APPENDIX I

CONCEPTUAL DRAINAGE STUDY AND STORM WATER QUALITY ANALYSIS

WISTARIA RANCH CONCEPTUAL DRAINAGE STUDY AND STORM WATER QUALITY ANALYSIS

Date: January 2014

Prepared By:

Fuscoe Engineering, Inc.
6390 Greenwich Drive, Suite 170
San Diego, CA 92122
858.554.1500

01-13-14

Paul D. Haaland, PE RCE 63656 Exp: 09-30-14

CONTENTS

APPENDIX

1.0 INTRODUCTION

1.1 STUDY DESCRIPTION

The purpose of this study is to describe the existing and proposed hydrologic conditions for the Wistaria Ranch Solar project. The study will analyze the peak runoff flow volume from existing and proposed site, provision of runoff detention with respect to County of Imperial standards, and potential 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) Guidelines, Appendix G.

1.2 PROJECT DESCRIPTION

The proposed 2,815.7-acre Wistaria Ranch Solar project is located between the All-American Canal and Schaniel Road, and between Brockman Road and Ferrell Road. The site is located in an unincorporated area of the County of Imperial, approximately 7 miles south-west of El Centro. The project proposes to construct a solar energy power plant within a limit of work of approximately 2,600 acres. See Vicinity Map in Appendix A. The project may be constructed in multiple phases over several years through 17 separate Conditional Use Permits.

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 (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 shallow detention basins located outside of the solar arrays or detention of runoff in shallow ponded areas under the arrays or combination of both. This study calculates a maximum volume of runoff to be stored (per County of Imperial standard of 3" of detention over the project site) for the purpose of studying a worst-case scenario, and the anticipated increase in runoff volume from the site due to development. At the time of final design, a final hydrology study will be prepared and processed for approval with the County of Imperial Department of Public Works.

Ultimate locations and limits of detention basins will be determined at the time of final engineering. The design of the project proposes to utilize connection to existing discharge locations to the IID Drain System and/or the New River, connection to relocated discharge locations to the IID Drain System and/or the New River, and percolation into the underlying soil. The final hydrology study will provide a more in-depth analysis of the project's hydrology and hydraulics, considering items such as finished ground topography, infiltration rates for underlying soils, final limits of array development, and routing of flow through discharge pipes to the IID Drain system. The final hydrologic design will be such that the proposed condition discharge flowrate is attenuated to be equal to or less than the existing condition discharge flowrate.

1.3 HYDROLOGIC SETTING

The perimeter of the project site is surrounded by public roads, IID Canals, and IID Drains (see Appendix E-1&2, Drainage Basin Map). Based upon review of topography and field investigation, it is determined that the only offsite flow that enters the project originates from adjacent paved and unpaved roads. The flow from adjacent fields does not enter the project. As such, this study includes consideration of runoff from adjacent paved roads, but runoff from adjacent fields entering the project limits need not be considered.

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 was 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 leach field systems or permanent structures (such as the Substation, Operation and Maintenance Building, or gen-tie/transmission poles, collection systems).

IID facilities that accept flow from the project include the A.A. Drains No. 11and No.13, Wistaria Drains No. 5 and No. 7, Greeson Drain and Greeson No. 2 Drain. Portions of the project discharge directly to the New River. Some of the IID facilities combine such that flow from the project is ultimately conveyed from the site in Greeson Drain and New River. Greeson Drain discharges to the New River approximately 1.6 miles north of the project. As discussed in sections 2.3.1 and 2.3.2, portions of the site are not adjacent to either an IID Drain or the New River. These portions of the site discharge either to existing ditches that convey runoff alongside existing roads or to underground storm drain pipe and ultimately discharge to an IID Drain or the New River.

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 peak 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. The final design of the project will satisfy each of these requirements or the applicable requirements as otherwise amended.

As discussed, the project site is divided into individual fields by existing Canals, Drains, public roads, and private roads that have multiple discharge points to the various IID Drains or the New River. The division of the site in this manner allows the project to be phased without the need for extensive storm drain infrastructure.

The majority of the project is located within FEMA flood hazard Zone X, however, portions of the project bounded by the New River and Greeson Drain are within Zone A. Zone X corresponds to areas that are located above the flood level having a 1% chance of occurrence (the 100-year event). Zone A corresponds to areas within the flood level having a 1% annual chance of flooding, however, no depth or base flood elevations have been determined through detailed analysis. 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 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 maximum volume of water to be detained will be equal to 3" of runoff from the project per County of Imperial Public Works Department (DPW) requirement. At final design and engineering, a final hydrology study will be prepared and processed for approval with DPW utilizing standard industry practice that models factors such as runoff coefficient or curve number, infiltration into underlying soils, and flow in storm drain discharge pipes connected to the IID Drain system and/or the New River.
2. Detention will be provided in shallow ponding areas within the project footprint or within designated detention basins outside arrays, or combination of both.
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. Existing surface connection points to the IID Drain system will either remain in their existing location and continue to be used if possible, be relocated as necessary, or be cut and capped if no longer needed. Addition of connection points to the IID Drain system is not proposed. All existing surface connection points that are proposed to be used for the project will be upgraded to meet current IID standards.
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 runoff coefficient). The modeling of runoff and routing of flow through proposed detention areas/basins will be provided at the time of final design. Said modeling and routing is beyond the scope of the concept study and is dependent upon and will consider factors such as infiltration rates of underlying soils, flow in discharge pipes outletting to the IID Drain system and/or the New River, final site development area, and final site finished ground topography.

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 similar recent projects, 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
104	Fluvaquents	Saline	D
106	Glenbar	Clay loam	B
109	Holtville	Silty clay	C
110	Holtville	Silty clay	C
112	Imperial	Silty clay	C
114	Imperial	Silty clay, wet	C
115	Imperial	Silty clay loams, wet	C
116	Imperial	Silty clay loams	C
117	Indio	Loam	B
118	Indio	Loam, wet	B
119	Indio	Vint Complex	A
122	Meloland	Loamy very fine sandy loam, wet	C
123	Meloland and Holtville	Loams, wet	C
142	Vint	Loamy very fine sand, wet	B
144	Vint and Indio	Very fine sandy loams, wet	B
145	Water	-	-

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 in tabular format the combined percentage of the soul groups presented on northern (1,899.5 ac), central (424.7 ac) and southern (491.5 ac) portions of the site. The Soils Group Maps in Appendix B graphically shows the locations of soil groups through the site.

Table 2 – Soil Group Distribution

Hydrologic Soil Group	% of Site
A	2.3%
B	29.1%
C	64.9%
D	3.7%

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	Sandy loan, clay loam, silty clay	0.08
Vegetal Cover	82% of area in good cover	Well cultivated crops > 80% cover	0.06
Surface Storage	Well defined system of small drainageways	Rows crops graded to convey irrigation well	0.09
Aggregate C Factor			0.31

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 A (2.3%), B (29.1%), C (64.9%), and D (3.7%), 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
A	0.22	2.3	0.00506
B	0.26	*29.1*	0.07566
C	0.30	64.9	0.1947
D	0.34	3.7	0.01258
Project Site Weighted "C" Factor			0.288

Determination of the existing condition runoff coefficient from both methods is consistent and for hydrologic calculation purposes, an existing condition average 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 L4-4, see Appendix P-1&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 will feature a 20' wide perimeter roadways consisting of native compacted material. 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. The geotechnical investigation for this site has not been prepared yet. Array clearing, disc-and-roll, and compaction for similar solar projects recommends that sheet graded areas may be compacted in-place to a minimum relative compaction of 85%. Since this may apply to the soils under the arrays, the array areas are assigned the same runoff coefficient (0.60) as the perimeter roadways. Note that final compaction requirements for the array footings/pilings are dependent on the recommendations of the final geotechnical report, 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 may 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. 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
Perimeter Roadways	0.60	3.6	4.4%	0.026
Arrays	0.60	48.5	60.0%	0.360
PCS Shelters	0.95	0.1	0.1%	0.001
Remaining Areas	0.60	28.6	35.5%	0.213
Total		80.8	100.0%	0.600

The runoff coefficient for the proposed condition to be used in hydrologic calculations is 0.60. 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. Storm duration of 24-hours is assumed, and the corresponding precipitation estimate is 3.77 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 for Drainage Basin Maps). Points of concentration in drainage basins are shown on Drainage Basin Maps. Ultimate points of discharge to the IID Drains for the existing and proposed conditions will be similar.

The project site is divided into watersheds that are tributary to eight distinct Drains that are the points of discharge from the subject site: the Greeson Drain (for which basins are noted with a "G"), the Greeson Drain #2 (for which basins are noted with a "G2"), the A.A. Drain No. 13 (for which basins are noted with an "AA13"), the A.A. Drain No. 11 (for which basins are noted with an "AA11"), a Spill to the Greeson Drain from the Wistaria Canal Lateral 4 (for which basins are noted with a "SP"), the Wistaria Drain (for which basins are noted with a "W"), the Wistaria 5 Drain (for which basins are noted with an "W5"), and the Wistaria 7 Drain (for which basins are noted with a "W7"). In addition, portions of the project (for which basins are noted with a "NR") are directly tributary to the New River and do not discharge to an IID Drain.

Ultimately, all discharge from the project tributary to an IID Drain is discharged to the Greeson Drain, either directly or in the manner summarized below:

- A.A. Drain #13 – Discharges to Mt. Signal Drain and Mt. Signal Drain discharges to Greeson Drain approximately 1 mile west of the project
- A.A. Drain #11, Greeson Drain #2, Wistaria Drain, Wistaria Canal Lateral 4 Spill, Wistaria 7 Drain – Discharge directly to Greeson Drain
- Wistaria 5 Drain – Discharges to the Spill from Wistaria Canal Lateral 4, which then discharges to Greeson Drain

Note that flow from the Greeson Drain is discharged to the New River approximately 1.6 miles north of the project. As such, the ultimate receiving bodies conveying flow from the project are the Greeson Drain and New River.

In the proposed condition, the conveyance situation described above will remain unchanged, and there is no change in basin areas from existing to proposed conditions. Therefore, the project does not propose a significant change in existing drainage patterns.

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 6. 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 0.3 and 100-year 24-hour precipitation of 3.77 inches.

Table 6: Existing Condition Storm Water Runoff

Receiving Drain: A.A. Drain No. 13			
Basin Name	Area (ac)	County Storage (ac-ft)	100-Year Runoff (ac-ft)
AA13-1	42.4	10.6	4.0
Total	42.4	10.6	4.0

Receiving Drain: A.A. Drain No. 11			
Basin Name	Area (ac)	County Storage (ac-ft)	100-Year Runoff (ac-ft)
AA11-1	90.8	22.7	8.6
Total	90.8	22.7	8.6

Receiving Drain: Greeson No. 2 Drain			
Basin Name	Area (ac)	County Storage (ac-ft)	100-Year Runoff (ac-ft)
G2-1	85.1	21.3	8.0
G2-2	74.2	18.6	7.0
G2-3	66.9	16.7	6.3
G2-4	62.5	15.6	5.9
Total	288.7	72.2	27.2

Receiving Drain: Greeson Drain			
Basin Name	Area (ac)	County Storage (ac-ft)	100-Year Runoff (ac-ft)
G-1	73.7	18.4	6.9
G-2	80.1	20.0	7.5
G-3	37.6	9.4	3.5
G-4	38.5	9.6	3.6
G-5	36.7	9.2	3.5
G-6	38.6	9.7	3.6
G-7	105.4	26.4	9.9
G-8	119.9	30.0	11.3
G-9	109.1	27.3	10.3
Total	639.6	160.0	60.1

Receiving Drain: Wistaria Drain			
Basin Name	Area (ac)	County Storage (ac-ft)	100-Year Runoff (ac-ft)
W-1	76.5	19.1	7.2
Total	76.5	19.1	7.2

Receiving Drain: Spill from the Wistaria Canal Lateral 4			
Basin Name	Area (ac)	County Storage (ac-ft)	100-Year Runoff (ac-ft)
SP-1	81.7	20.4	7.7
SP-2	80.8	20.2	7.6

SP-3	82.2	20.6	7.7
Total	244.7	61.2	23.0

Receiving Drain: Wistaria 5 Drain			
Basin Name	Area (ac)	County Storage (ac-ft)	100-Year Runoff (ac-ft)
W5-1	75.7	18.9	7.1
W5-2	74.0	18.5	7.0
W5-3	76.4	19.1	7.4
W5-4	77.5	19.4	7.2
W5-5	75.4	18.9	7.1
W5-6	31.0	7.8	2.9
W5-7	43.8	11.0	4.1
W5-8	75.9	19.0	7.2
W5-10	82.5	20.6	7.8
Total	612.2	153.2	57.8

Receiving Drain: Wistaria 7 Drain			
Basin Name	Area (ac)	County Storage (ac-ft)	100-Year Runoff (ac-ft)
W7-1	72.3	18.1	6.8
W7-2	80.8	20.2	7.6
W7-3	79.4	19.9	7.7
W7-4	78.2	19.6	7.5
W7-5	87.2	21.8	8.2
Total	397.9	99.6	37.8

Receiving Waterbody: New River			
Basin Name	Area (ac)	County Storage (ac-ft)	100-Year Runoff (ac-ft)
NR-6	25.7	6.4	2.4
NR-7	51.0	12.8	4.8
NR-8	53.3	13.3	5.0
NR-9	152.9	38.2	14.4
NR-10	127.0	31.8	12.0
Total	409.9	102.5	38.6

The majority of the drainage basins given in Table 6 are discharged directly to either an IID Drain or the New River. However, some are discharged to shallow earthen ditches or underground storm drain pipe. These ditches and pipes subsequently convey flow from the project site to an ultimate point of discharge to either an IID Drain or the New River. Basins discharging in this manner are summarized below:

- Basins W7-2, W7-3, W7-4, and W7-5 discharge to relatively shallow earthen ditches that convey flow to Wistaria 7 Drain
- Basins SP-1 and SP-2 discharge to relatively shallow earthen ditches that convey flow to the Spill from Wistaria Canal Lateral 4
- Basin SP-3 discharges to underground storm drain pipe that conveys flow to the Spill from Wistaria Canal Lateral 4
- Basin W5-10 discharges to underground storm drain pipe that conveys flow to Wistaria 5 Drain

b. Agricultural Runoff:

In the existing condition, runoff from agricultural activities is discharged to the Drain system or the New River. 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 the project limits to 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 which receive 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. As discussed in Section 2.3.2.b, some on-site soils may have the potential to infiltrate runoff. Where this is the case, runoff will be infiltrated. Where infiltration is not feasible, runoff will be detained and slowly released to the IID Drain system such that post-project flows do not exceed the flows in the existing conditions. Therefore, there will be no resultant impact to IID Drains due to the proposed project.

To enable the development of the solar arrays, private dirt roads and ditches within the project will be re-graded as necessary, and, if necessary, cultivated areas may be re-graded to provide smooth transitions across arrays and to produce positive surface drainage to the designated shallow ponding areas, which will provide storm water detention. A private perimeter access road will be constructed around the arrays. As discussed previously, this conceptual study calculates a maximum volume of runoff that may be detained in accordance with the County standard of 3" of runoff within the project site. Detention requirements over the project site will be satisfied by detention basins located outside of the solar arrays or detention of runoff in shallow ponded areas under the arrays or combination of both. At the time of final design and engineering, a final hydrology study will be prepared and processed for approval with DPW utilizing standard industry practice that models factors such as runoff coefficient or curve number, infiltration into underlying soils, and flow in storm drain discharge pipes connected to the IID Drain system and/or the New River. Ultimate locations, volumes, and limits of detention basins will be determined at the time of final engineering.

Table 7 provides the required volumes of detention to meet both the County standard of 3" of runoff from the project and the 100-year runoff. 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. The 100-year runoff is the estimated volume based on a "C" factor of 0.60 and a 100-year 24-hour precipitation of 3.77 inches.

The design of the project proposes to utilize connection to existing discharge locations to the IID Drain System and/or the New River, connection to relocated discharge locations to the IID Drain System and/or the New River, and percolation into the underlying soil.

Table 7: Proposed Condition Storm Water Runoff

Receiving Drain: A.A. Drain No. 13			
Basin Name	Area (ac)	County Storage (ac-ft)	100-Year Runoff (ac-ft)
AA13-1	42.4	10.6	8.0
Total	42.4	10.6	8.0

Receiving Drain: A.A. Drain No. 11			
Basin Name	Area (ac)	County Storage (ac-ft)	100-Year Runoff (ac-ft)
AA11-1	90.8	22.7	17.1
Total	90.8	22.7	17.1

Receiving Drain: Greeson No.2 Drain			
Basin Name	Area (ac)	County Storage (ac-ft)	100-Year Runoff (ac-ft)
G2-1	85.1	21.3	16.0
G2-2	74.2	18.6	14.0
G2-3	66.9	16.7	12.6
G2-4	62.5	15.6	11.8
Total	288.7	72.2	54.4

Receiving Drain: Greeson Drain			
Basin Name	Area (ac)	County Storage (ac-ft)	100-Year Runoff (ac-ft)
G-1	73.7	18.4	13.9
G-2	80.1	20.0	15.1
G-3	37.6	9.4	7.1
G-4	38.5	9.6	7.3
G-5	36.7	9.2	6.9
G-6	38.6	9.7	7.3
G-7	105.4	26.4	19.9
G-8	119.9	30.0	22.6
G-9	109.1	27.3	20.6
Total	639.6	160.0	120.7

Receiving Drain: Wistaria Drain			
Basin Name	Area (ac)	County Storage (ac-ft)	100-Year Runoff (ac-ft)
W-1	76.5	19.1	14.4
Total	76.5	19.1	14.4

Receiving Drain: Spill from Wistaria Canal Lateral 4			
Basin Name	Area (ac)	County Storage (ac-ft)	100-Year Runoff (ac-ft)
SP-1	81.7	20.4	15.4
SP-2	80.8	20.2	15.2
SP-3	82.2	20.6	15.5
Total	244.7	61.2	46.1

Receiving Drain: Wistaria 5 Drain			
Basin Name	Area (ac)	County Storage (ac-ft)	100-Year Runoff (ac-ft)
W5-1	75.7	18.9	14.3
W5-2	74.0	18.5	13.9
W5-3	76.4	19.1	14.4
W5-4	77.5	19.4	14.6
W5-5	75.4	18.9	14.2
W5-6	31.0	7.8	5.8
W5-7	43.8	11.0	8.3
W5-8	75.9	19.0	14.3
W5-10	82.5	20.6	15.6
Total	612.2	153.2	115.4

Receiving Drain: Wistaria 7 Drain			
Basin Name	Area (ac)	County Storage (ac-ft)	100-Year Runoff (ac-ft)
W7-1	72.3	18.1	13.6
W7-2	80.8	20.2	15.1
W7-3	79.4	19.9	15.0
W7-4	78.2	19.6	14.7
W7-5	87.2	21.8	16.4
Total	397.9	99.6	74.8

Receiving Waterbody: New River			
Basin Name	Area (ac)	County Storage (ac-ft)	100-Year Runoff (ac-ft)
NR-6	25.7	6.4	4.8
NR-7	51.0	12.8	9.6
NR-8	53.3	13.3	10.0
NR-9	152.9	38.2	28.8
NR-10	127.0	31.8	23.9
Total	409.9	102.5	77.1

As discussed previously, the majority of the drainage basins given in Table 7 are discharged directly to either an IID Drain or the New River. The connections to the IID Drain or the New River are such that it is typically feasible for a connection to be made from a detention basin of 3'-4' depth to the receiving drain or the river. These drainage basins could also provide the required detention via shallow ponding under the arrays.

However, some drainage basins are discharged to shallow earthen ditches or underground storm drain pipe. From field investigation, the earthen ditches receiving flow from fields are typically too shallow to receive a connection from a 3'-4' deep detention basin. These drainage basins (specifically Basins W7-2, W7-3, W7-4, W7-5, SP-1, and SP-2) will therefore need to provide detention via shallow ponding under arrays to allow for discharge from the site to the shallow ditches.

Underground storm drain pipe receiving flow from fields is typically deep enough to allow for a connection from a 3'-4' deep detention basin. As such, for Basins SP-3 and W5-10 it should be feasible to connect flow from a 3'-4' deep detention basin to the existing storm drain pipe. These drainage basins could also provide the required detention via shallow ponding under the arrays.

b. Potential for Infiltration of Runoff:
As discussed in Section 2.2.1b, the full range of hydrologic soil groups is present on site. In areas where the dominate soils belong to groups A or B, infiltration of storm water runoff may be feasible. While infiltration testing has not been done on the site at this time, groups A and B generally consist of soils that have moderate to high percolation rates (0.15 inches/hour and above) and are therefore suitable for infiltration. Soil groups A and B are generally present mostly in the northern portion of the project site. (Refer to Appendix B for an NRCS soils resource report and an exhibit showing the location of the various soil groups on the project site.)

At the time of final engineering, infiltration tests will be performed to confirm infiltration feasibility and calculate drawdown times at the proposed ponding locations. At this preliminary stage, ponding areas which are underlain by group A or B soils are proposed to drain primarily through infiltration into the ground, although storm drain connection to the receiving IID Drain or New River may be necessary. A maximum drawdown time of 72 hours will be considered during final design in order to prevent the creation of vector control issues. Ponding areas which are underlain by ground C or D soils, or are calculated to have a drawdown time of greater than 72 hours through infiltration alone, will be provided with a storm drain connection to the IID Drain system or the New River. These storm drain connections will take the place of existing connections, will be located at or near existing connections, and will be constructed in accordance with current standards. The project proposes to match or reduce the number of existing connections to the IID Drain system and/or New River. In combination with infiltration through the underlying soils, the connections will be designed to provide the ponding areas with a drawdown time of 72 hours or less while limiting proposed conditions flow rates to be equal to or below existing levels.

At the time of final design and engineering, a final hydrology study will be prepared and processed for approval with DPW utilizing standard industry practice that models factors such as runoff coefficient or curve number, infiltration into underlying soils, and flow in storm drain discharge pipes connected to the IID Drain system and/or the New River. Ultimate locations, volumes, and limits of detention basins will be determined at the time of final engineering.

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.

d. Phasing:
The project may be constructed in individual phases through 17 Conditional Use Permits. Should the phasing of the project be necessary, the hydrologic aspects of the project would be similar to constructing the project in one phase. Whether the project is constructed in several phases or one phase, the project can be constructed without substantial change to existing drainage patterns. The developer or contractor shall be aware of the following drainage considerations when planning and constructing the project, especially if the project is phased:

- A shallow earthen ditch receives flow from Basin W7-5 and conveys runoff along the northerly limit of Basin W7-2. At the northwesterly corner of Basin W7-2, flow between Basins W7-5 and W7-2 confluence and discharge to an earthen ditch along the northerly limit of Basin W7-3. At the northwesterly corner of Basin W7-3, the ditch receives runoff from the fields located to the north and conveys flow southerly to Wisteria 7 Drain. In the development and construction of Basins W7-2 and W7-3, the earthen ditch shall remain either undisturbed or otherwise reconstructed in a manner that continues the above described conveyance of flow.
- A shallow earthen ditch receives flow from Basin SP-1 and conveys runoff along the southerly limit of Basin SP-2. At the southwesterly corner of Basin SP-2, flow between Basins SP-1 and SP-2 confluence and discharge to an earthen ditch along the southerly limit of Basin SP-3. At the southwesterly corner of Basin SP-3, the ditch receives runoff from Basin SP-3, collecting runoff in an underground storm drain that conveys flow to the Spill from Wistaria Canal Lateral 4. In the development and construction of Basins SP-2 and SP-3, the earthen ditch shall remain either undisturbed or otherwise reconstructed in a manner that continues the above described conveyance of flow.
- Flow from the fields located to the east of Basin W5-10 is collected in a storm drainage structure and conveyed underground westerly across Basin W5-10. At the westerly limit of Basin W5-10, the pipe enters a storm drain structure that also collects surface and tile drain flow from Basin W5-10. The confluenced flow from adjacent fields and W5-10 continues in an underground pipe in a northwesterly direction across Basin SP-1, ultimately discharging to the Wistaria 5 Drain. In the development and construction of Basins SP-1 and W5-10, the underground pipe shall remain either undisturbed or otherwise reconstructed in a manner that continues the above described conveyance of flow.

See the following page for Table 8, which provides reference linking the CUP# to drainage basin identification. For each CUP, the required storage for the county requirement of 3" of runoff, as well as storage of the 100-year runoff is provided on a per drainage basin level.

e. FEM A Zone A
As shown on the enclosed Basin Maps, a portion of the site is located within FEMA Zone A, and as such are areas subject to inundation by the 100-year storm event. At this time, improvements associated with the project (including arrays, substations, O&M facilities, gen-tie, access roads, etc.) are not anticipated to be constructed within Zone A mapped areas. If improvements associated with the project are ultimately determined necessary, consideration of the 100-year storm will be made with respect to the design and construction of all improvements.

In addition, should access within Zone A mapped areas be necessary for ongoing project maintenance, prior to maintenance activities, rain forecasts will be reviewed and activities will be scheduled in a manner that considers potential for flooding.

Table 8: CUP/Basin Reference Table

CUP #	BASIN ID	STORAGE REQURIED (AC-FT)	
		COUNTY STORAGE	100- YR RUNOFF
13-0050	G2-1	21.3	8.0
	AA13-1	10.6	4.0
13-0051	G-8	30	11.3
	G-9	27.3	10.3
13-0052	G-7	26.4	9.9
	AA11-1	22.7	8.6
13-0036	G2-2	18.6	7.0
	G2-3	16.7	6.3
	G2-4	15.6	5.9
13-0037	G-1	18.4	6.9
	G-2	20.0	7.5
	W-1	19.1	7.2
13-0038	SP-2	20.2	7.6
	SP-3	20.6	7.7
13-0039	SP-1	20.4	7.7
	W5-10	20.6	7.8
13-0040	W5-1	18.9	7.1
	W5-2	18.5	7.0
13-0041	W5-3	19.1	7.4
	W5-4	19.4	7.2
13-0042	W5-5	18.9	7.1
	G-3	9.4	3.5
	G-4	9.6	3.6
	G-5	9.2	3.5
	G-6	9.7	3.6
13-0043	W5-6	7.8	2.9
	W5-7	11.0	4.1
	W5-8	19.0	7.2
13-0044	W5-4	19.6	7.5
13-0045	NR-6	6.4	2.4
	NR-7	12.8	4.8
13-0046	NR-8	13.3	5.0
	NR-9	38.2	14.4
13-0047	NR-10	31.8	12.0
13-0048	W7-1	18.1	6.8
	W7-5	21.8	8.2
13-0049	W7-2	20.2	7.6
	W7-3	19.9	7.7

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 Drains. 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. 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 8: 303(d) Impairments

RECEIVING WATER	HYDROLOGIC UNIT CODE	303(d) IMPAIRMENT(S)	DISTANCE FROM PROJECT (miles)
Imperial Valley Drains (Greeson Drains, Wistaria Drains, Mt. Signal Drain)	723.10	DDT Dieldrin Endosulfan PCBs Selenium Toxaphene	<0.1 miles
New River	728.00	Chlordane Chloroform Chlorpyrifos Copper DDT Diazinon Dieldrin Mercury Nutrients Organic/Low DO PCBs Xylene Pesticides Toluene Selenium Toxaphene Toxicity Trash Cymene Dichlorobenzene	<0.1 miles
Salton Sea	728.00	Nutrients Salinity Selenium	36 miles

3.2.3 TMDL STATUS

TMDLs established for receiving waters of the project are summarized in Tables 9 and 10 below.

Table 9: TMDLs

RECEIVING WATER	HYDROLOGIC UNIT CODE	TMDLs	DISTANCE FROM PROJECT (miles)
Imperial Valley Drains	723.10	Sediment/Siltation	<0.1 mile
New River	728.00	Pathogens Sediment/Siltation Trash	<0.1 miles

The Imperial Valley Drains' 2005 Sediment/Siltation TMDL sets numeric targets on the Imperial Valley Drains for Total Suspended Solids (TSS). The target is 200 mg/L which would achieve a low to moderate level of protection. According to the 2005 TMDL implementation plan, an overall 63% reduction from the current TSS level is required to meet the minimum targets set forth by the TMDL.

High sedimentation in the Imperial Valley Drains 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.

The New River's 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 10: 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 New River's 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.

The New River's 2007 Trash TMDL sets numeric targets on the New River for trash in the form of reduction percentages. These targets are a 75% reduction in trash within 2 years of USEPA approval of the TMDL, and a 100% reduction within 3 years of USEPA approval of the TMDL. This TMDL focuses on the reach of the New River immediately downstream of the international boundary, since this portion of the River is most impacted by trash, which primarily originates south of the international border.

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 as modified by Order 2010-0014-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 that 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 11 below.

Table 11: 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 16 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 12 on the following page provides the primary pollutants of concern for the project site.

Table 12: Primary Pollutants of Concern

PRIMARY POLLUTANTS OF CONCERN	SPECIFIC 303(D) IMPAIRMENT
SEDIMENT	Sedimentation/Siltation
HEAVY METALS	Arsenic, Copper, Mercury, Selenium, Zinc
OXYGEN DEMANDING SUBSTANCES	Organic/Low DO
TRASH AND DEBRIS	Trash
ORGANIC COMPOUNDS	PCBs
NUTRIENTS	Nutrients

Sediment: Sediment can result from erosion during storm events, as well as from dust generated by wind erosion and vehicular traffic. Sediments increase the turbidity of the receiving waters, and have the potential to adversely impact aquatic species.

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 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).

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. 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 visible and/or non-visible constituents become 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 or New River 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 13: 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
	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	

CONSTRUCTION ACTIVITY	CONSTRUCTION SITE MATERIAL	VISUALLY OBSERVABLE?
Painting	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. If the project is constructed in multiple phases, a NOI will be filed for each phase of construction.

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.

<u>Sediment Controls</u>

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

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-2 Dewatering Operations
NS-3 Paving and Grinding Operations
NS-4 Temporary Stream Crossing
NS-5 Clear Water Diversion
NS-6 IC/ID Detection and Reporting
NS-7 Potable Water / Irrigation
NS-8 Vehicle & Equipment Cleaning
NS-9 Vehicle & Equipment Fueling
NS-10 Vehicle & Equipment Maint.
NS-11 Pile Driving Operations
NS-12 Concrete Curing
NS-13 Concrete Finishing
NS-14 Material Use Over Water
NS-15 Demolition Over Water
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 14: 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. Asphaltic concrete (AC) paving of driveway connections to public roads may be required per County of Imperial standards, however the limit of paving will be kept to the minimum amount required by the County. The County may also require additional paving on some public roads in accordance with PM10 requirements, but the amount of paving will be limited to the areas required by County.
#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.
#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 15: 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 may require a Spill Prevention, Control, and Countermeasure (SPCC) Plan, and a Hazardous Materials Business Plan in accordance with Federal, State, or Local 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 Hydrologic Analysis, runoff from the project will be directed towards shallow ponding areas to meet the County requirements for storage of 3" of runoff within the project limits. The ponding areas will either drain through infiltration into the underlying soils or through a connection to the IID drain system. As discussed previously, the County required 3" of runoff from the project will either be infiltrated or drain to the IID system within 72 hours. Precise drawdown times and outlet configurations will be determined at the time of final engineering.

The ponding areas 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 0.60 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, the value of P_6 is approximately 0.43 inches. These values then yield a depth of runoff of P_O = 0.41 inches or 0.034 feet.

To determine the volume of runoff from the water quality storm event, the depth of runoff is multiplied by the tributary area. Table 16 on the following page provides the volume of runoff for the water quality storm event, the Water Quality Control Volume (WQCV), for each drainage basin.

Table 16: WQCV

Receiving Drain: A.A. Drain No. 13		
Basin Name	Area (ac)	Water Quality Control Volume (ac-ft)
AA13-1	42.4	1.4
Total	42.4	1.4

Receiving Drain: A.A. Drain No. 11		
Basin Name	Area (ac)	Water Quality Control Volume (ac-ft)
AA11-1	90.8	3.1
Total	90.8	3.1

Receiving Drain: Greeson No.2 Drain		
Basin Name	Area (ac)	Water Quality Control Volume (ac-ft)
G2-1	85.1	2.9
G2-2	74.2	2.5
G2-3	66.9	2.3
G2-4	62.5	2.1
Total	288.7	9.8

Receiving Drain: Greeson Drain		
Basin Name	Area (ac)	Water Quality Control Volume (ac-ft)
G-1	73.7	2.5
G-2	80.1	2.7
G-3	37.6	1.3
G-4	38.5	1.3
G-5	36.7	1.2
G-6	38.6	1.3
G-7	105.4	3.6
G-8	119.9	4.1
G-9	109.1	3.7
Total	639.6	21.7

Receiving Drain: Wistaria Drain		
Basin Name	Area (ac)	Water Quality Control Volume (ac-ft)
W-1	76.5	2.6
Total	76.5	2.6

Receiving Drain: Spill Drain		
Basin Name	Area (ac)	Water Quality Control Volume (ac-ft)
SP-1	81.7	2.8
SP-2	80.8	2.7
SP-3	82.2	2.8
Total	244.2	8.3

Receiving Drain: Wistaria 5 Drain		
Basin Name	Area (ac)	Water Quality Control Volume (ac-ft)
W5-1	75.7	2.6
W5-2	74.0	2.5
W5-3	76.4	2.6
W5-4	77.5	2.6
W5-5	75.4	2.6
W5-6	31.0	1.1
W5-7	43.8	1.5
W5-8	75.9	2.6
W5-10	82.5	2.8
Total	612.2	20.9

Receiving Drain: Wistaria 7 Drain		
Basin Name	Area (ac)	Water Quality Control Volume (ac-ft)
W7-1	72.3	2.5
W7-2	80.8	2.7
W7-3	79.4	2.7
W7-4	78.2	2.7
W7-5	87.2	3.0
Total	397.9	13.6

Receiving Waterbody: New River		
Basin Name	Area (ac)	Water Quality Control Volume (ac-ft)
NR-6	25.7	0.9
NR-7	51.0	1.7
NR-8	53.3	1.8
NR-9	152.9	5.2
NR-10	127.0	4.3
Total	409.9	13.9

As discussed in Section 2.3.2b, the County required 3" runoff volume will be designed to either infiltrate or drain to the IID system within 72 hours. Therefore, the lesser WQCV will also drain in less than 72 hours, and 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 17: 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 provision of shallow ponding areas, 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. If the project is phased, each phase of construction will be required to submit a Notice of Intent and SWPPP, and apply for 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.

Potential construction that may require dewatering includes footings and foundations for the project substation, gen-tie transmission poles, or overhead collection system poles. Dewatering associated with these portions of construction will be localized to transmission pole locations or the substation and will not result in a significant decrease in production rates of existing or planned wells.

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 and the New River. 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 shallow ponding areas.

Peak flow runoff from the project will be collected in shallow ponding areas and/or designated detention basins. The project facilities will be designed in anticipation of this ponding, and there is no potential for increased flooding onsite or in offsite IID Drains. 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 shallow ponding areas 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 majority of 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). Portions of the project bounded by the New River and Greeson Drain are located in within Zone A. Zone A corresponds to areas within the 100-year event, however no base flood elevations or depths have been determined.

The development of the project shall consider the limits of Zone A and locate structures outside Zone A or perform the analysis required to determine the depth of flooding and by the 100-year event and perform the grading and construction work necessary to ensure structures are above the 100-year flood elevation.

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. As shown on the FIRMettes, the 100-year flood is contained within the banks of the New River and Greeson Drain where array development is not proposed. 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: See response to Impact H and the FIRMettes in Appendix F. The proposed project does not propose development within the banks of the New River or Greeson Drain, which are the limits of the mapped Zone A. The project proposes to provide detention in shallow areas of ponding under arrays (approximately 1' deep) or in designated detention basins 3'-4' deep. These areas of ponding and/or detention will not contain habitable structures where significant numbers of people would be put at high risk. The project substation, permanent O&M building, and construction trailers will not be located in proposed areas of ponding or detention.

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 project developer/owner/applicant will maintain all onsite site design, source control, and treatment control features.

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 18: 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 project developer/owner/applicant. 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 or the New River. Post project site conditions reflect increases in unattenuated peak runoff generated by the project. However, the provision of detention (either through designated detention basins outside arrays or shallow areas of ponding under arrays, or a combination of both) will attenuate peak discharges from the project. Detained runoff will be either infiltrated into the underlying soil or slowly released at or below predevelopment levels into the IID Drain system or New River in a manner consistent with existing conditions.

This conceptual study calculates a maximum volume of runoff that may be detained in accordance with the County standard of 3" of runoff within the project site. At the time of final design and engineering, a final hydrology study will be prepared and processed for approval with DPW utilizing standard industry practice that models factors such as runoff coefficient or curve number, infiltration into underlying soils, and flow in storm drain discharge pipes connected to the IID Drain system and/or the New River. Ultimate locations, volumes, and limits of detention basins will be determined at the time of final engineering.

The project may be constructed in multiple phases. Whether the project is constructed in several phases or one phase, the project can be constructed without substantial change to existing drainage patterns. During final design and construction of the project, consideration shall be given to existing earthen drainage ditches and underground storm drain pipe. In the development and construction of the project, earthen ditches and underground storm drain pipes shall remain either undisturbed or otherwise reconstructed in a manner that continues the existing conveyance of flow as described in section 2.3.2.d.

6.2 STORM WATER QUALITY

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. If the project is constructed in multiple phases, a NOI will be filed for each phase of construction.

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.

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

6.3 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 19: CEQA Impact Summary

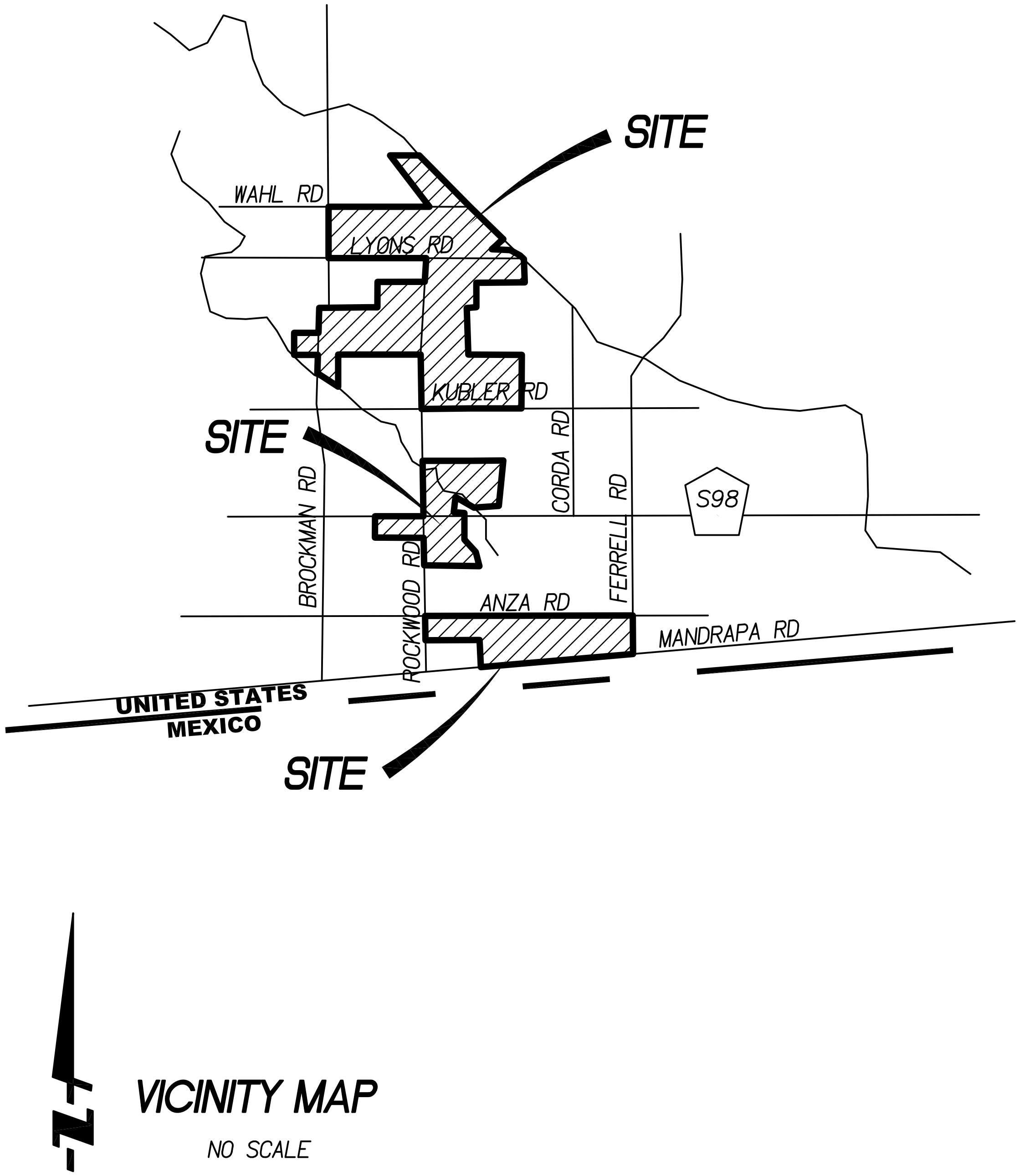
CEQA IMPACTS AND MITIGATION MEASURES		
CEQA SIGNIFICANCE CRITERIA	SIGNIFICANT IMPACT (YES/NO)	MITIGATION MEASURE
Impact A: Violate any water quality standards or waste discharge requirements?	NO	N/A
Impact B: Substantially deplete groundwater supplies or interfere substantially with groundwater recharge 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
WISTARIA RANCH SOLAR
COUNTY OF IMPERIAL, CA



APPENDIX A

VICINITY MAP
WISTARIA RANCH
COUNTY OF IMPERIAL, CA

JANUARY 2014

APPENDIX - B

Soils Data

United States Department of Agriculture

NRCS

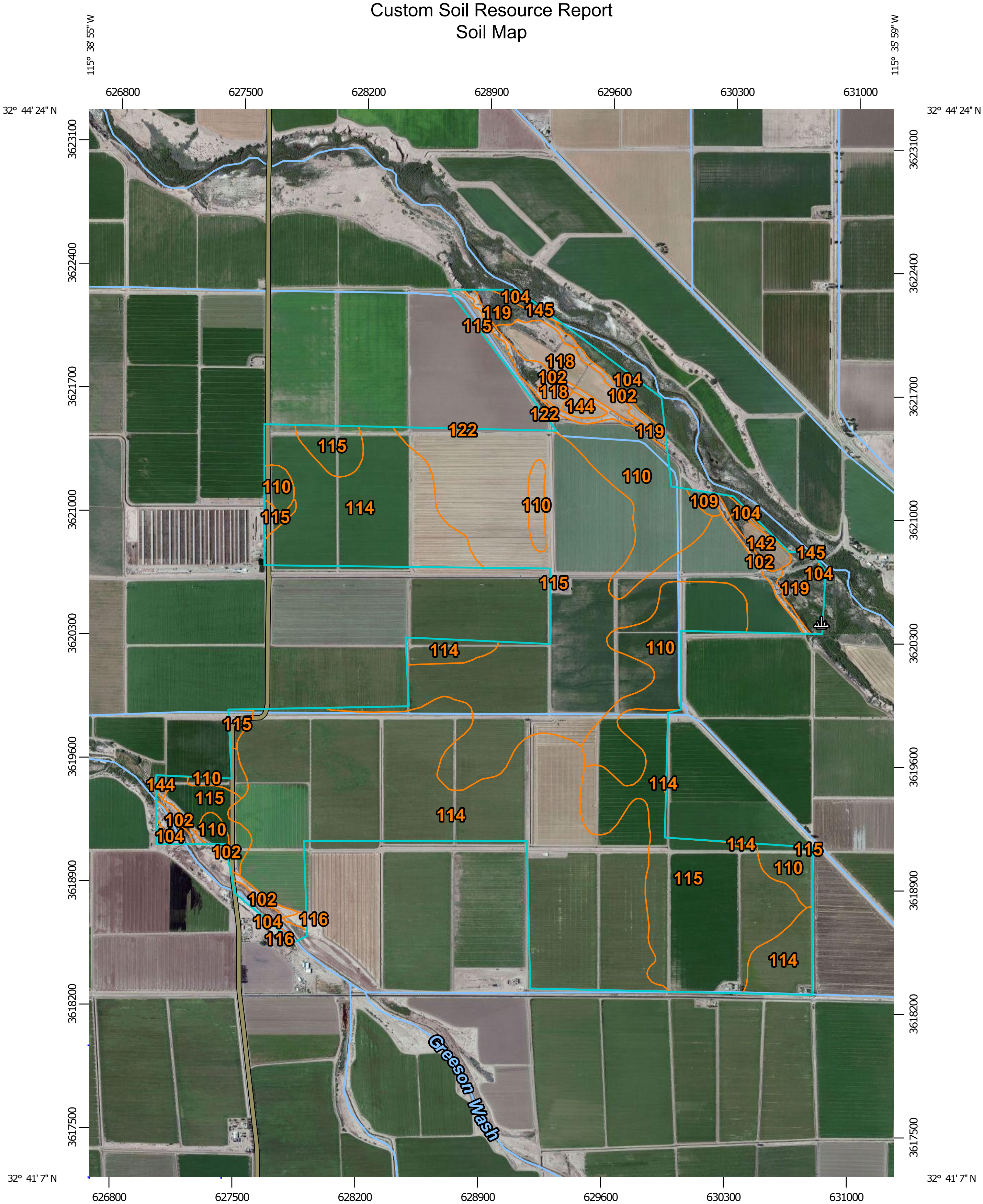
Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Imperial County, California, Imperial Valley Area

January 10, 2014

Soil Map



Map Scale: 1:29,600 if printed on A portrait (8.5" x 11") sheet.

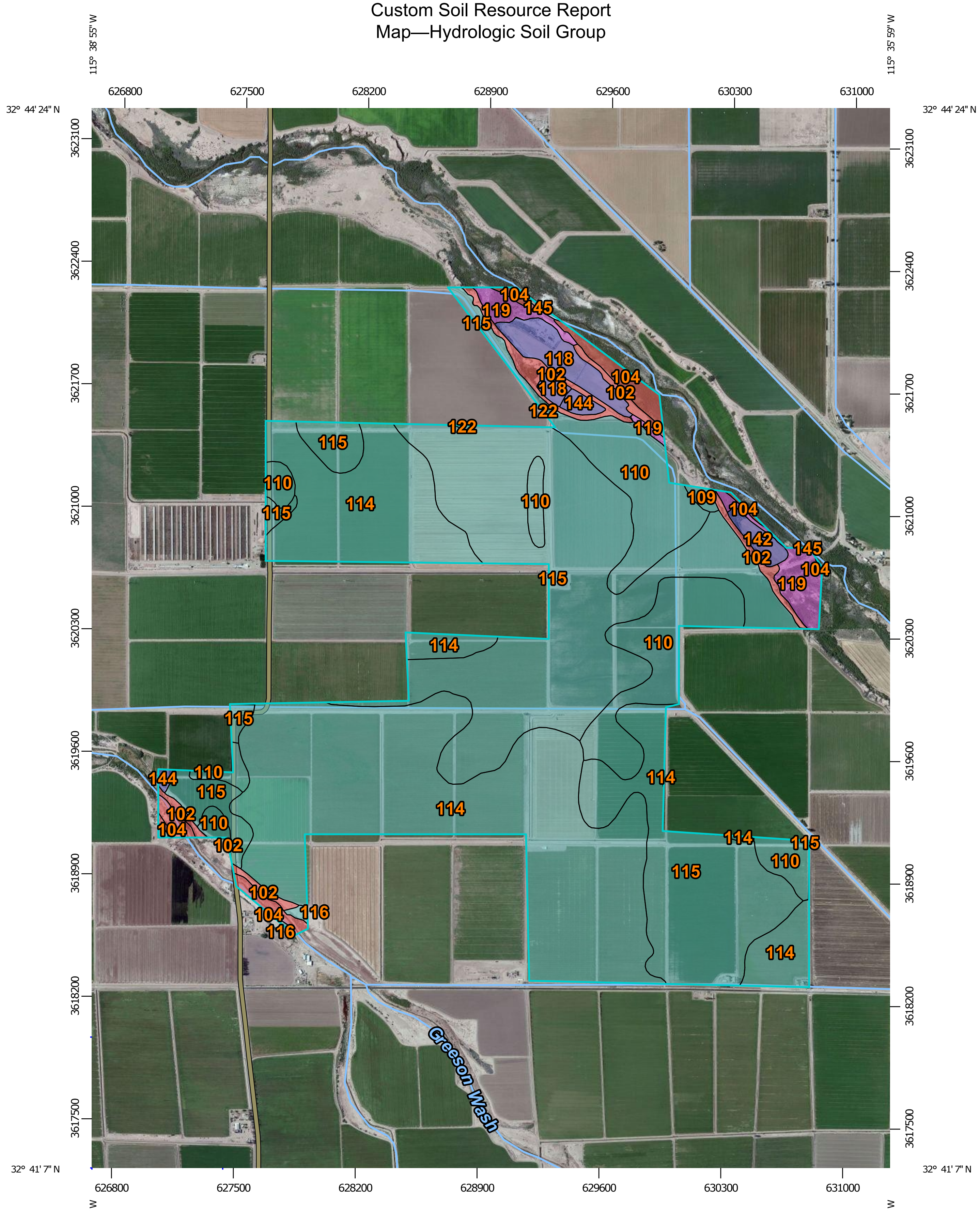
Meters: 0, 400, 800, 1600, 2400

Feet: 0, 1000, 2000, 4000, 6000

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

Map—Hydrologic Soil Group



Map Scale: 1:29,600 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 400, 800, 1600, 2400

Feet: 0, 1000, 2000, 4000, 6000

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

Table—Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Imperial County, California, Imperial Valley Area (CA683)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
102	BADLAND	D	39.5	2.2%
104	FLUVAQUENTS, SALINE	D	33.7	1.9%
109	HOLTVILLE SILTY CLAY	C	3.9	0.2%
110	HOLTVILLE SILTY CLAY, WET	C	242.4	13.3%
114	IMPERIAL SILTY CLAY, WET	C	707.0	38.8%
115	IMPERIAL-GLENBAR SILTY CLAY LOAMS, WET, 0 TO 2 PERCENT SLOPES	C	694.2	38.1%
116	IMPERIAL-GLENBAR SILTY CLAY LOAMS, 2 TO 5 PERCENT SLOPE S	C	2.5	0.1%
118	INDIO LOAM, WET	B	37.6	2.1%
119	INDIO-VINT COMPLEX	A	39.7	2.2%
122	MELOLAND VERY FINE SANDY LOAM, WET	C	0.4	0.0%
142	VINT LOAMY VERY FINE SAND, WET	B	11.1	0.6%
144	VINT AND INDIO VERY FINE SANDY LOAMS, WET	B	7.7	0.4%
145	WATER		1.2	0.1%
Totals for Area of Interest			**1,821.0**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

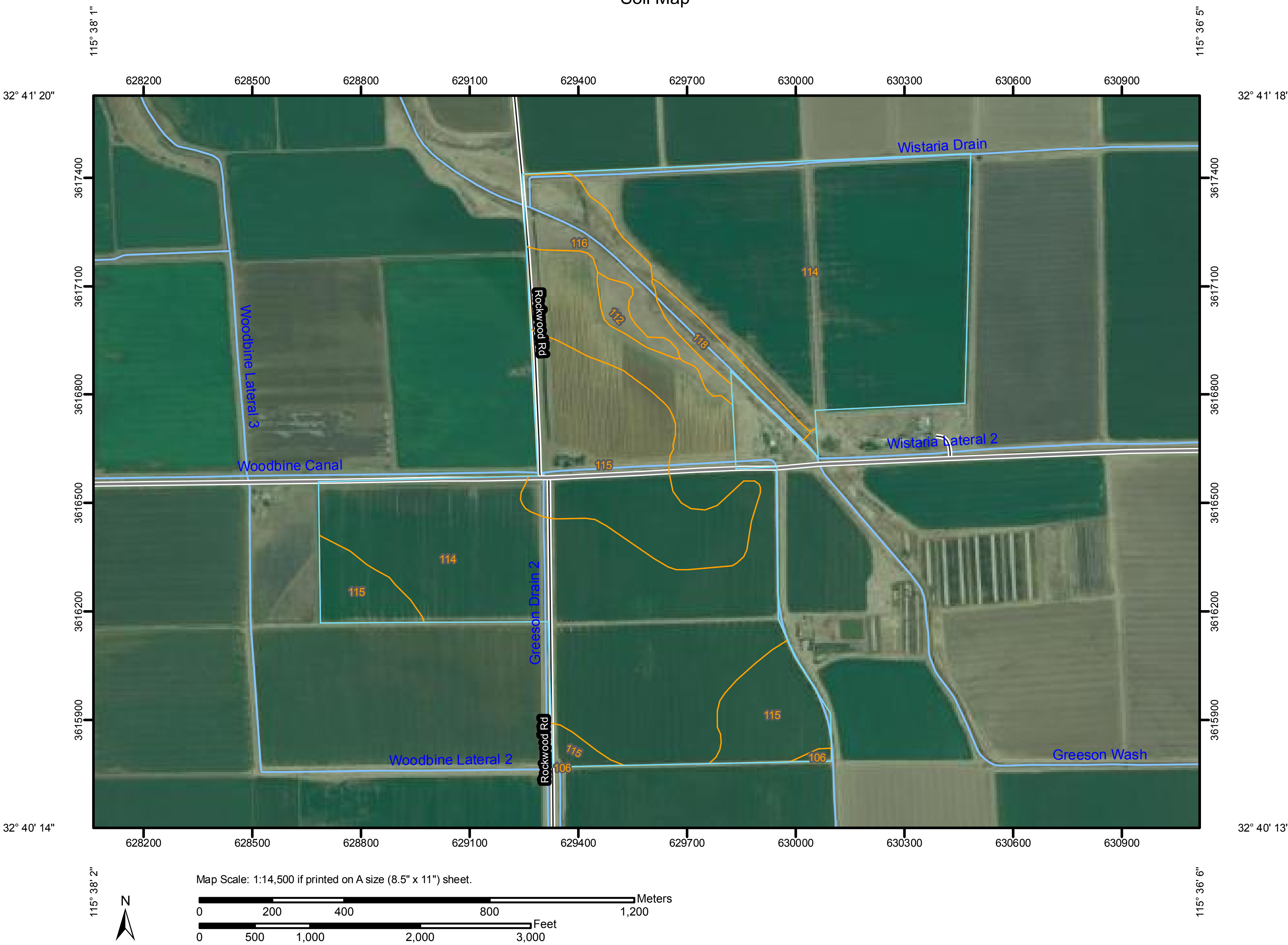
A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Imperial County, California, Imperial Valley Area

January 15, 2013

Soil Map



115° 38' 1"
115° 36' 5"
32° 41' 20"
32° 41' 18"
32° 40' 14"
32° 40' 13"
115° 38' 2"
115° 36' 6"
628200
628500
628800
629100
629400
629700
630000
630300
630600
630900
3617400
3617100
3616800
3616500
3616200
3615900
Wistaria Drain
Woodbine Lateral 3
Woodbine Canal
Rockwood Rd
Wistaria Lateral 2
Greeson Drain 2
Woodbine Lateral 2
Greeson Wash
116
112
118
114
115
106
Map Scale: 1:14,500 if printed on A size (8.5" x 11") sheet.
N
Meters
0
200
400
800
1,200
Feet
0
500
1,000
2,000
3,000

Map—Hydrologic Soil Group

Map Scale: 1:14,500 if printed on A size (8.5" x 11") sheet.

Meters: 0, 200, 400, 800, 1,200

Feet: 0, 500, 1,000, 2,000, 3,000

Table—Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Imperial County, California, Imperial Valley Area (CA683)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
106	GLENBAR CLAY LOAM, WET	B	0.7	0.2%
112	IMPERIAL SILTY CLAY	C	4.0	0.9%
114	IMPERIAL SILTY CLAY, WET	C	305.4	71.9%
115	IMPERIAL-GLENBAR SILTY CLAY LOAMS, WET, 0 TO 2 PERCENT SLOPES	C	86.6	20.4%
116	IMPERIAL-GLENBAR SILTY CLAY LOAMS, 2 TO 5 PERCENT SLOPE S	C	20.4	4.8%
118	INDIO LOAM, WET	B	7.4	1.8%
Totals for Area of Interest			**424.6**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

United States Department of Agriculture

Natural Resources Conservation Service

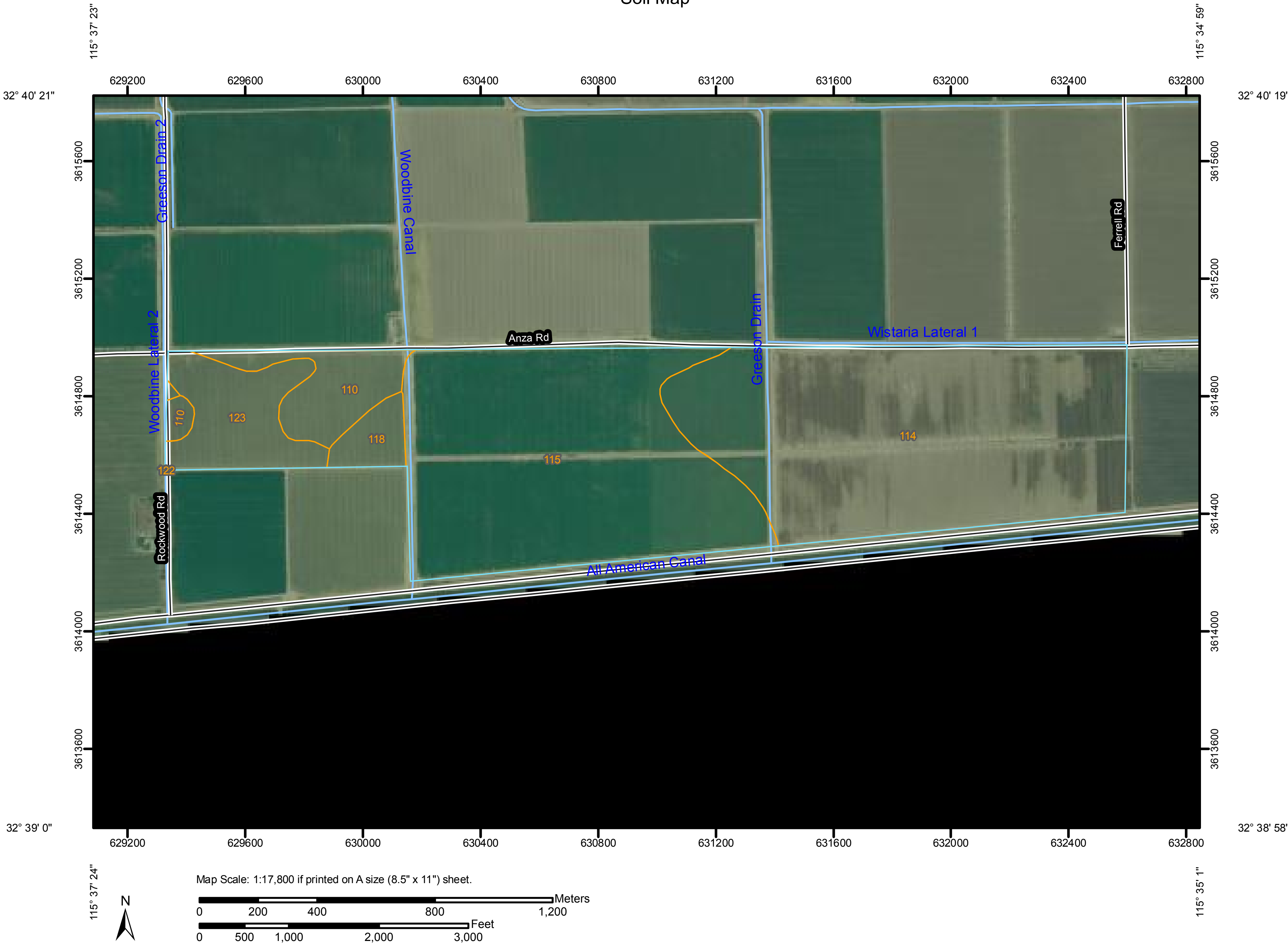
A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Imperial County, California, Imperial Valley Area

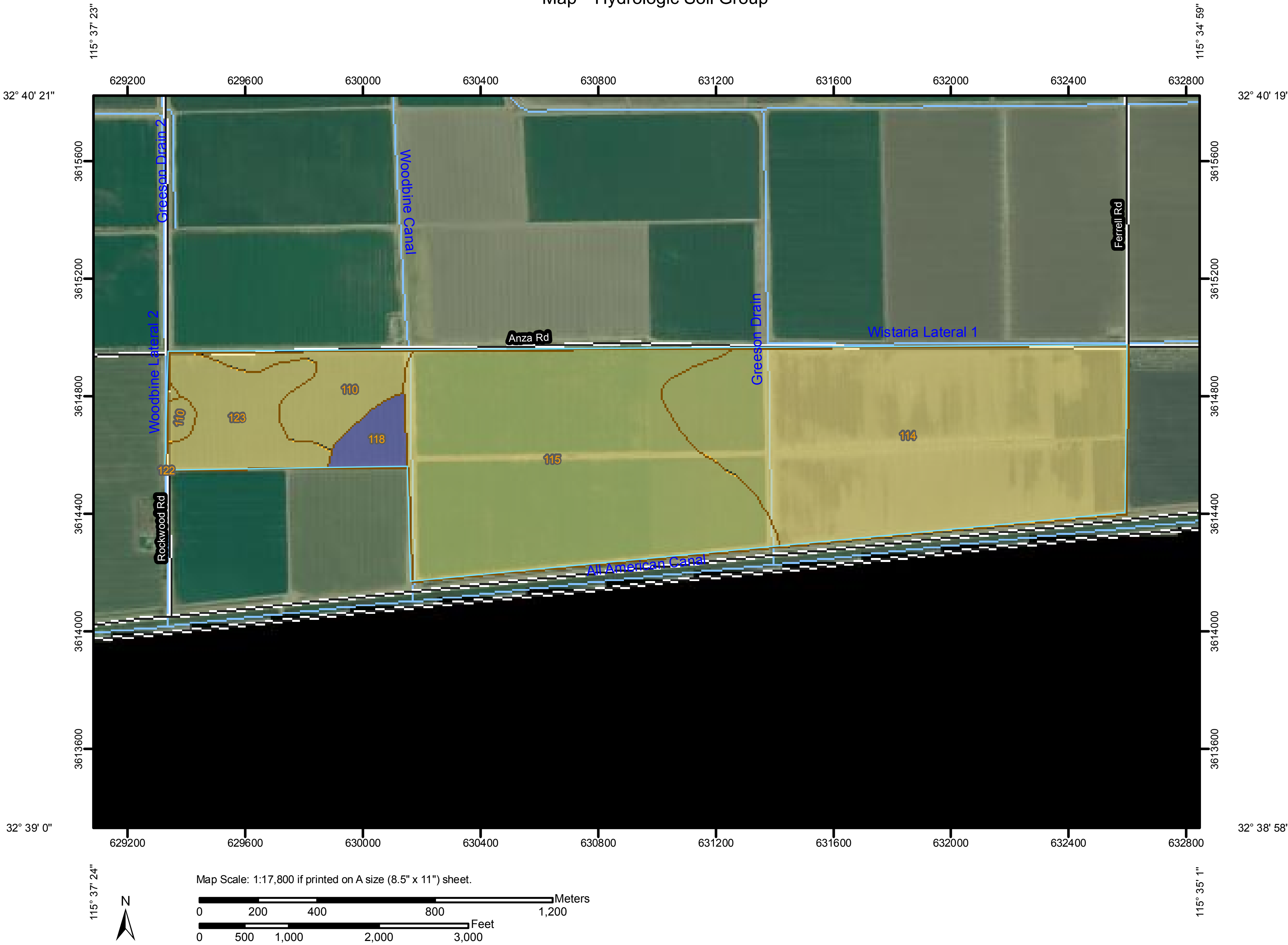
October 5, 2012

Custom Soil Resource Report
Soil Map



Map Scale: 1:17,800 if printed on A size (8.5" x 11") sheet.

Map—Hydrologic Soil Group



Map Scale: 1:17,800 if printed on A size (8.5" x 11") sheet.

Meters: 0, 200, 400, 800, 1,200

Feet: 0, 500, 1,000, 2,000, 3,000

Table—Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Imperial County, California, Imperial Valley Area (CA683)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
110	HOLTVILLE SILTY CLAY, WET	C	30.2	6.1%
114	IMPERIAL SILTY CLAY, WET	C	218.9	44.5%
115	IMPERIAL-GLENBAR SILTY CLAY LOAMS, WET, 0 TO 2 PERCENT SLOPES	C	192.9	39.3%
118	INDIO LOAM, WET	B	11.3	2.3%
122	MELOLAND VERY FINE SANDY LOAM, WET	C	0.0	0.0%
123	MELOLAND AND HOLTVILLE LOAMS, WET	C	38.1	7.7%
Totals for Area of Interest			**491.5**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Units

Soil Ratings

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Political Features

Cities

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

MAP INFORMATION

Map Scale: 1:35,100 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 11N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Imperial County, California, Imperial Valley Area
Survey Area Data: Version 5, Jul 25, 2008

Date(s) aerial images were photographed: 6/12/2005; 5/30/2005

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

APPENDIX - C

County Standards and Rational Method Parameters

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	<u>0.06</u>
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: Calexico, California, US*
Coordinates: 32.7000, -115.6100
Elevation: -10 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	**0.076** (0.065-0.091)	**0.121** (0.102-0.144)	**0.185** (0.156-0.221)	**0.242** (0.202-0.292)	**0.326** (0.263-0.409)	**0.398** (0.314-0.510)	**0.477** (0.367-0.627)	**0.565** (0.422-0.766)	**0.698** (0.497-0.988)	**0.855** (0.588-1.26)
10-min	**0.109** (0.093-0.130)	**0.173** (0.147-0.207)	**0.265** (0.224-0.317)	**0.346** (0.290-0.418)	**0.468** (0.378-0.586)	**0.571** (0.450-0.731)	**0.684** (0.525-0.899)	**0.811** (0.604-1.10)	**1.00** (0.713-1.42)	**1.23** (0.843-1.80)
15-min	**0.132** (0.112-0.158)	**0.210** (0.177-0.250)	**0.321** (0.270-0.384)	**0.419** (0.350-0.506)	**0.566** (0.457-0.709)	**0.690** (0.544-0.884)	**0.827** (0.635-1.09)	**0.980** (0.731-1.33)	**1.21** (0.862-1.71)	**1.48** (1.02-2.18)
30-min	**0.182** (0.154-0.217)	**0.288** (0.243-0.343)	**0.440** (0.371-0.527)	**0.575** (0.481-0.695)	**0.777** (0.627-0.972)	**0.947** (0.747-1.21)	**1.14** (0.872-1.49)	**1.34** (1.00-1.82)	**1.66** (1.18-2.35)	**2.04** (1.40-2.99)
60-min	**0.255** (0.216-0.304)	**0.403** (0.341-0.481)	**0.617** (0.520-0.738)	**0.806** (0.674-0.973)	**1.09** (0.878-1.36)	**1.33** (1.05-1.70)	**1.59** (1.22-2.09)	**1.89** (1.41-2.56)	**2.33** (1.66-3.29)	**2.85** (1.96-4.19)
2-hr	**0.348** (0.295-0.414)	**0.530** (0.449-0.633)	**0.786** (0.663-0.941)	**1.01** (0.844-1.22)	**1.33** (1.08-1.67)	**1.60** (1.26-2.05)	**1.90** (1.46-2.49)	**2.22** (1.65-3.00)	**2.69** (1.92-3.81)	**3.09** (2.12-4.54)
3-hr	**0.402** (0.341-0.480)	**0.605** (0.512-0.722)	**0.887** (0.749-1.06)	**1.13** (0.946-1.37)	**1.49** (1.20-1.86)	**1.78** (1.40-2.28)	**2.09** (1.61-2.75)	**2.44** (1.82-3.31)	**2.94** (2.10-4.17)	**3.37** (2.31-4.95)
6-hr	**0.492** (0.417-0.587)	**0.731** (0.619-0.873)	**1.06** (0.897-1.27)	**1.35** (1.13-1.63)	**1.76** (1.42-2.21)	**2.10** (1.66-2.69)	**2.47** (1.90-3.24)	**2.86** (2.13-3.88)	**3.44** (2.46-4.88)	**3.92** (2.70-5.77)
12-hr	**0.540** (0.457-0.643)	**0.806** (0.682-0.962)	**1.18** (0.998-1.42)	**1.51** (1.26-1.83)	**2.00** (1.61-2.50)	**2.40** (1.89-3.07)	**2.84** (2.18-3.73)	**3.32** (2.48-4.50)	**4.03** (2.87-5.71)	**4.62** (3.18-6.80)
24-hr	**0.669** (0.591-0.773)	**1.01** (0.888-1.16)	**1.50** (1.32-1.74)	**1.93** (1.69-2.26)	**2.59** (2.19-3.12)	**3.15** (2.62-3.86)	**3.77** (3.06-4.73)	**4.46** (3.53-5.74)	**5.50** (4.19-7.36)	**6.39** (4.72-8.82)
2-day	**0.747** (0.660-0.863)	**1.13** (0.996-1.31)	**1.69** (1.48-1.96)	**2.19** (1.91-2.56)	**2.94** (2.49-3.54)	**3.58** (2.98-4.40)	**4.30** (3.49-5.40)	**5.10** (4.04-6.57)	**6.31** (4.81-8.45)	**7.35** (5.43-10.2)
3-day	**0.790** (0.698-0.913)	**1.19** (1.05-1.38)	**1.78** (1.57-2.07)	**2.31** (2.02-2.70)	**3.11** (2.64-3.75)	**3.79** (3.15-4.66)	**4.55** (3.70-5.71)	**5.40** (4.28-6.96)	**6.69** (5.10-8.95)	**7.79** (5.75-10.8)
4-day	**0.821** (0.725-0.948)	**1.24** (1.09-1.43)	**1.85** (1.63-2.15)	**2.40** (2.09-2.80)	**3.22** (2.73-3.88)	**3.92** (3.26-4.81)	**4.70** (3.82-5.90)	**5.57** (4.41-7.18)	**6.88** (5.25-9.21)	**8.01** (5.92-11.1)
7-day	**0.868** (0.766-1.00)	**1.30** (1.15-1.50)	**1.93** (1.69-2.23)	**2.49** (2.17-2.90)	**3.33** (2.82-4.01)	**4.04** (3.36-4.96)	**4.83** (3.93-6.07)	**5.72** (4.53-7.36)	**7.04** (5.37-9.43)	**8.18** (6.04-11.3)
10-day	**0.890** (0.786-1.03)	**1.33** (1.17-1.54)	**1.97** (1.73-2.28)	**2.53** (2.21-2.96)	**3.38** (2.86-4.07)	**4.09** (3.40-5.02)	**4.88** (3.96-6.12)	**5.75** (4.56-7.41)	**7.06** (5.38-9.45)	**8.26** (6.10-11.4)
20-day	**0.967** (0.854-1.12)	**1.45** (1.28-1.68)	**2.15** (1.89-2.49)	**2.75** (2.41-3.22)	**3.65** (3.09-4.39)	**4.39** (3.65-5.39)	**5.19** (4.22-6.51)	**6.07** (4.80-7.81)	**7.34** (5.60-9.83)	**8.41** (6.21-11.6)
30-day	**1.01** (0.890-1.16)	**1.53** (1.35-1.77)	**2.27** (2.00-2.64)	**2.92** (2.55-3.41)	**3.85** (3.26-4.63)	**4.61** (3.83-5.66)	**5.42** (4.41-6.81)	**6.30** (4.99-8.12)	**7.56** (5.76-10.1)	**8.59** (6.34-11.9)
45-day	**1.08** (0.953-1.25)	**1.67** (1.47-1.93)	**2.48** (2.18-2.88)	**3.18** (2.78-3.71)	**4.18** (3.54-5.03)	**4.98** (4.14-6.12)	**5.83** (4.74-7.32)	**6.73** (5.33-8.67)	**8.00** (6.10-10.7)	**9.02** (6.66-12.5)
60-day	**1.14** (1.01-1.32)	**1.79** (1.58-2.07)	**2.68** (2.36-3.11)	**3.44** (3.00-4.02)	**4.50** (3.82-5.43)	**5.36** (4.45-6.58)	**6.25** (5.08-7.84)	**7.18** (5.69-9.25)	**8.48** (6.46-11.3)	**9.50** (7.02-13.1)

[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.

Back to Top

APPENDIX - E

Drainage Basin Maps