APPENDIX V

DRAINAGE REPORT

DESERT QUARTZITE SOLAR PROJECT

DRAINAGE REPORT

Prepared For:

First Solar Development, Inc.
1111 Broadway, Suite 400
Oakland, CA 94607

Prepared by:

TLA Engineering and Planning, Inc.
1528 Eureka Road, Suite 100
Roseville, CA 95661
(916) 786-0685

August 10, 2011

TABLE OF CONTENTS

TABLES

TABLE OF CONTENTS

FIGURES

1 EXECUTIVE SUMMARY

First Solar proposes to construct and operate a 300 Megawatt alternating current (MWac) solar photovoltaic energy generating facility known as Desert Quartzite Solar Project (Project). The Project is located on 5,000 acres in an unincorporated area of eastern Riverside County, south of Interstate 10 and west of Blythe, California. See Figure 1 for the Project vicinity map, Figure 2 for the Post Project site map and Figure 3 for the Project drainage shed map.

The purposes of this Report are to evaluate the Project's potential impact to drainage runoff depth, velocity, volume and sediment transport; determine the potential solar panel pedestal pier scour depths; and if necessary, propose mitigation measures for the identified Post Project drainage impacts.

The primary drainage criteria and methods follow the Riverside County Hydrology Manual. U.S Army Corps of Engineers HEC-1 modeling software was used to determine the mountain shed runoff hydrographs. FLO-2D modeling software was used to determine the alluvial fan area rainfall, flow depths, velocities, and sediment transport. HEC-18 method was used to determine the solar pedestal pier scour depths.

Based on the results of this Report, the proposed Desert Quartzite Solar Project will cause minor impacts to the existing drainage shed area. The impacts have been minimized due to the relatively flat terrain and presence of large natural depressions that range from one to five feet deep. These large depressions store significant volumes of water which attenuate the increased outflow. See Figure 4 for existing depression areas.

The unmitigated Post Project impacts during the 100-year storm event are as follows:

- Average Flow Depth increase of 0.03-feet
- Average Flow Velocity increase of 0.04 feet/second
- Total Outflow increase of 20 acre-feet (2.6%)

See Figures 5 and 6 for the maximum flow depth and velocity. The nominal Post Project increases in flow depth, velocity and outflow can be mitigated with onsite retention basins sized with at least 20 acre-feet of combined storm water storage capacity.

The unmitigated Post Project sediment transport will be less than the pre project conditions due to soil compaction. The Project site experiences relatively shallow and slow flows, so the nominal increases in Post Project flow depths and velocities do not overcome the decreased erosion potential due to compaction. See Figure 7 for maximum sediment scour depths.

The maximum potential pier scouring at the solar array pedestal supports is 1.22-feet. The structural design and embedment depth of the solar panel pedestal piers should account for the maximum potential scour plus a factor of safety. Monitoring after large storm events should be implemented to detect piers with significant scouring. See Figure 8 for pier scour depths.

2 INTRODUCTION

First Solar proposes to construct and operate a 300 Megawatt alternating current (MWac) solar photovoltaic energy generating facility known as Desert Quartzite Solar Project (Project). The Project is located in an unincorporated area of eastern Riverside County, south of Interstate 10 and west of Blythe, California. The Project will be located on federal lands managed by the U.S. Department of Interior, Bureau of Land Management (BLM), Palm Springs Field Office. See Figure 1 for the Project vicinity map and Figure 2 for the Post Project site map.

The Project boundary encompasses 5,310 acres and will ultimately develop approximately 2,500 acres of solar panels. The Project facilities will consist of: fixed tilted solar panels mounted above ground on supports consisting of wide flange pedestals; access roads; underground electrical wires from solar panels, transformer pads; maintenance and control buildings and facilities; water well for potable water supply and onsite sewage disposal system for the maintenance building; electrical interconnect equipment; overhead phone line; and a transmission line and facilities.

The Project is located in an existing drainage alluvial fan area which receives drainage from offsite mountains and offsite alluvial fan areas. The offsite downstream areas consist of alluvial fan areas with drainage flows that ultimately drain over bluffs east of the Project site.

The drainage areas, including the Project, are located in ungauged watershed runoff areas.

FIRM maps for all of the drainage studied area, including the Project area, are designated in The FIRM Riverside County panel index sheet 06065CIND2A, dated August 28, 2008 as “Zone D”, “Areas in which flood hazards are undetermined”.

The purposes of this Report are:

1. Evaluate the Project’s potential impact to drainage runoff depth, velocity, volume and sediment transport;
2. Determine the potential solar panel pedestal pier scour depths; and
3. If necessary, propose mitigation measures for the identified Post Project drainage impacts.

3 PROJECT SITE DESCRIPTION

The Project is located on largely undeveloped and relatively flat land on the Palo Verde Mesa in eastern Riverside County, approximately nine miles west of the City of Blythe and one mile south of the Interstate-10 freeway. See Figure 1 for the Project vicinity map.

The Project area is undeveloped except for the First Solar Electric Blythe 1 200-acre solar project abutting the northeast side of the Project; a portion of a developed subdivision located south of I-10 at the northeast side of the drainage shed studied; and overhead power line facilities that cross the drainage sheds studied. There are some areas in the alluvial fan area south of I-10 that were cultivated in the past. There also are some bermed areas in the alluvial fan that have evidently been constructed to divert drainage flows away from the internal areas protected by the berms. One of these bermed areas consists of a 160-acre parcel near the middle of and completely surrounded by the proposed Project.

3.1 Proposed Development

The Project will be a 300 Megawatt alternating current (MWac) solar photovoltaic energy generating facility. The Project will construct solar arrays, access roads, an on-site electrical substation, and maintenance facilities.

The photovoltaic (PV) modules are mounted on framing assemblies made of steel, each holding 16 modules and measuring approximately eight feet wide by sixteen feet long. The PV module assemblies are attached at an angle to vertical steel piers that are spaced eight feet center-to-center and are driven into the ground to a depth of four to seven feet below grade. Each steel pier is a single W6x7.2 “I” beam. Once mounted, the front of each PV module assembly will be approximately 1.5 feet above grade, while the rear will be approximately five to six feet above grade.

The PV modules are electrically connected by wiring harnesses running along the bottom of each assembly to combiner boxes that collect power from several rows of modules. The combiner boxes feed DC power from the modules to the Power Conversion Station (PCS) via underground cables. The inverters in the PCS convert the DC electric input into AC electric output and the isolation transformer steps the current up for on-site transmission of the AC power to the PV combining switchgear (PVCS). The PVCS collects the power for transmission to the substation.

3.2 Climate

The Riverside County Hydrology Manual describes the desert areas as extremely hot and dry during the summer months, with moderate temperatures occurring during the winter. The mean seasonal precipitation in the eastern desert region is three inches.

The region experiences three types of storms: general winter storms, general summer storms and high intensity thunderstorms. General winter storms generate most of the precipitation. As these storms move toward the eastern end of the County, beyond the Santa Ana Mountains, little moisture remains and precipitation decreases rapidly over the desert areas.

3.3 Geology

The Project is located in an alluvial fan area with the Mule Mountains located immediately to the southwest and the McCoy Mountains located north of I-10. As discussed in the Riverside County Hydrology Manual, mountain areas have extremely shallow soil depths and on many of the steepest slopes soil cover is virtually non-existent with bedrock exposed. These areas without soil cover have extremely low infiltration capacity.

The alluvial cones and fans near the mountains have coarse soils and are extremely porous. The soils further downstream tend to become finer and less porous.

3.4 Soil Type

A geotechnical investigation by Earth Systems Southwest was performed on the First Solar Electric Blythe 1 200-acre solar project abutting the northeast side of the Project. This report indicates the soil conditions consist generally of medium dense to dense, dry to damp, fine to course grained Silty Sands and Sands with Some Silt (Unified Soils Classification System symbols SM and SP-SM).

Additionally, soil maps from the U.S. Department of Agriculture Natural Resources Conservation Service were obtained and evaluated to determine the various soil types within the alluvial fan area. These soils maps were used to calculate a composite runoff index number from the Riverside County Hydrology Manual Plate E-6.1.

3.5 Drainage Area

The existing drainage areas surrounding the Project were determined from a combination of USGS topographic maps and a project specific topographic survey performed by Hillwig-Goodrow, Inc. in 2009. Hillwig-Goodrow’s survey utilized aerial Lidar scanning, ground survey control and conventional photogrammetry to generate one-foot elevation contours within the Project boundary. The drainage basins are shown on Figure 3.

There are two mountain areas that drain into and through portions of the Project that created the alluvial fan area.

One area is north of Interstate 10, and is designated as drainage shed M1 on Figure 3. This shed consists of a portion of the McCoy Mountains and a portion of alluvial fan that has been blocked and diverted to the southeast side of shed M1 by channelization and I-10. This shed consists of 3,343-acres and ranges in elevation from 1670-feet at the northwest corner to 470-feet at the southeast and the I-10 bridge crossing. The area drains under an I-10 bridge into an area south of the I-10 bridge and into the alluvial shed area north of the Project.

The other mountain area is towards the southwest side of the Project and consists of 27 sheds designated as sheds M2 through M28 on Figure 3. These sheds consist of a portion of the Mule Mountains that drain into the alluvial fan area west of the Project site. These 27 sheds have a cumulative acreage of 2,043-acres and range in elevations from 1750-feet to 395-feet where they enter into the alluvial fan.

The alluvial fan drainage area studied consists of the offsite and onsite areas and is located in the Palo Verde Mesa. The area consists of 14,847 offsite acres and 5,310 Project onsite acres for a total of 20,157-alluvial fan acres. The total alluvial fan area ranges in elevation from the highest elevation near the northwest of 525-feet to a lowest elevation of 320-feet near the southeast. The straight line length between these elevations is approximately 6.92-miles and yields a slope of 0.0056 feet/foot.

The northern portion of the alluvial fan can be considered inactive because of the construction of I-10 and the diversion of mountain shed’s M1 and alluvial fan drainage to the I-10 bridge as a concentrated flow under the bridge. This concentrated flow eventually becomes braided south of I-10 and reenters the alluvial fan drainage area near the north side of the Project.

4 HYDROLOGIC ANALYSIS

The primary drainage criteria and methods follow the Riverside County Hydrology Manual for precipitation, soil infiltration, and runoff index numbers. The drainage shed areas that affect the Project upstream and that the Project may affect downstream are shown on Figure 3.

The total drainage shed area studied is approximately 25,543 acres (39.91 square miles) and consists of:

1. Mountain shed M1, north of the Project and I-10: 3,343 acres
2. Mountain sheds M2-M28 southwest of the Project: 2,043 acres
3. Alluvial fan area south of I-10:
   a. Outside of Project 14,847 acres
   b. Project area 5,310 acres

4.1 Precipitation

The Riverside County Hydrology Manual relies on the National Oceanic and Atmospheric Administration (NOAA) for precipitation. NOAA Atlas 14 was utilized for determining point precipitation frequency estimates for the 100-year event.

Point precipitation for four representative locations throughout the total drainage shed areas studied were obtained. The unadjusted point frequencies for the four locations were tabulated and found to have very little difference by location. Thus, the average of the four locations was calculated for each time period within the 24-hour rainfall event.

A rainfall distribution is not specified in the Riverside County Hydrology Manual; therefore, the point precipitation was adjusted per the San Bernardino County Hydrology Manual by the respective drainage shed areas. Lag times were calculated using the curve number method (i.e. runoff index number).

The resultant 100-year, 24-hour rainfalls for the drainage sheds are:

- mountain shed M1 = 3.47” (adjusted for area)
- mountain sheds M2-M28 = 3.50” (unadjusted because shed areas are less than 1 sq. mile)
- alluvial fan = 3.40” (adjusted for area).

4.2 Infiltration

The Riverside County Hydrology Manual estimates infiltration rates based on the watershed’s soil-cover complex. This estimation is expressed as an index of runoff potential or “runoff index” number ranging from zero to 100. High runoff index numbers indicate a high runoff potential with low infiltration.

Riverside County specifies an antecedent moisture condition II for 100-year design storm events. Accordingly, Riverside County Plate E-6.1 provides the associated runoff index numbers.

The mountain shed areas have the following drainage shed characteristics:

1. Are undeveloped with Barren ground cover conditions;
2. For AMC II condition have a composite runoff index number:
   a. For mountain shed M1: RI = 88.5
   b. For mountain sheds M2-M28: RI = 93.0
3. Have a basin surface roughness coefficient “n” = 0.04;

The existing alluvial fan shed area has the following drainage characteristics:

1. Is mostly undeveloped with Barren ground cover conditions;
2. For AMC II condition has a composite runoff index number of 83.0;
3. Has a basin surface roughness coefficient “n” = 0.05;
4. Soil grading curve (using FSE Blythe1 geotechnical report) provides the following:
   a. D10 = 0.070 mm
   b. D50 = 0.270 mm
   c. D60 = 0.297 mm
   d. D95 = 2.700 mm
   e. Uniformity coefficient = D60/D10 = 4.24
   f. Specific gravity = 2.65
   g. Dry weight = 104 pounds/cubic feet

5 HYDRAULIC ANALYSIS

Because the proposed Project is located in ungauged watersheds with a large alluvial fan area, ephemeral drainages, and for most of the site not well defined drainage outlet channels, it is necessary to utilize several types of drainage technologies and methods in order to provide the information, results, and develop mitigation measures if needed.

U.S Army Corps of Engineers HEC-1 modeling software was used to determine the mountain shed runoff hydrographs. FLO-2D modeling software was used to determine the alluvial fan area rainfall, flow depths, velocities and sediment transport.

The hydrographs from the HEC-1 calculations were entered into the FLO-2D model and used along with the other parameters developed above for the alluvial fan area to calculate: maximum flow depths, maximum velocities and sediment aggregation/degradation depths. The FLO-2D model grid cells were set to dimensions of 300-feet by 300-feet.

FLO-2D output for maximum depths, velocities, and pier scour calculations are those that occurred at any time during the 36-hour runoff calculation period in each grid and they do not necessarily occur at the same time. Sediment aggregation/degradation amounts are those final amounts that result from the 100-year, 24-hour storm at the end of the 36-hour calculation period.

5.1 Pre to Post Project Characteristics

The Project will alter the soil's hydraulic characteristics within the solar arrays due to vegetation removal and grading as follows:

> Vegetation would not be removed from the Proposed Project site until the onset of construction of a given phase. Vegetation would be Disked under, mulched or composted and retained on site to assist in erosion control and limit waste disposal. In some areas to be graded outside of the solar field, native vegetation would possibly be harvested for replanting to augment soil stabilization.
>
> Area's comprising the solar array field will be prepared using conventional farming equipment including tractors with Disking equipment and vibratory rollers with limited use of scrapers to perform micrograding within sections of the solar array field. This method improves construction worker safety by eliminating trip hazards. The site will be contour graded level; the macro level topography will remain unchanged, but within each solar array, the vegetation will be disked into the top soil and then flattened with a drum roller.
>
> Under this approach, rubber-tired farming tractors towing Disking equipment will disc the top 5-7 inches of soil. A water truck will follow along the tractor to moisten the land and keep dust below acceptable levels. The tractor may make several passes to fully disc the vegetation into the top soil, preserving the underground root structure, top soil

nutrients and seed base. A drum roller will then be used to flatten the surface and return the soil compaction to a compaction level similar to the preconstruction compaction. The intent of the roller is to compact the soil under the solar field area, simply to even out the surface after the Disking is complete.

Lastly, limited use of scrapers for micrograding will be employed to even out areas of the ground to maintain a consistent grade in each solar field area. Hydrology analysis will evaluate these areas that are susceptible to scour from storm water runoff. The ground will be graded to a level topography using micrograding only where necessary.

Vegetation would be cleared from roadways, access ways, and where concrete foundations would be used for inverter equipment, substations, and the O&M facilities. Vegetation would be cleared for construction of the drainage controls, including berms. Organic matter would be mulched and redistributed within the construction area (except in trenches and under equipment foundations). Plant root systems would be left in place, except where grading and trenching would be required for placement of solar module foundations, underground electric lines, inverter and transformer pads, road and access ways, and other facilities to provide soil stability.

To account for the above described grading approach and the other facilities and impervious surfaces discussed in the Project Site Description, the Post Project soil characteristics were adjusted as follows:

	Pre Project	Post Project	Change
1. Composite runoff index number	83.0	88.0	+5.0
2. Surface roughness coefficient “n”	0.05	0.04	-0.01

Theoretically these soil characteristic changes will result in higher runoff potential with less infiltration.

The Project terrain is relatively flat with large natural depressions scattered across the southeast portion. The natural depressions range in depth from one to five feet, and are shown on Figure 4. These depressed areas trap and hold large volumes of runoff which will help attenuate increases in peak flow and volume associated with the Project.

5.2 Results

The Pre and unmitigated Post Project hydraulic analysis results are summarized in Table 1 below. Total rainfall volume from the mountain sheds and alluvial fan shed remained constant at a total of 6,679 acre-feet.

The total rainfall volume simulated over the alluvial fan shed area resulted in infiltration, storage in the natural depressions and outflow. The unmitigated Post Project infiltration decreased by 91 acre-feet or 3.4%; storage increased by 71 acre-feet or 2.2%; and outflow increased by 20 acre-feet or 2.6%.

The Pre and unmitigated Post Project flows have relatively shallow depths and low velocities due to the flat terrain. The maximum depth results are somewhat miss leading due to the natural depressions that are approximately five-feet deep. On average the majority of the Project site will experience flow depths less than half a foot (see Figure 5a & 5b). The unmitigated Post Project onsite flow depths increased by an average of 0.03-feet or 7.5% (see Figure 5c).

The maximum velocities occur on the fringe of the Project boundary where the mountain sheds enter the alluvial fan area. On average the majority of the Project site will experience flow velocities less than half a foot per second (see Figure 6a and 6b). The unmitigated Post Project onsite flow velocities increased by an average of 0.04 feet per second or 17.4% (see Figure 6c).

The unmitigated Post Project increases to depth, velocity and outflow are minimal as an order of magnitude to the drainage area studied. The flat terrain with natural depressions helped to attenuate the Post Project effects of decreasing the infiltration capability of the soil.

Mitigation for the Project's nominal increases can be achieved by constructing retention basins at the upstream and/or downstream edges of the Project. The retention basins should be sized with at least 20 acre-feet of combined storm water storage capacity.

TABLE 1: Hydraulic Analysis Summary

Item Description		Pre Project	Unmitigated Post Project	Post - Pre	Percent Change
Rainfall Volume					
Mountain Sheds	acre-feet	1,097	1,097	0	0.0%
Alluvial Fan Shed	acre-feet	5,582	5,582	0	0.0%
Total	acre-feet	6,679	6,679	0	0.0%
Alluvial Fan Flow Volume					
Infiltration	acre-feet	2,671	2,580	-91	-3.4%
Storage	acre-feet	3,245	3,316	71	2.2%
Outflow	acre-feet	763	783	20	2.6%
Total	acre-feet	6,679	6,679	0	0.0%
Onsite Flow Depth					
Maximum Depth	feet	5.23	5.63	0.40	7.6%
Average Depth	feet	0.40	0.43	0.03	7.5%
Onsite Flow Velocity					
Maximum Velocity	feet/sec	1.85	2.12	0.27	14.6%
Average Velocity	feet/sec	0.23	0.27	0.04	17.4%

6 SEDIMENT TRANSPORT ANALYSIS

Sediment transport occurs through the scour or deposition of soil based on storm event flow rates and soil characteristics. Hydrologic, hydraulic and soil data discussed earlier in this report were utilized for the sediment transport analysis.

6.1 Methodology

FLO-2D has a sediment transport component that can compute sediment scour or deposition for nine different methodologies. The FLO-2D user's manual identifies the Zeller and Fullerton methodology as appropriate for alluvial floodplain conditions.

Within each FLO-2D grid element, the sediment transport capacity is computed for overland flow based on the flow hydraulics. The sediment transport capacity is then compared with the sediment supply and the resulting sediment excess or deficit is uniformly distributed over the grid element.

6.2 Results

The Pre and unmitigated Post Project sediment transport analysis results are summarized in Table 2 below. On average the majority of the Pre and unmitigated Post Project site will experience sediment scour and deposition depths of plus or minus half a foot.

The unmitigated Post Project average onsite sediment scour depth (degradation) decreased by 0.07-feet or 15.9% and the deposition depth (aggradation) decreased by 0.03-feet or 5.0%. These decreases are attributable to the increase in the soil compaction which reduces the erosion potential.

The Project site experiences relatively shallow and slow flows, so the nominal increases in Post Project flow depths and velocities do not overcome the decreased erosion potential due to compaction.

TABLE 2: Sediment Transport Analysis Summary

Item Description			Pre Project	Unmitigated Post Project	Post - Pre	Percent Change
Onsite Sediment Transport						
Average Degradation Depth (-)		feet	-0.44	-0.37	0.07	-15.9%
Average Aggradation Depth (+)		feet	0.60	0.57	-0.03	-5.0%
Average Site Depth (+ or -)		feet	0.12	0.11	-0.01	-8.3%

7 PIER SCOUR ANALYSIS

As discussed earlier in this report, the solar panel pedestals will be supported by vertical steel piers. Each pier is a single W6x7.2 "I" beam. As storm water flow encounters the piers, turbulent flow will occur. The turbulent flow will cause increased local scour around the piers.

7.1 Methodology

The pier scour analysis followed the Federal Highway Administration's Hydraulic Engineering Circular No. 18 (HEC-18), "Evaluating Scour at Bridges" (4th Edition). Flow depth and velocity outputs from the FLO-2D model were used to calculate the pier scour depths at each grid element. The local scour equation and the various parameters and assumed values are as follows:

$$\frac{y_s}{a} = 2.0 K_1 K_2 K_3 K_4 \left(\frac{y}{a}\right)^{0.35} Fr^{0.43}$$

Where:
y_s = Local scour depth (ft)
K_1 = 1.1 (correction factor for pier nose shape)
K_2 = 1.29 (correction factor for angle of attack of flow)
K_3 = 1.1 (correction factor for bed condition)
K_4 = 1.0 (correction factor for armoring)
a = 0.33 (pier width in feet)
y = FLO-2D average flow depth (ft);
Fr = Froude number: $Fr = \frac{V}{\sqrt{gy}}$

Where:
V = FLO-2D average velocity (ft/s)
g = Acceleration due to gravity (32.2 ft/s^2)

7.2 Results

The pier scour analysis results are summarized in Table 3 below. The maximum pier scour depth is 1.22-feet and the average depth is 0.39-feet (see Figure 8). The structural design and embedment depth of the solar panel pedestal piers should account for the maximum potential scour plus a factor of safety. Monitoring after large storm events should be implemented to detect piers with significant scouring.

TABLE 3: Local Pier Scour Analysis Summary

Item Description		Unmitigated Post Project
Local Pier Scour		
Maximum Depth	feet	1.22
Average Depth	feet	0.39

8 CONCLUSIONS

The proposed Desert Quartzite Solar Project will cause minor impacts to the existing drainage shed area. The impacts have been minimized due to the relatively flat terrain and presence of large natural depressions that range from one to five feet deep. These large depressions store significant volumes of water which attenuate the increased runoff.

The unmitigated Post Project impacts during the 100-year storm event are as follows:

- Average Flow Depth increase of 0.03-feet
- Average Flow Velocity increase of 0.04 feet/second
- Total Outflow increase of 20 acre-feet (2.6%)

The nominal Post Project increases in flow depth, velocity and outflow can be mitigated with onsite retention basins sized with at least 20 acre-feet of combined storm water storage capacity.

The unmitigated Post Project sediment transport will be less than the pre project conditions due to soil compaction. The Project site experiences relatively shallow and slow flows, so the nominal increases in Post Project flow depths and velocities do not overcome the decreased erosion potential due to compaction.

The maximum potential pier scouring at the solar array pedestal supports is 1.22-feet. The structural design and embedment depth of the solar panel pedestal piers should account for the maximum potential scour plus a factor of safety. Monitoring after large storm events should be implemented to detect piers with significant scouring.

9 REFERENCES

1. "Hydrology Manual", Riverside County (California) Flood Control and Water Conservation District, April 1978, John W. Bryant, Chief Engineer

2. Flood Insurance Rate Map (FIRM). FIRM maps for the all of the drainage area and Project area consist of four Panels as follows: Panel Numbers *06065C2550G, *06065C2575G, *06065C3200G, and *06065C3225G. These panels are not printed by NFIP and for the areas are designated in the FIRM Index Sheet 2 for Riverside County, California as "Zone D", "Areas in which flood hazards are undetermined".

   Thus, flood plains in the area have not been determined and no flood plain elevations or flows have been developed.

3. "Geotechnical Engineering Report, Proposed Solar Field Facility, North of 16th Avenue on both sides Haig Road, Blythe, Riverside county, CA", March 27, 2008 by Earth Systems Southwest for First Solar Electric.

   This report is for an approximately 240 acre site abutting and near the northeast side of the Project.

4. "Web Soil Survey, National Cooperative Soil Survey", by USDA, Natural Resources Conservation Service. (See Appendix I for applicable excerpts).

5. "Point Precipitation Frequency Estimates from the National Oceanic & Atmospheric Administration (NOAA) Atlas 14". 2006, National Weather Service, Silver Spring, Maryland.

6. "San Bernardino County, Hydrology Manual", August 1986 (SBCHM).

7. "HEC-1", US Army Corps of Engineers, Hydraulic Engineering Center.

   This is a computer program that allows runoff and hydrographs to be computed utilizing various input data. This program is used for the Project offsite Mountain Shed areas.

8. FLO-2D, Version 2007.06.

   FLO-2D is a two-dimensional surface-water-flow and sediment-transport model computer drainage calculation program used for the Projects alluvial fan drainage areas.

9. "Evaluating Scour at Bridges, 4th Edition", May/Sept 2001, Publication No. FHWA NHI 01-001, Hydraulic Engineering Center No. 18 (HEC-18).

   Chapter 6 of this document provides the background methods used to calculate scour depths at the solar support pedestals.

10. "Drainage Calculations for x1-Riv-64-D,E", April 1964, by California Department of Public Works-Division of Highways.

The calculations include information relative to I10 and DOH station 927+50 and shown as the Palowalla Ditch. This is the ditch and area that drains to the southeast and under the I10 bridge which drainage is directed towards the northeast side of the Project site.

11. "Desert Quartzite Field Visit" 1 page email of August 14, 2009 from Crystal Eggers.

This email provides a general description of soil conditions in the Project site.

12. "Sedimentation Engineering", ASCE Manuals and Reports on Engineering Practice No. 54, 2006 originally published 1975 and republished as Classic Edition, 2006

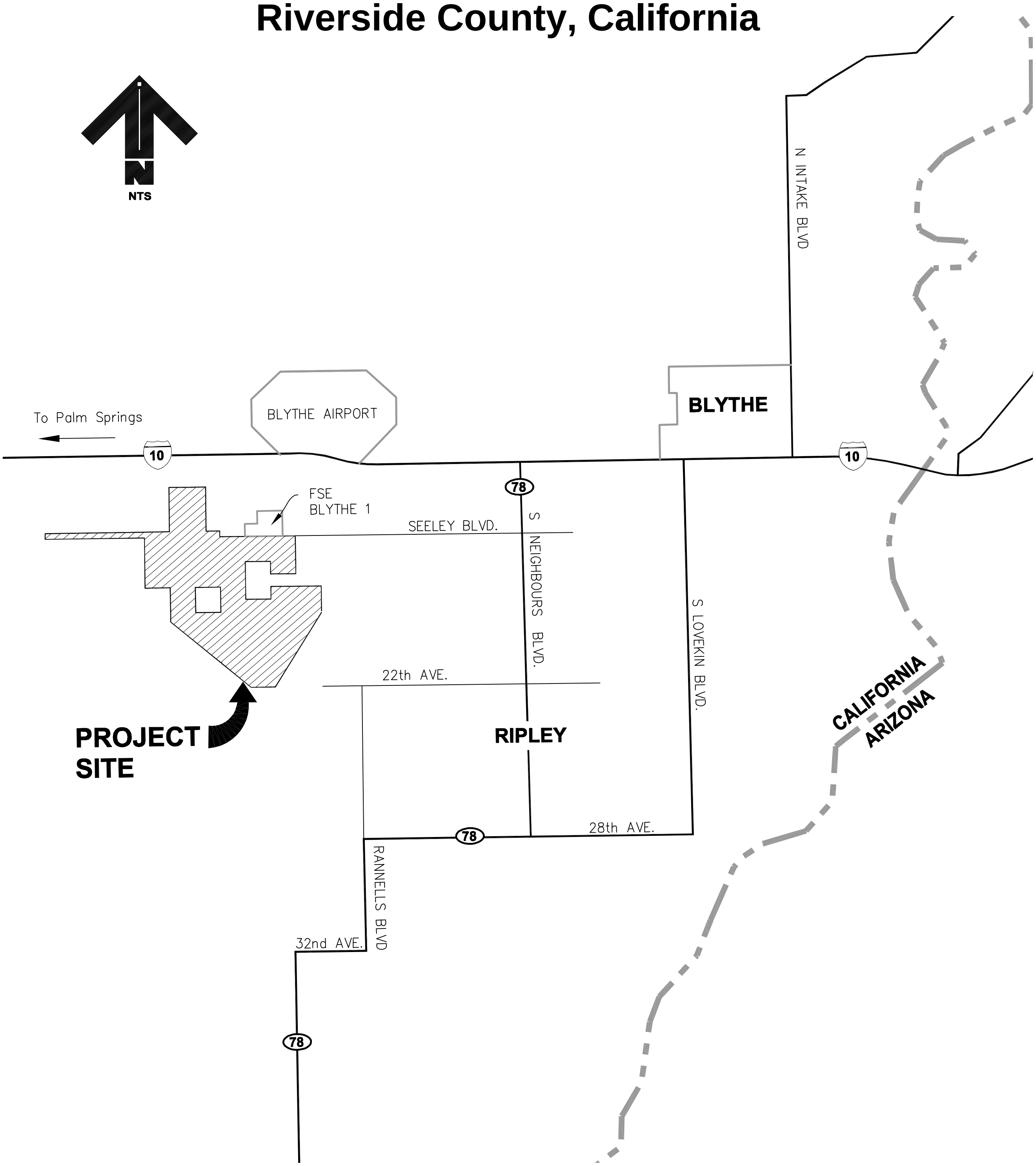
13. "Sedimentation Engineering, Processes, Measurements, Modeling, and Practice", ASCE Manuals and Reports on Engineering Practice No. 110, 2007

14. "Sediment Yield Computed with Universal Equation", December 1972, Journal of the Hydraulics Division, Proceedings of ASCE, by Jimmy R. Williams and Harold D. Berndt.

15. 'Predicting Soil Erosion by Water: A Guide to Conservation Planning With the Revised Universal Soil Loss Equation (RUSLE)", January 1997, USDA, Agricultural Research Service, Agriculture Handbook Number 703

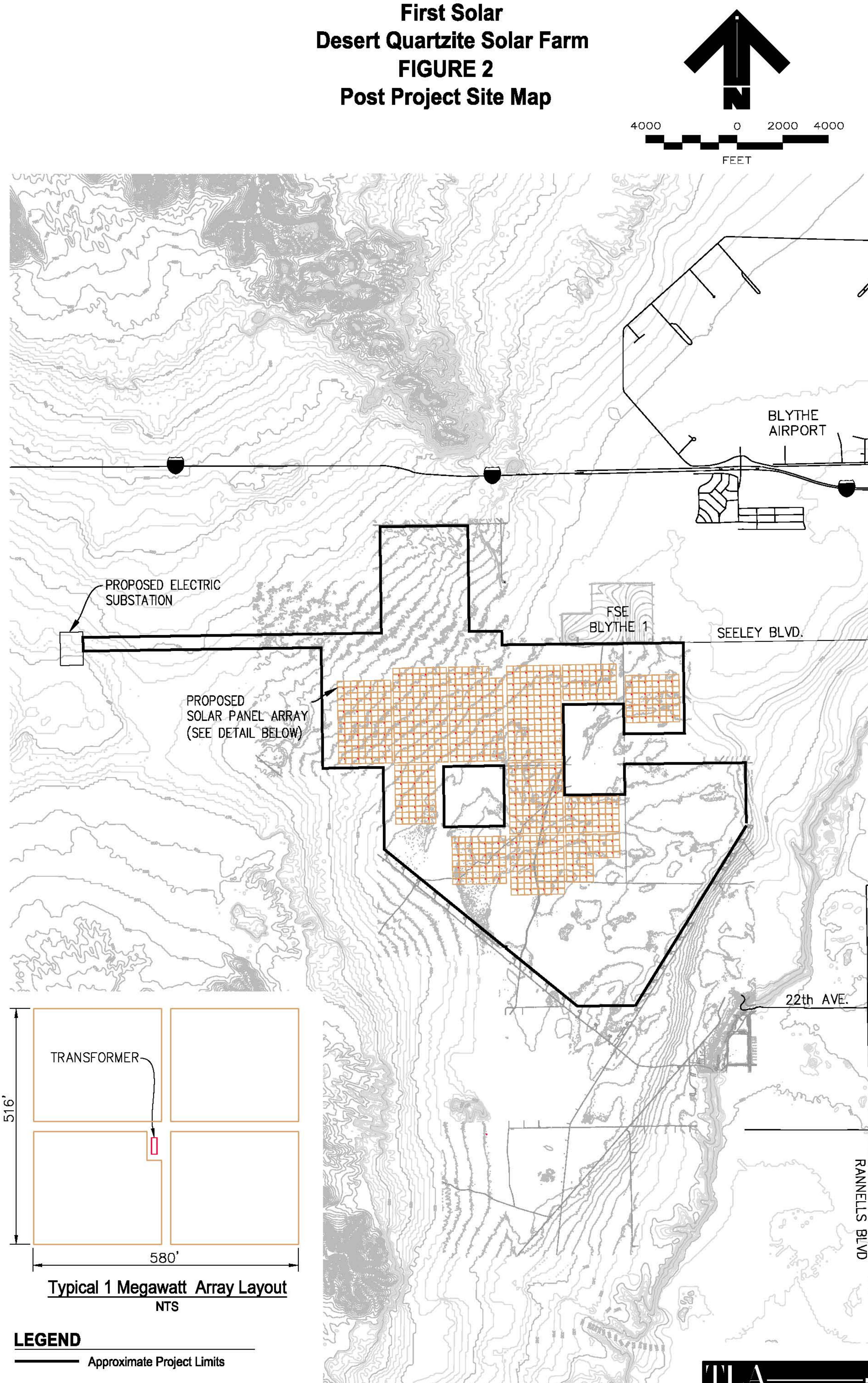
16. "Draft, User's Reference Guide, Revised Universal Soil Loss Equation, Version 2 (RUSLE@), May 15, 2008, prepared for USDA-Agricultural Research Service, Washington, D.C.

First Solar
Desert Quartzite Solar Farm
Figure 1
General Project Vicinity Map
Riverside County, California



TLA
ENGINEERING & PLANNING

First Solar
Desert Quartzite Solar Farm
FIGURE 2
Post Project Site Map



Typical 1 Megawatt Array Layout

NTS

LEGEND

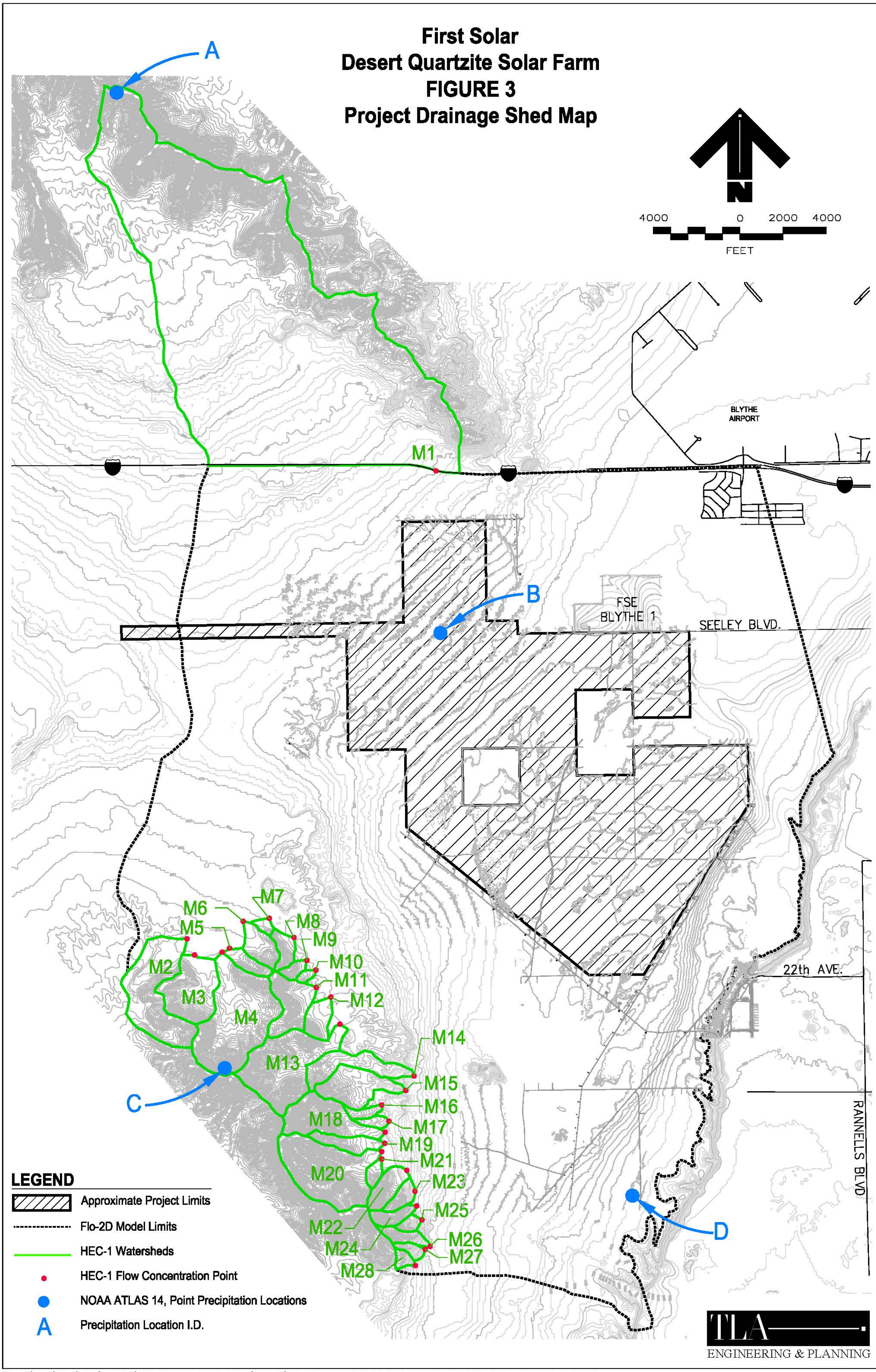
Approximate Project Limits

1 Megawatt Array (Typ)
(See Array Layout above)

TLA
ENGINEERING & PLANNING

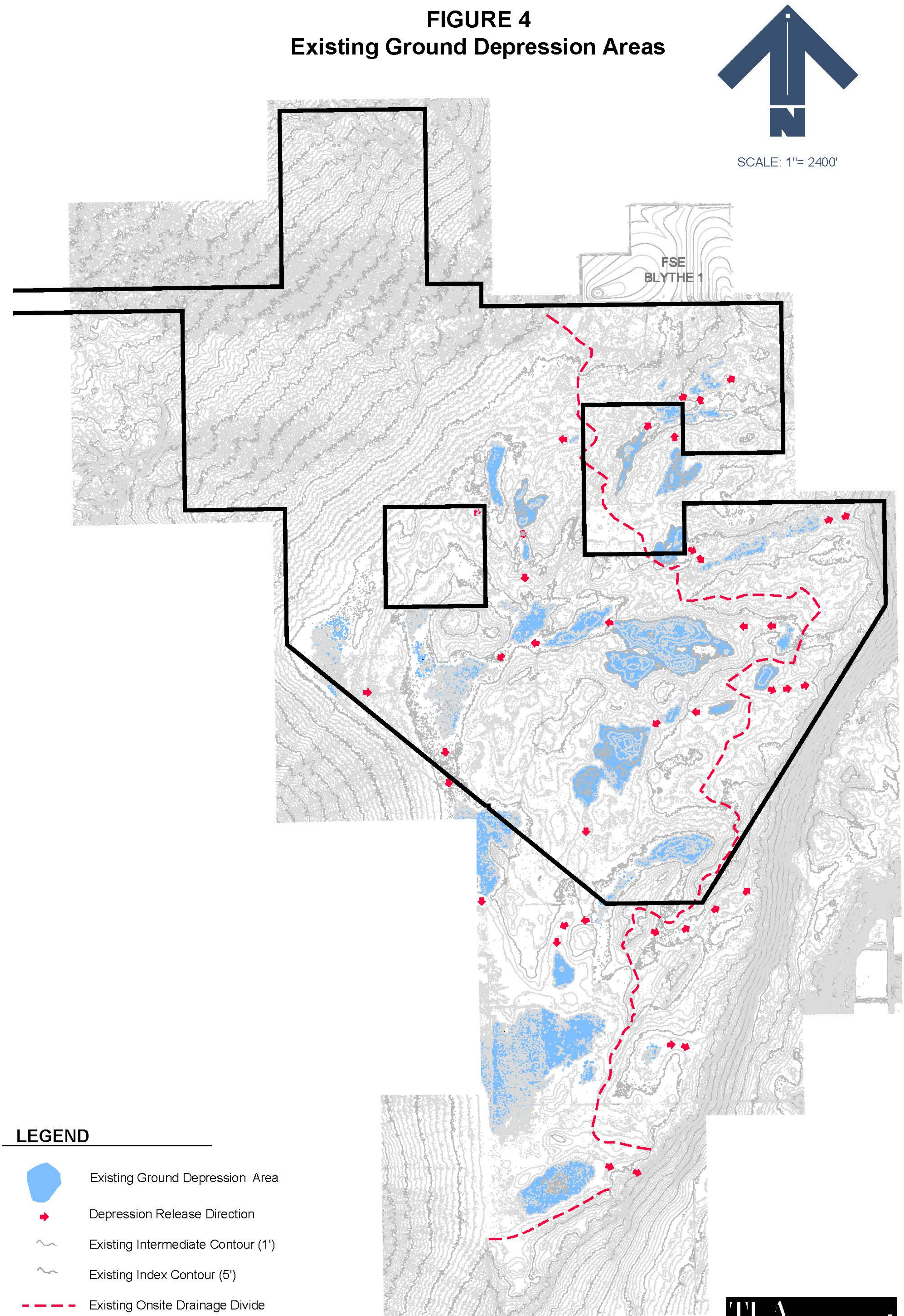
File: K:\1proj\14XX\1468\Drainage\2011 Riverside Method Report\Exhibits\Fig-2_Post-Project Site Map.dwg Aug 04, 2011 - 9:59am jhenderson

First Solar
Desert Quartzite Solar Farm
FIGURE 3
Project Drainage Shed Map



File: K:\1proj\14XX\1468\Drainage\2011 Riverside Method Report\Exhibits\Fig-03 Project Drainage Shed Map.dwg Aug 04, 2011 - 12:52pm Jhenderson

First Solar
Desert Quartzite Solar Farm
FIGURE 4
Existing Ground Depression Areas



TLA
ENGINEERING & PLANNING

File: K:\1proj\14XX\1468\Drainage\2011 Riverside Method Report\Exhibits\Fig-04_Ex-Depression Areas.dwg   Aug 04, 2011 – 1:05pm jhenderson

Grid Element Maximum Flow Depth

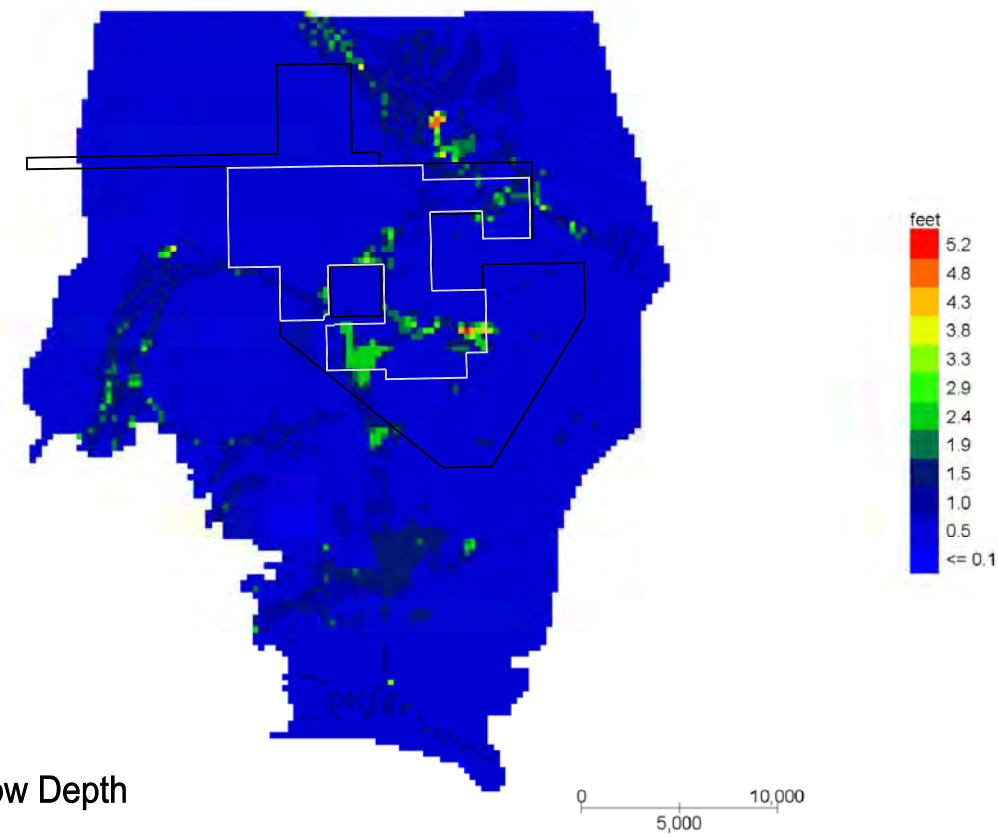


Figure 5a
Pre Project Flow Depth

Grid Element Maximum Flow Depth

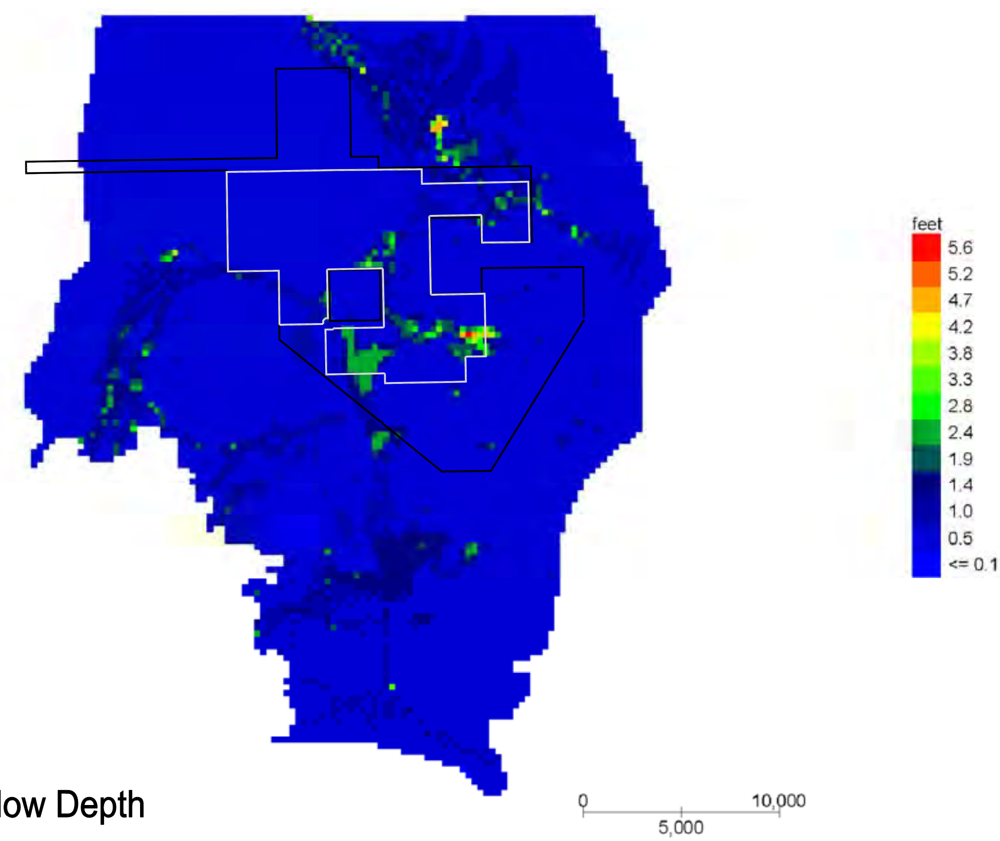


Figure 5b
Post Project Flow Depth

Grid Element Maximum Flow Depth

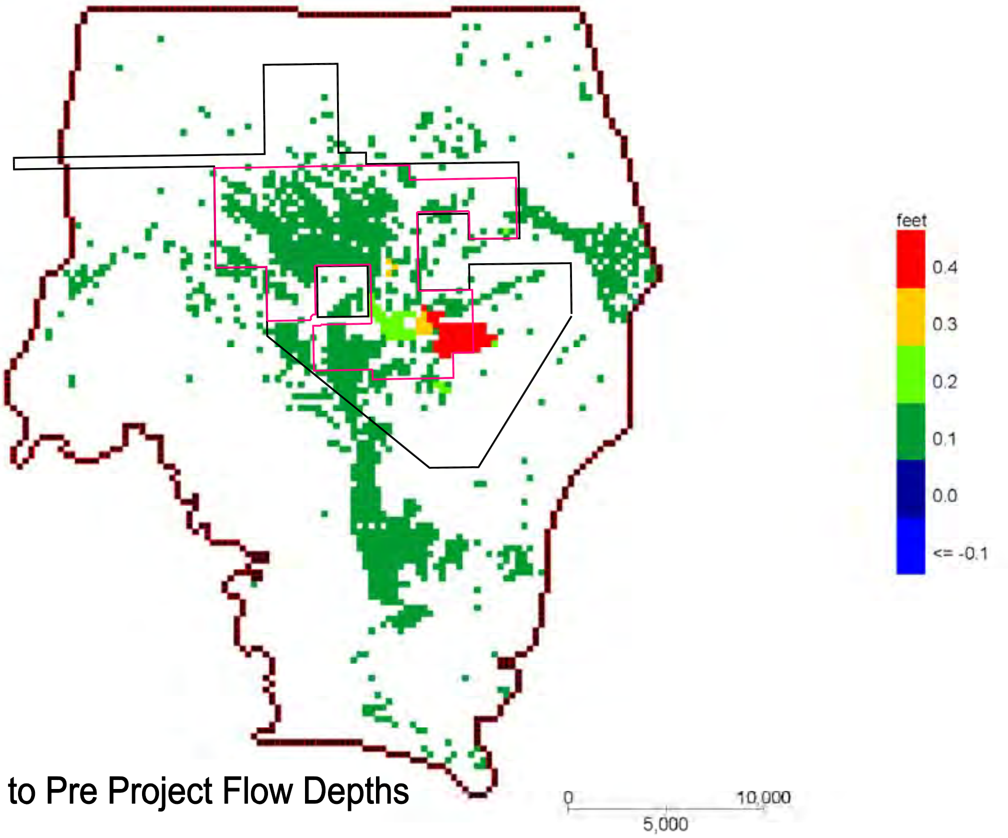


Figure 5c
Difference Post to Pre Project Flow Depths

Grid Element Maximum Velocity

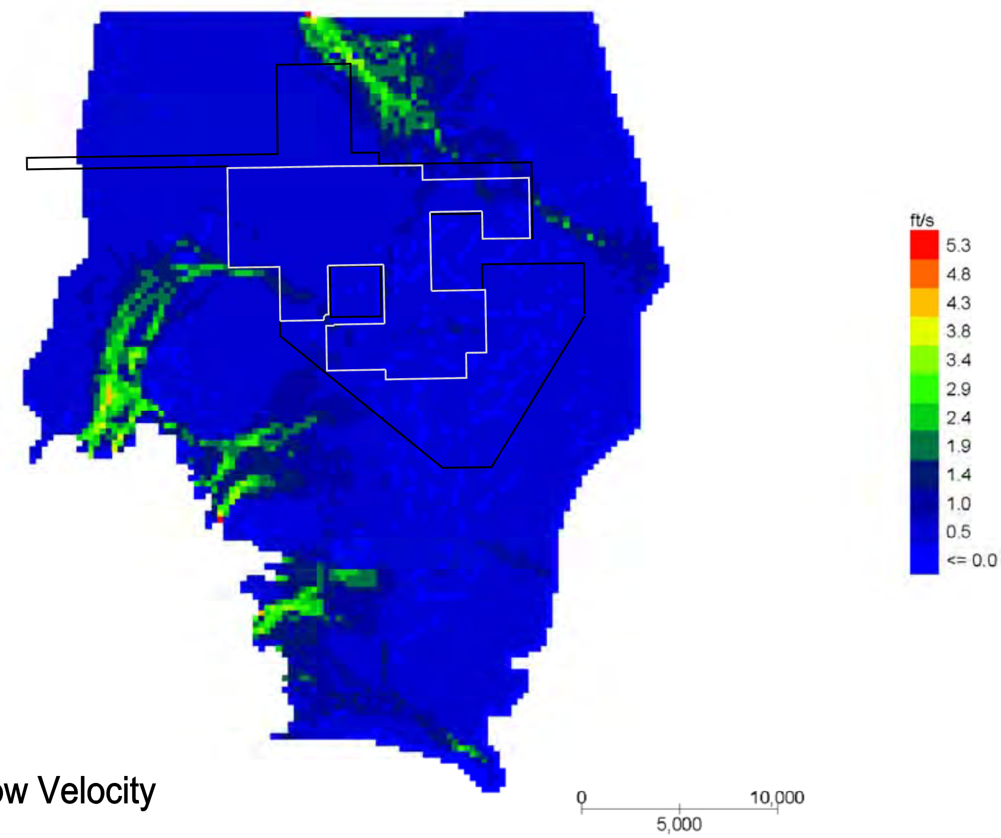


Figure 6a
Pre Project Flow Velocity

Grid Element Maximum Velocity

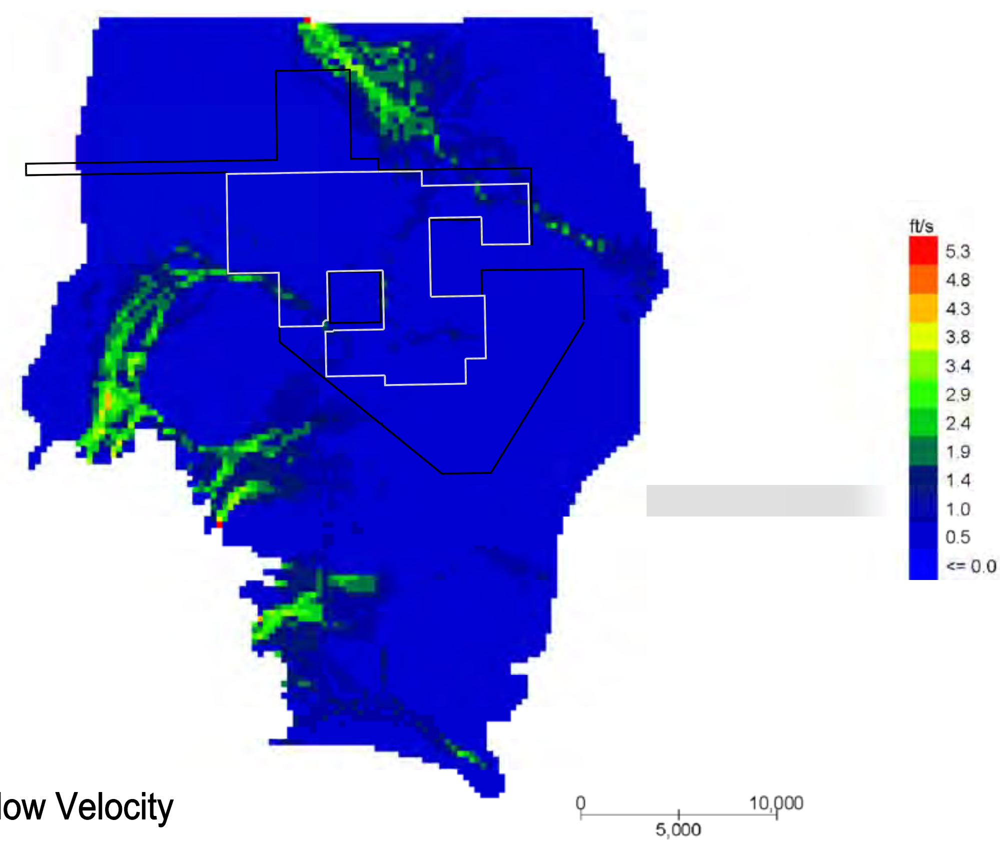


Figure 6b
Post Project Flow Velocity

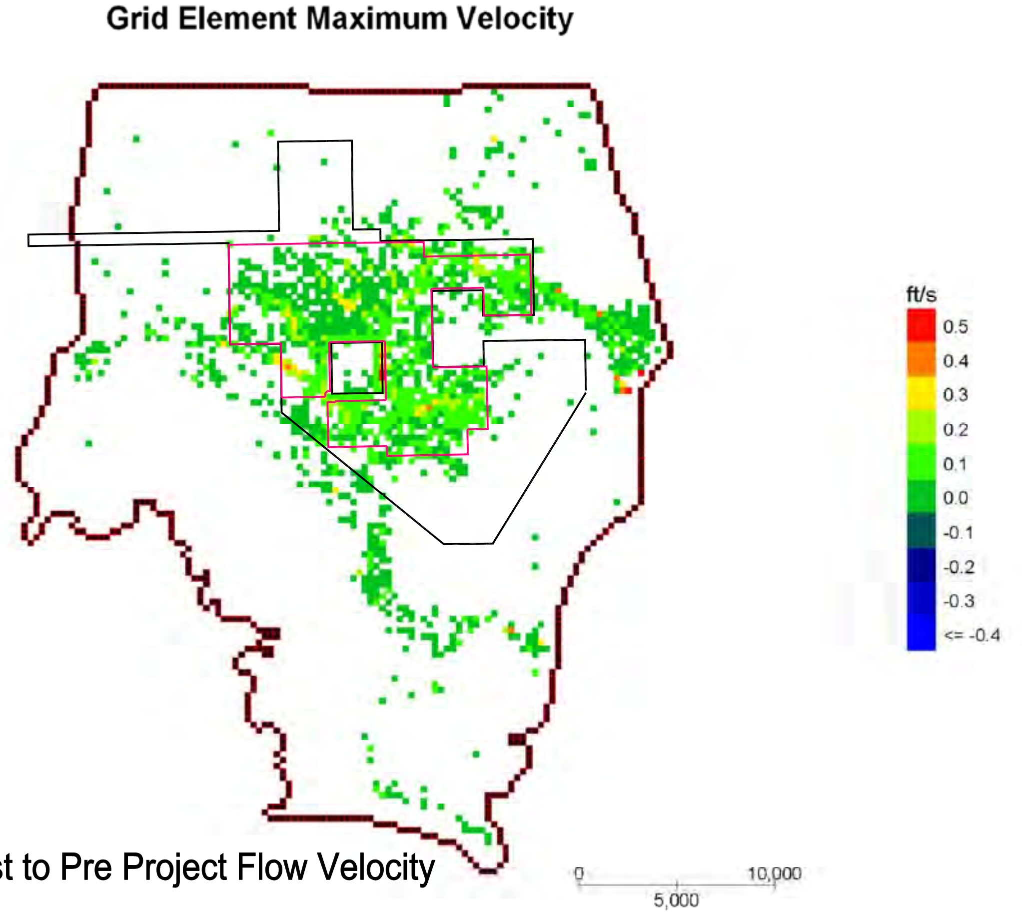


Figure 6c
Difference Post to Pre Project Flow Velocity

Grid Element Maximum Scour

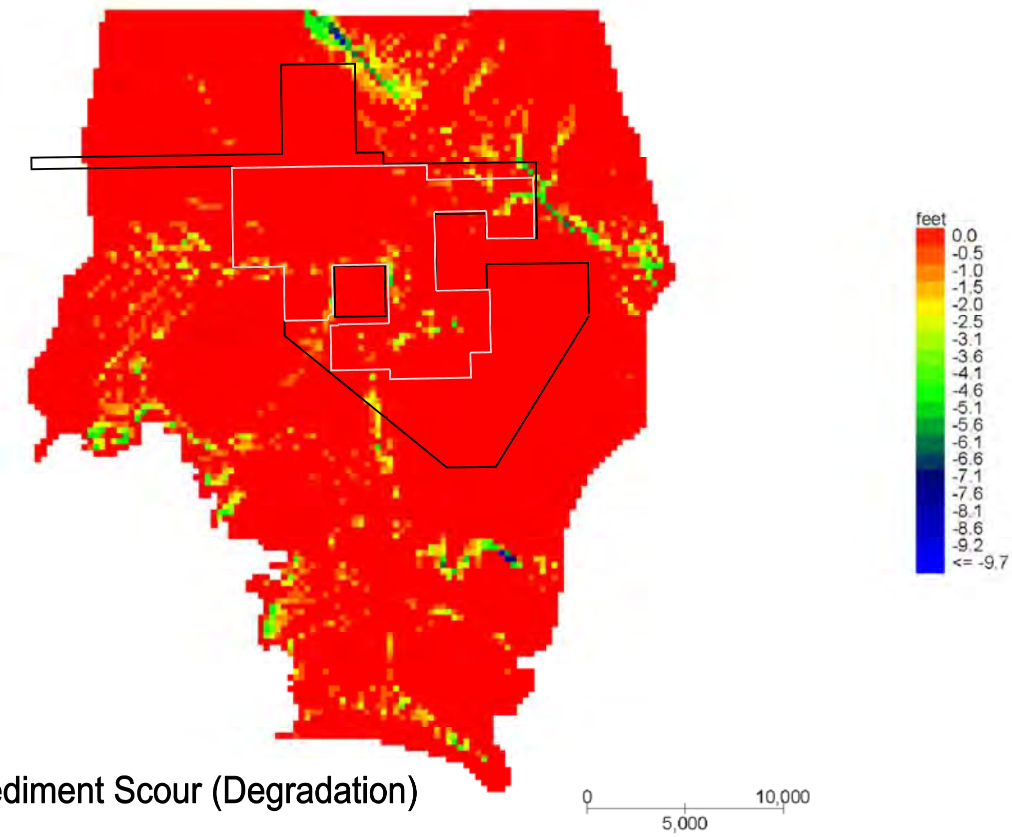


Figure 7a
Pre Project Sediment Scour (Degradation)

Grid Element Maximum Scour

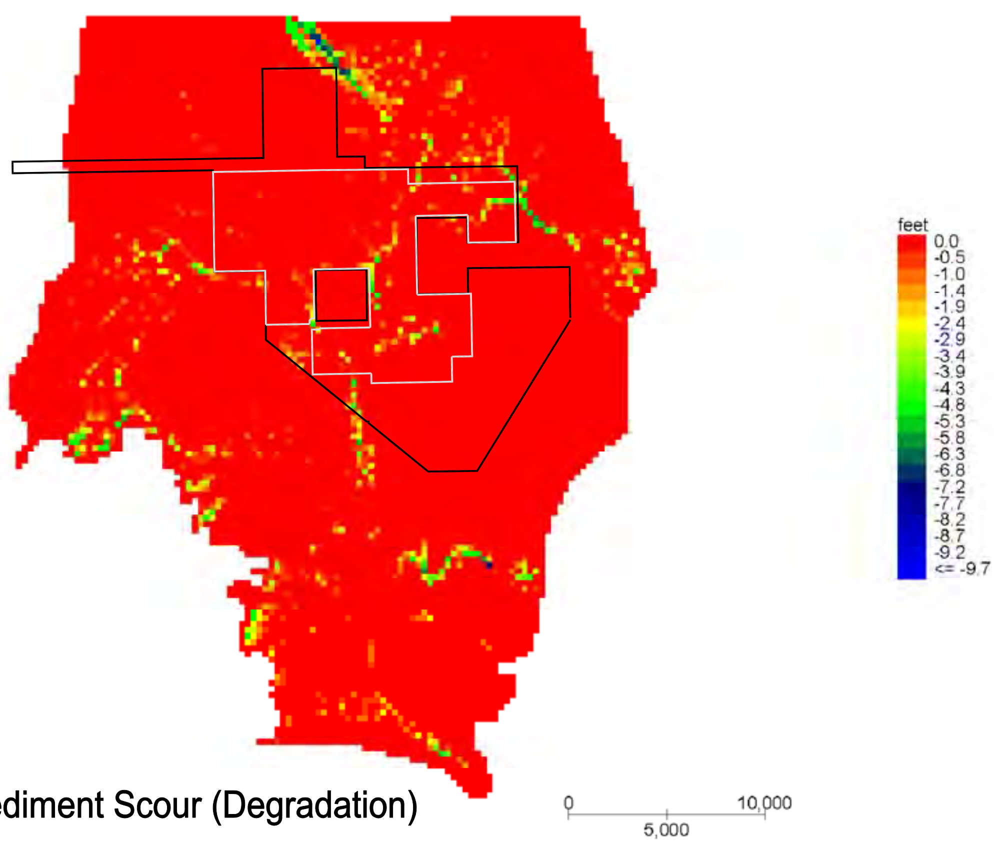


Figure 7b
Post Project Sediment Scour (Degradation)

Grid Element Maximum Pier Scour

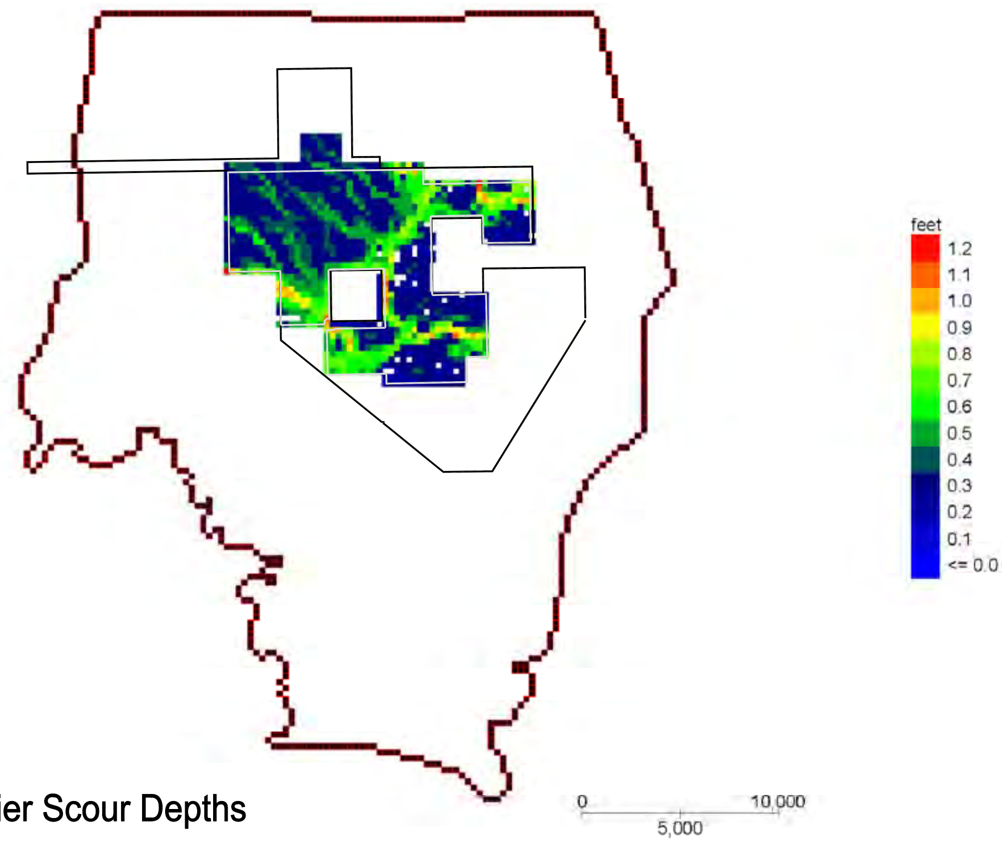


Figure 8
Post Project Pier Scour Depths