APPENDIX I

CONCEPTUAL DRAINAGE STUDY AND STORMWATER QUALITY ANALYSIS

CAMPO VERDE SOLAR CONCEPTUAL DRAINAGE STUDY AND STORM WATER QUALITY ANALYSIS

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CONTENTS

1.0 INTRODUCTION

1.1 STUDY DESCRIPTION

The purpose of this study is to describe the existing and proposed hydrologic conditions for the Campo Verde Solar project. The study will show that the proposed condition does not substantially increase the peak runoff flowrate from the site, substantially maintains existing drainage patterns, detains runoff in accordance with County of Imperial standards, and results in no significant impact to the Imperial Irrigation District (IID) Drain system.

This study also includes an analysis of storm water quality concerns as they pertain to the site with respect to the California Environmental Quality Act (CEQA) and demonstrates that there are no significant impacts from the project in accordance with CEQA Guidelines, Appendix G.

1.2 PROJECT DESCRIPTION

The proposed 1,998-acre Campo Verde Solar project is located between Drew Road and the Westside Main Canal, south of Interstate 8. The site is located in an unincorporated area of the County of Imperial, approximately 10 miles west of El Centro. The project proposes to construct a solar energy power plant within a limit of work of approximately 1,812 acres. See Vicinity Map in Appendix A.

The (IID) has constructed a network of Canals and Drains that are located both within the project and along portions of the perimeter of the project. The IID Canals convey water to customers and the IID Drains collect and convey agricultural and storm water runoff from (surface and subsurface). The subject properties are served by IID Canals and discharge to IID Drains that are on and adjacent to the subject properties.

Storm water detention can be defined as the impoundment of runoff resulting from a rainfall event, and either slow release of impounded water to receiving water bodies or infiltration into underlying soil. The general purpose of detention is to attenuate (lessen) peak flow rates of runoff from a site.

Detention requirements over the project site will be satisfied by a combination of detention basins (typically less than 3.5′ deep) located outside the solar arrays and detention of runoff in shallow ponded areas (less than 12″ deep) under the arrays such that the County of Imperial standard of 3″ of detention over the project site is satisfied. Locations and sizes of detention basins and limits of shallow ponding will be determined at the time of final engineering. The design of the project proposes to utilize both connection to existing discharge locations to the IID Drain System and percolation into the underlying soil. Preliminary infiltration tests have been performed for the site and are provided for reference in Appendix B.

1.3 HYDROLOGIC SETTING

The perimeter of the project site is surrounded by public roads, IID Canals, and IID Drains (see Appendix E-1, Existing Basin Map). Based upon review of topography and field investigation, it is determined that offsite flow does not enter the project development areas. Therefore further analysis of offsite runoff is a part of this study. Under existing conditions, two types of flow, agricultural and storm water, are discharged to the IID Drains through a combination of surface runoff collection and subsurface perforated tile drain collection. During the life of the proposed project, agricultural runoff from the project limits to the Drains will cease and the Drains will only receive storm water runoff.

The site is underlain by a network of perforated tile drains (typically clay pipes). This network of tile drains were installed by prior landowners (farmers) to collect runoff that percolates into the soil. Tile drains will only be removed from the site if they are in conflict with proposed septic leachfield systems.

In accordance with IID requirements, tile drains will be cut and capped near the point of discharge to the IID Drains, thus tile drain flow will be removed as a source of water to the IID Drains.

IID facilities that accept flow from the project include the Dixie Drain #3, Dixie Drain #3A, Dixie Drain #3C, Wixom Drain, Diehl Drain, and Fig Drain. Some of these facilities combine within the project limits such that flow from the project is conveyed in only three Drains, the Dixie Drain #3, Wixom Drain, and the Fig Drain. Dixie Drain #3 discharges to the Salt Creek approximately 1.2 miles north of the project and flow is conveyed in the Salt Creek approximately 6.3 miles before ultimately discharging to the New River. The Wixom and Fig Drains discharge to the Fig Evaporation Pond immediately north and east of the project site, which then discharges to the New River approximately 1.1 miles from the site.

Based upon a conversation with the IID, the IID Drain system was not designed to convey runoff from large storm events. Rather, the primary purpose of the Drains is to convey agricultural runoff. The Drains typically have the capacity to convey flow from the 5-year to 10-year storm event. Runoff from larger storm events (for example the 100-year event) is detained within low lying areas of agricultural fields until the peak of the storm has passed, after which the detained runoff is slowly discharged to the Drains via pipe connections from surface collection and/or tile drains that are typically 12" in diameter or less.

To mimic the existing condition and provide storage of storm water runoff, the County of Imperial requires that projects provide storage for 3" of runoff from project sites. The County of Imperial further requires that storage areas provided with development be designed such that they are able to drain within 72 hours. In addition, the IID does not allow pipe connections from development to IID Drains that are greater than 12" in diameter. He final design of the project will satisfy each of these requirements.

The project is located within FEMA flood hazard Zone X. Zone X corresponds to areas that are located above the flood level having a 1% chance of occurrence (the 100-year event). Please see the FEMA FIRMettes (reduced size maps providing FIRM information for a project site rather than the entire area covered by a full sized FIRM) located in Appendix For illustration of the project location with respect to FEMA flood hazard zones.

2.0 HYDROLOGIC ANALYSIS

2.1 METHOD OF ANALYSIS

Hydrologic calculations are made within this section of the study in accordance with the following parameters/criteria:

1. The total volume of water to be detained will be equal to 3" of runoff from the project per County of Imperial Public Works Department requirement.
2. Project preference is for a combination of detention basins outside the arrays to be approximately 3'-3.5' deep and detention of runoff in shallow ponded areas (less than 12" deep) under the arrays.
3. Infiltration of runoff into native soils is preferred, where percolation rates allow.
4. Discharge of runoff to IID Drains via 12" storm drain connection per IID standards for connection of private facilities, may be utilized where necessary. Existing surface connection points to the IID Drain system will either remain in their existing location and continue to be used if necessary, relocated as necessary, or cut and capped if no longer needed. Addition of connection points to the IID Drain system is not proposed.
5. The volume of runoff from the 100-year storm is calculated by the Rational Method with weighted C value.
6. Information gained from the National Resource Conservation Service (NRCS) website is used to determine hydrologic soil classification.
7. National Oceanic and Atmospheric Administration (NOAA) precipitation data is used for determination of the 100-year storm rainfall.

See Appendix C for reference material pertaining to County standards and Rational Method parameters (including off coefficient).

2.2 RATIONAL METHOD PARAMETERS

The Rational Method, used for determination of runoff volumes, is provided by the equation below:

$V = C \times P \times A$

V = Volume of runoff, acre-feet
C = Runoff coefficient
P = Precipitation, converted to feet
A = Area, acres

2.2.1 RUNOFF COEFFICIENT

The runoff coefficient is an empirical value to estimate the runoff expected from rainfall. The value for the runoff coefficient is based on site characteristics that influence runoff including topography, land use, vegetation, and soil type. To assign runoff coefficients to existing and proposed conditions, multiple references were reviewed and compared for consistency. Chapter 810 of the CalTrans Highway Design Manual (HDM, which is commonly used and accepted for use in the County of Imperial) and Chapter 13 of the Wisconsin DOT Facilities Development Manual (which provides runoff coefficient reference for row crops, has been accepted for use by the County of Imperial on a similar, recent project, and due to its relevance to the existing land use of farming row crops) were reviewed.

a. Soil Group Determination:

The runoff coefficient was determined for existing and proposed conditions through consideration of two separate sources and reference to the soil classes found onsite as given in the NRCS Soil Survey for Imperial County. From the soil survey, the following soil types are located onsite:

Table 1 – Soil Types

Soil Map Symbol	Soil Type Name	Soil Description	Hydrologic Soil Group
102	Badland	-	D
110	Holtville	Silty clay	C
114	Imperial	Silty clay loam	C
115	Imperial	Silty clay loam	C
121	Meloland	Loamy fine sand to silt loam	C
122	Meloland	Loamy fine sand to silt loam, silty clay loam	C
123	Meloland	Loamy fine sand to silt loam, silty clay loam	C
142	Vint	Loamy fine sand	B
144	Vint	Loamy fine sand	B

GIS information from the soil survey was overlaid into the project limits to determine the distribution of soil groups as a percentage of the site and to graphically determine the locations of the different hydrologic soil groups for use in hydrologic calculations. Table 2 below provides the site breakdown in tabular format and the Soils Group Map in Appendix C graphically shows the locations of soil groups.

Table 2 – Soil Group Distribution

Hydrologic Soil Group	% of Site
A	0%
B	12.4%
C	86.2%
D	1.4%

b. Existing Condition "C" Factor:
For the existing condition, Figure 819.2A of the CalTrans HDM was reviewed to determine a runoff coefficient for cultivated field areas. Below is a summary of the components of the runoff coefficient per Figure 819.2A.

Table 3 – Existing "C" Factor Per HDM Figure 819.2A

Component	Manual Description	Site Condition	"C" Contribution
Relief	Relatively flat, slopes 0%-5%	Slopes generally < 0.5%	0.08
Soil Infiltration	Clay/shallow loams or sandy/silty loams	Silty clay loams, fine sandy loams	0.08
Vegetal Cover	90% of area in good cover	Well cultivated crops > 90% cover	0.05
Surface Storage	Well defined system of small drainageways	Rows crops graded to convey irrigation well	0.09
Aggregate C Factor			0.30

The runoff coefficient determined from Figure 819.2A of the HDM was then cross-checked against Figure 2, Detail B of Procedure 13-10-5 from the WDOT Manual for consistency with another accepted reference for runoff coefficient from cultivated areas. Figure 2, Detail B provides a range of runoff coefficients based on land use, soil group, slope of topography, and storm recurrence interval. The project site is soil groups C (86.2%), B (12.4%), and D (1.4%), topographic slope is between 0% and 2%, and the recurrence interval being considered is the 100-year event. For a land use of row crops, the runoff coefficients for each soil group and the weighted "C" factor for the site are provided in Table 4 below.

Table 4 – Existing "C" Factor Per WDOT Manual, Figure 2, Detail B

Hydrologic Soil Group	"C" Factor	% of Site	Weighted "C" Factor
B	0.26	12.4	0.032
C	0.30	86.2	0.2586
D	0.34	1.4	0.0476
Project Site Weighted "C" Factor			0.296

Determination of the existing condition runoff coefficient from both methods is consistent and for hydrologic calculation purposes, an existing condition runoff coefficient of 0.30 is to be used.

c. Proposed Condition "C" Factor:

For the proposed condition, a study was performed on a representative portion of the project (Basin D3, see Exhibit E-2, Proposed Basin Map for the location of the study area), and the results of the study were then applied throughout the project. For the study, the following elements were considered:

a. Perimeter Roadways – typical developed areas feature a 20' wide perimeter roadway consisting of native material compacted to 90%. Figure 2, Detail B of the WDOT Manual gives a runoff coefficient range of 0.40 - 0.60 for gravel roads and shoulders and a value of 0.60 is selected for the 100-year storm. The CalTrans HDM does not provide a runoff coefficient for gravel or base roads.
b. Array clearing and compaction – at minimum, array areas are to be prepared which may include conventional grading, disked and rolled and may be scarified and recompacted, pending results of pile testing to be performed during final engineering. Due to the potential for soils under the arrays to be compacted, they are assigned the same runoff coefficient (0.60) as the perimeter roadways. Note that final compaction requirements are dependent on pile testing, which will be performed at the time of final engineering. Assignment of a runoff coefficient of 0.60 to arrays is a conservative, worst-case approach taken at this preliminary phase.
c. Power Conversion Station (PCS) Shelters – each array block will require a sheltered PCS on impervious concrete foundation. Both Figure 2B of the HDM and Figure 2, Detail B of the WDOT Manual give a runoff coefficient range of 0.75 – 0.95 for roofs, and a value of 0.95 is selected for the 100-year storm.
d. Detention basins – runoff from arrays will typically be directed to detention basins located downstream of arrays. Calculations assume soils in the detention basins are in a saturated state or inundated when considering the 100-year storm. Therefore a runoff coefficient of 1.00 is used for the footprints of detention basins.
e. Remaining areas – remaining areas within the developable limit of work outside of the above listed elements considered have the potential to be developed as part of the project and are therefore assigned a runoff coefficient equal to that of the gravel/base roads and areas under the arrays (0.60).

The weighted runoff coefficient for the study area is determined in the table below:

Table 5 – Proposed "C" Factor

Description	Runoff Coefficient	Area, ac	% of Total Area	Weighted C
Detention Basin	1	11.3	7.1%	0.071
PCS Shelters	0.95	0.2	0.1%	0.001
Arrays/Roads/Fencing/Etc.	0.6	149.2	92.8%	0.557
Total		160.7	100.0%	0.629

The runoff coefficient for the proposed condition to be used in hydrologic calculations is 0.63. As the proposed project site is similar in composition, this weighted coefficient is used for the entire site.

2.2.2 PRECIPITATION

A precipitation estimate for the 100-year storm is obtained through referencing data available on the NOAA website for Imperial Valley. A storm duration of 24-hours is assumed, and the corresponding precipitation estimate is 3.76 inches. NOAA data is provided in Appendix D.

2.2.3 AREA

The project site has been delineated into tributary drainage basins for the existing and proposed conditions (see Appendix E-1 and E-2 for Basin Maps). Ultimate points of discharge to the IID Drains for the existing and proposed conditions are similar, however - due to grading required for the development of arrays - for the proposed condition some of the smaller existing drainage sub-basins are combined into larger drainage basins.

The project site is divided into 3 watersheds that are tributary to four distinct Drains that are the ultimate points of discharge from the subject site – the Dixie Drain #3 (for which basins are noted with a "D"), the Wixom Drain (for which basins are noted with a "W"), the Diehl Drain (for which basins are noted with a "L"), and the Fig Drain (for which basins are noted with a "F").

Table 6 on the following page provides a summary of the drainage basin and sub-basin areas for the existing and proposed conditions. Note that flow from the Diehl Drain is discharged to the Fig Drain within the project limits. As such, the Drains conveying flow from the project to ultimate receiving waters are the Dixie Drain #3, Wixom Drain, and the Fig Drain.

Note that Table 6 assumes that flow is detained and discharged into receiving Drains. As discussed in Section 2.3.2.b of this study, preliminary infiltration tests show that the site has the potential to infiltrate runoff, thus limiting discharge to the Drain system.

In the proposed condition, as some of the drainage sub-basins are combined into larger drainage basins, in three instances flows are routed from one IID Drain tributary basin to another IID Drain tributary area. These three instances are summarized below:

1. Flow from Basin W2 will be routed/combined with flow from Basin D7
2. Flow from Basin L1 will be routed/combined with flow from Basin W3
3. Flow from Basin L2 will be routed/combined with flow from Basin F1

Although there is a routing of flow from being tributary to one IID Drain to being tributary to another IID Drain (for example from the Wixom Drain to the Dixie Drain #3 in instance 1 above), because the project proposes to infiltrate runoff, there will not be an impact to the receiving Drain. Further the routing of flow described above results in a net decrease in area potentially tributary to the Fig Drain, Diehl Drain, and the Wixom Drain in the proposed condition when compared to the existing condition. In the proposed condition, the area potentially tributary to the Dixie Drain #3 will be increased when compared to the existing condition. However, this increase is occurring within sub-basin D7, which (as discussed in Section 2.3.2.b) is comprised of Type B soils that typically have high rates of infiltration, and it is anticipated that runoff stored in the detention basin will be able to percolate into the subsoil within 72 hours, per County requirement. Therefore, it is not anticipated that the increase in tributary area will result in an increase in storm water runoff being discharged to the Dixie Drain #3. Final design will be based on additional infiltration tests in this area.

Table 6 – Basin Areas

Receiving Drain: Dixie Drain #3			
Existing Condition		Proposed Condition	
Basin Name	Area (ac)	Basin Name	Area (ac)
D1	223.5	D1	223.5
D2	135.3	D2	135.3
D3A	78.4	D3	160.7
D3B	82.3	D4	70.2
D4	70.2	D5	325.2
D5A	132.7	D6	27.0
D5B	67.3	D7	174.7
D5C	50.9	Total	1,116.5
D5D	65.7		
D5E	8.5		
D6	27.0		
D7	84.1		
Total	1,025.9		

Receiving Drain: Wixom Drain			
Existing Condition		Proposed Condition	
Basin Name	Area (ac)	Basin Name	Area (ac)
W1	165.7	W1	165.7
W2	90.6	W2	0
W3	75.8	W3	109.5
W4	8.9	W4	8.9
Total	341.0	Total	284.1

Receiving Drain: Fig Drain			
Existing Condition		Proposed Condition	
Basin Name	Area (ac)	Basin Name	Area (ac)
L1	33.7	L1	0
L2	28.9	L2	0
F1	26.6	F1	55.5
F2	81.0	F2	81.0
F3	125.8	F3	125.8
F4A	74.2	F4	220.7
F4B	57.9	F5	46.2
F4C	71.4	Total	529.2
F4D	17.2		
F5	46.2		
Total	562.9		

2.3 CALCULATIONS/RESULTS

2.3.1 EXISTING CONDITIONS

a. Storm Water Runoff:

Volumes of storm water runoff for the existing condition are provided in Table 7. The volume reported as "County Storage" is the volume based on 3.00" of runoff. The volume reported as "100-year Runoff" is the estimated volume anticipated based on a "C" factor of 0.30 and 100-year 24-hour precipitation of 3.76 inches.

Table 7: Existing Condition Storm Water Runoff

Receiving Drain: Dixie Drain #3			
Basin Name	Area (ac)	County Storage (ac-ft)	100-year Runoff (ac-ft)
D1	223.5	55.9	21.0
D2	135.3	33.8	12.7
D3A	78.4	19.6	7.4
D3B	82.3	20.6	7.7
D4	70.2	17.6	6.6
D5A	132.7	33.2	12.5
D5B	67.3	16.8	6.3
D5C	50.9	12.7	4.8
D5D	65.7	16.4	6.2
D5E	8.5	2.1	0.8
D6	27.0	6.7	2.5
D7	84.1	21.0	7.9
Total	1,025.9	256.5	96.4

Receiving Drain: Wixom Drain			
Basin Name	Area (ac)	County Storage (ac-ft)	100-year Runoff (ac-ft)
W1	165.7	41.4	15.6
W2	90.6	22.6	8.5
W3	75.8	19.0	7.1
W4	8.9	2.2	0.8
Total	341.0	85.2	32.1

Receiving Drain: Fig Drain			
Basin Name	Area (ac)	County Storage (ac-ft)	100-year Runoff (ac-ft)
L1	33.7	8.4	3.2
L2	28.9	7.2	2.7
F1	26.6	6.6	2.5
F2	81.0	20.3	7.6
F3	125.8	31.4	11.8
F4A	74.2	18.5	7.0
F4B	57.9	14.5	5.4
F4C	71.4	17.9	6.7
F4D	17.2	4.3	1.6
F5	46.2	11.6	4.3
Total	562.9	140.7	52.9

b. Agricultural Runoff:
In the existing condition, runoff from agricultural activities is discharged to the Drain system. The IID meters agricultural runoff to their Drain system. Metered values of agricultural runoff are not available, so an average annual volume of agricultural runoff from within the project limits to the Drain system cannot be determined.

However, in general, the average annual amount of water applied to fields and subsequently discharged to the Drain system from agricultural runoff is greater than that which is discharged from storm water runoff. For example, the average annual rainfall in Imperial Valley is approximately 2.9 inches (0.24 acre-feet per acre per year) and by contrast, alfalfa, the dominant crop grown in Imperial Valley, requires at least 6 acre-feet of irrigation water per acre per year under the surface/flood irrigation practices typically used at the site. The use of such flood irrigation practices result in annual agricultural runoff to the IID Drains that far exceeds the annual storm water runoff to the IID Drains.

2.3.2 PROPOSED CONDITIONS

a. Storm Water Runoff:
Under proposed conditions, the existing drainage characteristics of the project site will remain substantially the same. Existing low lying areas receiving runoff will continue to do so in the proposed conditions. Section 2.2.3 discusses the areas of existing and proposed drainage basins and sub-basins and the three instances where there is a proposed routing of flow between basins, resulting in a change in area potentially tributary to IID Drains. As shown in Section 2.3.2.b, on-site soils are able to infiltrate runoff and there is no resultant impact to IID Drains due to the proposed routing.

To enable the development of the solar arrays, private dirt roads and ditches within the project will be re-graded as necessary, and the cultivated areas will be re-graded to provide smooth transitions across arrays and to produce positive surface drainage to the onsite detention basins. A private perimeter access road will be constructed around the arrays. As discussed previously, the project proposes to detain the estimated runoff from the 100-year storm event in detention basins located outside arrays (basins will be approximately 3’-3.5’ deep). Additional detention of runoff necessary to comply with the County standard to store 3” of runoff will occur under the arrays as necessary to a depth less than 12”.

Table 8 on the following page provides the required volumes of detention to meet both the County standard of 3” of runoff from the project and the design concept to detain the 100-year runoff outside of the arrays. Note that the required storage to meet the County standard is the same for the existing and proposed conditions due to the fact that the County does not consider the runoff coefficient in its standard.

Table 8: Proposed Condition Storm Water Runoff

Receiving Drain: Dixie Drain #3			
Basin Name	Area (ac)	County Storage (ac-ft)	100-year Runoff (ac-ft)
D1	223.5	55.9	44.1
D2	135.3	33.8	26.7
D3	160.7	40.2	31.7
D4	70.2	17.6	13.9
D5	325.2	81.3	64.2
D6	27.0	6.7	5.3
D7	174.7	43.7	34.5
Total	1,116.5	279.1	220.4

Receiving Drain: Wixom Drain			
Basin Name	Area (ac)	County Storage (ac-ft)	100-year Runoff (ac-ft)
W1	165.7	41.4	32.7
W2	-	-	-
W3	109.5	27.4	21.6
W4	8.9	2.2	1.8
Total	284.1	71.0	56.1

Receiving Drain: Fig Drain			
Basin Name	Area (ac)	County Storage (ac-ft)	100-year Runoff (ac-ft)
L1	-	-	-
L2	-	-	-
F1	55.5	13.9	11.0
F2	81.0	20.3	16.0
F3	125.8	31.4	24.8
F4	220.7	55.2	43.6
F5	46.2	11.6	9.1
Total	529.2	132.3	104.5

Note: See section 2.2.3 regarding routing of flow from basins W2, L1, and L2.

On the Proposed Conditions Basin Map in Appendix E-2, locations of proposed detention basins are provided for reference. Note that the site plan shown on the Proposed Conditions Basin Map is consistent with the layout for the fixed-tilt array layout. The project is also considering array layouts for a tracking module. Upon selection of product by the project applicant, the final array layout will be shown, and location/sizes of detention basins will be finalized and discussed in the project final hydrology study.

b. Potential for Infiltration of Runoff:
Preliminary infiltration tests (provided in Appendix B) were performed to determine infiltration rates at two locations within the project site for the purposes of preliminary planning. The two locations are shown on the Soils Group Map in Appendix C. Two tests were performed at each location – one 12" below the existing ground surface and one 2" below existing ground surface. Infiltration rates are summarized in Table 9 below. As shown on the Soil Group Map, Location 1 is within an area with soils of Group B and Location 2 is within an area soils of Group C.

Table 9: Infiltration Summary

Location	Depth	Infiltration Rate (min/in)	Infiltration Rate (in/hr)
1	2"	11.24	5.34
1	12"	8.00	7.50
2	2"	11.41	5.26
2	12"	41.50	1.45

Additional infiltration testing is planned for the project; however the infiltration rates at 12" depths were utilized for preliminary calculations. For detention basins located in underlying soils of Soil Group B, the 7.50 in/hr rate determined at Location 1 is estimated. For detention basins located in underlying soils of Soil Group C, the 1.45 in/hr rate determined at Location 2 is estimated. Per County standards, infiltration is feasible if a basin is able to infiltrate detained runoff within 72 hours.

To determine the time required to infiltrate into the underlying soil, the area of ponding was determined to be the area of the detention basin. The volumetric rate of infiltration was determined as the product of the percolation rate and the area of ponding. The time to percolate for each sub-basin was then calculated to demonstrate that the detained runoff can percolate into the underlying soil within 72 hours. Table 10 provides the time to percolate for each sub-basin.

Table 10: Time for Detained Volume to Infiltrate

Receiving Drain: Dixie Drain #3						
Basin Name	Area (ac)	County Storage (ac-ft)	Infiltration Rate (in/hr)	Basin Area (ac)	Infiltration Rate (ac-ft/hr)	Time to Infiltrate (hr)
D1	223.5	55.9	1.45	13.3	1.6	34.8
D2	135.3	33.8	1.45	8.2	1.0	34.1
D3	160.7	40.2	1.45	9.4	1.1	35.4
D4	70.2	17.6	1.45	3.6	0.4	40.4
D5	325.2	81.3	1.45	19.3	2.3	34.9
D6	27.0	6.7	1.45	1.4	0.2	39.8
D7	174.7	43.7	7.50	12.31	7.7	5.7

Receiving Drain: Wixom Drain						
Basin Name	Area (ac)	County Storage (ac-ft)	Infiltration Rate (in/hr)	Basin Area (ac)	Infiltration Rate (ac-ft/hr)	Time to Infiltrate (hr)
W1	165.7	41.4	1.45	9.4	1.1	36.5
W2	-	-	-	-	-	-
W3	109.5	27.4	1.45	5.6	0.7	40.5
W4	8.9	2.2	1.45	0.5	0.1	36.8

Receiving Drain: Fig Drain						
Basin Name	Area (ac)	County Storage (ac-ft)	Infiltration Rate (in/hr)	Basin Area (ac)	Infiltration Rate (ac-ft/hr)	Time to Infiltrate (hr)
L1	-	-	-	-	-	-
L2	-	-	-	-	-	-
F1	55.5	13.9	1.45	2.7	0.3	42.5
F2	81.0	20.3	1.45	4.9	0.6	34.2
F3	125.8	31.4	1.45	7.2	0.9	36.1
F4	220.7	55.2	1.45	11.3	1.4	40.4
F5	46.2	11.6	1.45	2.7	0.3	35.4

From Table 10, based on preliminary infiltration rates, it is evident that all of the basins have the potential to infiltrate into the underlying soil in less than 72 hours. As mentioned previously, additional infiltration testing is planned for the project. In the event that, based on additional infiltration testing, any detention basin(s) will not be able to infiltrate within 72 hours, they will be required to discharge to the IID Drain system through use of existing 12" storm drain connections.

c. Agricultural Runoff:

In the proposed condition, runoff from agricultural activities will cease during the life of the project. As such, the total volume of runoff (storm water plus agricultural runoff) discharged to the IID Drain system will decrease during the life of the project.

3.0 STORM WATER QUALITY ANALYSIS

3.1 HYDROLOGIC UNIT CONTRIBUTION

The project is located in the Brawley Hydrologic Area, in the Imperial Hydrologic Unit. The corresponding number designation is 723.10.

The Imperial Hydrologic Unit consists of the majority of the Imperial Valley, encompassing over 1.3 million acres of land. The watershed includes vast acreages of agricultural land; towns such as El Centro, Calexico, and Brawley, along with a large network of IID operated canals and drainage ditches. The watershed is atypical of most watersheds in California, as it currently and historically has been shaped by man-made forces. The watershed's primary watercourses, the New and Alamo rivers, flow north, from the Mexican border toward their final destination, the Salton Sea. The Salton Sea, a 376 square mile inland lake was created in 1905 through a routing mistake and subsequent flood on the Colorado River. The Sea has been fed primarily by agricultural runoff from the New and Alamo Rivers ever since.

303(d) listed water quality impairments and TMDLs are present for the receiving waters of the project, and are discussed in Section 3.3.2.

3.2 WATER QUALITY ENVIRONMENT

3.2.1 BENEFICIAL USES

According to Table 2-3 of the Water Quality Control Plan for the Colorado River Basin Region (WQCP), the beneficial uses for the project's receiving waters are:

a. Imperial Valley Drains:
FRSH – Freshwater Replenishment
REC I – Water Contact Recreation (unauthorized, infrequent fishing activity)
REC II – Non-Contact Water Recreation (unauthorized)
WARM – Warm Freshwater Habitat
WILD – Wildlife Habitat
RARE – Preservation of Rare, Threatened or Endangered Species (only exists in some of the waterways)

It shall be noted that the above beneficial uses for the Imperial Valley Drain system are broadly based considering the fact that many of the Drains are open channel conveyance systems.

b. New River:
FRSH – Freshwater Replenishment
IND- Industrial Service Supply (potential)
REC I – Water Contact Recreation (hazardous due to contamination)
REC II – Non-Contact Water Recreation
WARM – Warm Freshwater Habitat
WILD – Wildlife Habitat
RARE – Preservation of Rare, Threatened or Endangered Species

c. Salt Creek:
FRSH – Freshwater Replenishment
GWR – Ground Water Recharge
REC I – Water Contact Recreation (hazardous due to contamination)
REC II – Non-Contact Water Recreation

WARM – Warm Freshwater Habitat
WILD – Wildlife Habitat
RARE – Preservation of Rare, Threatened or Endangered Species

d. Salton Sea:
AQUA- Aquaculture
IND- Industrial Service Supply (potential)
REC I – Water Contact Recreation
REC II – Non-Contact Water Recreation
WARM – Warm Freshwater Habitat
WILD – Wildlife Habitat
RARE – Preservation of Rare, Threatened or Endangered Species

3.2.2 303(d) STATUS

According to the California 2006 303d list published by the State Water Resources Control Board (SWRCB), the project's receiving waters have beneficial use impairments as follows.

Table 11: 303(d) Impairments

RECEIVING WATER	HYDROLOGIC UNIT CODE	303(d) IMPAIRMENT(S)	DISTANCE FROM PROJECT (miles)
Imperial Valley Drains (Dixie Drain 3, Dixie Drain 3-A, Dixie Drain 3-B, Wixom Drain, and Diehl Drain)	723.10	None	<0.1 miles
New River	723.10	1,2,4 Trimethylbenzene Chlorodane Chloroform Chlorpyrifos DDT Diazanon Dieldrin Mercury meta-para xylenes Nutrients Organic/Low DO o-xylenes PCBs p-Cymene p-Dicholorobenzene Pesticides Selenium Toluene Toxaphene Toxicity Trash	1.1 miles
Salton Sea	728.00	Nutrients, Salinity, Selenium	31 miles

3.2.3 TMDL STATUS

TMDLs established for receiving waters of the project are summarized in Tables 12 and 13 below.

Table 12: TMDLs

RECEIVING WATER	HYDROLOGIC UNIT CODE	TMDLs	DISTANCE FROM PROJECT (miles)
New River	723.10	Pathogens Sediment/Siltation	1.1 miles

The 2002 Pathogens TMDL sets numeric targets on the New River with 30 day mean, and instantaneous maximum limits for Fecal Coliforms, *E. Coli*, and Enterococci. Those limits are shown in the table below.

Table 13: TMDL Limits

	Fecal Coliforms	*E.Coli*	Enterococci
30 day Geometric Mean	200	126	33
Instantaneous Maximum	<10% Over 400	400	100

The New River's main sources of pathogens (indicated by fecal coliforms and E. coli bacteria) are discharges of municipal wastes from the Mexicali Valley in Mexico and non-disinfected but treated wastewater from five domestic Imperial Valley wastewater treatment plants. Natural sources of pathogens play a relatively insignificant role. The significance of contributions from confined animal feeding operations and other nonpoint sources of pollution in the Imperial Valley are not fully known at this time (California EPA TMDL Implementation Plan, 2002).

The 2002 Sediment/Siltation TMDL sets numeric targets on the New River for Total Suspended Solids (TSS). The target is 200 mg/L which would achieve a low to moderate level of protection. According to the 2002 TMDL implementation plan, an overall 17% reduction from the current TSS level is required to meet the minimum targets set forth by the TMDL.

High sedimentation in the New River has led to increased mobilization of agricultural pesticides and a highly turbid environment for sensitive aquatic species. The main source of sediment to the New River is agricultural runoff from the Imperial Valley and Mexico.

3.3 REGULATORY FRAMEWORK

3.3.1 State Water Resources Control Board

In the State of California, the State Water Resources Control Board (SWRCB) and local Regional Water Quality Control Boards (RWQCBs) have assumed the responsibility of implementing the US EPA's NPDES Program and other programs under the CWA such as the Impaired Waters Program and the Antidegradation Policy. The primary quality control law in California is the Porter-Cologne Water Quality Act (Water Code Sections 13000 et seq.). Under Porter-Cologne, the SWRCB issues joint federal NPDES Storm Water permits and state Waste Discharge Requirements (WDRs) to operators of municipal separate storm sewer systems (MS4s), industrial facilities, and construction sites to obtain coverage for the storm water discharges from these operations.

a. Basin Plan Requirement:

In addition to its permitting programs, the SWRCB, through its nine RWQCBs, developed Regional Water Quality Control Plans (or Basin Plans) that designate beneficial uses and water quality objectives for California's surface waters and groundwater basins, as mandated by both the CWA and the state's Porter-Cologne Water Quality Control Act. Water quality standards are thus established in these Basin Plans and provide the foundation for the regulatory programs implemented by the state. The Colorado River Basin RWQCB Basin Plan, which covers the project area, designates beneficial uses for surface waters and ground waters.

b. General Construction Permit:

The General Construction Permit (GCP), (Order 2009-0009-DWQ, NPDES Permit No. CAS000002), issued by the SWRCB, regulates storm water and non-storm water discharges associated with construction activities disturbing 1 acre or greater of soil. Construction sites that qualify must submit a Notice of Intent (NOI) with the SWRCB to gain permit coverage or otherwise be in violation of the CWA and California Water Code.

The GCP requires the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP) for each individual construction project greater than or equal to 1 acre of disturbed soil area. The SWPPP must list Best Management Practices (BMPs) that the discharger will use to control sediment and other pollutants in storm water and non-storm water runoff. The GCP requires that the SWPPP is prepared by a Qualified SWPPP Developer (QSD) and implemented at the site under the review/direction of a Qualified SWPPP Practioner (QSP).

The project includes over 1 acre of grading within the County of Imperial, and is therefore subject to the storm water discharge requirements of the GCP. The Project will submit a NOI and prepare a SWPPP prior to the commencement of soil disturbing activities. In the Colorado River Basin Region, where the project resides, the SWRCB is the permitting authority, while the County of Imperial and Colorado River Basin RWQCB provide local oversight and enforcement of the GCP.

c. Phase II MS4 Permit:

In 2003, the State Water Resources Control Board issued the Phase II regulations concerning Small Municipal Storm Sewer Systems (MS4) (Water Quality Order No. 2003-0005-DWQ). This NPDES permit was issued by the State of California to all qualifying municipalities and agencies who operate a storm drain system and meet certain size criteria for MS4 system discharges into waters of the United States. Pursuant to the Permit, dischargers are required to develop a Storm Water Management Plan (SWMP) and enroll in the program. The County of Imperial has enrolled in the Permit, but does not have specific storm water related criterion for new development, related to the NPDES Program. If and when the County does develop said criterion, new development projects will be required to comply with the provisions set forth by the County of Imperial.

3.4 POTENTIAL POLLUTANTS

There is no sampling data available for the existing site condition. The following constituents have commonly been found on agricultural areas and could potentially affect water quality:

- Organic compounds found in pesticides used on agricultural fields
- Agricultural waste
- Loose sediments
- Excess nutrients from fertilizers

In addition to potential pollutants due to the existing agricultural land use, potential pollutants due to the proposed land use of a solar power station include the following:

- Heavy metals from infrastructure and vehicular use
- Trash and debris from human activity
- Oil and grease from vehicular use

Potential pollutants are summarized in Table 14 below.

Table 14: Potential Pollutants

SEDIMENT
HEAVY METALS
ORGANIC COMPOUNDS
TRASH & DEBRIS
OXYGEN DEMANDING SUBSTANCES
NUTRIENTS
OIL & GREASE

In examining these anticipated pollutants, the proposed project has the potential to be a source of pollutants based on historic/existing land use and typical activities involved in operating a solar power station. Through proper planning and operation of the facility however, the concentrations can be reduced to levels which will not contribute to the impairment of beneficial uses in downstream surface waters. In addition, through the source control BMPs outlined in Table 17 of Section 3.7.2., the amounts of these pollutants will be reduced to the maximum extent practicable, through behavioral and programmatic means.

Primary pollutants of concern consist of those pollutants which are anticipated onsite, and are coupled with an existing impairment on surface waters downstream of the project site. Table 15 on the following page provides the primary pollutants of concern for the Campo Verde Solar Power Station project site.

Table 15: Primary Pollutants of Concern

PRIMARY POLLUTANTS OF CONCERN	SPECIFIC 303(D) IMPAIRMENT
HEAVY METALS	Mercury, Selenium
OXYGEN DEMANDING SUBSTANCES	Organic/Low DO
TRASH AND DEBRIS	Trash
ORGANIC COMPOUNDS	Chloroform, PCBs, p-Cymene, p-Dicholorobenzene, Toxaphene
OIL AND GREASE	meta-para xylenes, o-xylenes, Toluene

Heavy Metals. The primary sources of metals in storm water are metals typically used in transportation, buildings and infrastructure and also paints, fuels, adhesives and coatings. Potential sources of heavy metals from the project include vehicular use, building construction, solar array construction, and underground pipes. Copper, lead, and zinc are the most prevalent metals typically found in urban runoff. Other trace metals, such as cadmium, chromium, manganese, and mercury are typically not detected in urban runoff or are detected at very low levels. Trace metals have the potential to cause toxic effects on aquatic life and are a potential source of groundwater contamination.

Oxygen Demanding Substances Plant debris, food waste, and some chemical wastes fall into a category of water pollutants known as oxygen demanding substances. Such substances use dissolved oxygen in water when they decay or chemically react. If dissolved oxygen levels in water become too low, aquatic animals can become stressed or die.

Animal wastes, food wastes, leaves and twigs, and other miscellaneous organic matter carried by storm water runoff into surface water can lead to reduced oxygen levels. Potential sources of oxygen demanding substances from the project include human use and landscaping. Slow-moving waters are particularly susceptible to oxygen depletion because aeration of the water by turbulence is lacking. Therefore, oxygen that is depleted in slow-moving waters due to the presence of excess organic matter or unnatural chemical compounds is not replaced. Reduced oxygen levels in these waters are often particularly severe after a storm.

Trash and Debris Improperly disposed or handled trash (from human use of the site) such as paper, plastics and debris including the biodegradable organic matter such as leaves, grass cuttings, and food waste can accumulate on the ground surface where it can be entrained in urban runoff. A large amount of trash and debris can have significant negative impacts on the recreational value of water body. Excessive organic matter can create a high biochemical oxygen demand in a stream and lower its water quality.

Organic Compounds. Organic compounds are carbon-based, and are typically found in pesticides, solvents, and hydrocarbons. Dirt, grease, and other particulates can also adsorb organic compounds in rinse water from cleaning objects, and can be harmful or hazardous to aquatic life either indirectly or directly. Organic compounds are therefore potentially present in runoff from the site due to prior agricultural use (pesticides) and vehicular use (hydrocarbons and grease).

Oil and Grease. Oil and Grease in storm water typically stems from parking lots, roadways, machinery areas, or anywhere else leaks from machinery can occur. Potential sources of oil and grease from the project include vehicular and machine/equipment use. Typical compounds which are indicators of oil and grease problems are BTEX, (Benzene, Toluene, Ethylbenzene, and Xylenes), and visual clues, such as oily sheens on the water surface.

Nutrients. The primary sources of nutrients in storm water are fertilizers. Potential sources of nutrients from the project include historic agricultural land use and landscaping. Nitrogen and phosphorus are the most prevalent nutrients typically found in urban runoff. Failing septic tanks are also potential sources of nutrients in runoff.

3.5 GROUNDWATER QUALITY

Geographically, the project site is located within the Imperial Groundwater Basin. The Imperial Valley Groundwater basin is bounded on the east by the Sand Hills and on the west by the impermeable rocks of the Fish Creek and Coyote Mountains. To the north, the basin is bounded by the Salton Sea, which is the discharge point for groundwater in the basin. Major hydrologic features include the Alamo and New Rivers, which flow north towards the Salton Sea.

Per Table 2-5 of the WQCP, beneficial uses of groundwater within the Imperial Hydrologic Unit include:

MUN – Municipal and Domestic Supply;
IND – Industrial Service Supply.

The MUN beneficial use for groundwater within the Imperial Hydrologic Unit is limited only to a small portion of the ground water unit. Within the project area, groundwater is not used for municipal uses. Rather, all municipal and domestic water supply is obtained from the IID Canals. Wells do not exist within project boundary. Wells are located south of the Westside Main Canal. However the proposed infiltration basins are located at least 1,400' from the Westside Main Canal and an impact to the wells due to seepage from the basins is not anticipated. Per Table 2-1 of the WQCP, IND is defined as a use of water for industrial activities that do not depend on water quality. Therefore, impacts from the project on leading to a loss in beneficial uses of groundwater are not anticipated.

3.6 WATER QUALITY – CONSTRUCTION PHASE

Construction of the project includes site preparation, foundation construction, erection of major equipment and structures, installation of piping, electrical systems, control systems, and start-up/testing. In addition, the construction of transmission lines, utility pole pads, conductors, and associated structures will be required.

During the construction phase, sedimentation and erosion can occur because of tracking from earthmoving equipment, erosion and subsequent runoff of soil, and improperly designed stockpiles. The utilization of proper erosion and sediment control BMPs is critical in preventing discharge to surface waters/drains. The project proposes to employ proper SWPPP practices to minimize any discharges in order to meet the Best Available Technology/Best Conventional Technology (BAT/BCT) standard set forth in the General Construction Permit.

Although the project site is relatively flat, the large amount of potential disturbed area results in the potential for erosion/sediment issues.

In addition to erosion and sedimentation, the use of materials such as fuels, solvents, and paints has the potential to effect surface water quality. Many different types of hazardous compounds will be used during the construction phase, with proper containment being of high importance. Poorly managed construction materials can lead to the possibility for exposure of potential contaminants to precipitation. When this occurs, these constituents become visible and/or non-visible pollutants entrained in storm water runoff. If they are not intercepted or are left uncontrolled, the polluted runoff would otherwise freely sheet flow from the project to the IID Drains and could cause pollution accumulation in the receiving waters. A list of anticipated construction materials and their associated construction activity are provided in the table below.

Table 16: Potential Construction Related Pollutants

CONSTRUCTION ACTIVITY	CONSTRUCTION SITE MATERIAL	VISUALLY OBSERVABLE?
Paving	Hot Asphalt	Yes - Rainbow Surface or Brown Suspension
	Asphalt Emulsion	
	Liquid Asphalt (tack coat)	
	Cold Mix	
	Crumb Rubber	Yes – Black, solid material
	Asphalt Concrete (Any Type)	Yes - Rainbow Surface or Brown Suspension
Substation and Transmission Line Construction	Gasoline/Diesel	No
	Mineral and Crankcase Oil	
	Lubricants	
	Cleaning Solvents	
Equipment Cleaning	Acids	No
	Bleaches	
	Detergents	Yes - Foam
	Solvents	No
Concrete Work	Portland Cement (PCC)	Yes - Milky Liquid
	Masonry products	No
	Sealant (Methyl Methacrylate - MMA)	No

CONSTRUCTION ACTIVITY	CONSTRUCTION SITE MATERIAL	VISUALLY OBSERVABLE?
Concrete Work	Incinerator Bottom Ash, Bottom Ash, Steel Slag, Foundry Sand, Fly Ash, Municipal Solid Waste	No
	Mortar	Yes - Milky Liquid
	Concrete Rinse Water	Yes - Milky Liquid
	Non-Pigmented Curing Compounds	No
	Lime	No
Painting	Paint	Yes
	Paint Strippers	No
	Resins	
	Sealants	
	Solvents	
	Lacquers, Varnish, Enamels, and Turpentine	
	Thinners	
Portable Toilet Facilities	Portable Toilet Waste	Yes
Adhesives	Adhesives	No
Dust Control	Water	No
	Liquid Polymer or Polymer Blend	
Vehicle Maintenance	Antifreeze and Other Vehicle Fluids	Yes - Colored Liquid
	Batteries	No
	Fuels, Oils, Lubricants	Yes - Rainbow Surface Sheen and Odor
Soil Amendment/Stabilization	Polymer/Copolymer	No
	Quicklime	No
	Herbicide, Pesticide	No
	Lignin Sulfonate	No
	Psyllium	
	Guar/Plant Gums	
	Gypsum	
Wood (Treated) Work	Ammoniacal-Copper-Zinc-Arsenate, Copper-Chromium-Arsenic, Ammoniacal-Copper-Arsenate, Copper Naphthenate	No
	Creosote	Yes - Rainbow Surface or Brown Suspension

Prior to the beginning of construction, a complete SWPPP will be provided to show evidence that the development of the project will comply with the GCP and associated local NPDES regulations. Also, in accordance with the GCP, a Notice of Intent (NOI) for coverage of projects under the GCP will be filed with the SWRCB. The Waste Discharge Identification (WDID) Number will be issued to the project before any land disturbance may begin.

Accordingly, the SWPPP will be implemented at the project site, and revised as necessary, as administrative or physical conditions change. The Region 7 Colorado River Basin RWQCB, upon request, must instruct the developer to make the SWPPP available for public review. The SWPPP will fully describe Best Management Practices (BMPs) that address pollutant source reduction and provide measures/controls necessary to mitigate potential pollutant sources. These include, but are not limited to: erosion controls, sediment controls, tracking controls, non-storm water management, materials & waste management, and good housekeeping practices. The above-mentioned BMPs for construction activities are discussed further below. The SWPPP will be prepared by a Qualified SWPPP Developer (QSD) and implemented at the site under the review/direction of a Qualified SWPPP Practioner (QSP).

3.6.1 Erosion Controls

Erosion Control, also referred to as soil stabilization, is a source control measure designed to prevent soil particles from detaching and becoming transported in storm water runoff. Erosion Control BMPs protect the soil surface by covering and/or binding the soil particles. The scheduling of soil disturbing activities should be minimized during the wet season, which is Aug 1- Oct 1, and Nov 1-May 1. If such activities occur in the wet season, all exposed slopes or areas with loose soil will be stabilized. This may involve the application of soil binders, or geotextiles and mats. Due to the flat surface, creating temporary earth dikes or drainage swales may also be employed/installed prior to large, forecasted storm events to divert runoff away from exposed areas and into more suitable locations. If implemented correctly, erosion controls can effectively reduce the sediment loads entrained in storm water runoff from construction sites. Below is a list of approved construction BMPs that can be implemented for the proposed Project's SWPPP.

<u>Erosion Controls</u>

EC-1 Scheduling
EC-2 Preservation of Existing Vegetation
EC-5 Soil Binders
EC-6 Straw Mulch
EC-7 Geotextiles and Mats
EC-8 Wood Mulching
EC-9 Earth Dikes and Swales
EC-10 Velocity Dissipation Devices
EC-11 Slope Drains

3.6.2 Sediment Controls

Sediment controls are structural measures that are intended to complement and enhance the soil stabilization/erosion control measures and reduce sediment discharges from construction areas. Sediment controls are designed to intercept and filter out soil particles that have been detached and transported by the force of water. In addition, silt fencing will be installed along the perimeter of work areas upstream of discharge points, and will also be placed around stockpiles, and areas of soil disturbance. Check dams or chevrons will be situated in areas where high velocity runoff is anticipated/potential (such as in drainage ditches/swales). Gravel bag berms or fiber rolls should be used to intercept sheet flows on streets or at the toe of slopes (such as along streets or canal and drain access roads) to minimize sediment mobilization. Street sweeping will also be scheduled in areas where sediment can be tracked from the project site onto paved streets or roads. Below is a list of approved construction BMPs that can be implemented for the proposed Project's SWPPP.

Sediment Controls

SE-1	Silt Fence	SE-7	Street Sweeping
SE-2	Desilting Basin (Detention Basins)	SE-8	Sandbag Barrier
SE-3	Sediment Trap	SE-9	Straw Bale Barrier
SE-4	Check Dam	SE-10	Chemical Treatment
SE-5	Fiber Rolls	SE-11	Chemical Treatment
SE-6	Gravel Bag Berm		

3.6.3 Tracking Controls

The proposed project site will stabilize all construction entrance/exit points to reduce the tracking of sediments onto paved streets and roads by construction vehicles. Construction roadways should also be stabilized to minimize off-site tracking of mud and dirt. Wind erosion controls will be employed in conjunction with tracking controls. Below is a list of approved construction BMPs that can be implemented for the proposed Project's SWPPP.

Tracking Controls

TC-1	Stabilized Construction Entrance / Exit
TC-2	Stabilized Construction Roadway
TC-3	Entrance / Outlet Tire Wash
WE-1	Wind Erosion Control

3.6.4 Non-Storm Water Management Controls

Non-storm water discharges consist of all discharges from a municipal storm water conveyance which do not originate from precipitation events (i.e., all discharges from a conveyance system other than storm water).

Paving and grinding operations on the project site, along with any operations which involve using water on landscape are classified as having potential for non-storm water pollutants. This also includes illegal connection and dumping on the construction site, vehicle equipment cleaning, fueling, and maintenance. The construction of project may involve the use of heavy equipment and hazardous materials. Adequate BMPs and protections will be in place at all times.

Non-Storm Water Management Controls

NS-1	Water Conservation Practices	NS-9	Vehicle & Equipment Fueling
NS-2	Dewatering Operations	NS-10	Vehicle & Equipment Maint.
NS-3	Paving and Grinding Operations	NS-11	Pile Driving Operations
NS-4	Temporary Stream Crossing	NS-12	Concrete Curing
NS-5	Clear Water Diversion	NS-13	Concrete Finishing
NS-6	IC/ID Detection and Reporting	NS-14	Material Use Over Water
NS-7	Potable Water / Irrigation	NS-15	Demolition Over Water
NS-8	Vehicle & Equipment Cleaning	NS-16	Temporary Batch Plants

3.6.5 Materials and Waste Management

Waste management consists of implementing procedural and structural BMPs for collecting, handling, storing and disposing of wastes generated by a construction project to prevent the release of waste materials into storm water discharges. All materials with the potential to contaminate storm water runoff should be delivered and stored in designated areas with secondary containment measures (i.e. covered and bermed). Chemicals, drums, and bagged materials will not be stored directly on soil, but on pallets instead. Personnel will also be trained on the proper use of the materials.

Construction staging areas will be located on the site. These areas will include construction yards that serve as field offices, reporting locations for workers, parking space for vehicles and equipment, and sites for material storage. Facilities will be fenced as necessary. Security guards will be stationed where needed.

A temporary barrier around stockpiles should be installed and a cover provided during the rainy season. Spill cleanup procedures and kits should be made readily available near hazardous materials and waste. Solid wastes, such as trash and debris, should be collected on a regular basis and stored in designated areas. Concrete and paint washout areas should be installed and properly maintained in areas conducting the associated activities. Below is a list of approved construction BMPs that can be implemented for the proposed project's SWPPP.

<u>Waste Management and Materials</u>

WM-1 Material Delivery & Storage
WM-2 Material Use
WM-3 Stockpile Management
WM-4 Spill Prevention and Control
WM-5 Solid Waste Management
WM-6 Hazardous Waste
WM-7 Contaminated Soil
WM-8 Concrete Waste
WM-9 Sanitary / Septic Waste

3.6.6 Monitoring Program

A monitoring program will also be included in the SWPPP that outlines storm event inspections of the project site and a sampling plan in accordance with the GCP. The monitoring program will be prepared by a QSD and implemented at the site under the review/direction of a QSP. The goals of [the program] are (1) to identify areas contributing to a storm water discharge; (2) to evaluate whether measures to reduce pollutant loadings identified in the SWPPP are adequate, properly installed, and functioning in accordance with the terms of the General Construction Permit; and (3) whether additional control practices or corrective maintenance activities are needed. If a discharge is observed during these inspections, a sampling and analysis of the discharge is required.

<u>Sampling and Analysis</u>

Any breach, malfunction, leakage, or spill observed which could result in the discharge of pollutants to surface waters that would not be visually detectable in storm water shall trigger the collection of a sample of discharge…The goal of the sampling and analysis is to determine whether the BMPs employed and maintained on site are effective in preventing the potential pollutants from coming in contact with storm water and causing or contributing to an exceedance of water quality objectives in the receiving waters. In any case of breakage and potential for non-visible pollution, sampling and analysis will be required to ensure that the beneficial uses of downstream receiving waters are protected. In addition, sampling is required for any site which directly discharges runoff into a receiving water listed in the GCP listed as impaired for sedimentation.

3.7 WATER QUALITY – POST-CONSTRUCTION

3.7.1 Site Design BMPs

The project is designed to include Site Design BMPs which reduce runoff, prevent storm water pollution associated with the project, and conserve natural areas onsite.

Table 17: Site Design BMPs

	DESIGN CONCEPT	DESCRIPTION
#1	MINIMIZE IMPERVIOUS FOOTPRINT	The project site will include a significant amount of undeveloped land and pervious area. The footprint for the solar arrays will be predominately pervious ground. A minimal amount of Class II base paving for access roads and parking will be constructed.
#2	CONSERVE NATURAL AREAS	Only a small amount of existing site area can be classified as natural landscape, and will only be disturbed in necessary areas at the project.
#3	PROTECT SLOPES AND CHANNELS	The project site and surrounding areas is comprised of extremely flat topography. Erosion of slopes due to stabilization problems is not a concern, except where flow enters detention basins. Basins will feature 8:1 side slopes where flow enters. Stabilization needs will be evaluated at final engineering.
#4	MIMIMIZE DCIAS (DIRECTLY CONNECTED IMPERVIOUS AREAS)	Minimal storm drain will be constructed onsite. The impervious areas will drain and will be allowed to pond in the detention basins and/or under the arrays. This will effectively limit all DCIAs on the project site.

3.7.2 Source Control BMPs

"Source control BMPs (both structural and non-structural)" means land use or site planning practices, or structures that aim to prevent urban runoff pollution by reducing the potential for contamination at the source of pollution. Source Control BMPs minimize the contact between pollutants and urban runoff. The following table identifies source control BMPs that would be applicable to the proposed project.

Table 18: Source Control BMPs

SOURCE CONTROL BMP		DESCRIPTION
#1	DESIGN TRASH STORAGE AREAS TO REDUCE POLLUTION INTRODUCTION	Any outdoor trash storage areas will be designed not to allow run-on from adjoining areas, screened or walled to prevent off-site transport of trash.
#2	ACTIVITY RESTRICTIONS	Restrictions include activities that have the potential to create adverse impacts on water quality.
#3	NON-STORM WATER DISCHARGES	Illegal dumping educational materials as well as spill response materials will be provided to employees.
#4	OUTDOOR LOADING AND UNLOADING	Material handling will be conducted in a manner as to prevent any storm water pollution. .
#5	SPILL PREVENTION, CONTROL, AND CLEANUP	The project will require a Spill Prevention, Control, and Countermeasure (SPCC) Plan, and a Hazardous Materials Business Plan in accordance with Federal and State requirements.
#6	EDUCATION	Employees will receive materials for storm water pollution prevention in the form of brochures and other information in a format approved by the County of Imperial.
#7	INTEGRATED PEST MANAGEMENT	If any pesticide is required onsite, the need for pesticide use in the project design will be reduced by: • Keeping pests out of buildings using barriers, screens and caulking • Physical pest elimination techniques, such as squashing, trapping, washing or pruning out pests • Relying on natural enemies to eat pests • Proper use of pesticides as a last line of defense
#8	VEHICLE AND EQUIPMENT FUELING, CLEANING, AND REPAIR	All vehicles will be serviced offsite whenever possible. If servicing is required onsite, it must be conducted in an area isolated from storm drain inlets or drainage ditch inlets. The area must be bermed and precluded from run on. Any spillage must be fully contained and captured and disposed of per County of Imperial Hazardous Waste requirements.
#9	WASTE HANDLING AND DISPOSAL	Materials will be disposed of in accordance with Imperial County Hazardous Material Management guidelines, and will be sent to appropriate disposal facilities. Under no circumstances shall any waste or hazardous materials be stored outside without secondary containment.

In addition to said Source Controls, specific precautions will be taken when handling, storing or processing any materials during all phases of the proposed project. The utmost care and planning must be taken when using materials outside, and near any storm drain/drainage ditch inlets.

3.7.3 Treatment Control BMPs

As discussed in the Hydrology Study, runoff from the project will be directed towards detention basins and/or pond under arrays as necessary to meet the design goal to detain the 100-year runoff in basins outside the arrays, and to meet the County requirements for storage of 3" of runoff under the arrays as necessary. The preliminary design of the project considers 2 locations where infiltration testing was performed. It has been shown that the County required 3" of runoff from the project can be infiltrated within 72 hours, typically between 30 and 40 hours.

The detention basins will also have the capacity to store and infiltrate runoff from the more frequent storm events, which typically lead to storm water quality concerns. The runoff volume for the water quality storm event was calculated based on the Urban Runoff Quality Management Approach outlined in the California Stormwater BMP Handbook for New Development and Redevelopment. Based on this approach, a runoff coefficient for the site is calculated using the following regression equation:

$$C = 0.858i^3 – 0.78i^2 + 0.774i + 0.04$$

where i is the impervious fraction of the site. However, given the fact that the site impervious percentage is nearly negligible (approaches 0.1% of the developed site), use of the above regression equation is impractical (in that it yields a runoff coefficient that approaches a value of 0.04) with the proposed project. For the purpose of calculations and analysis, the Rational Method C value of 0.63 is used for water quality purposes. The depth of runoff, P_O, is then calculated as:

$$P_O = (a * C) * P_6$$

Where:
a = regression constant = 1.582 for a 24 hour draw down time
P_6 = mean annual runoff-producing rainfall depth, in watershed inches

The value for P_6 is determined using tables provided in the California Stormwater BMP Handbook. Using the table provided for the Palm Springs Thermal Airport, the location which is most representative of conditions in Imperial Valley, and a C value of 0.63, the value of P_6 is approximately 0.43 inches. These values then yield a depth of runoff of P_O = 0.43 inches or 0.036 feet.

To determine the volume of runoff from the water quality storm event, the depth of runoff is multiplied by the tributary area. Table 19 on the following page provides the volume of runoff for the water quality storm event, Water Quality Control Volume (WQCV), for each drainage basin. The infiltration time of the water quality volume was calculated using the same methods for calculating the infiltration time for the County requirement of 3" of runoff as described in the Hydrology Study portion of this document.

Table 19: WQCV and Infiltration Time

Receiving Drain: Dixie Drain #3						
Basin Name	Area (ac)	WQCV (ac-ft)	Infiltration Rate (in/hr)	Basin Area (ac)	Infiltration Rate (ac-ft/hr)	Time to Infiltrate (hr)
D1	223.5	8.0	1.45	13.3	1.6	5.0
D2	135.3	4.8	1.45	8.2	1.0	4.9
D3	160.7	5.8	1.45	9.4	1.1	5.1
D4	70.2	2.5	1.45	3.6	0.4	5.8
D5	325.2	11.7	1.45	19.3	2.3	5.0
D6	27.0	1.0	1.45	1.4	0.2	5.7
D7	174.7	6.3	7.50	12.31	7.7	0.8
Receiving Drain: Wixom Drain						
Basin Name	Area (ac)	WQCV (ac-ft)	Infiltration Rate (in/hr)	Basin Area (ac)	Infiltration Rate (ac-ft/hr)	Time to Infiltrate (hr)
W1	165.7	5.9	1.45	9.4	1.1	5.2
W2	-	-	-	-	-	-
W3	109.5	3.9	1.45	5.6	0.7	5.8
W4	8.9	0.3	1.45	0.5	0.1	5.3
Receiving Drain: Fig Drain						
Basin Name	Area (ac)	WQCV (ac-ft)	Infiltration Rate (in/hr)	Basin Area (ac)	Infiltration Rate (ac-ft/hr)	Time to Infiltrate (hr)
L1	-	-	-	-	-	-
L2	-	-	-	-	-	-
F1	55.5	2.0	1.45	2.7	0.3	6.1
F2	81.0	2.9	1.45	4.9	0.6	4.9
F3	125.8	4.5	1.45	7.2	0.9	5.2
F4	220.7	7.9	1.45	11.3	1.4	5.8
F5	46.2	1.7	1.45	2.7	0.3	5.1

As anticipated, the WQCV is infiltrated into the underlying soil in less than 72 hours. Therefore the basins are deemed adequate as treatment control BMPs for the project.

4.0 ENVIRONMENTAL IMPACTS

According to Appendix G of the CEQA Guidelines, a project would normally have a significant effect on the environment if the project would impact any of the items listed in the table below.

The following discussions are based on the proposed drainage system within the proposed and potential development area. The impact assessments are based on the significance criteria listed below for hydrology/water quality.

4.1 THRESHOLDS OF SIGNIFICANCE

Table 20: CEQA Thresholds of Significance

THRESHOLDS OF SIGNIFICANCE – VIII. HYDROLOGY AND WATER QUALITY	
Would the Project:	
A	Violate any water quality standards or waste discharge requirements?
B	Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table?
C	Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or in a manner which would result in a substantial erosion or siltation on- or off-site?
D	Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site?
E	Create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff?
F	Otherwise substantially degrade water quality?
G	Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?
H	Place within a 100- year flood area structures which would impede or redirect flood flows?
I	Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?
J	Be subject to inundation by seiche, tsunami, or mudflow?

4.1.1 Impact A

Would the Project violate any water quality standards or waste discharge requirements?

Impact Analysis: As a result of the recommended site design and source control measures, and the construction of the required detention basins, water quality exceedances are not anticipated, and pollutants are not expected within project runoff that would adversely affect beneficial uses in downstream receiving waters. Although specific County of Imperial regulations regarding storm water NPDES and new development do not exist, the project plans to institute controls designed to limit discharges to the appropriate standard. The project will comply with the requirements of the State

Regional Water Quality Control Board concerning coverage under the General Construction Permit. It is concluded that this issue is considered a less than significant impact.

4.1.2 Impact B

Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table (e.g. the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted).

Impact Analysis: Groundwater recharge in the area will not be significantly affected due to the fact that the majority of the site will feature a pervious landscape in both the existing and proposed conditions. Detention basins will also provide infiltration and groundwater recharge. In the post construction condition, no pumping of groundwater is anticipated. During the construction phase, a significant amount of construction dewatering is not expected to be required.

As discussed in Section 3.5, groundwater at/near the project site is not used for beneficial uses, such as municipal, domestic, or industrial supply. Water needs will be provided by adjacent IID Canals, and are expected to be much less than the needs of the existing agricultural land. It is concluded that this issue is considered no impact.

4.1.3 Impact C

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.

Impact Analysis: The proposed drainage patterns and general drainage system will be similar to the existing site. Drainage will be routed to the detention basins for detention and infiltration. In addition, the remainder of the site will follow existing drainage patterns, with storm flows conveyed toward existing IID Drains. There is proposed rerouting of flows in three instances as discussed in Section 2.2.3, however the proposed rerouting is not substantially different from the existing condition, and will not result in substantial erosion or siltation on or off-site. Based on preliminary infiltration testing, it is shown that the project is able to infiltrate runoff. Therefore the proposed routing of flow will not result in an increase in runoff to an IID Drain or an increase in erosion or siltation on- or off-site. Due to the postponement of agricultural irrigation during the life of the project, it is anticipated that the annual runoff from the proposed project site will decrease when compared to the existing condition, which is similar to when agricultural fields are abandoned. It is concluded that this issue is considered no impact.

4.1.4 Impact D

Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site.

Impact Analysis: Existing drainage patterns will not be substantially altered due to the proposed project. The majority of the site will sheet flow through the pervious landscape, toward the detention basins. There is proposed rerouting of flows in three instances as discussed in Section 2.2.3, however the proposed rerouting is not substantially different from the existing condition, and will not result in substantial erosion or siltation on or off-site. Based on preliminary infiltration testing, it is shown that the project is able to infiltrate runoff.

Peak flow runoff from the project will be infiltrated in designated detention basins and there is no potential for increased flooding potential onsite or in offsite IID Drains. Ponding of runoff under arrays will occur to depths less than 12" and will not lead to on-site flooding. Due to the elimination of agricultural use, it is anticipated that the annual runoff from the proposed project site will decrease when compared to the existing condition. It is concluded that this issue is considered no impact.

4.1.5 Impact E

Create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff.

Impact Analysis: Runoff from the project will be controlled by detention basins to not exceed existing peak storm water flow rates as discussed previously. Due to the postponement of agricultural irrigation during the life of the project, it is anticipated that the annual runoff from the proposed project site will decrease when compared to the existing condition. As such, it is concluded that this issue is considered no impact.

4.1.6 Impact F

Otherwise substantially degrade water quality

Impact Analysis: Refer to the water quality discussion included in the Impact A analysis above.

4.1.6 Impact G

Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation.

Impact Analysis: There is no housing proposed for the project. It is concluded that there is no impact related to this issue.

4.1.7 Impact H

Place within a 100-year flood hazard area structures which would impede or redirect flood flows.

Impact Analysis: Based on current FEMA Flood Insurance Rate Maps (FIRM), the project is located in Zone X. Zone X corresponds to areas that are located above the flood level having a 1% chance of occurrence (the 100-year event). Therefore the project will not place structures within a 100-year flood hazard area. Please see the FEMA FIRMettes (reduced size maps providing FIRM information for a project site rather than the entire area covered by a full sized FIRM) located in Appendix F. It is concluded that there is no impact related to this issue.

4.1.8 Impact I

Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam.

Impact Analysis: The proposed project site is not located in a FEMA flood hazard area, nor will the site contain habitable structures where significant numbers of people would be put at high risk. However, existing levees are located adjacent to the project site on the Fern Canal, as well as on the Fern

Sidemain, Fig Canal and Westside Main Canal. These levees are designed to maximize water volume in the channel, predominately for agricultural use. The levees are currently maintained by the Imperial Irrigation District (IID). There are no dams immediately upstream of the project; therefore dam breakage is not a risk concerning the project site.

The Imperial Valley with its low-lying canal/drain systems, lack of relief, and infrequent, intense storm periods can lead to high intensity runoff events. However, the project site does not include any residential development or significant populations of people. It is concluded that there is no impact related to this issue.

4.1.9 Impact J

Inundation by seiche, tsunami, or mudflow.

Impact Analysis: The site is approximately 25 miles from the Salton Sea, which is the nearest large water body. Due to the distance, the Salton Sea is does not pose a particularly significant danger of inundation from seiche or tsunami as related to the proposed project site.

The site is approximately 7 miles from Mt. Signal, which is the nearest significantly sloped landscape, located across the border in Mexico. The project site is not in any danger of inundation by mudflow. It is concluded that no impact associated with this issue will occur.

5.0 MAINTENANCE

The operation and maintenance requirements for each type of BMP are contained in the following sections. The following entity will maintain all onsite site design, source control, and treatment control features.

ORGANIZATION	Campo Verde Solar, LLC.

5.1 POST-CONSTRUCTION BMPs

Post-construction BMPs will be maintained in perpetuity. Maintenance requirements for source control BMPs as well as treatment control BMPs are shown below. It shall be noted that preventative maintenance such as removal of trash and debris from the site will help ensure proper function of the BMPs.

Table 21: O&M Summary

SUMMARY OF BMP O&M	
BMP NAME	FREQUENCY
DESIGN TRASH STORAGE AREAS TO REDUCE POLLUTION INTRODUCTION	Inspect Monthly
ACTIVITY RESTRICTIONS	Review Bi-Yearly
NON-STORM WATER DISCHARGES	Review Bi-Yearly
OUTDOOR LOADING AND UNLOADING	Supervisors/Workers Shall Monitor Continuously
SPILL PREVENTION, CONTROL, AND CLEANUP	Supervisors/Workers Shall Monitor Continuously
EDUCATION	Review and Distribute Bi-Yearly
INTEGRATED PEST MANAGEMENT	Review Protocols and Educate Bi-Yearly
WASTE HANDLING AND DISPOSAL	Inspect Monthly
VEHICLE AND EQUIPMENT FUELING, CLEANING, AND REPAIR	Inspect/Review Monthly
HAZARDOUS MATERIAL MANAGEMENT	Supervisors/Workers Shall Monitor Continuously
DETENTION BASINS	Inspect Quarterly

Maintenance of the project site will be conducted by the owner, Campo Verde Solar, LLC. All construction and post construction BMPs will be the responsibility of the owner during the lifetime of the project.

The owners of the project are required to perform maintenance in perpetuity, keeping maintenance records for submittal to the County of Imperial and Regional Water Quality Control Board, if requested. In addition, the following maintenance activities will be conducted.

- Continued education of staff responsible for hazardous material hauling, loading, and use.
- Periodic visual monitoring to ensure materials are not contaminating areas exposed to storm water.

If a transfer of the property area occurs, the owner will notify the County of Imperial, and the Region 7 Colorado River Basin Regional Water Quality Control Board. The new owner will assume all responsibilities for BMP maintenance.

6.0 SUMMARY AND CONCLUSIONS

6.1 HYDROLOGY

From the analysis provided in this study, it is concluded that the project will not have a substantial impact on the hydrology of the surrounding area or of the IID Drain system. The County standard requirement to provide 3" of detention per tributary acre is being met. Detained runoff will be infiltrated into the underlying soil. Where feasible, detention basins have been provided outside of the project solar arrays. Where necessary, the project will be graded to provide the required detention under the arrays.

6.2 STORM WATER QUALITY

Post project site conditions reflect increases in impervious surfaces; however peak discharge will not be significantly altered by the proposed project. The use of source control and site design BMPs in practice through the day to day function of the project will result in a decreased potential for storm water pollution.

Maintenance will be the responsibility of the owner, who will maintain the Site Design, and Source Control, and Treatment Control BMPs throughout the lifetime of the project. In the event of sale of the site, the new owner will be required to maintain BMPs, ensuring proper function in perpetuity.

6.2.1 Long-Term Funding

Long-term funding for BMP maintenance shall be funded by the owner.

6.2.2 Access for Inspection

The private owner entity assumes responsibility for operation and maintenance of BMPs, however if needed the County of Imperial shall be granted able access for inspection through a formal agreement.

6.2.3 CEQA Impact Summary

The development of Project SWPPP and adherence to its prescribed BMPs will minimize the potential for a net increase in sediment loads in storm water discharges, relative to pre-construction levels. Furthermore, the SWPPP will prevent or minimize the discharges of polluted storm water and prohibited non-storm waters at levels that would cause or contribute to the exceedance of applicable water quality standards of downstream receiving waters during the construction period.

Based on the proposed Project improvements and associated BMPs, no substantial water quality impairments or significant increases in Project runoff are anticipated, and no adverse levels of pollutants are expected in Project runoff that would violate water quality standards or adversely affect beneficial uses of the downstream receiving waters.

Table 22: CEQA Impact Summary

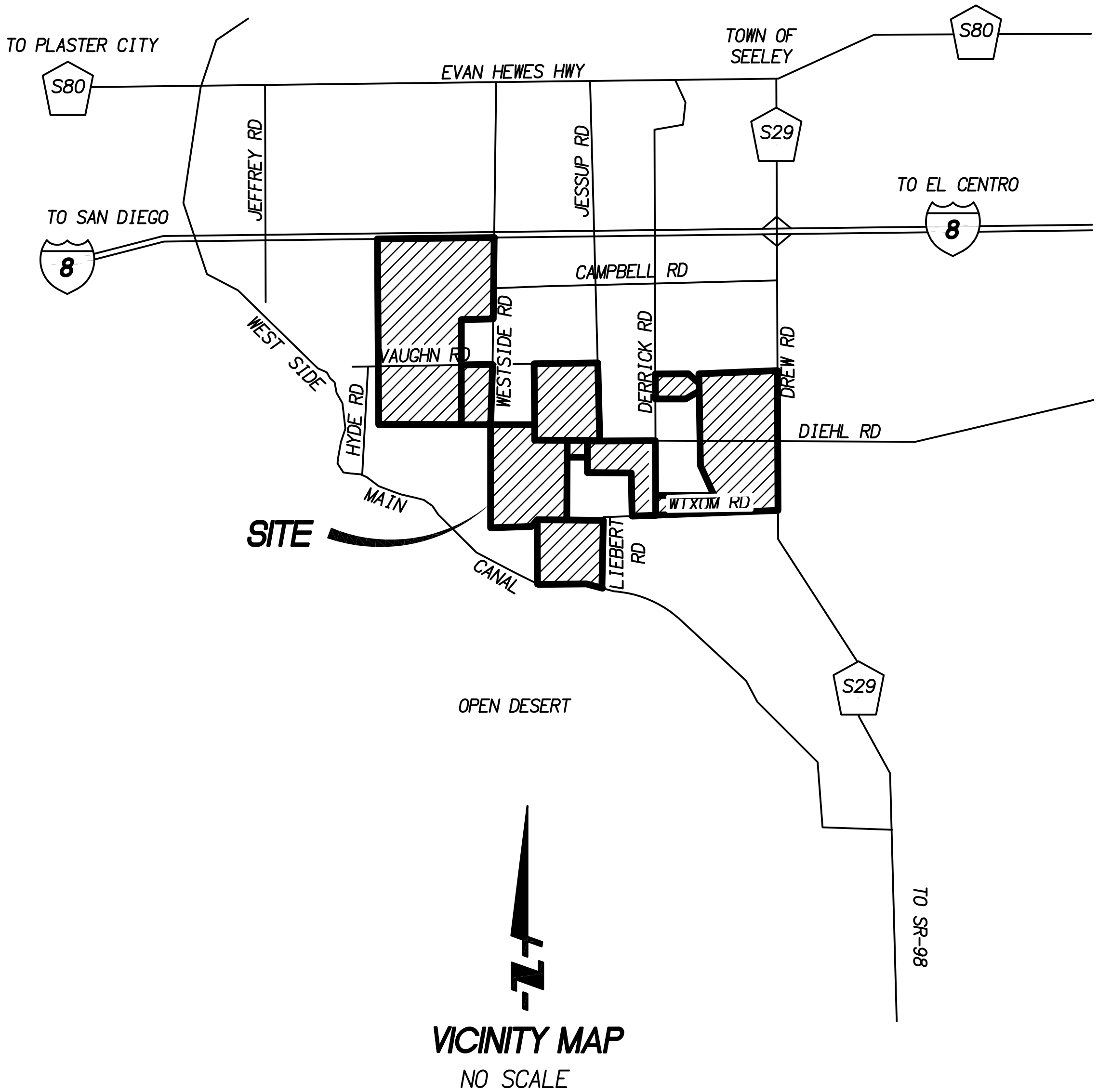
CEQA IMPACTS AND MITIGATION MEASURES		
CEQA SIGNIFICANCE CRITERIA	SIGNIFICANT IMPACT (YES/NO)	MITIGATION MEASURE
Impact A: Violate any water quality standards or waste discharge requirements?	NO	N/A
Impact B: Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table?	NO	N/A
Impact C: Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or in a manner which would result in a substantial erosion or siltation on- or off-site?	NO	N/A
Impact D: Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site?	NO	N/A
Impact E: Create or contribute runoff water which would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff?	NO	N/A
Impact F: Otherwise substantially degrade water quality?	NO	N/A
Impact G: Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	NO	N/A
Impact H: Place within a 100- year flood area structures which would impede or redirect flood flows?	NO	N/A

CEQA IMPACTS AND MITIGATION MEASURES		
CEQA SIGNIFICANCE CRITERIA	SIGNIFICANT IMPACT (YES/NO)	MITIGATION MEASURE
Impact I: Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	NO	N/A
Impact J: Be subject to inundation by seiche, tsunami, or mudflow?	NO	N/A

APPENDIX - A

Vicinity Map

VICINITY MAP
CAMPO VERDE SOLAR
COUNTY OF IMPERIAL, CA



APPENDIX A
VICINITY MAP CAMPO VERDE SOLAR COUNTY OF IMPERIAL, CA
DECEMBER 2011

APPENDIX - B

Preliminary Infiltration Tests

LANDMARK
Geo-Engineers and Geologists

780 N. 4th Street
El Centro, CA 92243
(760) 370-3000
(760) 337-8900 fax

77-948 Wildcat Drive
Palm Desert, CA 92211
(760) 360-0665
(760) 360-0521 fax

September 1, 2011

Mr. Tommy Nelson
US Solar Holdings
6111 Severin Drive
La Mesa, CA 91942

Preliminary Infiltration Tests
Proposed Mt. Signal Solar Project
SW of Drew Road and I-8 Freeway
Imperial County, California
LCI Project No. LE11197

Dear Mr. Nelson:

Infiltration tests were performed on August 29 through 31, 2011 at the locations specified by US Solar for general clear water infiltration rates of the near surface soils within the proposed Mt. Signal Solar Project located between Drew Road and the West Side Main Canal south of the I-8 Freeway approximately 10 miles west of El Centro, California.. The native soils consisted of dominantly silty clays with low infiltration and minor areas of silty sands with a moderate infiltration.

Infiltration tests were conducted at two (2) locations delineated by the client within the project site. Two (2) infiltration tests were conducted at each location, one test at a depth of 12 inches below existing ground surface and one test at a depth of 2 inches (ground surface). The infiltration tests were conducted to evaluate the stormwater infiltration capacity of the soils.

The tests were conducted by drilling 6-inch diameter borings to the specified depths. A 4-inch diameter solid PVC pipe was placed in the boreholes and the bottom of the pipe pushed into the soil at the bottom of the borehole to create a seal. The PVC pipes were then filled with water. Water was maintained at a hydrostatic level of 12 inches in the bottom of each of the PVC pipes. The tests were performed over a 3 day period.

The measured infiltration rates of the soils are tabulated below:

Location	Depth	Infiltration Rate
I-1	Surface	11.24 min/inch
I-2	12 inches	8.00 min/inch
I-3	Surface	11.41 min/inch
I-4	12 inches	41.50 min/inch

The infiltration rates for stormwater basin designs are typically determined by applying a Factor of Safety of 3 to 6 to the field test rates.

Groundwater was generally encountered at a depth of 10 to 12 feet below existing ground surface in April 2011 during a geotechnical investigation conducted by EGA Consultants at the project site. The groundwater levels noted by EGA are at time of drilling and may rise with time to a stabilized level.

The project site is divided into two Soil Conservation Survey soil classifications types. The first soil type is dominated by silty sand to sandy silt with minor clay layers (Soil Types 110, 118, 122, 123, 142, and 144 of the US Soil Conservation Survey Soil Map) and the second soil type is dominated by clay soils (Soil Types 114 and 115). The USCS soil survey map (Plate A-3) shows the extent of the various soil types.

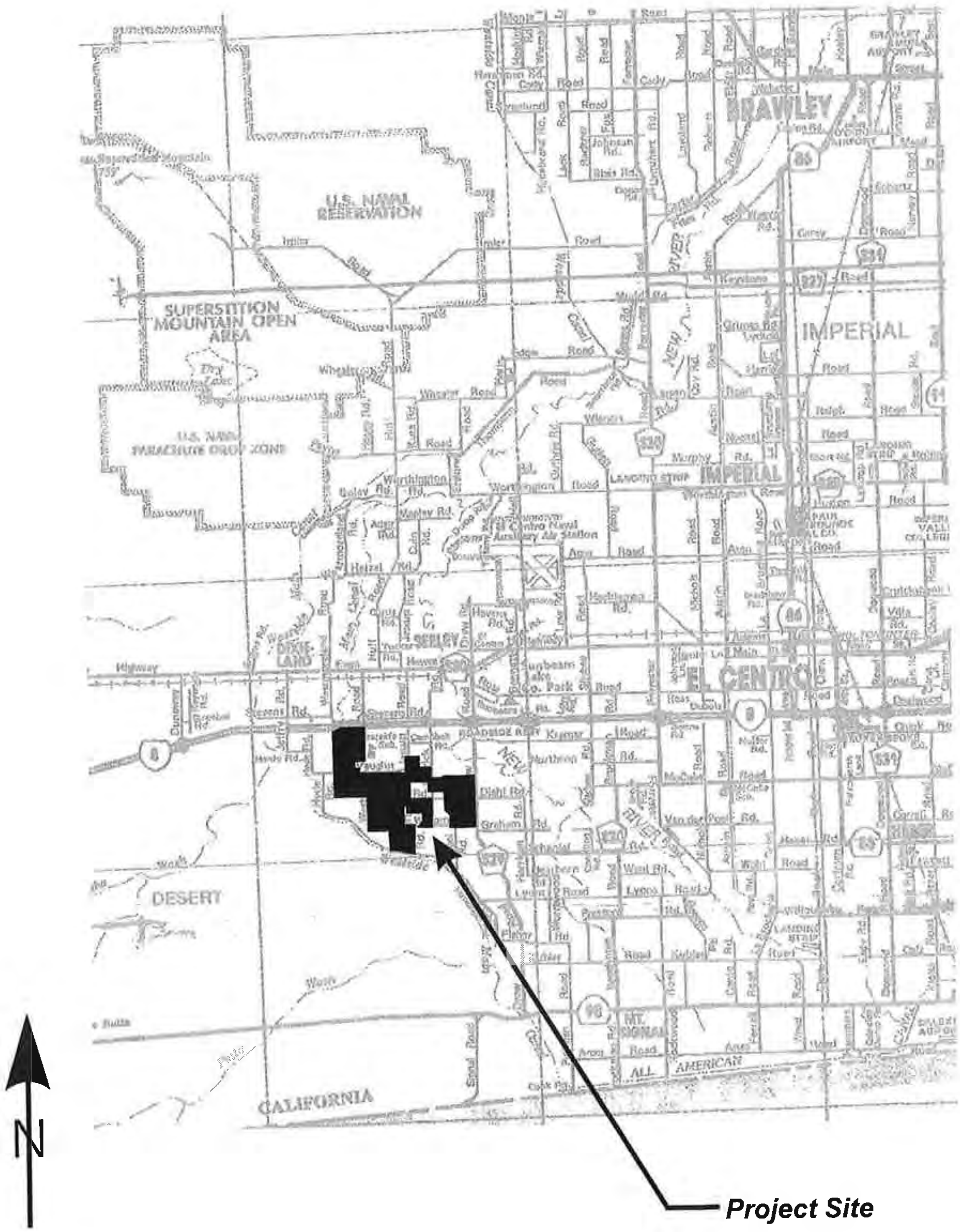
Please contact our office if there are any questions or comments regarding the infiltration tests conducted at this site.

Sincerely Yours,
Landmark Consultants, Inc.

Jeffrey O. Lyon, PE
Principal Engineer

Steven K. Williams, PG, CEG
Senior Engineering Geologist

APPENDIX A



LANDMARK
Geo-Engineers and Geologists
Project No.: LE11197

Vicinity Map

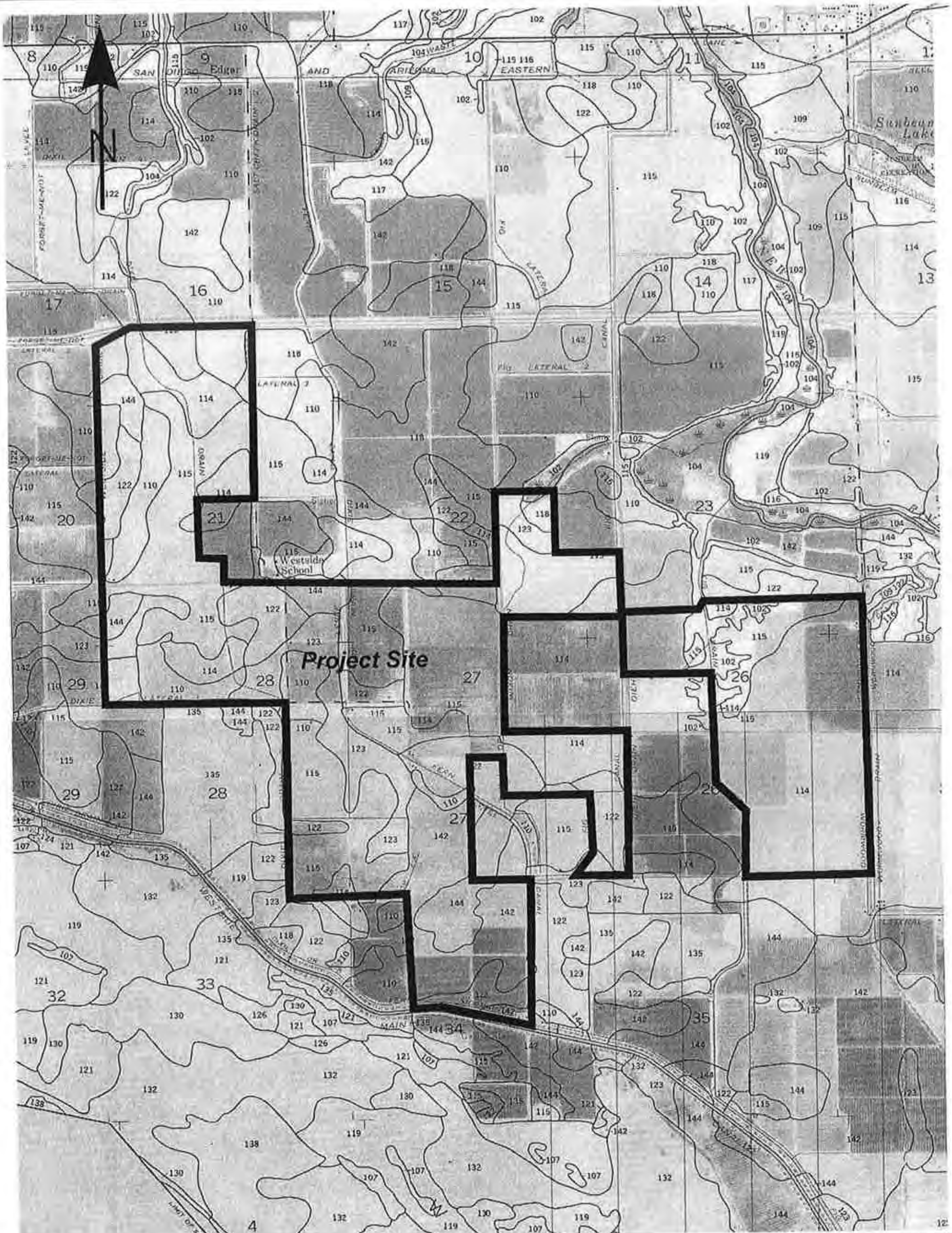
Plate
A-1

LANDMARK
Geo-Engineers and Geologists

Project No.: LE11197

Site and Exploration Map

Plate
A-2



LANDMARK

Geo-Engineers and Geologists

Project No.: LE11197

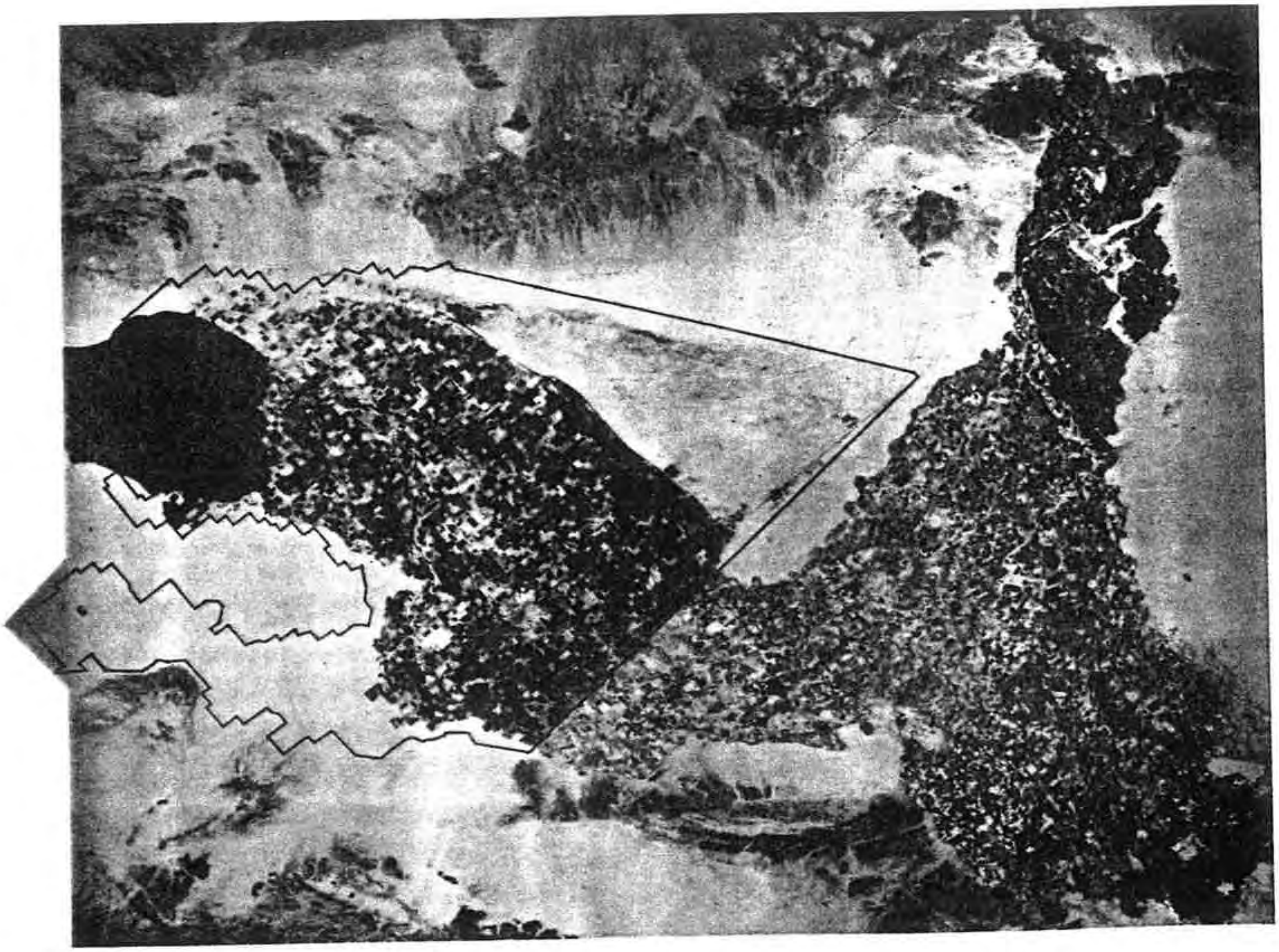
Soil Survey Map

Plate

A-3

Soil Survey of

IMPERIAL COUNTY CALIFORNIA IMPERIAL VALLEY AREA



United States Department of Agriculture Soil Conservation Service
in cooperation with
University of California Agricultural Experiment Station
and
Imperial Irrigation District

TABLE 11.--ENGINEERING INDEX PROPERTIES

[The symbol > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
100----------------- Antho	0-13	Loamy fine sand	SM	A-2	0	100	100	75-85	10-30	---	NP
	13-60	Sandy loam, fine sandy loam.	SM	A-2, A-4	0	90-100	75-95	50-60	15-40	---	NP
101*:											
Antho--------------	0-8	Loamy fine sand	SM	A-2	0	100	100	75-85	10-30	---	NP
	8-60	Sandy loam, fine sandy loam.	SM	A-2, A-4	0	90-100	75-95	50-60	15-40	---	NP
Superstition------	0-6	Fine sand-------	SM	A-2	0	100	95-100	70-85	15-25	---	NP
	6-60	Loamy fine sand, fine sand, sand.	SM	A-2	0	100	95-100	70-85	15-25	---	NP
102*. Badland											
103----------------- Carsitas	0-10	Gravelly sand---	SP, SP-SM	A-1, A-2	0-5	60-90	50-85	30-55	0-10	---	NP
	10-60	Gravelly sand, gravelly coarse sand, sand.	SP, SP-SM	A-1	0-5	60-90	50-85	25-50	0-10	---	NP
104* Fluvaquents											
105----------------- Glenbar	0-13	Clay loam-------	CL	A-6	0	100	100	90-100	70-95	35-45	15-30
	13-60	Clay loam, silty clay loam.	CL	A-6	0	100	100	90-100	70-95	35-45	15-30
106----------------- Glenbar	0-13	Clay loam-------	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	15-25
	13-60	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	15-25
107*---------------- Glenbar	0-13	Loam------------	ML, CL-ML, CL	A-4	0	100	100	100	70-80	20-30	NP-10
	13-60	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	95-100	75-95	35-45	15-30
108----------------- Holtville	0-14	Loam------------	ML	A-4	0	100	100	85-100	55-95	25-35	NP-10
	14-22	Clay, silty clay	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
	22-60	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	65-85	25-35	NP-10
109----------------- Holtville	0-17	Silty clay------	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
	17-24	Clay, silty clay	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
	24-35	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	65-85	25-35	NP-10
	35-60	Loamy very fine sand, loamy fine sand.	SM, ML	A-2, A-4	0	100	100	75-100	20-55	---	NP
110----------------- Holtville	0-17	Silty clay------	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-35
	17-24	Clay, silty clay	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-35
	24-35	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	55-85	25-35	NP-10
	35-60	Loamy very fine sand, loamy fine sand.	SM, ML	A-2, A-4	0	100	100	75-100	20-55	---	NP

See footnote at end of table.

TABLE 11.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
111*:											
Holtville----------	0-10 10-22 22-60	Silty clay loam Clay, silty clay Silt loam, very fine sandy loam.	CL, CH CL, CH ML	A-7 A-7 A-4	0 0 0	100 100 100	100 100 100	95-100 95-100 95-100	85-95 85-95 65-85	40-65 40-65 25-35	20-35 20-35 NP-10
Imperial----------	0-12 12-60	Silty clay loam Silty clay loam, silty clay, clay.	CL CH	A-7 A-7	0 0	100 100	100 100	100 100	85-95 85-95	40-50 50-70	10-20 25-45
112---------------- Imperial	0-12 12-60	Silty clay------ Silty clay loam, silty clay, clay.	CH CH	A-7 A-7	0 0	100 100	100 100	100 100	85-95 85-95	50-70 50-70	25-45 25-45
113---------------- Imperial	0-12 12-60	Silty clay------ Silty clay, clay, silty clay loam.	CH CH	A-7 A-7	0 0	100 100	100 100	100 100	85-95 85-95	50-70 50-70	25-45 25-45
114---------------- Imperial	0-12 12-60	Silty clay------ Silty clay loam, silty clay, clay.	CH CH	A-7 A-7	0 0	100 100	100 100	100 100	85-95 85-95	50-70 50-70	25-45 25-45
115*:											
Imperial----------	0-12 12-60	Silty clay loam Silty clay loam, silty clay, clay.	CL CH	A-7 A-7	0 0	100 100	100 100	100 100	85-95 85-95	40-50 50-70	10-20 25-45
Glenbar-----------	0-13 13-60	Silty clay loam Clay loam, silty clay loam.	CL CL	A-6, A-7 A-6, A-7	0 0	100 100	100 100	90-100 90-100	70-95 70-95	35-45 35-45	15-25 15-25
116*:											
Imperial----------	0-13 13-60	Silty clay loam Silty clay loam, silty clay, clay.	CL CH	A-7 A-7	0 0	100 100	100 100	100 100	85-95 85-95	40-50 50-70	10-20 25-45
Glenbar-----------	0-13 13-60	Silty clay loam Clay loam, silty clay loam.	CL CL	A-6, A-7 A-6	0 0	100 100	100 100	90-100 90-100	70-95 70-95	35-45 35-45	15-25 15-30
117, 118----------- Indio	0-12 12-72	Loam------------ Stratified loamy very fine sand to silt loam.	ML ML	A-4 A-4	0 0	95-100 95-100	95-100 95-100	85-100 85-100	75-90 75-90	20-30 20-30	NP-5 NP-5
119*:											
Indio-------------	0-12 12-72	Loam------------ Stratified loamy very fine sand to silt loam.	ML ML	A-4 A-4	0 0	95-100 95-100	95-100 95-100	85-100 85-100	75-90 75-90	20-30 20-30	NP-5 NP-5
Vint--------------	0-10 10-60	Loamy fine sand Loamy sand, loamy fine sand.	SM SM	A-2 A-2	0 0	95-100 95-100	95-100 95-100	70-80 70-80	25-35 20-30	--- ---	NP NP
120*--------------- Laveen	0-12 12-60	Loam------------ Loam, very fine sandy loam.	ML, CL-ML ML, CL-ML	A-4 A-4	0 0	100 95-100	95-100 85-95	75-85 70-80	55-65 55-65	20-30 15-25	NP-10 NP-10

See footnote at end of table.

TABLE 11.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
121----------------- Meloland	0-12	Fine sand--------	SM, SP-SM	A-2, A-3	0	95-100	90-100	75-100	5-30	---	NP
	12-26	Stratified loamy fine sand to silt loam.	ML	A-4	0	100	100	90-100	50-65	25-35	NP-10
	26-71	Clay, silty clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-40
122----------------- Meloland	0-12	Very fine sandy loam.	ML	A-4	0	95-100	95-100	95-100	55-85	25-35	NP-10
	12-26	Stratified loamy fine sand to silt loam.	ML	A-4	0	100	100	90-100	50-70	25-35	NP-10
	26-71	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-40
123*:											
Meloland-----------	0-12	Loam-------------	ML	A-4	0	95-100	95-100	95-100	55-85	25-35	NP-10
	12-26	Stratified loamy fine sand to silt loam.	ML	A-4	0	100	100	90-100	50-70	25-35	NP-10
	26-38	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-40
	38-60	Stratified silt loam to loamy fine sand.	SM, ML	A-4	0	100	100	75-100	35-55	25-35	NP-10
Holtville----------	0-12	Loam-------------	ML	A-4	0	100	100	85-100	55-95	25-35	NP-10
	12-24	Clay, silty clay	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-35
	24-36	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	55-85	25-35	NP-10
	36-60	Loamy very fine sand, loamy fine sand.	SM, ML	A-2, A-4	0	100	100	75-100	20-55	---	NP
124, 125------------ Niland	0-23	Gravelly sand---	SM, SP-SM	A-2, A-3	0	90-100	70-95	50-65	5-25	---	NP
	23-60	Silty clay, clay, clay loam.	CL, CH	A-7	0	100	100	85-100	80-95	40-65	20-40
126----------------- Niland	0-23	Fine sand--------	SM, SP-SM	A-2, A-3	0	90-100	90-100	50-65	5-25	---	NP
	23-60	Silty clay-------	CL, CH	A-7	0	100	100	85-100	80-95	40-65	20-40
127----------------- Niland	0-23	Loamy fine sand	SM	A-2	0	90-100	90-100	50-65	15-30	---	NP
	23-60	Silty clay-------	CL, CH	A-7	0	100	100	85-100	80-95	40-65	20-40
128*:											
Niland-------------	0-23	Gravelly sand---	SM, SP-SM	A-2, A-3	0	90-100	70-95	50-65	5-25	---	NP
	23-60	Silty clay, clay, clay loam.	CL, CH	A-7	0	100	100	85-100	80-100	40-65	20-40
Imperial-----------	0-12	Silty clay-------	CH	A-7	0	100	100	100	85-95	50-70	25-45
	12-60	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	100	85-95	50-70	25-45
129*: Pits											
130, 131------------ Rositas	0-27	Sand-------------	SP-SM	A-3, A-1, A-2	0	100	80-100	40-70	5-15	---	NP
	27-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2, A-1	0	100	80-100	40-85	5-30	---	NP

See footnote at end of table.

TABLE 11.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
132, 133, 134, 135- Rositas	0-9	Fine sand	SM	A-3, A-2	0	100	80-100	50-80	10-25	---	NP
	9-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2, A-1	0	100	80-100	40-85	5-30	---	NP
136 Rositas	0-4	Loamy fine sand	SM	A-1, A-2	0	100	80-100	40-85	10-35	---	NP
	4-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2, A-1	0	100	80-100	40-85	5-30	---	NP
137 Rositas	0-12	Silt loam	ML	A-4	0	100	100	90-100	70-90	20-30	NP-5
	12-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2, A-1	0	100	80-100	40-85	5-30	---	NP
138*:											
Rositas	0-4	Loamy fine sand	SM	A-1, A-2	0	100	80-100	40-85	10-35	---	NP
	4-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2, A-1	0	100	80-100	40-85	5-30	---	NP
Superstition	0-6	Loamy fine sand	SM	A-2	0	100	95-100	70-85	15-25	---	NP
	6-60	Loamy fine sand, fine sand, sand.	SM	A-2	0	100	95-100	70-85	15-25	---	NP
139 Superstition	0-6	Loamy fine sand	SM	A-2	0	100	95-100	70-85	15-25	---	NP
	6-60	Loamy fine sand, fine sand, sand.	SM	A-2	0	100	95-100	70-85	15-25	---	NP
140*:											
Torriorthents											
Rock outcrop											
141*:											
Torriorthents											
Orthids											
142 Vint	0-10	Loamy very fine sand.	SM, ML	A-4	0	100	100	85-95	40-65	15-25	NP-5
	10-60	Loamy fine sand	SM	A-2	0	95-100	95-100	70-80	20-30	---	NP
143 Vint	0-12	Fine sandy loam	ML, CL-ML, SM, SM-SC	A-4	0	100	100	75-85	45-55	15-25	NP-5
	12-60	Loamy sand, loamy fine sand.	SM	A-2	0	95-100	95-100	70-80	20-30	---	NP
144*:											
Vint	0-10	Very fine sandy loam.	SM, ML	A-4	0	100	100	85-95	40-65	15-25	NP-5
	10-40	Loamy fine sand	SM	A-2	0	95-100	95-100	70-80	20-30	---	NP
	40-60	Silty clay	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
Indio	0-12	Very fine sandy loam.	ML	A-4	0	95-100	95-100	85-100	75-90	20-30	NP-5
	12-40	Stratified loamy very fine sand to silt loam.	ML	A-4	0	95-100	95-100	85-100	75-90	20-30	NP-5
	40-72	Silty clay	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35

* See description of the map unit for composition and behavior characteristics of the map unit.

APPENDIX B

US Solar Infiltration Test Results

I-1 (Surface)

	Time	Time Interval	Initial Ht. (in)	Final Ht. (in)	Drop (in)	Infiltration Rate (min/in)	
8/29/2011	12:00 PM						
	12:35 PM	35	12	7.875	4.125	8.48	
	12:35 PM						
	2:04 PM	89	12	2.5	9.5	9.37	
	2:04 PM						**Average**
	3:29 PM	85	12	1.75	10.25	8.29	**8.83**
8/30/2011	10:11 AM						
	11:21 AM	70	12	8.375	3.625	19.31	
	11:21 AM						**Average**
	11:54 AM	33	12	10.25	1.75	18.86	**19.08**
8/31/2011	3:21 PM						
	4:26 PM	65	12	6.5	5.5	11.82	
	4:26 PM						**Average**
	4:50 PM	24	12	9.75	2.25	10.67	**11.24**

US Solar Infiltration Test Results

I-2 (12 in. Depth)

	Time	Time Interval	Initial Ht. (in)	Final Ht. (in)	Drop (in)	Infiltration Rate (min/in)	
8/29/2011	12:00 PM						
	12:35 PM	35	12	10.625	1.375	25.45	
	12:35 PM						
	2:04 PM	89	12	9.125	2.875	30.96	
	2:04 PM						**Average**
	3:29 PM	85	12	8.875	3.125	27.20	**29.08**
8/30/2011	10:11 AM						
	11:21 AM	70	12	9.75	2.25	31.11	
	11:21 AM						**Average**
	11:54 AM	33	12	10.875	1.125	29.33	**30.22**
8/31/2011	3:21 PM						
	4:26 PM	65	12	3.5	8.5	7.65	
	4:26 PM						**Average**
	4:50 PM	24	12	9.128	2.872	8.36	**8.00**

US Solar Infiltration Test Results

I-3 (Surface)

	Time	Time Interval	Initial Ht. (in)	Final Ht. (in)	Drop (in)	Infiltration Rate (min/in)	
8/29/2011	12:25 PM						
	1:10 PM	45	12	2.25	9.75	4.62	
	1:10 PM						
	2:53 PM	103	12	0	12	8.58	
	2:53 PM						**Average**
	3:41 PM	48	12	4.75	7.25	6.62	**7.60**
8/30/2011	10:35 AM						
	11:10 AM	35	12	6.75	5.25	6.67	
	11:10 AM						**Average**
	12:05 PM	55	12	6	6	9.17	**7.92**
8/31/2011	3:39 PM						
	4:15 PM	36	12	8.5	3.5	10.29	
	4:15 PM						**Average**
	5:02 PM	47	12	8.25	3.75	12.53	**11.41**

US Solar Infiltration Test Results

I-4 (12 in. Depth)

	Time	Time Interval	Initial Ht. (in)	Final Ht. (in)	Drop (in)	Infiltration Rate (min/in)	
8/29/2011	12:25 PM						
	1:10 PM	45	12	4	8	5.63	
	1:10 PM						
	2:53 PM	103	12	9.25	2.75	37.45	
	2:53 PM						**Average**
	3:41 PM	48	12	11	1	48.00	**42.73**
8/30/2011	10:35 AM						
	11:10 AM	35	12	11.25	0.75	46.67	
	11:10 AM						**Average**
	12:05 PM	55	12	11.125	0.875	62.86	**54.76**
8/31/2011	3:39 PM						
	4:15 PM	36	12	11	1	36.00	
	4:15 PM						**Average**
	5:02 PM	47	12	11	1	47.00	**41.50**

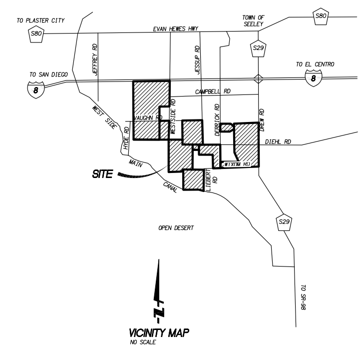
APPENDIX - C

County Standards and Rational Method Parameters

HYDROLOGIC SOIL GROUP MAP

LEGEND

- PROJECT LIMIT
- SOIL GROUP B
- SOIL GROUP C
- SOIL GROUP D
- INFILTRATION TEST LOCATION



SCALE: 1" = 800'

800 400 0 800 1600 2400

GRAPHIC SCALE IN FEET

CAMPO VERDE SOLAR

APPENDIX C

SOIL GROUP MAP

NOVEMBER 2011

02713-002-02

FUSCOE ENGINEERING

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www.fuscoe.com

SOURCE: USDA NATIONAL RESOURCE CONSERVATION SERVICE

Detail A - Runoff Coefficients (C), Rational Formula

Land Use	Percent Impervious Area	Hydrologic Soil Group											
		A			B			C			D		
		Slope Range Percent			Slope Range Percent			Slope Range Percent			Slope Range Percent		
		0-2	2-6	6 & over	0-2	2-6	6 & over	0-2	2-6	6 & over	0-2	2-6	6 & over
Industrial	90	0.67 0.85	0.68 0.85	0.68 0.86	0.68 0.85	0.68 0.86	0.69 0.86	0.68 0.86	0.69 0.86	0.69 0.87	0.69 0.86	0.69 0.86	0.70 0.88
Commercial	95	0.71 0.88	0.71 0.89	0.72 0.89	0.71 0.89	0.72 0.89	0.72 0.89	0.72 0.89	0.72 0.89	0.72 0.90	0.72 0.89	0.72 0.89	0.72 0.90
High Density Residential	60	0.47 0.58	0.49 0.60	0.50 0.61	0.48 0.59	0.50 0.61	0.52 0.64	0.49 0.60	0.51 0.62	0.54 0.66	0.51 0.62	0.53 0.64	0.56 0.69
Med. Density Residential	30	0.25 0.33	0.28 0.37	0.31 0.40	0.27 0.35	0.30 0.39	0.35 0.44	0.30 0.38	0.33 0.42	0.38 0.49	0.33 0.41	0.36 0.45	0.42 0.54
Low Density Residential	15	0.14 0.22	0.19 0.26	0.22 0.29	0.17 0.24	0.21 0.28	0.26 0.34	0.20 0.28	0.25 0.32	0.31 0.40	0.24 0.31	0.28 0.35	0.35 0.46
Agriculture	5	0.08 0.14	0.13 0.18	0.16 0.22	0.11 0.16	0.15 0.21	0.21 0.28	0.14 0.20	0.19 0.25	0.26 0.34	0.18 0.24	0.23 0.29	0.31 0.41
Open Space	2	0.05 0.11	0.10 0.16	0.14 0.20	0.08 0.14	0.13 0.19	0.19 0.26	0.12 0.18	0.17 0.23	0.24 0.32	0.16 0.22	0.21 0.27	0.28 0.39
Freeways & Expressways	70	0.57 0.70	0.59 0.71	0.60 0.72	0.58 0.71	0.60 0.72	0.61 0.74	0.59 0.72	0.61 0.73	0.63 0.76	0.60 0.73	0.62 0.75	0.64 0.78

Detail B - Runoff Coefficients for Specific Land Use

Land Use	Hydrologic Soil Group											
	A			B			C			D		
	Slope Range Percent			Slope Range Percent			Slope Range Percent			Slope Range Percent		
	0-2	2-6	6 & over	0-2	2-6	6 & over	0-2	2-6	6 & over	0-2	2-6	6 & over
Row Crops	.08 .22	.16 .30	.22 .38	.12 .26	.20 .34	.27 .44	.15 .30	.24 .37	.33 .50	.19 .34	.28 .41	.38 .56
Median Stripturf	.19 .24	.20 .26	.24 .30	.19 .25	.22 .28	.26 .33	.20 .26	.23 .30	.30 .37	.20 .27	.25 .32	.30 .40
Side Slopeturf			.25 .32			.27 .34			.28 .36			.30 .38
PAVEMENT												
Asphalt	.70 - .95											
Concrete	.80 - .95											
Brick	.70 - .80											
Drives, Walks	.75 - .85											
Roofs	.75 - .95											
Gravel Roads Shoulders	.40 - .60											

NOTE: The lower C values in each range should be used with the relatively low intensities associated with 2 to 10 year design recurrence intervals whereas the higher C values should be used for intensities associated with the longer 25 to 100 year deign recurrence intervals.

Figure 819.2A

Runoff Coefficients for Undeveloped Areas

Watershed Types

	Extreme	High	Normal	Low
Relief	.28 -.35 Steep, rugged terrain with average slopes above 30%	.20 -.28 Hilly, with average slopes of 10 to 30%	.14 -.20 Rolling, with average slopes of 5 to 10%	.08 -.14 Relatively flat land, with average slopes of 0 to 5%
Soil Infiltration	.12 -.16 No effective soil cover, either rock or thin soil mantle of negligible infiltration capacity	.08 -.12 Slow to take up water, clay or shallow loam soils of low infiltration capacity, imperfectly or poorly drained	.06 -.08 Normal; well drained light or medium textured soils, sandy loams, silt and silt loams	.04 -.06 High; deep sand or other soil that takes up water readily, very light well drained soils
Vegetal Cover	.12 -.16 No effective plant cover, bare or very sparse cover	.08 -.12 Poor to fair; clean cultivation crops, or poor natural cover, less than 20% of drainage area over good cover	.06 -.08 Fair to good; about 50% of area in good grassland or woodland, not more than 50% of area in cultivated crops	.04 -.06 Good to excellent; about 90% of drainage area in good grassland, woodland or equivalent cover
Surface Storage	.10 -.12 Negligible surface depression few and shallow; drainageways steep and small, no marshes	.08 -.10 Low; well defined system of small drainageways; no ponds or marshes	.06 -.08 Normal; considerable surface depression storage; lakes and pond marshes	.04 -.06 High; surface storage, high; drainage system not sharply defined; large flood plain storage or large number of ponds or marshes

Given An undeveloped watershed consisting of;
1) rolling terrain with average slopes of 5%,
2) clay type soils,
3) good grassland area, and
4) normal surface depressions.

Solution:

Relief	0.14
Soil Infiltration	0.08
Vegetal Cover	0.04
Surface Storage	0.06
C=	0.32

Find The runoff coefficient, C, for the above watershed.

APPENDIX - D

NOAA Data

NOAA Atlas 14, Volume 6, Version 2
Location name: El Centro, California, US*
Coordinates: 32.7559, -115.7264
Elevation: -35 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.075** (0.064-0.089)	**0.115** (0.098-0.138)	**0.175** (0.148-0.210)	**0.229** (0.191-0.276)	**0.311** (0.250-0.389)	**0.382** (0.301-0.489)	**0.461** (0.354-0.607)	**0.552** (0.412-0.749)	**0.692** (0.493-0.981)	**0.815** (0.560-1.20)
10-min	**0.108** (0.091-0.128)	**0.166** (0.140-0.198)	**0.251** (0.211-0.301)	**0.328** (0.274-0.396)	**0.445** (0.359-0.558)	**0.547** (0.431-0.701)	**0.661** (0.508-0.870)	**0.792** (0.590-1.07)	**0.992** (0.707-1.41)	**1.17** (0.803-1.72)
15-min	**0.130** (0.110-0.155)	**0.200** (0.169-0.239)	**0.303** (0.256-0.363)	**0.396** (0.331-0.479)	**0.539** (0.434-0.675)	**0.662** (0.521-0.848)	**0.800** (0.614-1.05)	**0.958** (0.714-1.30)	**1.20** (0.855-1.70)	**1.41** (0.970-2.08)
30-min	**0.179** (0.152-0.214)	**0.276** (0.233-0.329)	**0.418** (0.352-0.500)	**0.546** (0.456-0.660)	**0.742** (0.598-0.929)	**0.911** (0.718-1.17)	**1.10** (0.846-1.45)	**1.32** (0.983-1.79)	**1.65** (1.18-2.34)	**1.95** (1.34-2.86)
60-min	**0.250** (0.212-0.299)	**0.385** (0.326-0.460)	**0.584** (0.492-0.700)	**0.763** (0.638-0.922)	**1.04** (0.836-1.30)	**1.27** (1.00-1.63)	**1.54** (1.18-2.03)	**1.84** (1.37-2.50)	**2.31** (1.65-3.27)	**2.72** (1.87-4.00)
2-hr	**0.341** (0.289-0.407)	**0.508** (0.429-0.606)	**0.748** (0.631-0.896)	**0.962** (0.804-1.16)	**1.28** (1.04-1.61)	**1.56** (1.23-2.00)	**1.87** (1.43-2.46)	**2.21** (1.65-3.00)	**2.74** (1.95-3.89)	**3.20** (2.20-4.71)
3-hr	**0.395** (0.334-0.471)	**0.580** (0.491-0.693)	**0.846** (0.713-1.01)	**1.08** (0.905-1.31)	**1.44** (1.16-1.80)	**1.74** (1.37-2.23)	**2.07** (1.59-2.73)	**2.45** (1.83-3.32)	**3.02** (2.15-4.28)	**3.52** (2.42-5.17)
6-hr	**0.487** (0.412-0.581)	**0.709** (0.599-0.846)	**1.02** (0.864-1.23)	**1.30** (1.09-1.58)	**1.72** (1.39-2.16)	**2.07** (1.64-2.66)	**2.46** (1.89-3.24)	**2.90** (2.16-3.93)	**3.55** (2.53-5.04)	**4.12** (2.83-6.05)
12-hr	**0.546** (0.463-0.652)	**0.803** (0.679-0.959)	**1.17** (0.988-1.40)	**1.50** (1.25-1.81)	**1.99** (1.60-2.49)	**2.40** (1.89-3.08)	**2.86** (2.20-3.76)	**3.37** (2.51-4.57)	**4.13** (2.95-5.86)	**4.79** (3.29-7.04)
24-hr	**0.683** (0.603-0.789)	**1.01** (0.896-1.17)	**1.50** (1.32-1.74)	**1.93** (1.69-2.26)	**2.59** (2.19-3.12)	**3.14** (2.61-3.86)	**3.76** (3.06-4.73)	**4.46** (3.53-5.75)	**5.51** (4.20-7.38)	**6.41** (4.73-8.86)
2-day	**0.767** (0.677-0.886)	**1.15** (1.01-1.33)	**1.71** (1.50-1.98)	**2.21** (1.93-2.58)	**2.96** (2.50-3.56)	**3.60** (2.99-4.42)	**4.31** (3.50-5.41)	**5.11** (4.04-6.58)	**6.31** (4.81-8.45)	**7.34** (5.42-10.2)
3-day	**0.812** (0.717-0.938)	**1.22** (1.07-1.41)	**1.81** (1.59-2.10)	**2.34** (2.05-2.74)	**3.14** (2.66-3.78)	**3.82** (3.18-4.69)	**4.58** (3.72-5.75)	**5.42** (4.29-6.99)	**6.70** (5.10-8.97)	**7.79** (5.75-10.8)
4-day	**0.841** (0.743-0.972)	**1.26** (1.11-1.46)	**1.88** (1.65-2.18)	**2.43** (2.12-2.84)	**3.25** (2.75-3.92)	**3.95** (3.28-4.85)	**4.72** (3.84-5.93)	**5.59** (4.43-7.21)	**6.90** (5.25-9.23)	**8.01** (5.91-11.1)
7-day	**0.888** (0.784-1.02)	**1.32** (1.17-1.53)	**1.97** (1.73-2.28)	**2.53** (2.21-2.96)	**3.39** (2.87-4.08)	**4.11** (3.41-5.04)	**4.90** (3.98-6.16)	**5.79** (4.58-7.46)	**7.11** (5.42-9.53)	**8.24** (6.08-11.4)
10-day	**0.907** (0.801-1.05)	**1.35** (1.19-1.57)	**2.01** (1.76-2.33)	**2.58** (2.26-3.02)	**3.45** (2.92-4.16)	**4.18** (3.47-5.13)	**4.97** (4.04-6.25)	**5.86** (4.64-7.55)	**7.18** (5.47-9.61)	**8.29** (6.12-11.5)
20-day	**0.989** (0.874-1.14)	**1.49** (1.32-1.73)	**2.21** (1.95-2.57)	**2.85** (2.49-3.33)	**3.79** (3.21-4.56)	**4.57** (3.79-5.61)	**5.41** (4.39-6.79)	**6.33** (5.01-8.16)	**7.67** (5.84-10.3)	**8.77** (6.47-12.1)
30-day	**1.02** (0.899-1.18)	**1.56** (1.38-1.80)	**2.34** (2.06-2.71)	**3.02** (2.63-3.52)	**4.01** (3.40-4.83)	**4.83** (4.01-5.93)	**5.70** (4.63-7.16)	**6.64** (5.26-8.55)	**7.98** (6.08-10.7)	**9.06** (6.69-12.5)
45-day	**1.08** (0.956-1.25)	**1.69** (1.49-1.95)	**2.55** (2.24-2.96)	**3.30** (2.88-3.85)	**4.39** (3.72-5.29)	**5.28** (4.38-6.48)	**6.21** (5.04-7.79)	**7.20** (5.70-9.27)	**8.59** (6.54-11.5)	**9.69** (7.15-13.4)
60-day	**1.14** (1.01-1.32)	**1.81** (1.60-2.09)	**2.76** (2.43-3.20)	**3.58** (3.13-4.18)	**4.76** (4.03-5.73)	**5.71** (4.75-7.02)	**6.71** (5.46-8.43)	**7.76** (6.14-10.0)	**9.21** (7.01-12.3)	**10.3** (7.63-14.3)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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APPENDIX - E

Existing and Proposed Conditions Basin Maps

APPENDIX E-1

Existing Basin Map

LEGEND

FLOW DIRECTION

E-1 - EXISTING BASIN MAP

CAMPO VERDE SOLAR PROJECT

IMPERIAL COUNTY

PROJECT NUMBER: 02713-02-001

SCALE: 1"=500'

DATE: 01/2012

SHEET 1 OF 1

FUSCOE ENGINEERING
6390 Greenwich Drive, Suite 170
San Diego, California 92122
tel 858.554.1500 • fax 858.597.0335
www.fuscoe.com

APPENDIX E-2

Proposed Conditions Basin Map

E-2 PROPOSED BASIN MAP

CAMPO VERDE SOLAR PROJECT

IMPERIAL COUNTY

PROJECT NUMBER: 02713-02-001

SCALE: 1"=500'

DATE: 01/2012

SHEET 1 OF 1

FUSCOE ENGINEERING
6390 Greenwich Drive, Suite 170
San Diego, California 92122
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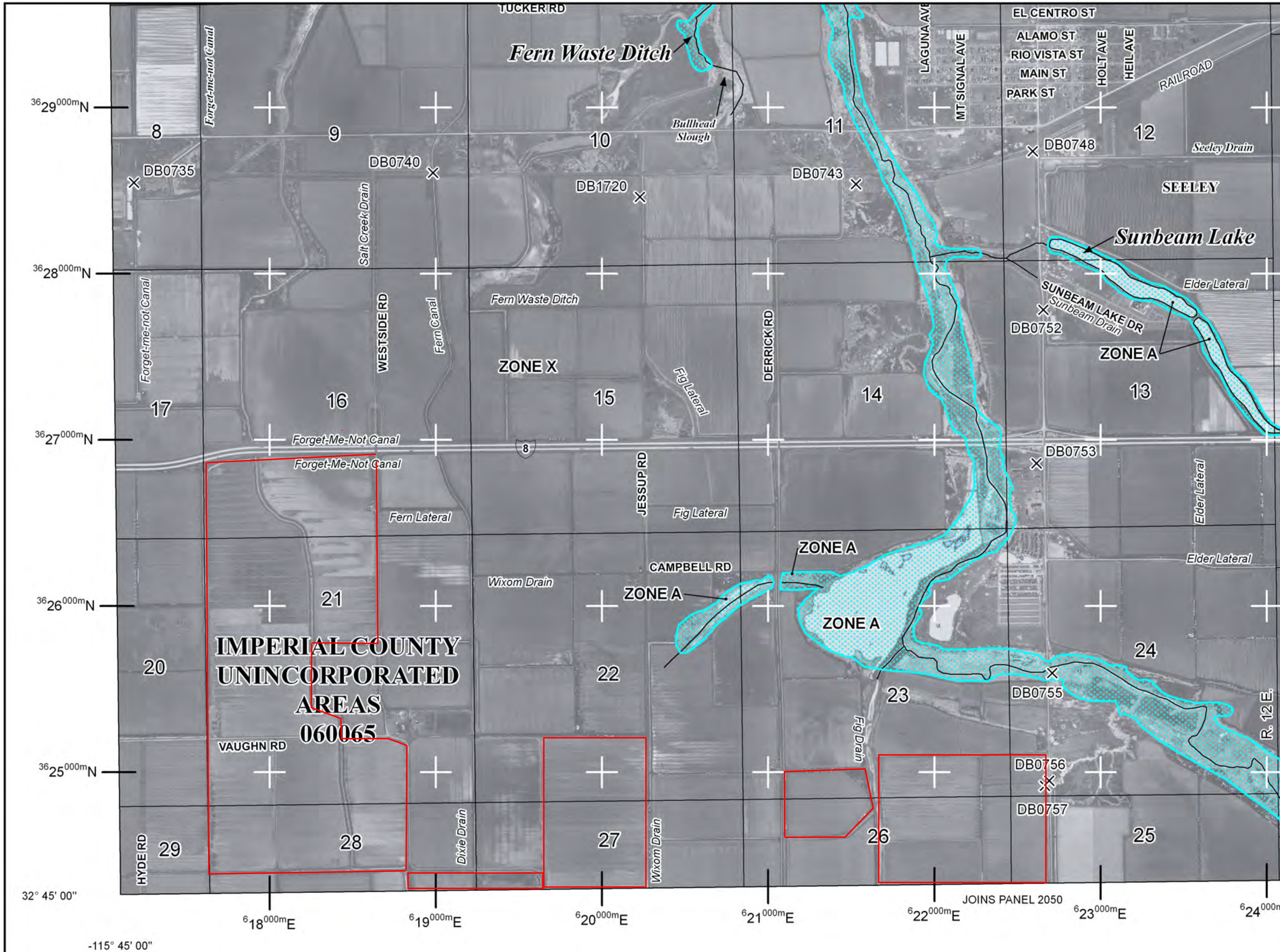
M:\PROJECTS\02713 FIRST SOLAR\002-01 CAMPO VERDE SOLAR PLANT\ENG\H-H\BASIN MAPS\PROPOSED.---->LAYOUT

APPENDIX - F

FEMA FIRMettes



MAP SCALE 1" = 2000'

0 2000 4000 FEET

METERS

NFIP

PANEL 1700C

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP
IMPERIAL COUNTY, CALIFORNIA
AND INCORPORATED AREAS

PANEL 1700 OF 2300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
IMPERIAL COUNTY, UNINCORPORATED AREAS	060065	1700	C

Notice to User: The **Map Number** shown below should be used when placing map orders: the **Community Number** shown above should be used on insurance applications for the subject

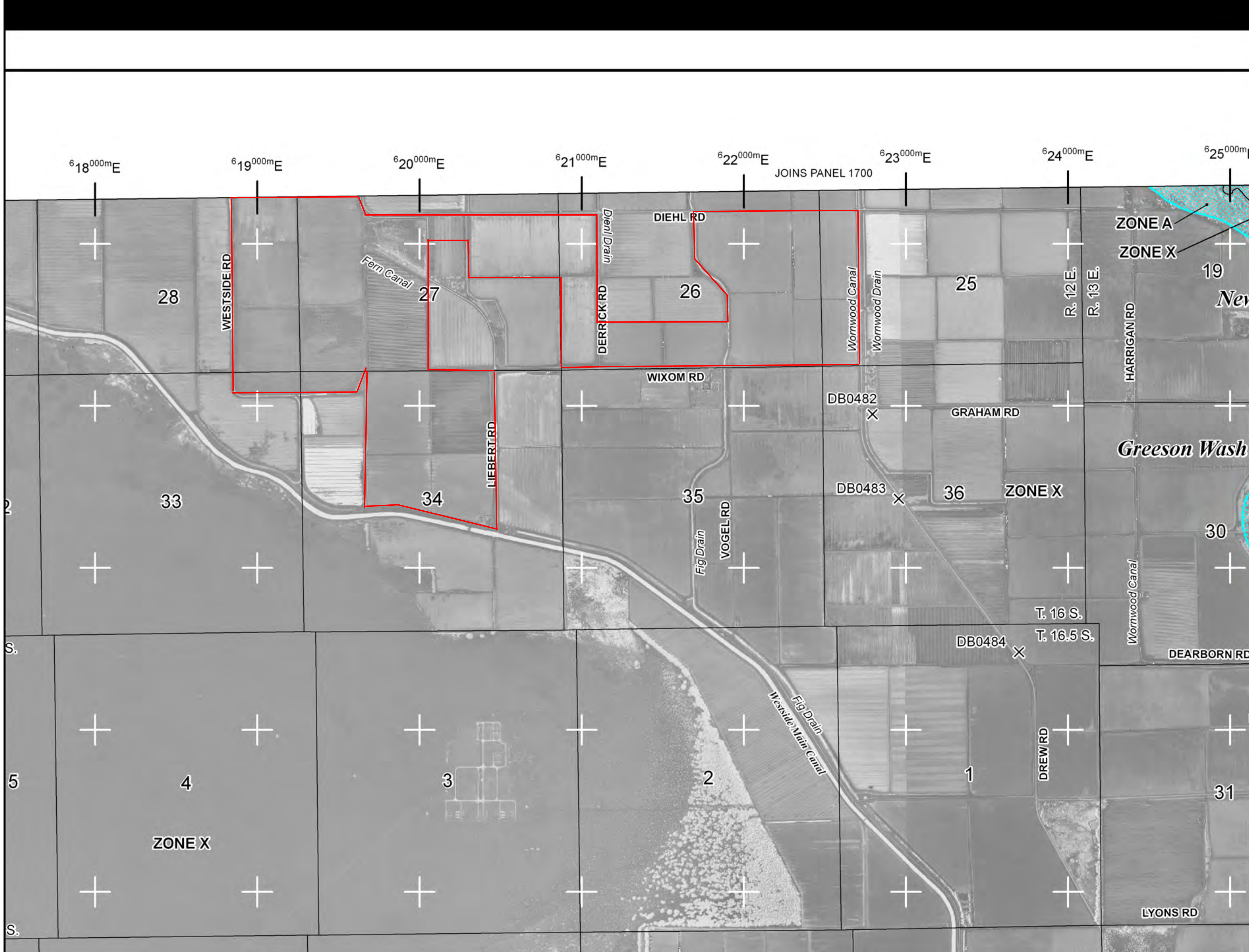
MAP NUMBER 06025C1700C

EFFECTIVE DATE SEPTEMBER 26, 2008

Federal Emergency Management Agency

PROJECT LIMITS

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2050C

FIRM

FLOOD INSURANCE RATE MAP

IMPERIAL COUNTY, CALIFORNIA

AND INCORPORATED AREAS

PANEL 2050 OF 2300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
IMPERIAL COUNTY, UNINCORPORATED AREAS	060065	2050	C

Notice to User: The **Map Number** shown below should be used when placing map orders: the **Community Number** shown above should be used on insurance applications for the subject

MAP NUMBER 06025C2050C

EFFECTIVE DATE SEPTEMBER 26, 2008

Federal Emergency Management Agency

PROJECT LIMITS

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov