Appendix G.1

Preliminary Drainage Study

Preliminary CEQA Drainage Study

Starlight Solar PDS2022-MUP-22-010

Prepared For:

Major Use Permit Area:
Assessor Parcel Number (APN)
portions of 612-082-12, 612-110-02, 612-110-04, 612-110-17, 612-110-18, 612-110-19, 612-120-01, 659-020-01, 659-020-02, 659-020-05, 659-020-06, 659-020-08, 659-080-02, 659-080-09

Gen Tie Route:
Assessor Parcel Number (APN)
portions 612-090-59, 612-090-68

Boulevard Substation:
Assessor Parcel Number (APN)
612-092-130

County of San Diego

PDS2022-MUP-22-010

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Prepared:

July 28, 2022
Revised: November 8, 2023
Revised: March 15, 2024

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Section 1 Project Description and Scope

1.1 Project Location

The proposed project includes eight (8) development areas located approximately one (1) mile south of Route 94 at the easterly terminus with Interstate 8 in un-incorporated east San Diego County. The "project site," herein refers to all respective "development areas" collectively.

The project site is located east of the Salton Sea Divide and thus ultimately drains to the Salton Sea. A Standard Development Project (SDP) SWQMP has been compiled under separate cover.

1.2 Scope of Report

This report addresses the existing and proposed hydrologic and hydraulic properties of each development area under 100-year peak flow conditions. This report includes an analysis of the respective tributary watersheds and develops 100-year limits of inundation, depth, and velocity. This report also addresses threshold of significance as defined by the California Environmental Quality Act (CEQA).

Temporary Best Management Practices (BMPs) will be discussed in the project specific Storm Water Pollution Prevention Plan (SWPPP), developed during final engineering. The SWPPP will be processed through the CA. Statewide SMARTS system. Permanent BMPs are addressed in the project specific Standard Development Storm Water Quality Management plan (SDP SWQMP), found under separate cover.

1.3 Project Site Information

Proposed development consists of a total 100 mega-watt (MW) photovoltaic electricity generating facility. Development is consistent throughout the 557.5-acre Major Use Permit (MUP) project area and primarily includes photovoltaic modules mounted on steel structures. To a lesser extent, other site features include substations, inverter pads & main transformers, electrical equipment, decomposed granite (DG) driveways and on-site DG access roads. Proposed improvements also include at-grade, concrete road crossings typically referred to as "AZ Crossings" in areas where concentrated storm water crosses an access road.

Phase 1 development will be limited to a 20 MW photovoltaic electricity generating facility within an approximate 125-acre portion of Area A. Phase 2 includes an additional approximate 456 acres of development. Infrastructure to support an additional 80 MW of photovoltaic electricity (for a total of 100 MW) is proposed in future phases to be determined. This study supports total buildout of the 100 MW facility (Phases 1 and 2) and is assumed sufficient for Phase 1 given Phase 1 is less intensive and less overall impact.

Based on the Natural Resources Conservation Service's (NRCS) Websoil Survey, the project site is comprised primarily of hydrologic soil type A. In some cases, project areas also contain hydrologic

soil type D. Refer to Appendix A for project area soil information. A geotechnical investigation was provided in June of 2022 by Bruin Geotechnical Services, Inc. and is included herein as Appendix G.

The Federal Emergency Management Agency (FEMA) has not mapped a Special Flood Hazard Areas (SFHAs) for the project site, or respective project areas. The entire project site lies within a "Not Printed" area.

The project areas and tributary areas are undeveloped and consist of scattered desert brush. Most project areas receive run-on from undeveloped tributary watersheds. Where this upstream tributary area exceeds 25 acres, the limits of 100-year inundation have been plotted on the work maps found herein. Runoff from all project areas confluences within a southeasterly-flowing, unnamed tributary to the Salton Sea.

Throughout the project areas, there are various dirt roads and scattered culverts sized for low-flow conditions. The existing culverts are not designed to convey the 100-year peak flow without overtopping, rather allow for dry-weather crossing during moderate storms. In large storms, runoff overtops the respective dirt road in all cases. A private, non-operable railroad owned by MTS separates Project Areas F and G and includes an existing 42" to-remain culvert.

1.4 Post-Development Conditions

Proposed improvements within each project area include minor grading limited to at-grade access roads, small pads for electrical equipment, and the softening of contours to support installation of the photovoltaic panels. Clearing and grubbing will be required only for proposed foundations and access roads; and will be re-established to the maximum extent practicable prior to project completion. Re-establishment in accordance with the CA. Construction General Permit will be required (i.e., minimum 70% final coverage or as defined in the current CA CGP).

New impervious area will be limited and scattered throughout each respective project area. Proposed impervious areas include concrete pads for electrical equipment, solar panel posts, and water tanks. Access roads will be constructed with decomposed granite; except where noticeable concentrated flow crosses over, concrete will be used for short lengths to reduce maintenance and prolong usage for a majority of runoff producing storm events. Break-away fencing is also proposed to prevent obstruction of flood flows and debris to accumulate. Additionally, rock-lined flow paths are proposed in specific locations through the site to protect against erosion.

Project site runoff will convey as sheet flow and shallow-concentrated flow under proposed conditions as it does under existing conditions, there is no diversion of flow. Existing on-site, private culverts will be replaced in kind and lengthened to accommodate the on-site access roads. Existing off-site, public culverts within the project vicinity (Jewel Valley Road) have been identified on the hydrologic work maps herein and will not be impacted by proposed improvements.

This report addresses the ultimate build-out condition, which will locate additional battery storage within area 'A' (northern limit of development). Two (2) detention basins are proposed in the northeastern portion of Area A to mitigate peak flow. Three (3) additional locations require peak flow mitigation and will utilize F-Type inlets, pipe storage, and orifice-controlled discharge.

An existing airstrip located south of Jewel Valley Road (between Areas A and B) will be abandoned as part of this MUP. The area will be re-established with native vegetation to the maximum extent practicable. This area will be used by the contractor as a laydown area during construction.

Section 2 Study Objectives

The specific objectives of this study are as follows:

- Quantify the pre- and post-development 100-year peak flow rates for each respective project area,
- Quantify 100-year off-site peak flow rates for each project area,
- Develop 100-year peak flow mitigation strategies,
- Develop 100-year limits of inundation, including depth and velocity, for project areas with tributary areas greater than 25 acres,
- Document compliance with CEQA thresholds of significance.

Section 3 Methodology

3.1 Hydrology

Advanced Engineering Solutions (AES – HydroWIN 2013) has been used to develop the anticipated 100-year peak flow runoff from each of the six (6) project areas and off-site tributary areas under pre and post development conditions, where watersheds do not exceed 640 acres (1 square mile).

This software utilizes the Rational Method and conforms to the hydrologic methodologies outlined in the San Diego County Hydrology Manual (SDCHM, June 2003). The Rational Method is a physically based model that calculates peak flow rates (Q) as a function of runoff coefficients (C), rainfall intensities (I), and drainage areas (A):

$$Q = C * I * A$$

Runoff coefficients (c) where established based upon guidance found in Table 3-1 from page 3-6 of the SDCHM (June 2003). Under existing conditions, runoff coefficients are based on soil type and land-use. Under proposed conditions, weighted runoff coefficients have been developed based on soil type, land-use, and proposed impervious cover. Refer to Appendix B.

Time of concentration and rainfall intensities are developed internally within the AES software. The 'San Diego' AES module has been used for this analysis and conforms to the methodologies described in the SDCHM (June 2003). Refer to Appendices B and C for AES output.

Area delineations have been developed using a combination of on-site 1' contour topography and off-site 40' and 200' contour topography obtained from aerial imaging and SanGIS.

Where tributary watersheds exceed 640 acres, the San Diego Unit Hydrology (SDUH) software has been used to develop the anticipated 100-year peak flow. This software requires input for rainfall depth, area, lag time, and adjusted curve number; and is an appropriate modeling approach based on no existing or proposed attenuation occurring via regional or on-site detention basins. Area and flow path have been determined using 40' and 200' contour topography obtained from SanGIS. An adjusted curved number based on project location and precipitation zone index has been developed using guidance found in Section 4 of the SDCHM.

3.2 Hydraulics

HEC-RAS has been used to determine the 100-year limits of inundation throughout the project site under existing and proposed conditions where the tributary area is greater than 25 acres. A uniform roughness coefficient of 0.03 has been used based field visits performed by MBI and guidance found in Table A-5 of the San Diego County Hydraulic Design Manual (SDCHDM, September 2014), refer to Appendix A. This approach is used to determine maximum permissible flow velocities and recommend rock-lined flow paths where appropriate. A roughness coefficient of 0.15 has also been used within HEC-RAS to determine the maximum water surface elevation used for establishing the minimum one (1) foot of freeboard for all structures and lowest handing mechanical equipment (i.e., solar panel at max. tilt).

A sub-critical flow regime has been used consistent with industry standards for floodplain mapping. Cross sections have been derived automatically within HEC-RAS using a surface generated from the project specific contour topography for pre- and post-development conditions.

Standard contraction (0.1) and expansion (0.3) coefficients have been used for most cross sections within HEC-RAS. Where culverts are modeled, the contraction (0.3) and expansion (0.5) coefficients have been increased consistent with modeling guidelines.

Hydraflow Hydrographs (Autodesk Civil 3D) software has been used to route 100-year peak flows for design of proposed detention facilities in the northeast portion of the site (where most proposed impervious area is located). The storage element, weir element, and orifice element were created and connected to simulate the proposed grading. Rick Engineering Company's RatHydro software was used to create a hydrograph based on results from the rational method. The peak flow rate leaving the detention basins and storage pipes is compared to the existing condition to confirm the flows are properly mitigated. Refer to Appendix D for the modelling input and output.

The proposed detention basins and sub-grade storage pipes have been designed in accordance with the County of San Diego's Hydraulic Design Manual (HDM, 2014). An emergency spillway is included along with one (1) of freeboard for the basins. Riprap energy dissipators (or equivalent) is proposed at all new pipe outfalls.

There are three (3) existing on-site pipe culverts that will be extended as part of the proposed improvements to accommodate fire access through portions of the site. One of these three will be upsized from 24" to 36" given it is located downstream of an existing 36" culvert. These culverts are identified on the work maps in Appendices B, C and F and have been included in the HEC-RAS modeling. In all cases, the existing culverts are not designed for 100-year conveyance, overtopping occurs but is limited on-site and does not impact neighboring properties.

Peak flow rates used within HEC-RAS are slightly conservative (i.e., higher) as compared to the AES hydrology developed herein. This approach will be re-evaluated during Final Engineering but is expected to have minimal, if any, impact on the results derived herein (primarily the water surface elevations used to elevate proposed infrastructure).

3.3 Hydromodification

The project site is considered exempt from hydromodification mitigation based on location (east of the Salton Sea Divide).

Section 4 Results

4.1 Hydrologic Results

The tables on the following pages summarize the hydrologic results under pre- and post-development conditions for the project areas and upstream tributary areas. Calculations are included in Appendices B and C.

Table 4-1. Summary of Pre - Development Peak Flow Rates

Project Area	Node	Tc (min)	I (in/hr)	C	A (ac)	Q100 (cfs)	V100 (ft/s)
A	106	36.6	2.2	0.20	73.4	32.2	6.0
A	128	22.0	3.0	0.20	24.2	14.7	4.1
A	129	5.0	7.9	0.20	11.3	17.9	8.5
A	156	19.4	3.3	0.20	21.0	13.8	5.2
A	166	13.4	4.2	0.20	57.3	47.9	5.4
Area A (North) Subtotal					187.2	126.5	-
A	118	28.7	2.6	0.20	51.2	26.2	3.9
A	138	28.8	2.6	0.20	89.1	45.5	3.7
A	149	21.8	3.1	0.20	108.6	66.5	4.2
A	170	5.0	7.9	0.20	13.6	21.5	9.3
A	180	5.0	7.9	0.20	7.0	11.1	9.7
Area A (South) Subtotal					269.5	170.8	-
B	216	18.3	2.9	0.20	13.2	7.6	0.9
B	226	18.4	3.4	0.20	5.7	3.9	1.5
Area B Subtotal					18.9	11.5	-
C	330	29.1	2.2	0.20	45.5	20.2	2.4
Area C Subtotal					45.5	20.2	-
D	420	53.3	1.7	0.20	73.3	25.2	2.4
Area D (East) Subtotal					73.3	25.2	-
Area D (South), E, F, G & H	550	42.1	2.2	0.20	323.0	141.5	3.0
Area D (South), E, F, G & H Subtotal					323.0	141.5	-

Table 4-2. Summary of Unmitigated Post - Development Peak Flow Rates

Project Area	Node	Tc (min)	I (in/hr)	C	A (ac)	Q100 (cfs)	V100 (ft/s)
A	106	33.9	2.3	0.23	73.4	38.9	5.8
A	128	21.0	3.1	0.23	24.2	17.5	4.3
A	129	5.0	7.9	0.23	11.3	20.5	8.5
A	156	18.4	3.4	0.23	21.0	16.4	5.5
A	166	13.1	4.1	0.23	57.3	54.5	4.4
Area A (North) Subtotal					187.2	147.8	-
A	118	28.7	2.6	0.20	51.2	26.2	3.9
A	138	28.8	2.6	0.20	89.1	45.5	3.7
A	149	21.8	3.1	0.20	108.6	66.5	4.2
A	170	5.0	7.9	0.20	13.6	21.5	9.3
A	180	5.0	7.9	0.20	7.0	11.1	9.7
Area A (South) Subtotal					269.5	170.8	-
B	216	18.3	2.9	0.20	13.2	7.6	0.9
B	226	18.4	3.4	0.20	5.7	3.9	1.5
Area B Subtotal					18.9	11.5	-
C	330	22.2	2.9	0.20	45.5	26.7	2.4
Area C Subtotal					45.5	26.7	-
D	420	53.0	1.7	0.20	73.3	25.3	2.2
Area D (East) Subtotal					73.3	25.3	-
Area D (South), E, F, G & H	550	42.1	2.2	0.20	323.0	141.5	3.0
Area D (South), E, F, G & H Subtotal					323.0	141.5	-

Impervious surfaces have been accounted for and itemized as part of the weighted runoff coefficient determination; and have been determined to not increase as a result of the proposed development for a majority of the site. In the northeastern portion of Area A, proposed impervious increases the project site runoff coefficient by 0.02 (from 0.20 to 0.23). Detention basins and sub-grade storage pipes are proposed to mitigate peak flow to less than existing conditions before runoff is discharge from the project site. Refer to Appendices B and C for hydrologic calculations and Appendix D for detention calculations.

It is understood that the DG access roads will likely result in less absorption, as compared to native ground, during the initial onset of rainfall; however, these access roads are not anticipated to impact peak flow within the confines of 100-year Rational Method hydrology. Proposed access-road width and length have been reduced to the maximum extent. Based on the limited area of non-paved road, the non-condensed layout (i.e., *spread out over the entire site, not condensed like a parking lot),* and the immediately adjacent native ground; access roads are not expected to impact the time of concentration or weighted runoff coefficient, as compared to pre-development conditions. As such, the post-development runoff coefficients are expected to remain unchanged, as they relate to determining peak flow runoff between pre- and post-development conditions for 100-year conditions.

Concrete is proposed to protect the DG access roads where natural concentrated flow crosses an access road. Ten (10) feet of rock is proposed upstream and downstream of these concrete crossings to protect the solar panel posts from any minor increase in velocity that may occur as flow crosses over the road. The associated impervious area has been accounted for in the weighted runoff coefficient determination, refer to Appendix A.

Re-establishment of existing vegetation density will be critical to substantiating no increase in post-development runoff coefficient as compared to existing conditions. The contractor shall re-establish vegetation density throughout each respective project area, consistent with pre-development conditions, prior to project completion.

Grading is limited in nature and will not impact the flow path length or time of concentration across each respective project area, as compared to pre-development conditions. On-site roughness coefficients are not expected to be impacted by proposed improvements, within the confines of the Rational Method. The addition of on-site solar posts could theoretically increase the roughness coefficient, effectively increasing the Tc and reducing the peak flow; however, this has been conservatively omitted from the hydrologic analyses.

Proposed grading is limited and will not result in the diversion of flow, as compared to pre-development conditions. Runoff will discharge from each respective project area as shallow concentrated flow, consistent with pre-development conditions.

The table below summarizes the total project site discharge between existing and proposed conditions for the portion of the project area where the runoff coefficient is increased as a result

of proposed improvements, as compared to existing. Refer to Section 4.2 for additional information on the proposed detention basin.

Table 4-3. Summary of Existing vs. Mitigated Peak Flow

Project Area	Node	EXISTING				MITIGATED			
		C	A (ac)	Q100 (cfs)	V100 (ft/s)	C	A (ac)	Q100 (cfs)	V100 (ft/s)
A (North)	106	0.20	73.4	32.2	6.0	0.23	73.4	30.2	5.8
	128		24.2	14.7	4.1		24.2	9.3	4.0
	129		11.3	17.9	8.5		11.3	14.2	8.0
	156		21.0	13.8	5.2		21.0	13.4	5.1
	166		57.3	47.9	5.4		57.3	19.8	4.9
A (South)	118	0.20	51.2	26.2	3.9	0.20	51.2	26.2	3.9
	138		89.1	45.5	3.7		89.1	45.5	3.7
	149		108.6	66.5	4.2		108.6	66.5	4.2
	170		13.6	21.5	9.3		13.6	21.5	9.3
	180		7.0	11.1	9.7		7.0	11.1	9.7
B	216	0.20	13.2	7.6	0.9	0.20	13.2	7.6	0.9
B	226	0.20	5.7	3.9	1.5	0.20	5.7	3.9	1.5
C	330	0.20	45.5	20.2	2.4	0.20	45.5	20.2	2.4
D (East)	420	0.20	73.3	25.2	2.4	0.20	73.3	25.2	2.4
Area D (South), E, F, G & H	550	0.20	323.0	141.5	3.0	0.20	323.0	141.5	3.0

The table below summarizes the off-site hydrologic results. These flow rates have been used to support mapping of the 100-year limits of inundation. Refer to Appendix E for calculations.

Table 4-4. Summary of Off-Site Peak Flow Rates

Project Node	Area (sq-mi)	Lag (hrs)	Adjusted CN	Q100 (cfs)
199	**2.89**	**0.54**	**71.4**	**1,116**
299	**1.34**	**0.54**	**76.6**	**659**

4.2 Hydraulic Results

The tables below summarize the proposed detention facilities. Refer to Appendix D for supporting calculations.

Table 4-5. Proposed Storage Pipe

Area A (North) Node 106	
Storage Pipes for Peak Flow Mitigation	
Location	Northern limit of work
Drainage Area (ac)	73.4 ac
100-YR Storage (cf)	16,093 cf
Q100 Inflow	38.9 cfs
Q100 Outflow	30.2 cfs
100-year Depth	4.99’
Storage	Dual 60”, each 410 LF
Inlet	Dual F-Type Inlets open on all sides
Outlet	24” HDWL
Drawdown (hours)	0.59 hrs

Table 4-6. Proposed Detention Basin

Area A (North) Node 128	
Detention Basin for Peak Flow Mitigation	
Location	Northeastern limit of work
Drainage Area (ac)	24.2 ac
100-YR Storage (cf)	15,263 cf
Q100 Inflow	17.5 cfs
Q100 Outflow	9.3 cfs
100-year Depth	1.9’
Side Slopes	3:1
Outlet	18” RCP with IE matching basin bottom
Emergency Spillway Crest	L= 10’
Emergency Weir Crest Elevation	2’ off basin bottom
Un-Mitigated Depth through Spillway	0.64’
Total Basin Depth	4’
Freeboard*	1.36’
Drawdown (hours)	3.1 hrs
** Measured from the un-mitigated WSE passing through emergency spillway*	

Table 4-7. Proposed Storage Pipe

Area A (North) Node 156	
Storage Pipes for Peak Flow Mitigation	
Location	Northeastern limit of work
Drainage Area (ac)	21.0 ac
100-YR Storage (cf)	3,271 cf
Q100 Inflow	16.4 cfs
Q100 Outflow	13.4 cfs
100-year Depth	3.24’
Storage	300 LF of 48” Diameter Pipe
Inlet	F-Type Inlet open on all sides
Outlet	18” HDWL
Drawdown (hours)	0.32 hrs

Table 4-8. Proposed Detention Basin

Area A (North) Node 165	
Detention Basin for Peak Flow Mitigation	
Location	Northeastern limit of work
Drainage Area (ac)	33.4 ac
100-YR Storage (cf)	39,117 cf
Q100 Inflow	33.8 cfs
Q100 Outflow	9.0 cfs
100-year Depth	1.97’
Side Slopes	3:1
Outlet	18” RCP with IE matching basin bottom
Emergency Spillway Crest	L= 15’
Emergency Weir Crest Elevation	2’ off basin bottom
Un-Mitigated Depth through Spillway	0.77’
Total Basin Depth	4’
Freeboard*	1.23’
Drawdown (hours)	6.7 hrs
** Measured from the un-mitigated WSE passing through emergency spillway*	

Table 4-9. Proposed Storage Pipe

Area A (North) Node 129	
Storage Pipes for Peak Flow Mitigation	
Location	Northern limit of work
Drainage Area (ac)	11.3 ac
100-YR Storage (cf)	1,762 cf
Q100 Inflow	20.5 cfs
Q100 Outflow	14.2 cfs
100-year Depth	3.54’
Storage	150 LF of 48” Diameter Pipe
Inlet	F-Type Inlet open on all sides
Outlet	18” HDWL
Drawdown (hours)	0.11 hrs

The results of the HEC-RAS analyses are presented in Appendix F, along with exhibits showing the flow paths and modeling cross sections. RAS Mapper has been used to facilitate mapping of the 100-year limits of inundation for existing and proposed conditions. A comparison of water surface elevations is also included in Appendix F.

Mitigation measures will be needed to elevate the proposed infrastructure above the 100-year water surface elevation (based on n=0.15) and to protect the site from erosion (based on n=0.03). Results from the HEC-RAS analyses (n=0.03) have been used to determine locations where rock-lined channels (or similar) are recommended for erosion protection. All Solar Panels will be elevated a minimum one (1) above the 100-year water surface elevation derived from the HEC-RAS modeling using n=0.15, which represents a fully vegetated, un-maintained flow path.

Summary tables are included in Appendix F comparing the water surface elevations (WSE's) for existing, proposed (n=0.03), and proposed (n=0.15) HEC-RAS analyses. Increases in proposed (0.03) as compared to existing are less than one (1.0) foot in all cases. These minor changes are limited to on-site only and do not impact neighboring properties.

The table on the following page is taken from the SDCHDM as a reference for maximum permissible velocity, which is understood to be six (6) feet per second based on site conditions. Concrete road crossings with 10 feet of rock upstream and downstream are proposed at low points along the interior, private access roads throughout the site. Break-away fencing is also proposed perpendicular to the flood ways to prevent obstruction and debris to accumulate. Location of the fencing can be found in Appendix G.

Table 4-10. County HDM Permissible Velocities

Table 5-1 Maximum Permissible Velocities for Lined and Unlined Channels

Material or Lining	Maximum Permissible Average Velocity* (fps)
Natural and Improved Unlined Channels	
Fine Sand, Colloidal	1.50
Sandy Loam, Noncolloidal	1.75
Silt Loam, Noncolloidal	2.00
Alluvial Silts, Noncolloidal	2.00
Ordinary Firm Loam	2.50
Volcanic Ash	2.50
Stiff Clay, Very Colloidal	3.75
Alluvial Silts, Colloidal	3.75
Shales And Hardpans	6.00
Fine Gravel	2.50
Graded Loam To Cobbles When Noncolloidal	3.75
Graded Silts To Cobbles When Colloidal	4.00
Coarse Gravel, Noncolloidal	4.00
Cobbles And Shingles	5.00
Sandy Silt	2.00
Silty Clay	2.50
Clay	6.00
Poor Sedimentary Rock	10.0
Fully-Lined Channels	
Unreinforced Vegetation	5.0
Reinforced Turf	10.0
Loose Riprap	Per Table 5-3
Grouted Riprap	25.0
Gabions	15.0
Soil Cement	15.0
Concrete	35.0

** Maximum permissible velocity listed here is basic guideline; higher design velocities may be used, provided appropriate technical documentation from manufacturer. Shear stress calculations are also acceptable, provided the appropriate technical justification is provided.*

Section 5 CEQA Thresholds of Significance

1. **Will the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?**

   The project will not alter the existing drainage pattern across the site. Minor grading is proposed for at-grade, non-paved access roads and small, at-grade pads for electrical equipment. Existing contours will be softened to reduce the potential for rill erosion, without diverting flow, as compared to pre-development conditions. Concrete and upstream/downstream riprap is proposed at locations where concentrated flow crosses the on-site access roads to protect against erosion.

2. **Will the project increase water surface elevation in a watercourse within a watershed equal to or greater than 1 square mile, by 1 foot or more in height and in the case of the San Luis Rey River, San Dieguito River, San Diego River, Sweetwater River and Otay River, 2/10 of a foot or more?**

   The project is located east of the Salton-Sea divide and thus does not drain to any of the listed rivers. Minor fluctuations in the 100-year water surface elevations on the order of a few tenths of a foot are anticipated through the site, as a result of the proposed project. In all cases, increases in WSE are less than one (1.0) foot. The small fluctuations in WSE's are attributed to minor changes in the roughness coefficients associated with proposed rock and concrete used for erosion protection, along with the softening of existing contours. The project will not result in a measurable impact to upstream or downstream water surface elevations outside the boundary of the project, nor will any water be diverted as a result of the project. Proposed improvements will not alter the existing hydrologic and hydraulic properties of the site. No increase in peak flow discharge is anticipated as a result of the proposed project. Small increases in impervious area (off-site cul-de-sac improvements and concrete crossings) are insignificant when compared to the total tributary area.

3. **Will the project result in increased velocities and peak flow rates exiting the project site that could cause flooding downstream or exceed the storm water drainage system capacity serving the site?**

   The project will not increase runoff velocities or peak flow rates leaving the site. Runoff will continue to flow as it does under existing conditions. The project will not cause flooding downstream, nor will it hydraulically impact downstream storm water infrastructure.

4. **Will the project result in placing housing, habitable structures, or unanchored impediments to flow in a 100-year floodplain area or other special flood hazard area, as shown on a FIRM, a County Flood Plain Map or County Alluvial Fan Map, which would subsequently endanger health, safety, and property due to flooding?**

There are no proposed housing, habitable structures, or unanchored impediments to flow proposed as part of the project. The project site is located in a FEMA Zone D, correlating with an unstudied, or "Not Printed" area. Break-away fencing is used where located in 100-year limits of inundation.

The project site does contain a tributary watershed over 25 acres (County standard for 100-year limits of inundation determination). Limits of inundation have been determined and will not be significantly impacted as a result of proposed improvements.

5. Will the project place structure within a 100-year flood hazard or alter the floodway in a manner that would redirect or impede flow resulting in any of the following:

a) Alter the line of inundation resulting in the placement of other housing in a 100-year flood hazard.

b) Increase water surface elevation in a watercourse with a watershed equal to or greater than 1 square mile by 1 foot or more in height and in the case of the San Luis Rey River, San Dieguito River, San Diego River, Sweetwater River and Otay River, 2/10 of a foot or more?

All structures located within the 100-year inundation limits have been raised a minimum one (1) foot above the 100-year WSE, consistent with County of San Diego requirements. The proposed structures do not impede flow. FEMA has not mapped a specifical flood hazard area within the vicinity of the site, nor has the County of San Diego, thus there is no floodway.

a) The project will not alter the line of inundation nor will the project place housing (or any habitable structure) within a 100-year flood hazard.

b) The project will not increase water surface elevations across the site (on private property) by more than one (1.0) foot. No change to off-site water surface elevations will occur, as compared to existing conditions. Proposed improvements will not alter the existing hydrologic and hydraulic properties of the site. No increase in peak flow discharge, as compared to pre-development conditions, is anticipated as a result of the proposed project based on the inclusion of proposed storage facilities.

Section 6 Conclusions

Proposed improvements are not anticipated to have any adverse impact on peak flow runoff, including quantity and discharge velocity. The proposed project will not substantially alter the existing drainage pattern of the project area. No substantial increase in the potential for erosion or siltation on- or offsite is anticipated as compared to existing conditions. This assertion is substantiated by no change to flow path length, time of concentration, drainage area, or runoff coefficients; as compared to pre-development conditions, for a majority of the site. A series of detention basins and sub-grade storage pipes are proposed to mitigate peak flow in the northeastern portion of Area A where proposed improvements result in an un-mitigated increase in peak flow. This un-mitigated flow is mitigated below existing conditions through inclusion of storage facilities.

The proposed project will not create or contribute enough runoff to exceed the capacity of the three (3) existing public right of way culverts beneath Jewel Valley Road (off-site). These public culverts will not be impacted by the proposed improvements.

Three (3) existing on-site culverts will be extended to accommodate the proposed fire access road. On the west side of Area B, the existing 36" pipe will be extended from 14 feet to 24 feet. On the east side of Area B, the existing 24" pipe will be replaced with a 36" pipe and extended (from 14 feet to 24 feet) to accommodate the proposed fire access road. Between Areas A and B, an existing 36" pipe will be extended from 16 feet to 26 feet.

The 100-year limits of inundation have been determined using SDCHM methodology for determining Q100, water surface elevations (HEC-RAS), and contour topography. Results from these analyses are used to assess the panel layout. All proposed infrastructure will be raised a minimum one (1.0) foot above the 100-year water surface elevation derived from the HEC-RAS analysis where channel roughness is set to n=0.15. This represents full vegetative overgrowth under a "non-maintained" scenario. Based on the lack of perennial streams on-site or within the vicinity of the proposed development, this approach is understood to be conservative.

All newly added imperious area has been accounted for in the post-development hydrologic analyses. In the NE portion of the site, the increase in impervious area requires new storage facilities to mitigate peak flow back to pre-development conditions. Elsewhere on site, the added impervious area is not enough to trigger a change in the runoff coefficient, thus no change to peak flow, as compared to pre-development. Minor off-site improvements are proposed east of the solar panels and consist of cul-de-sac improvements to Jewel Valley Road. This added impervious area (roughly 776 SF) is insignificant in the context of the watershed (2.9 square miles).

Changes in post-development 100-year water surface elevations (WSE's) are less than one (1.0) foot in all locations, as compared to pre-development. The slight increases and decreases are a function of minor grading and changes to the roughness coefficients associated with rock and concrete. All locations where a minor increase in 100-year WSE occurs are limited to on-site and

thus do not impact any neighboring properties. There is no change to the post-development WSE at the downstream end of each analysis, as compared to pre-development.

This drainage study meets mitigation requirements outlined by the County of San Diego DPW Flood Control by providing the following:

1) Hydrology and hydraulic analysis in compliance with the County of San Diego Hydrology Manual, and the County of San Diego Hydraulic Design Manual.
2) The work has been performed by a California licensed engineer.
3) Perimeter fencing (break-away) will not cause alteration of drainage patterns from the existing condition and prevent accumulation of debris.

CEQA thresholds of significance have been addressed and included herein.

Section 7 Declaration of Responsible Charge

I, hereby declare that I am the Civil Engineer of work for this project, that I have exercised responsible charge over the design of the project as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with current design.

I understand that the check of project drawings and specifications by the City of San Diego is confined to a review only and does not relieve me, as Engineer of Work, of my responsibilities for the project design.

03/15/2024

Jay Sullivan, PE, CFM, QSD RCE #77445

Date

Section 8 References

County, S. D. (2014). Hydraulic Design Manual.

County, S. D. (June 2003). *San Diego County Hydrology Manual.*

Diego, C. o. (April 1984). *Drainage Design Manual.* San Diego.

Engineering, G. &. (June 2015). *Model BMP Design Manual.* San Diego.

FEMA. (1997). *Flood Insurance Rate Map.* San Diego.