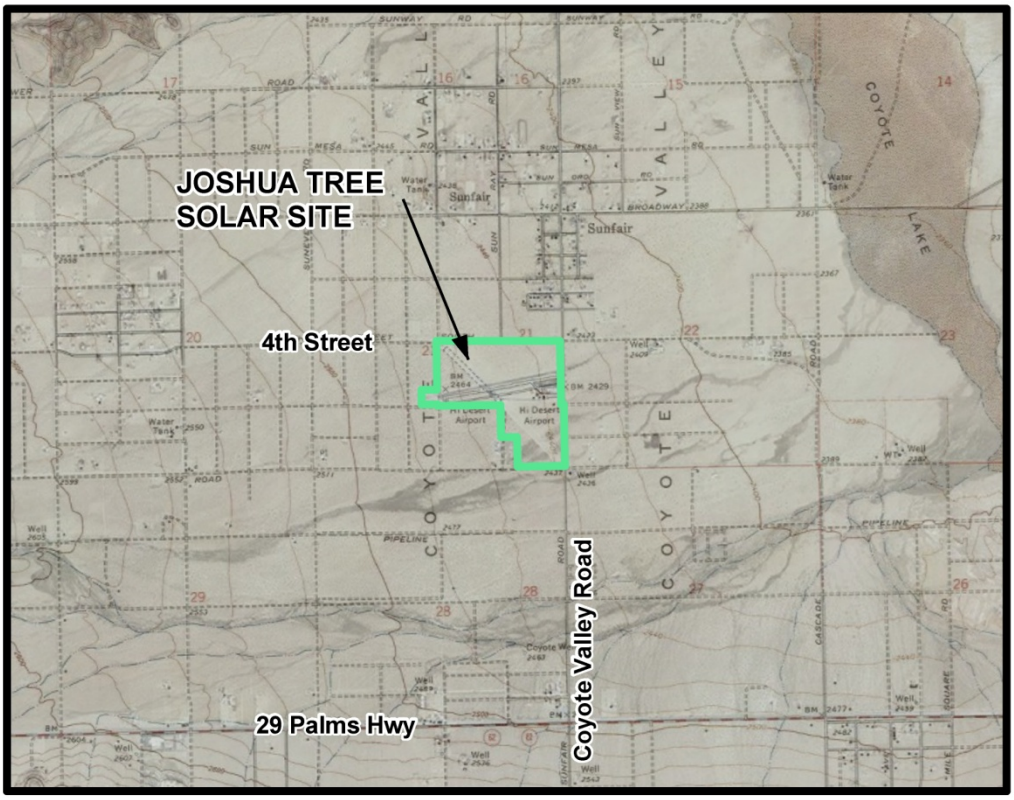


Figure 1 – Vicinity Map

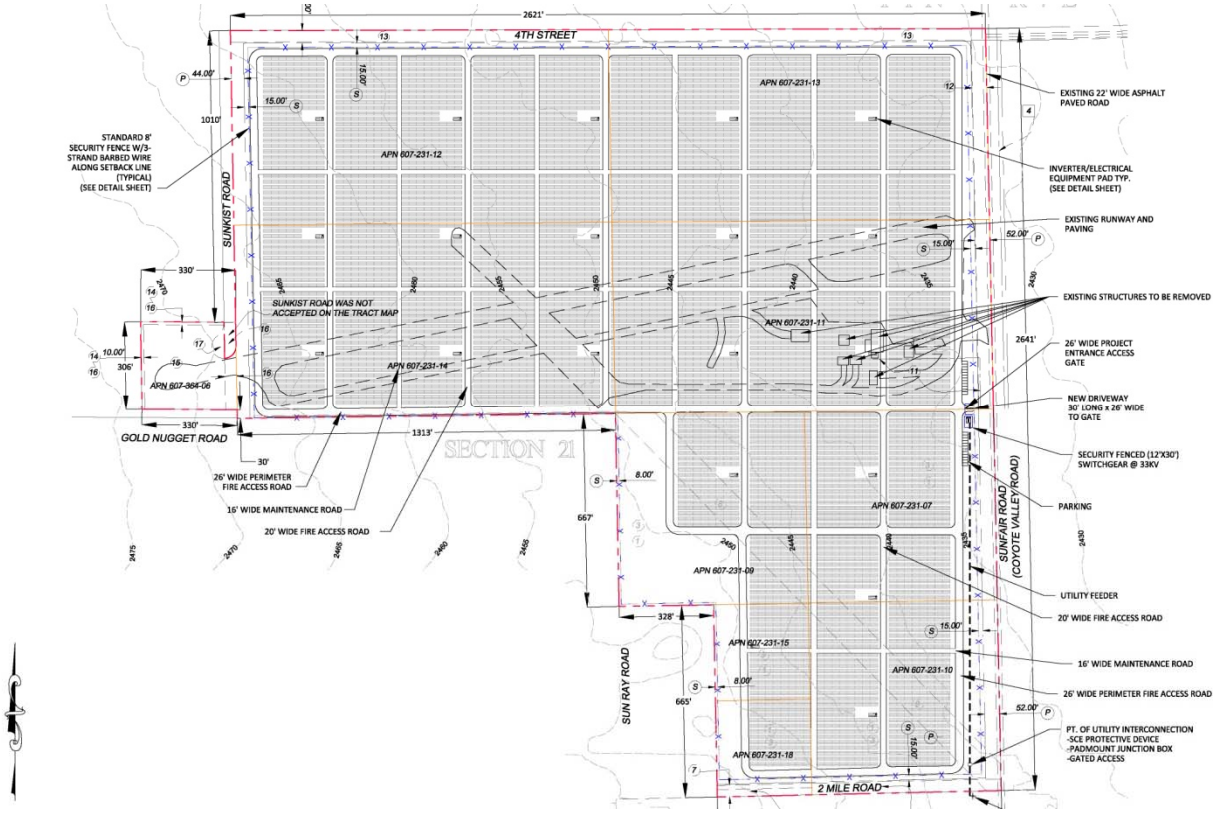


Figure 2 – Site Plan

JURISDICTION

The site is located in unincorporated San Bernardino County, and within the Planning Region boundary of the Joshua Tree Community Plan.

Flood Control Facilities

The project site is within the San Bernardino County Flood Control District (SBCFCD) Zone 6. There are no existing flood control facilities on or adjacent to the project site. The SBCFCD is in the process of completing a Master Plan of Drainage (MPD) for the Joshua Tree area, which encompasses the project site. Timing for completion of the MPD is unknown.

Jurisdictional Waters

The jurisdictional delineation conducted for the project determined that there are no drainages found on the site that are subject to regulatory authority. Per the jurisdictional delineation, no on-site drainage features and no stream flow characteristics within definable bed-to-bank features were observed.

RISK ASSESSMENT

This section discusses flooding risk assessment for the project site.

Federal Emergency Management Authority (FEMA)

The project site is not located within a FEMA defined floodplain.

The land area south of the site is located in FEMA Zone A, which is defined as areas subject to inundation by the 1-percent-annual-chance flood (100-year) event, determined using approximate methodologies. The 100-year floodplain southwest (upstream) of the project site is a FEMA Zone AE, where base flood elevations have been calculated using detailed methods.

San Bernardino County Multi-Hazard Mitigation Plan

San Bernardino County has prepared a multi-jurisdictional Hazard Mitigation Plan that assesses risk and potential damage for a variety of conditions, including flooding. According to the County document, the County has experienced severe and widespread flooding throughout its history. The following items are pertinent to the project site:

- The desert area mountain ranges experience summer thunder storms causing flash floods in many dry washes on the desert floor.
- The majority of flooding instances in the County, as well as high winds, have been related to severe thunderstorms.

NOAA Flooding History

Flooding history for the Joshua Tree vicinity is documented in the *History of Significant Weather Events in Southern California* prepared by NOAA. The following items are pertinent to the project site:

- 7.12.1954: Flash floods hit Yucca Valley. Numerous roads were severely damaged and closed. Some roads were left covered in sand and mud.
- 7.23-28.1956: Strong monsoon flow hit the region with thunderstorms each day. Roads were washed out in Joshua Tree.
- 9.3.1959: An intense thunderstorm hit east of Joshua Tree. Heavy debris flow came from the canyons, and sand more than three feet deep covered some properties.
- 8.15.1961: Extensive flash flooding washed out roads. Homes in southeast Joshua Tree were flooded.

- 8.15.1971: Heavy thunderstorms strike the Joshua Tree region. Flash flooding put debris and mud up to three feet deep on several highways around Joshua Tree city.
- 7.11-13.1999: Heavy thunderstorms in and around the higher mountains. Flooding in Yucca Valley area. Roadways closed due to flash flooding.
- 9.2-3.2003: Thunderstorms in mountains and deserts. Flash flooding and roadways flooded in Yucca Valley.

WATERSHED CHARACTERISTICS

This section presents hydrologic characteristics of the site and overall watershed.

Site Investigation

We conducted a site review and investigation on June 18, 2012, to confirm our in-office analysis and develop a better understanding of regional drainage and existing site conditions. Pertinent photos taken during the site investigation are attached as Appendix B.

Project Site Topography

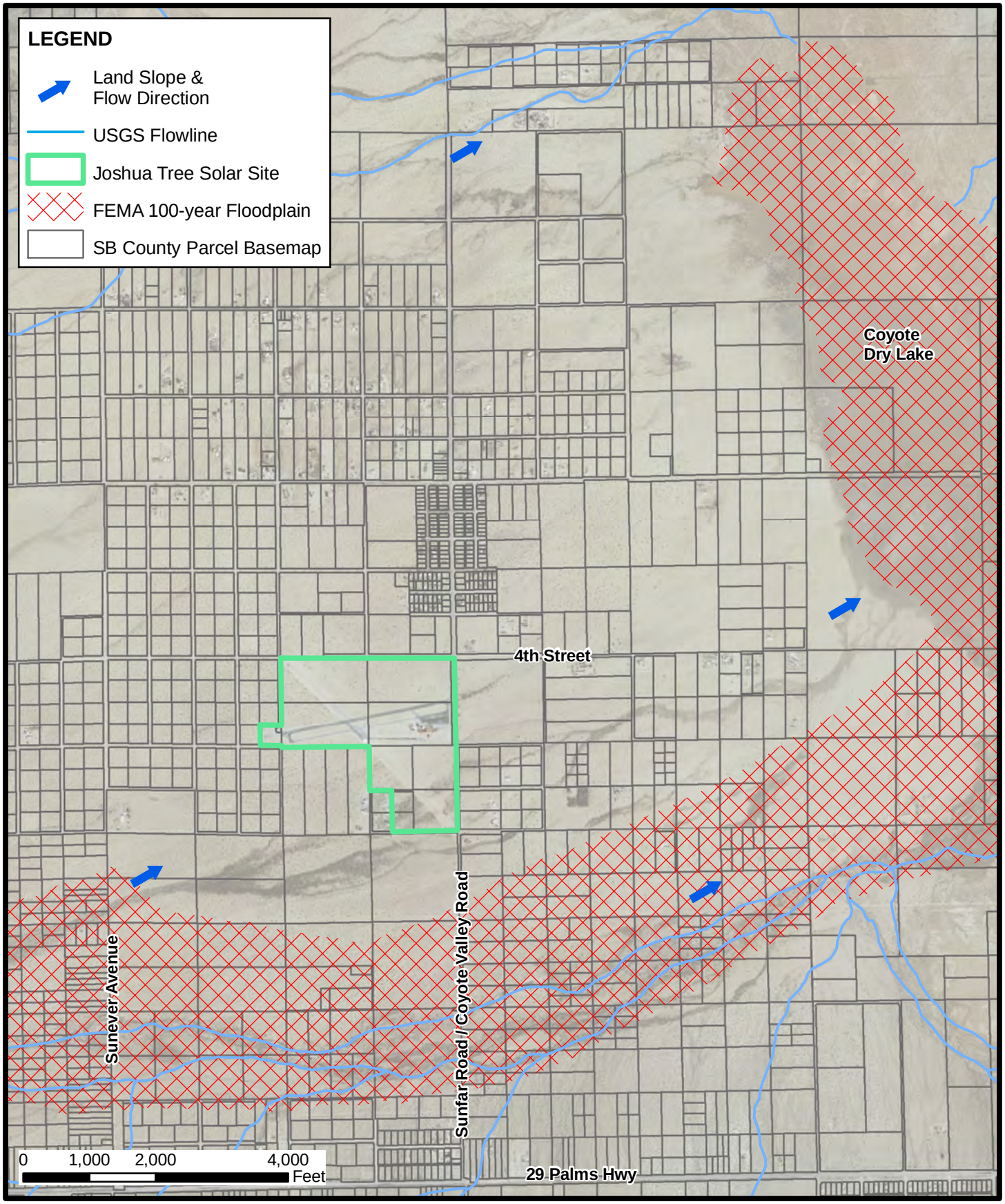
The project site and surrounding land is relatively flat, with average ground slopes between 1 and 2 percent from west to east. Site drainage is characterized by shallow sheet flow conditions, with no significant drainage channels on the site. The current composition of the existing land is best described as mostly vacant land of dirt and sand with a sparse vegetative community consisting of native grasses and shrubs. See photos 1 through 6 Appendix B for typical sheet flow conditions across the site.

Project Site Watershed

The Joshua Tree solar site is located in the southeastern Mojave desert, within the Southern Mojave watershed in the Colorado River basin. The site is north of Coyote Wash, a regional drainage which collects flow from a large watershed and terminates at Coyote Dry Lake east of the site. Through floodplain modeling we have determined that a portion of the stormwater flow from Coyote Wash reaches the site. Therefore, the site watershed is the area tributary to the Coyote Wash, which includes Yucca Creek. The Yucca Creek drainage area encompasses 174 square miles, as described in the FEMA Flood Insurance Study 06071CV001A (FIS) for San Bernardino County. The watershed extends west from Coyote Lake across the majority of the town of Yucca Valley, and south into the mountains between Yucca Valley and Palm Springs. Refer to Figure 3 on the following page for a map of the site and regional drainage features.

Regional Drainage Patterns

The drainage channels upstream from the site are characterized by shallow depths with meandering and braided alignments. Based on this channel type, it is anticipated that existing upstream channels will have a tendency to shift location over time. Sediment deposition from prior storm events can decrease channel capacity, and cause floodwaters to form new channels, or overflow to other nearby channels. Of particular concern is the current “flow split” near the intersection of Pipeline Road and Rice Avenue. At this location a smaller secondary drainage channel breaks away from the Coyote Wash and flows toward the site. The unimproved Coyote Wash has the potential to shift course at this flow split and direct additional flood flow toward the project site. If a full diversion of flow occurred upstream of the site, the increased flood flow could result in significant site impacts, particularly to the southern half of the site. This is a risk to be considered in the course of project design, and alleviation would require considerable improvements and/or maintenance to the Coyote Wash upstream of the site. Offsite improvements of the Wash are not anticipated as a part of this project. See photos 21 and 22 Appendix B, of the Coyote Wash south and west of the site.



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1 inch = 2,000 feet

FIGURE 3:
REGIONAL DRAINAGE MAP

JOSHUA TREE SOLAR SITE
PRELIMINARY HYDROLOGY STUDY

JOB NO: 1100.0002
MAP DOC: HYDROLOGY
CREATED BY: VGH
DATE: JULY 2012

EXHIBIT NOTES:
BASEMAP BY USGS.
WALLACE GROUP DID NOT PERFORM SURVEY SERVICES FOR THIS MAP.

Prepared For

Joshua Tree Solar Farm, LLC

Hydrologic Parameters

Hydrologic data for the Coyote Wash, including peak flow, depth, and velocity, is based on the FIS. Due to the significant size of the regional watershed and the scale of study required to evaluate regional hydrology, we have referenced data contained in the FIS and have not performed hydrologic calculations as a part of this study.

The FEMA detailed study for Yucca Creek extends to Sunever Avenue, approximately ½ mile upstream of the project site. The additional tributary area between Sunever Avenue and the site is insignificant compared to the 174 square mile tributary area upstream of Sunever Avenue; therefore the upstream flow peak flow rate is applicable to the site. Table 1 provides a summary of peak flow for the Coyote Wash, as listed in the FIS.

Table 1 – Hydrologic Data Summary

RETURN INTERVAL (YEAR)	FEMA PEAK RUNOFF RATE (CFS)
10	5,500
50	22,000
100	30,000

Proposed Site Hydrology

The project site has gone through significant development, so the entire 115 acre site can be classified as “previously disturbed” and “previously developed.” As such, the project has the advantage of repurposing otherwise unused (but developed) property rather than new development of undisturbed land. Where possible and feasible, existing structures will be reused or recycled. All concrete structures (hangar aprons, foundations, and slabs) are expected to be demolished and removed. All paved areas will be left in place.

It is anticipated that stormwater runoff will not increase compared to existing conditions, as construction of new impervious surfaces will be minimal, and in some cases existing impervious surfaces are to be removed. The only permanent concrete slab foundations will be for the switchgear; all other foundation elements will be driven steel piers. While the solar panels are impervious, the panels are separated and elevated from the ground surface. Any precipitation that falls onto a solar panel will run off on the soil and either infiltrate or run off the site as it has done historically. In addition, proposed roads are not paved and will allow for infiltration.

FLOODPLAIN ANALYSIS

A preliminary floodplain model was developed to analyze stormwater flow across the site.

Methodology

The floodplain model was created using the software program FLO-2D. This program is a dynamic two-dimensional flood routing model that is FEMA approved for riverine studies and unconfined flood analysis.

Basis of Model

The following inputs formed the basis of the floodplain model:

- Upstream Limits: The study area begins approximately 1,000 feet upstream of Sunever Avenue, in order to include a portion of the FEMA Zone AE floodplain upstream from the project site.
- Downstream limits: The model extends approximately 800 feet downstream of the east project site boundary (Coyote Valley Road).
- Grid Size: A grid size of 25-feet by 25-feet was chosen to accurately represent variations in flood depth and velocity. Based on the average ground slopes of 1 to 2 percent in the study area, average ground elevation is anticipated to differ by 3 to 6 inches across one model grid element.
- Topography. The modeled surface was developed from two sources: two foot contour lidar data from Airborne 1 Corporation that covers approximately 290 acres south of the project site, and a digital terrain model purchased from Intermap Technologies Inc with a stated 5-meter grid resolution and 1-meter vertical accuracy. The purchased elevation data was reviewed with respect to the two-foot contour lidar data. In addition, cross sections of the purchased topography were analyzed using AutoCAD Civil 3D® for comparison to the FEMA defined Zone AE floodplain limits and work maps obtained through the SBCFCD. This review confirmed the purchased topographic data correlated well with both the 2-foot contour data and topographic work maps.
- Peak Flow: The peak 100-year and 10-year flowrate as listed in the FEMA FIS were distributed equally to each upstream grid element within the FEMA defined floodplain.
- Flow Hydrograph: A schematic hydrograph was developed to represent only peak flow across the project site. A total hydrograph duration of 7 hours was chosen to ensure that peak flows reached the downstream study limits.
- Surface Roughness: A Manning's n value of 0.050 was assigned to each cell based on the overbank n value listed in the FEMA FIS. A second model run was developed using a Manning's n value of 0.035 to assess model sensitivity for n factor modifications.
- Area Reduction Factors: Within FLO-2D a reduction factor accounts for obstructions to flow such as buildings, walls, and other above ground features. Above ground obstructions can redirect flood flow, altering flow direction, depth, and velocity. For model development we assumed unconfined, full flow conditions across the study area (no reduction factor applied). There may be a slight area reduction effect due to existing buildings and other minor features such as utility poles; however due to the shallow widespread nature of flow across the study area these features are considered negligible for the purposes of this study.

Model Results – Existing Conditions

The FLO-2D model results were evaluated for maximum flood depth throughout the study area. See Appendix A for exhibits of the flood model results.

Overall, the modeled floodplain limits matched closely to the FEMA Zone AE floodplain limits, which were derived using a similar detailed modeling methodology. Downstream of Sunever Avenue (FEMA detailed study limits) the modeled floodplain diverges from the FEMA Zone A floodplain and shows floodwater flowing north and northeast across the project site. The southern modeled floodplain boundary and FEMA floodplain boundary correlate closely throughout the study area. The modeled floodplain flow also correlates well to drainage pathways visible on aerial imagery of the study area. A field review of drainage conditions confirmed that in general the flood model adequately represents sheet flow conditions across the site; however due to the accuracy of the topographic data used the flood model may not capture enough detail to be representative of smaller storm events.

Model Results – Proposed Conditions
A proposed conditions model was developed to review flood depths based on proposed site grading. See Appendix A for exhibits of the flood model results. Site grading was designed to spread storm water flow across the site, to minimize depth of flow and maximize sheet flow conditions. The model results demonstrate that with the proposed grading the desired sheet flow conditions are achieved with minimal to no change in the drainage patterns downstream from the project.

It is important to note that the modeled flow across the site represents existing topographic conditions upstream of the project. It is anticipated that upstream unimproved channels will move and shift over time, which may also change the locations of stormwater flow on the project site. Of concern is the potential for additional flood flow to be directed towards the site at the existing "flow split", where a smaller secondary channel breaks away from the Coyote Wash and flows toward the site.

EROSION ASSESSMENT
A preliminary assessment of general erosion was performed for the project site, based on available soils information and observed site conditions.

Site Soils
The National Resource Conservation Service (NRCS) has not completed soil mapping in the project vicinity. The County General Plan describes soils in the Desert Region as predominantly sandy gravel with high runoff coefficients and fast percolation. The soil maps included in the County Hydrology Manual classify site soils as hydrologic soil group (HSG) B, also indicating that relatively high infiltration rates are expected.

We observed that site soils are characterized by a thin crust that forms over the surface, likely due to silt content. However, the site soil was very loose where disturbed. The crust appears to protect against wind and water erosion, but when the crust is broken, or its protective capacity exceeded, the soil is essentially loose sand and is highly erosive. Even the crusted soil would likely flow (erode and deposit) under faster moving sheet flow conditions. See photos 19 and 20 Appendix B for typical soil conditions.

Existing Site Erosion
We observed a single area of the site with definite signs of erosion. This existing erosion is on the graded dirt runway east of the concrete plant. We believe the cause of this erosion to be change in grade, as the cross slope across the runway at this particular location is steeper than the surrounding areas. Where the runway cross slope flattens out again the erosion ended and evidence of ponding and sheet flow was observed. This further confirms our view that slope is the main factor for erosion at this location. Lack of vegetation may also contribute to the erosion, however the majority of sheet flow areas onsite also have sparse vegetation and therefore the presence or absence of vegetation likely plays a lesser role in erosion compared to land slope. See photos 7 through 10 Appendix B for existing site erosion.

We anticipate that under typical dry conditions, onsite soils will infiltrate the majority of smaller, more frequent rain events, thereby limiting the potential for erosion. However, the desert climate will produce heavy rain and thunderstorms on a more infrequent basis. Intense rain and runoff from thunderstorms can lead to dramatic erosion, especially under saturated conditions. The existing erosion area along the dirt runway is a good example of the type of erosion that could occur throughout the site due to less frequent, and more intense, storm events. The site may undergo many years with little to no erosion, dependent on weather conditions. However,

based on the extreme weather events documented by NOAA it is reasonable to assume that a thunderstorm and/or flash flood will occur during the lifespan of the project.

Erosion Prevention and Mitigation
Based on our observations of existing site conditions, the recommended method to reduce ongoing stormwater erosion is to perform grading to flatten the areas with slopes susceptible to erosion. We have observed other solar plants in desert regions experience erosion in sheet flow areas based on subtle changes in slope. For final design we recommend detailed survey to confirm slopes that are associated with the existing site erosion, and verification that final grading design will reduce cross slope across the eroded area of the site.

Another consideration for erosion is the potential effect of stormwater dripping off of the solar panels. Evaluation of the panels during the operating term could be useful to determine if the drip-line will break the soil's protective crust and initiate erosion channels. If erosion occurs at the panel drip line, a surface treatment such as aggregate base along the drip line could be used to help spread the water back to sheet flow conditions, minimizing erosion and any potential offsite impact.

During and immediately following construction the soils in the disturbed areas of the site are likely to be loose and susceptible to wind and water erosion. The topsoil, which contains the native seed bank, should be separated and set aside during grading and redistributed over temporarily disturbed areas. Using the topsoil will facilitate passive re-vegetation of temporarily disturbed areas. There are no formal re-vegetation plans for the site. Foregoing vegetation management is a tradeoff for utilizing other types of erosion control. A non-vegetation solution for immediate, more short term stabilization is the use of a dust palliative. A dust palliative product could serve the dual purpose of erosion and dust control, but can be detrimental to vegetation. Over time, the soil surface will likely form the same crust characteristic of the existing site conditions. The need for ongoing surface erosion control will be dependent on limits of disturbance, weather conditions during and post-construction, and how quickly the disturbed soil and vegetation return to a condition similar to existing. Specific erosion control measures will be reviewed and designed in more detail during final project design and for preparation of the Final Water Quality Management Plan and SWPPP.

SITE DESIGN
This section discusses site design relative to stormwater flow.

Site Fencing
Fencing will be installed around the perimeter of the site. The fencing will be eight feet tall consisting of a 7 foot tall chain link fence topped with approximately a one foot height of barbed wire. Desert tortoise exclusion fencing may be attached to the lower two feet of the chain link fence, and buried at least one foot, according to specifications from the United States Fish and Wildlife Service. Fencing installed in the path of stormwater flow will likely accumulate sediment and debris over time. However, since upstream drainage patterns may change over time it is not possible to determine location of flow over the life-span of the project, and some sediment accumulation is unavoidable. If sediment accumulation becomes an issue then breakaway fence panels could be installed in locations of stormwater flow, or the lower portion of the chain link fence could be replaced with a rail and post type fence that allows for passage of sediment and debris. See photo 23 Appendix B for an example photo of fencing that has been damaged due to siltation and stormwater flow.

Grading
Site grading will be solely for storm water control. The previous development significantly reduces the need for site leveling, cut and fill, and other invasive site modifications. For the vast majority of the array area, no site grading will be employed.

Site grading has been designed to spread areas of existing deeper sheet flow to a shallower sheet flow condition. It is recommended that the existing eroded area onsite is surveyed in detail during final design, to verify that proposed grading will reduce the cross slope at this location.

Roadways
Access roads will be constructed along the interior perimeter of the site and between the one-megawatt block solar arrays. It is recommended that all roadways are constructed at grade to allow for existing flow patterns to remain, and to prevent redirecting and possibly channelizing stormwater flow across the site.

PROJECT PERMITTING
This section discusses project permitting relevant to stormwater.

Storm Water Pollution Prevention Plan
A Storm Water Pollution Prevention Plan (SWPPP) incorporating Best Management Practices (BMPs) for erosion control will be prepared prior to the start of construction. During site preparation the SWPPP will be implemented and initial erosion and sedimentation controls will be installed. In addition, water truck reloading stations will be established for dust control. No retention basins or ponds will be necessary for the project. The project will also comply with applicable post-construction water quality requirements adopted by the Regional Water Quality Control Board and the State Water Resources Control Board.

Water Quality Management Plan
A Water Quality Management Plan is not required for the project, per email correspondence with staff of the San Bernardino County Public Works Department.

OPERATIONS AND MAINTENANCE CONSIDERATIONS
Once placed into service, the project will be operated on an unstaffed basis and monitored remotely with scheduled personnel visitations for security, maintenance, services, and system monitoring. Ongoing system maintenance will be minimal. Planned maintenance is expected to happen on a quarterly basis and will be scheduled to avoid peak power demand periods, and unplanned maintenance will typically be responded to as needed depending on the event.

Site Access During Flood Events
The Joshua Tree Community Plan describes the intersection of Coyote Valley Road (Sunfair Road) and Highway 62 as prone to flooding and in need of flood improvements (Goal JT/CI 1.10). This intersection is the main access south of the site, and therefore flooding has the potential to limit site access during rain events.

Flash Flooding
The proposed project site is located in a region with potential for flash flooding. If a flash flood does occur due to upstream rainfall, the site could experience stormwater flow even if it is not raining onsite. It is recommended that a standard protocol be developed for contacting personnel responsible for onsite operations and maintenance in the case that flash flooding conditions are predicted.

Maintenance Related to Storm Events

In addition to the planned quarterly site maintenance schedule, it is recommended to review site conditions before and immediately following storm events. The pre-storm maintenance should include removal of sediment and debris that may have built up along site fencing. An example photo of fencing that has been damaged due to storm flows is included in Appendix C. The post-storm field review is recommended to include inspection for unanticipated surface erosion and inspection of the site fencing for sediment accumulation. Maintenance for erosion channels may require temporary removal of some solar panels to allow for equipment access under the panels themselves. These inspections will be most critical immediately following construction when the soils have been recently disturbed. Over time the soils may likely form the protective crust that exists onsite now, creating some erosion protection for smaller storm events. Once the site is stabilized following construction, the inspections may be able to be limited to larger more unusual storm events.

CONCLUSION AND RECOMMENDATIONS

Overall, the Joshua Tree solar site is well suited for a solar array installation. The site has been previously disturbed, and therefore has the advantage of repurposing otherwise unused (but developed) property rather than new development of undisturbed land. The proposed development is designed to maintain existing sheet flow conditions, and is not anticipated to increase stormwater runoff.

Site grading is solely for stormwater control, and has been designed to spread existing sheet flow into a shallower sheet flow condition. For the vast majority of the site array area no site grading will be employed. A flood model has been prepared to evaluate sheet flow conditions for existing and proposed site conditions, and demonstrates that proposed grading has minimal to no impact on downstream drainage patterns.

Site soils are characterized by a crust that protects from wind and some water erosion. However, once the crust is broken or otherwise disturbed the soils are very loose and susceptible to erosion. Based on our site review we believe that the most important factor in limiting long term erosion potential is land slope. There is a single area of the site that has eroded, along the existing dirt runway. Based on our visual inspection the erosion appears to be caused by a steeper cross slope than the surrounding land. During final design it is recommended to obtain detailed topographic information at this erosion location, to verify cross slopes and confirm that proposed grading will lessen the slope in this location.

During and immediately following construction the disturbed site soils are anticipated to be susceptible to erosion. Potential mitigation methods include vegetative cover (limited based on climate and water availability) or a dust palliative. Construction erosion control BMPs and post construction BMPs will be selected and designed as a part of the final design process, and for the development of the WQMP and SWPPP.

Site maintenance should include pre and post storm event inspections, and repairs if necessary. Pre-storm inspections should include the removal of any silt or debris that may have accumulated along the site fencing, which could block stormwater flow paths. Maintenance of the fencing could be minimized by installing a fence designed to pass the majority of debris, such as a post and rail configuration below the chain link. Post-storm inspections are required to evaluate erosion that may have occurred on the site. Once the site is stabilized following construction, the inspections may be able to be limited to larger more unusual storm events.

We anticipate that the majority of storms will be infiltrated into the ground surface or result in minor runoff that does not cause significant erosion. The site may undergo many years with little to no erosion, dependent on weather conditions. However, based on the extreme weather events documented by NOAA it is reasonable to assume that a thunderstorm and/or flash flood will occur during the lifespan of the project, which could result in erosion channels forming through flood paths. Maintenance for erosion channels may require temporary removal of some solar panels to allow for equipment access.

There is potential for the unimproved Coyote Wash to shift alignment during a large storm event and direct flood flows towards the project site. This is a risk for the project site, and alleviation of this risk would require considerable improvements or ongoing maintenance to the Coyote Wash upstream of the project site. Offsite improvements of the Wash are not anticipated as a part of this project.

LIST OF ACRONYMS AND TECHNICAL TERMS

1% ANNUAL CHANCE FLOOD: Commonly known as the 100-year flood or the base flood, it is the flood that has a 1% chance of being equaled or exceeded in any given year. The boundaries and depths of this flood are shown on maps or published by FEMA.

2% ANNUAL CHANCE FLOOD: Commonly known as the 50-year flood. Not shown on maps or published by FEMA.

4% ANNUAL CHANCE FLOOD: Commonly known as the 25-year flood. Not shown on maps or published by FEMA.

10% ANNUAL CHANCE FLOOD: Commonly known as the 10-year flood. Not shown on maps or published by FEMA.

50% ANNUAL CHANCE FLOOD: Commonly known as the 2-year flood. Not shown on maps or published by FEMA.

ACOE: Army Corps of Engineers.

AMC: Antecedent Moisture Condition. An empirical coefficient representing the changes in soil infiltration after subsequent storms.

BMP: Best Management Practices. These methods prevent or reduce the movement of sediment, nutrients, pesticides, and other pollutants from land to surface or groundwater. CASQA has published guidelines which quantify the effectiveness of these methods.

C: Runoff coefficient. An empirical coefficient representing a relationship between rainfall and runoff.

CASQA: California Stormwater Quality Association.

CFS: Cubic Feet per Second. This is a common unit of flow measurement in hydraulic analysis.

CN: Curve Number. An empirical coefficient representing a watershed, and is based on the land use, soil type, ground cover, and other factors. See NRCS.

DFG: Department of Fish and Game.

FEMA: Federal Emergency Management Agency.

FIRM: Flood Insurance Rate Map. The FIRM is an official map published by FEMA indicating boundaries and depths of flooding in a 1% chance (100-year) flood. Also referred to as the “FEMA map”.

FPS: Feet per Second. This is a common unit of velocity in hydraulic analysis.

I: Intensity of rainfall for the time of concentration for a selected storm.

LOMR: Letter of Map Revision. An application for a LOMR is a formal process requesting a change to the official flood map (FIRM) published by FEMA.

“n”: Manning’s n. An empirical coefficient representing the roughness or resistance of a conveyance system to the flow of water in it.

NOAA ATLAS 14 MAPS: Precipitation frequency atlas maps published by the National Oceanic and Atmospheric Administration.

NRCS: Natural Resource Conservation Service, formerly known as the Soil Conservation Service (SCS).

RWQCB: Regional Water Quality Control Board.

TC or Tc: Time of Concentration. This is the time required for runoff to flow from the most hydraulically remote part of the drainage area to the point under consideration.

WSE: Water surface elevation.

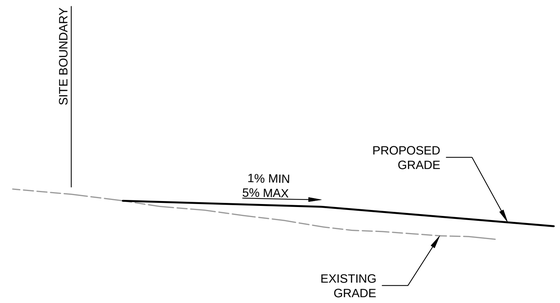
APPENDIX A

Flood Model Exhibits and Preliminary Grading Plan

FILE NAME: 1100-0002-RGP-AIRPORT.DWG

FOR REDUCED PLANS
ORIGINAL SCALE IS IN INCHES
0 1 2 3
5

1 PLAN VIEW



A TYPICAL GRADING SECTION

NTS

LEGEND

EXISTING	PROPOSED	DESCRIPTION
		MINOR CONTOUR
		MAJOR CONTOUR
100.00 EG	100.00 FG	SPOT ELEVATION
(2.00) %	2.00 %	SLOPE PERCENTAGE

SITE LOCATION & SWPPP IDENTIFICATION

5500 SUNFAIR ROAD
JOSHUA TREE, CA 92252
ASSESSOR PARCEL NUMBERS: 0607-231-07,-09,-10, -11, -12, -13, -14, -15, -18 AND 0607-364-06
WDID NUMBER: TO BE OBTAINED PRIOR TO CONSTRUCTION

GRADING QUANITITES

THE FOLLOWING SOIL QUANTITIES ARE ESTIMATES ONLY AND ARE NOT ADJUSTED FOR REMOVAL OF VEGETATION OR FOR ROCK INCURRED DURING EXCAVATION. QUANTITY ESTIMATES SHOWN ON THESE PLANS ARE INTENDED TO BE USED FOR PROJECT PERMITTING PURPOSES ONLY. NET FILL VOLUME IS ADJUSTED FOR AN ESTIMATED 20% SHRINKAGE FACTOR.

CUT = 9,900 CUBIC YARDS MAX DEPTH OF CUT = 2.2 FT
FILL = 8,250 CUBIC YARDS MAX DEPTH OF FILL = 2.3 FT
ADJUSTED FILL = 9,900 CUBIC YARDS
NET (ADJUSTED) = 0 CUBIC YARDS CUT/FILL
DISTURBED AREA = 25.9 ACRES (1,128,000 SF)

GENERAL EARTHWORK NOTES

1. TOPSOIL SHALL BE REMOVED AND REPLACED IN ALL GRADING AREAS. STOCKPILED TOPSOIL SHALL BE PROTECTED FROM WIND AND WATER EROSION.
2. ALL EARTHWORK SHALL BE CONDUCTED IN ACCORDANCE WITH THE CURRENT SAN BERNARDINO COUNTY STANDARDS AND SPECIFICATIONS.
3. EARTHWORK WITHIN THE RIGHTS-OF-WAY OF THE COUNTY ROAD DEPARTMENT OR OTHER GOVERNMENTAL AGENCY HAVING JURISDICTION SHALL BE CONDUCTED IN ACCORDANCE WITH THE REQUIREMENTS AND PROVISIONS OF THE PERMITS ISSUED BY THOSE AGENCIES FOR CONSTRUCTION WITHIN THEIR RESPECTIVE RIGHTS-OF-WAY.

TOPOGRAPHIC DATA

THE TOPOGRAPHIC DATA DISPLAYED ON THIS PLAN SHEET IS A COMPILATION OF 2-FOOT CONTOUR LIDAR DATA FROM AIRBORNE 1 CORPORATION AND A DIGITAL TERRAIN MODEL PURCHASED FROM INTERMAP TECHNOLOGIES INC WITH A STATED 5-METER GRID RESOLUTION AND 1-METER VERTICAL ACCURACY. 2-FOOT CONTOURS ARE DISPLAYED FOR REFERENCE ONLY AND MAY NOT REFLECT ACTUAL DATA ACCURACY. ELEVATIONS SHOWN ARE BASED ON NAVD 88.

PARCEL BASEMAP

THE PARCEL BASEMAP DISPLAYED ON THIS PLAN SHEET WAS PROVIDED BY THE SAN BERNARDINO COUNTY INFORMATION SERVICES DEPARTMENT IN GEOGRAPHIC INFORMATION SYSTEMS (GIS) FORMAT.

EXISTING IMPROVEMENTS

THIS PLAN SHEET DOES NOT DISPLAY INFORMATION PERTAINING TO EXISTING UTILITIES. UNLESS OTHERWISE NOTED ON THESE PLANS, EXISTING IMPROVEMENTS ARE TO REMAIN AND SHALL BE PROTECTED IN PLACE.

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612 CLARION COURT
SAN LUIS OBISPO, CA 93401
T 805 544-4011 F 805 544-4294
www.wallacegroup.us

REGISTERED PROFESSIONAL ENGINEER
VALERIE G. HUFF
No. 72426
Exp. 06-30-14
CIVIL
STATE OF CALIFORNIA

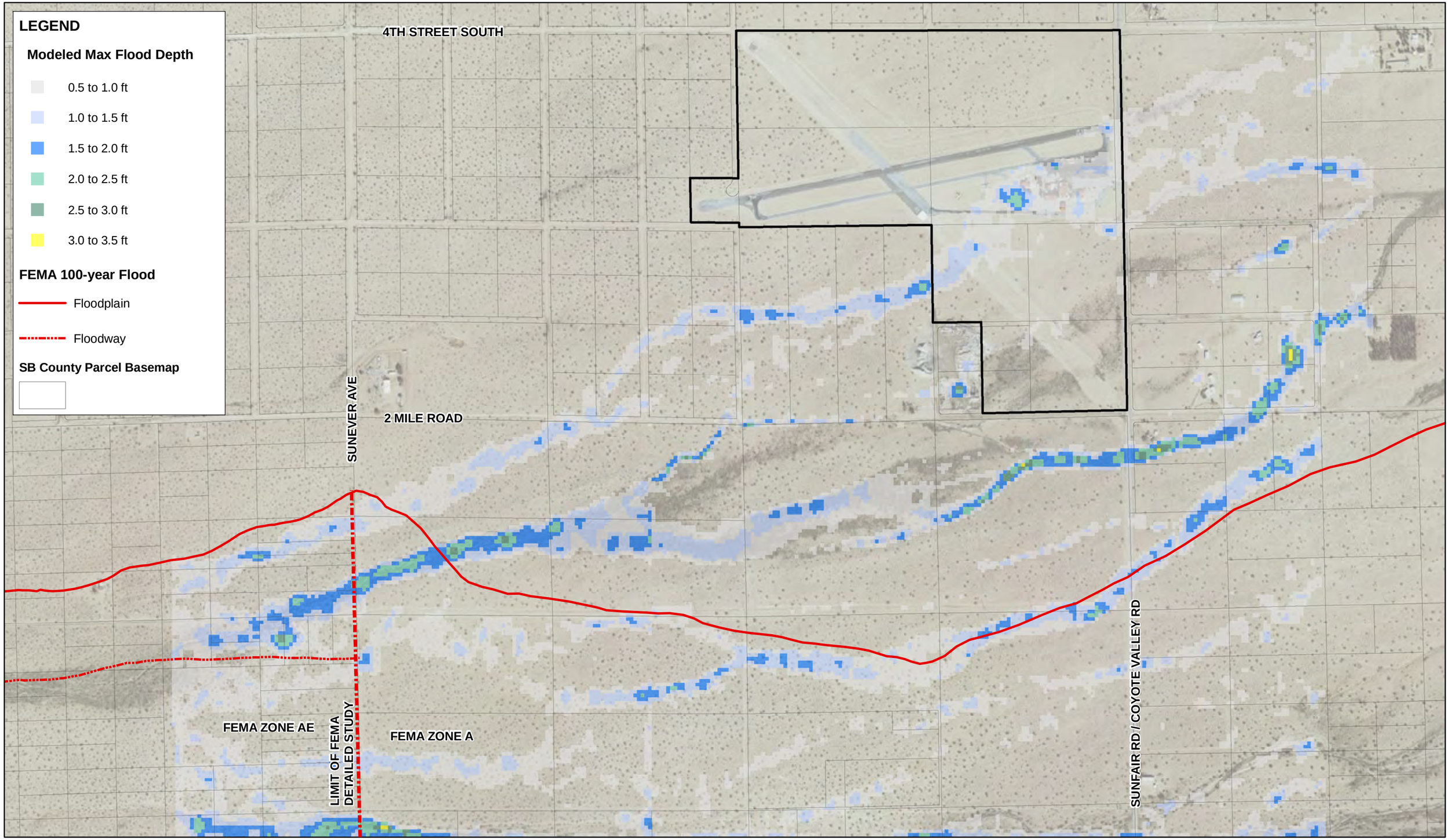
SIGNATURE
07/06/2012
DATE SIGNED

PRELIMINARY
NOT FOR CONSTRUCTION

JOSHUA TREE SOLAR FARM, LLC
JOSHUA TREE SOLAR SITE
PRELIMINARY GRADING PLAN

JOB #: 1100-0002
DESIGNERS: VGH
DRAWN BY: VGH
DATE: 07/06/2012

DRAWING NO.
C-1
1 OF 1 SHEET



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1 inch = 600 Feet

0 300 600

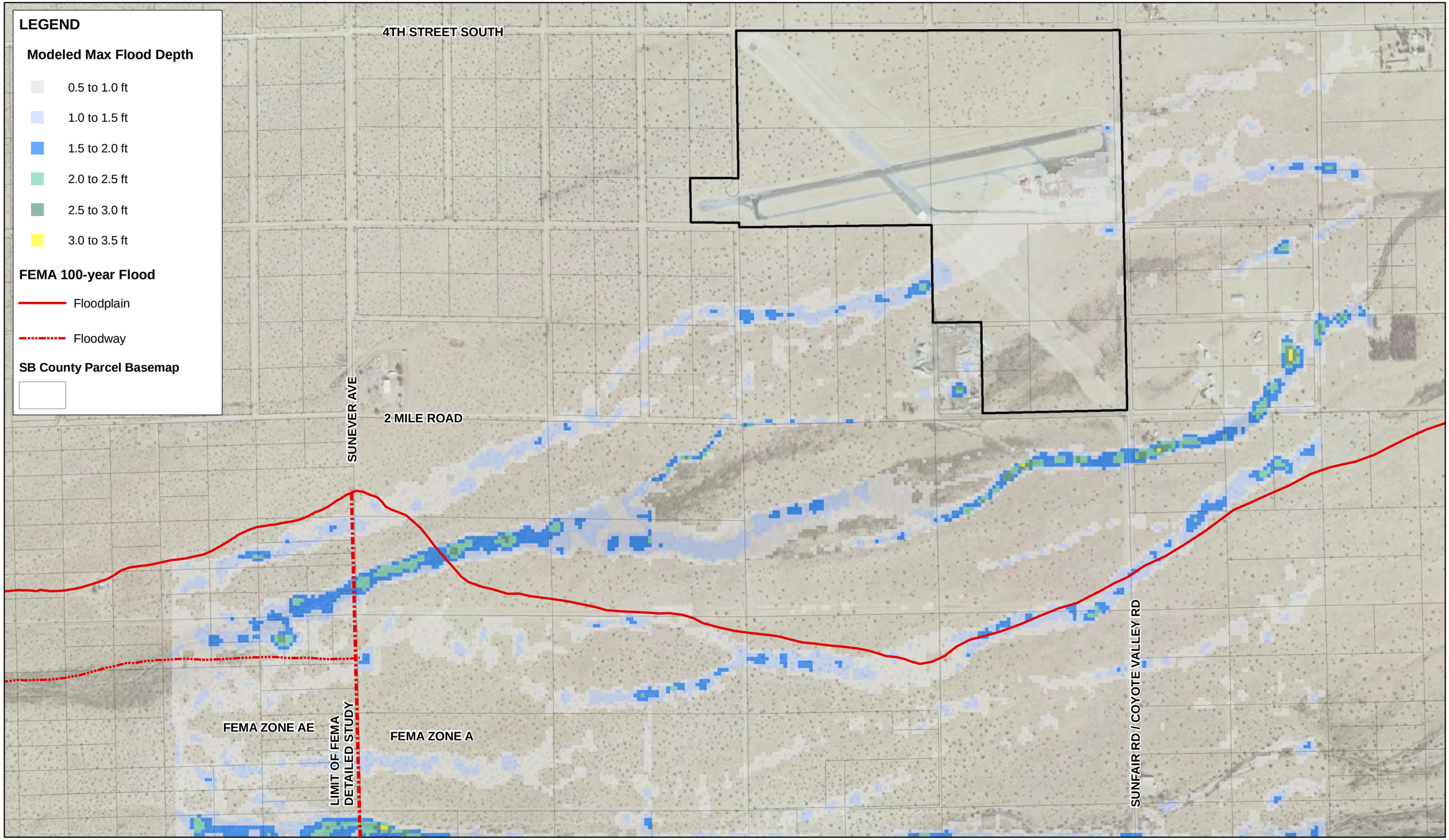
EXISTING CONDITIONS 10-YEAR FLOOD DEPTH
JOSHUA TREE SOLAR SITE

PREPARED FOR: JOSHUA TREE SOLAR FARM, LLC

DATE PREPARED:
JULY 6, 2012

JOB NO: 1100-0002
MAP DOC: JT_AIRPORT
CREATED BY: VGH
DATE: JULY 2012

EXHIBIT NOTES:
WALLACE GROUP DID NOT PERFORM SURVEY SERVICES FOR THIS MAP. NOT A LEGAL DOCUMENT.



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PROPOSED CONDITIONS 10-YEAR FLOOD DEPTH
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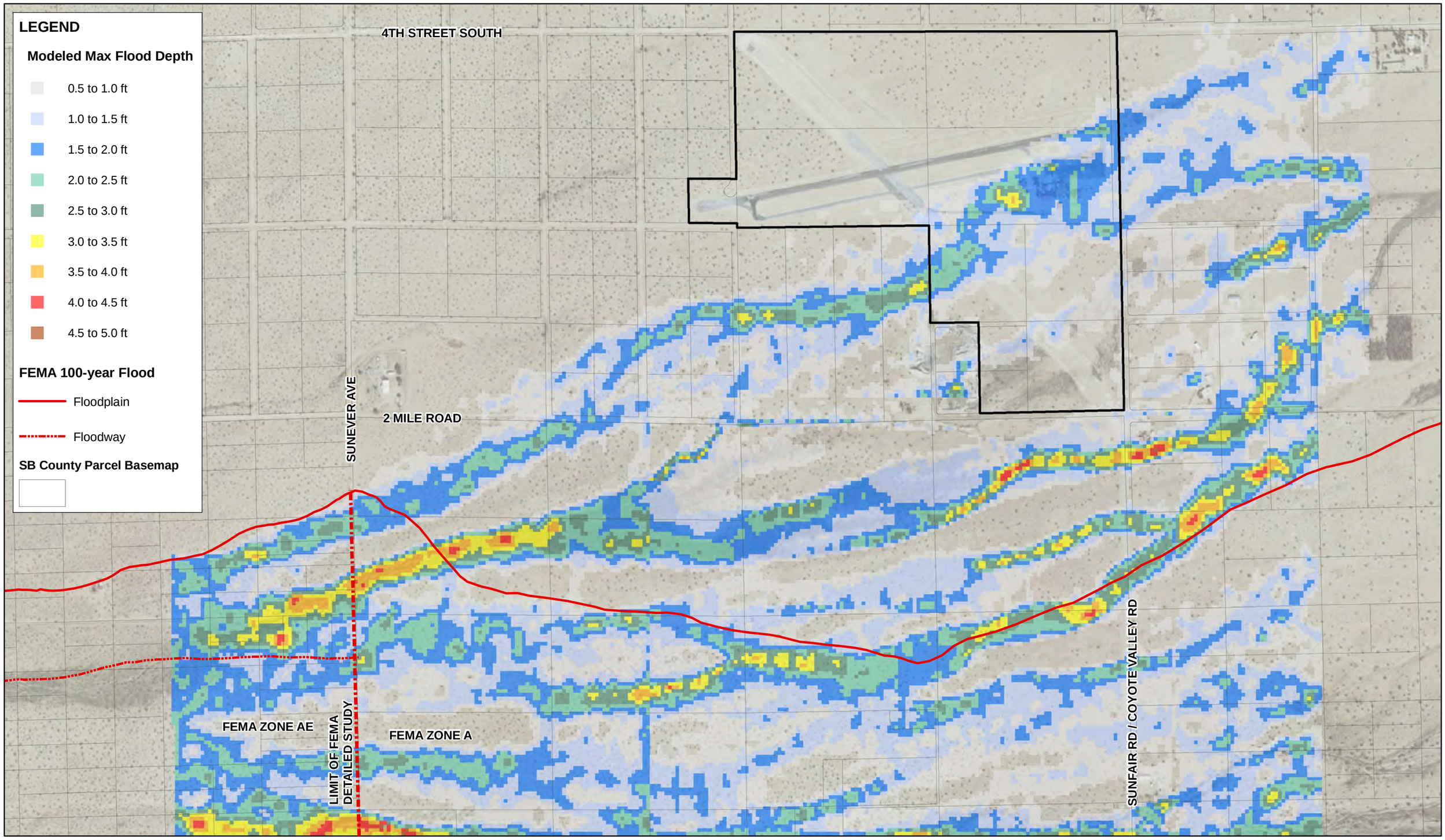

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EXISTING CONDITIONS 100-YEAR FLOOD DEPTH
JOSHUA TREE SOLAR SITE

PREPARED FOR: JOSHUA TREE SOLAR FARM, LLC

DATE PREPARED:
JULY 6, 2012

JOB NO: 1100-0002
MAP DOC: JT_AIRPORT
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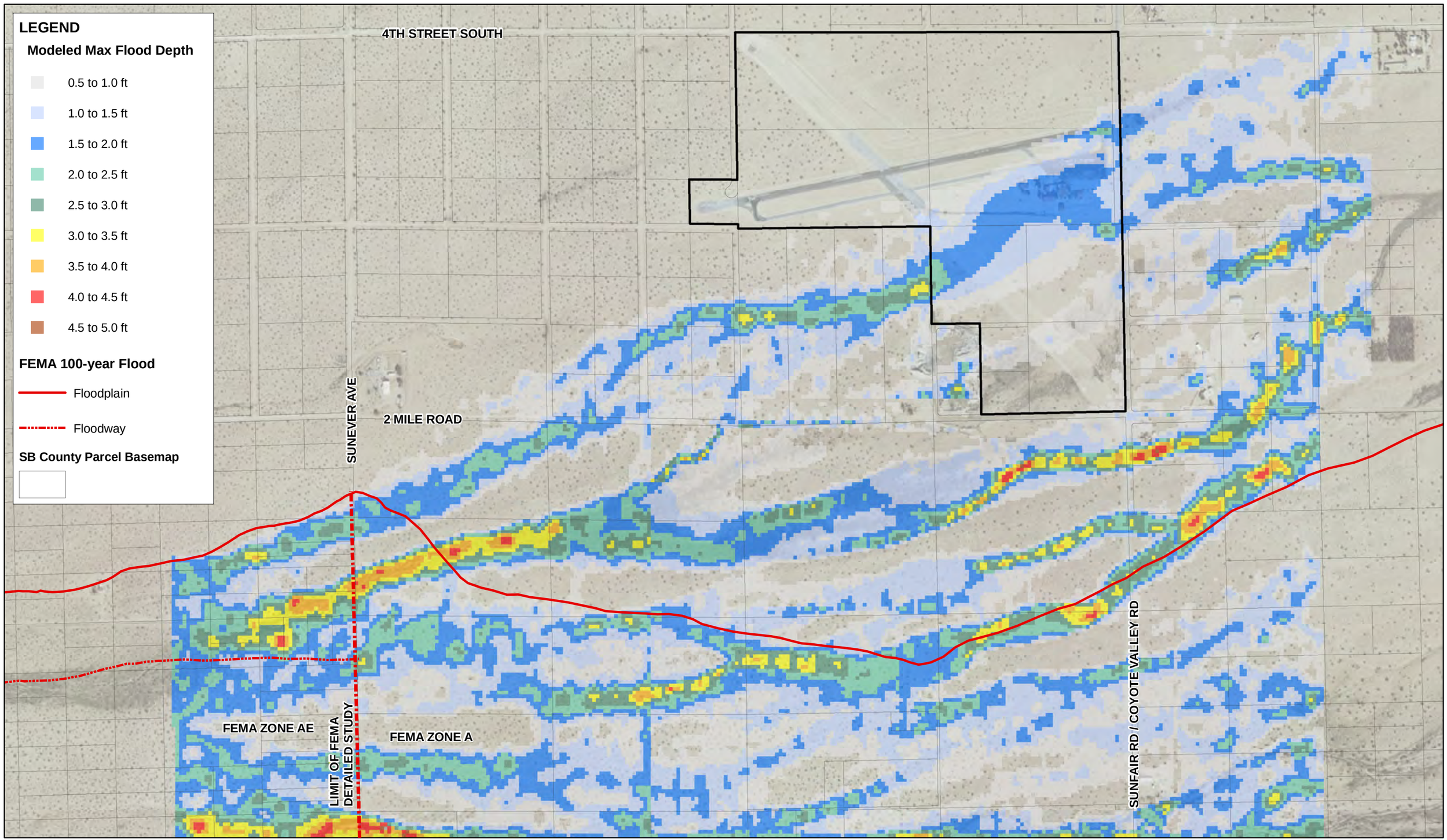

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PROPOSED CONDITIONS 100-YEAR FLOOD DEPTH
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CREATED BY: VGH
DATE: JULY 2012

EXHIBIT NOTES:
WALLACE GROUP DID NOT PERFORM SURVEY SERVICES FOR THIS MAP. NOT A LEGAL DOCUMENT.

APPENDIX B

Site Photos

WALLACE GROUP

1 inch = 250 feet

APPENDIX B
SITE PHOTO LOCATION MAP

JOSHUA TREE SOLAR SITE
PRELIMINARY HYDROLOGY STUDY

JOB NO: 1100.0002
MAP DOC: HYDROLOGY
CREATED BY: VGH
DATE: JULY 2012

EXHIBIT NOTES:
BASEMAP BY USGS.
WALLACE GROUP DID NOT PERFORM SURVEY SERVICES FOR THIS MAP.

Prepared For

Joshua Tree Solar Farm, LLC

Photo 1: Indication of sheet flow towards project site, north of concrete plant and west of graded dirt runway, looking southwest.

Photo 2: Runoff from concrete plant onto site, looking south.

Photo 3: Runoff from concrete plant onto site, looking north.

Photo 4: Concrete washout area upstream of runoff pictured above, northeast corner of the concrete plant site.

Photo 5: Indication of sheet flow onto the site, southwest corner of the site looking southwest.

Photo 6: Indication of sheet flow across the site, mixed with concrete, southwest corner of the site looking northeast.

Photo 7: Erosion across graded dirt runway, looking northeast.

Photo 8: Sheet flow just upstream from runway erosion, looking southwest.

Photo 9: Erosion across graded dirt runway, looking northeast.

Photo 10: Sheet flow downstream from runway erosion, looking northeast.

Photo 11: Offsite berm along south side of concrete plant (left side of photo) redirects flow away from the project site (channel to the right of the roadway).

Photo 12: Offsite channel erosion downstream from berm pictured above. Vertical face approximately 18 to 24 inches high.

Photo 13: Indication of sheet flow leaving project site, southeast project corner at Sunfair Road looking west (flow direction is towards viewer).

Photo 14: Offsite flow path, downstream from project site and across runway from Coyote Valley Road, looking east.

Photo 15: Offsite flow path, downstream from project site and across Coyote Valley Road, looking east.

Photo 16: Graded shoulder along east side of Coyote Valley Road, directs stormwater flow to path pictured above, looking north.

Photo 17: Offsite channel exhibits typical crust on soil surface and loose conditions where soil has been disturbed.

Photo 18: Low berm along south of project site, notice loose soil in area of disturbance.

Photo 19: Typical crust on soil surface.

Photo 20: Loose, previously disturbed soil.

Photo 21: Coyote Wash at Hollinger Road, looking east. (offsite)

Photo 22: Southern channel of Coyote Wash at Coyote Valley Road, looking west. (offsite)

Photo 23: Fence crossing desert wash that has been covered with debris and silt over time. (offsite)