

# HISTORIC AND DESIGN REVIEW COMMISSION

August 02, 2017

**HDRC CASE NO:** 2017-376  
**ADDRESS:** 555 FUNSTON PLACE  
**LEGAL DESCRIPTION:** NCB A-50 BLK 3 LOT 1 (31.933 AC) & P-100 (1.79 AC / PT OF ROW CLOSED) MAHNCKE PARK SUBD  
**ZONING:** R-4,NCD-6  
**CITY COUNCIL DIST.:** 2  
**APPLICANT:** Sage Warren  
**OWNER:** Bob Brackman  
**TYPE OF WORK:** Installation of solar panels  
**REQUEST:**

The applicant is requesting a Certificate of Appropriateness for approval to install a 31kW solar array on the roof of the new Welcome and Discovery Complex building at the San Antonio Botanical Gardens. The array will be installed on a standing seam metal roof. The proposal includes associated transformers, distribution panels, service feeders, and utility revenue meters to be installed at various locations on the property.

## APPLICABLE CITATIONS:

*Sec. 35-642. - New Construction of Buildings and Facilities.*

In considering whether to recommend approval or disapproval of a certificate, the historic and design review commission shall be guided by the following design considerations. These are not intended to restrict imagination, innovation or variety, but rather to assist in focusing on design principles, which can result in creative solutions that will enhance the city and its neighborhoods. Good and original design solutions that meet the individual requirements of a specific site or neighborhood are encouraged and welcomed.

### (a) *Site and Setting.*

- (1) Building sites should be planned to take into consideration existing natural climatic and topographical features. The intrusive leveling of the site should be avoided. Climatic factors such as sun, wind, and temperature should become an integral part of the design to encourage design of site-specific facilities which reinforces the individual identity of a neighborhood and promotes energy efficient facilities.
- (2) Special consideration should be given to maintain existing urban design characteristics, such as setbacks, building heights, streetscapes, pedestrian movement, and traffic flow. Building placement should enhance or create focal points and views. Continuity of scale and orientation shall be emphasized.
- (3) Accessibility from streets should be designed to accommodate safe pedestrian movement as well as vehicular traffic. Where possible, parking areas should be screened from view from the public right-of-way by attractive fences, berms, plantings or other means.
- (4) Historically significant aspects of the site shall be identified and if possible incorporated into the site design. Historic relationships between buildings, such as plazas or open spaces, boulevards or axial relationships should be maintained.

### (b) *Building Design.*

- (1) Buildings for the public should maintain the highest quality standards of design integrity. They should elicit a pride of ownership for all citizens. Public buildings should reflect the unique and diverse character of San Antonio and should be responsive to the time and place in which they were constructed.
- (2) Buildings shall be in scale with their adjoining surroundings and shall be in harmonious conformance to the identifying quality and characteristics of the neighborhood. They shall be compatible in design, style and materials. Reproductions of styles and designs from a different time period are not encouraged, consistent with the secretary of the interior's standards. Major horizontal and vertical elements in adjoining sites should be respected.

(3) Materials shall be suitable to the type of building and design in which they are used. They shall be durable and easily maintained. Materials and designs at pedestrian level shall be at human scale, that is they shall be designed to be understood and appreciated by someone on foot. Materials should be selected that respect the historic character of the surrounding area in texture, size and color.

(4) Building components such as doors, windows, overhangs, awnings, roof shapes and decorative elements shall all be designed to contribute to the proportions and scale of their surrounding context. Established mass/void relationships shall be maintained. Patterns and rhythms in the streetscape shall be continued.

(5) Colors shall be harmonious with the surrounding environment, but should not be dull. Choice of color should reflect the local and regional character. Nearby historic colors shall be respected.

(6) Mechanical equipment or other utility hardware should be screened from public view with materials compatible with the building design. Where possible, rooftop mechanical equipment should be screened, even from above. Where feasible, overhead utilities should also be underground or attractively screened. Exterior lighting shall be an integral part of the design. Interior lighting shall be controlled so that the spillover lighting onto public walkways is not annoying to pedestrians.

(7) Signs which are out of keeping with the character of the environment in question should not be used. Excessive size and inappropriate placement on buildings results in visual clutter. Signs should be designed to relate harmoniously to exterior building materials and colors. Signs should express a simple clear message with wording kept to a minimum.

(8) Auxiliary design. The site should take into account the compatibility of landscaping, parking facilities, utility and service areas, walkways and appurtenances. These should be designed with the overall environment in mind and should be in visual keeping with related buildings, structures and places.

(c) *Multiple Facades*. In making recommendations affecting new buildings or structures which will have more than one (1) important facade, such as those which will face two (2) streets or a street and the San Antonio River, the historic and design review commission shall consider the above visual compatibility standards with respect to each important facade.

(Ord. No. 98697 § 6)

## **FINDINGS:**

- a. The proposed solar array installation will be located atop a new Welcome and Discovery Complex building at the San Antonio Botanical Gardens. The complex received final HDRC approval on November 5, 2014.
- b. SOLAR ARRAY – The array will be flush mounted to a standing seam roof. According to UDC Section 35-642(b)(6), rooftop equipment should be screened where feasible. The flush mount installation will be minimally visible from the public right-of-way. Additionally, the installation of the solar array will not impact any historic structures and will be compatible with the design and materiality of the new building. Staff finds the proposal consistent with this citation.
- c. SITE ELEMENTS – The proposed solar array requires the installation of several transformers, distribution panels, service feeders, and utility revenue meters. The main building contains an equipment yard that is screened from the public right-of-way. The site elements will be minimally visible and will not be intrusive to the overall Botanical Gardens complex. Staff finds the proposal acceptable and consistent with the UDC.

## **RECOMMENDATION:**

Staff recommends approval based on findings a through c.

## **CASE MANAGER:**

Stephanie Phillips



## Flex Viewer

Powered by ArcGIS Server

Printed: Jul 23, 2017

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BIKE LANE

CITY of SAN ANTONIO  
NOTICE of HEARING  
HISTORIC & DESIGN  
REVIEW COMMISSION  
ADDRESS: [REDACTED]  
REQUEST: [REDACTED]  
HEARING DATE: [REDACTED] Time: 3:00 PM  
FOR MORE INFORMATION CONTACT  
(214) 207-2035  
ALL HDRC MEETINGS TAKE PLACE AT 1901 S. ALAMO









# SOLAR PV INSTALLATION PROJECT

## Solar Photovoltaic Array

San Antonio Botanical Garden

555 Funston Place, San Antonio TX 78209

### PROJECT CONTACTS

#### ONE80 SOLAR PROJECT MANAGERS

Patrick Attwater  
patrick.attwater@one80solar.com  
210.802.7405  
John Peterson  
john.peterson@one80solar.com  
210.802.7428

#### ONE80 SOLAR PROJECT ENGINEER

Shannon Ware  
shannon.ware@one80solar.com  
314.541.2027

PROJECT NUMBER: xxxx

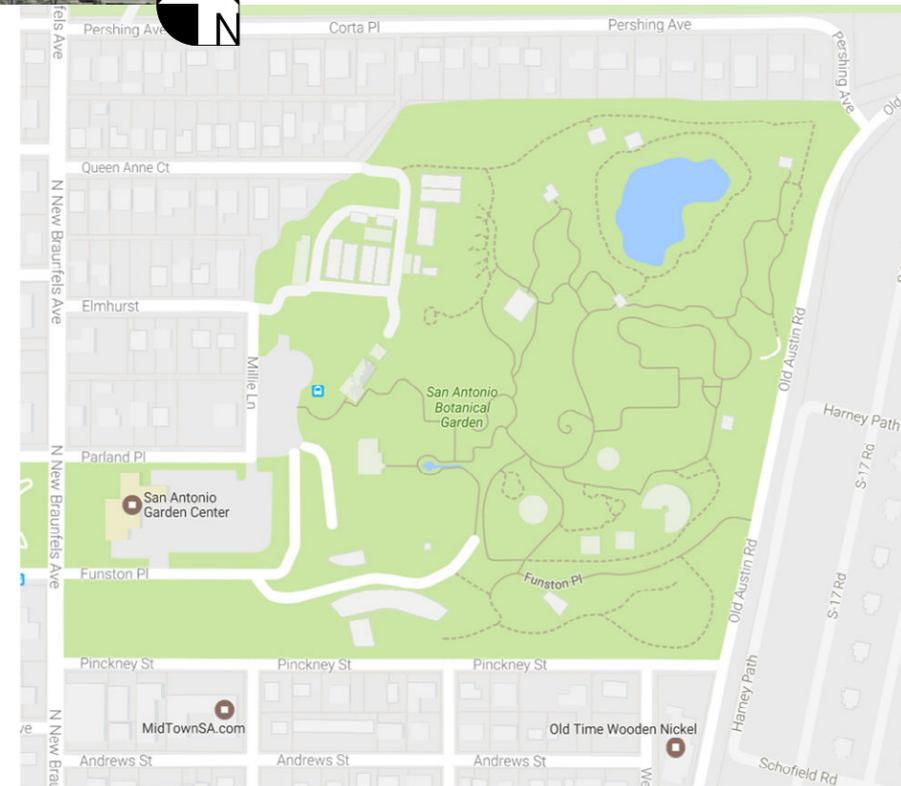
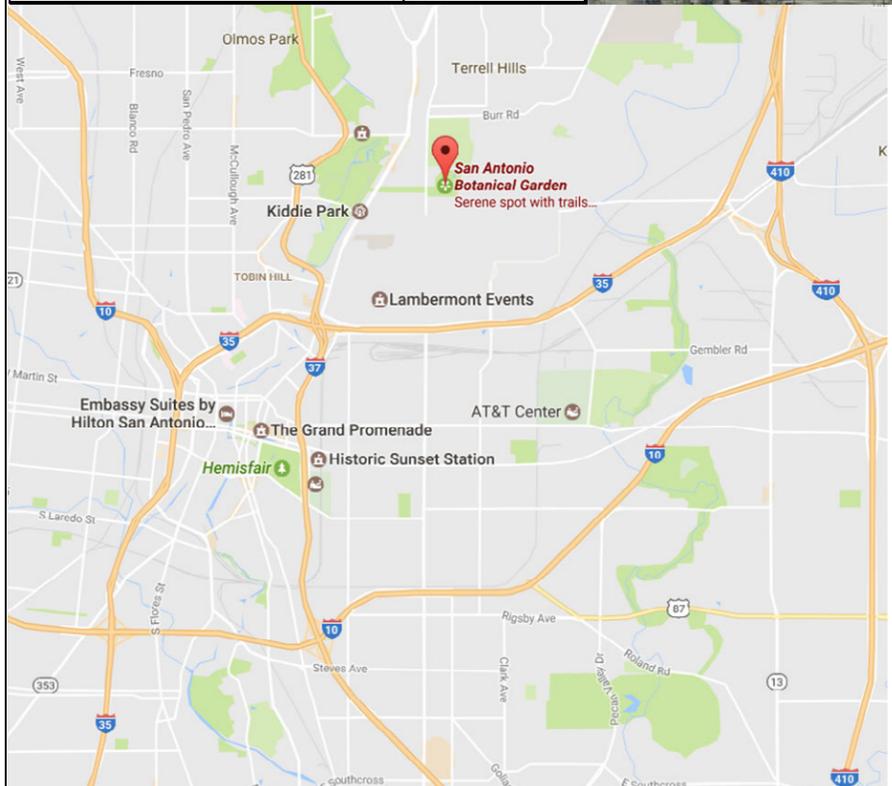
### APPLICABLE CODES

2012 International Building Code  
2012 International Fire Code  
2014 National Electrical Code  
  
Wind Speed  
IBC Risk Category I Vult 105 mph  
Wind Exposure Category B  
Ground Snow Load 5 PSF  
Seismic Design Category A

### Sheet Index

- PV 1.0 Title Page
- PV 1.1 Site Plan
- PV 1.2 Local Site Plan
- PV 1.3 Racking Layout
- PV 2.1 Roof Electrical
- PV 2.2 Kitchen Electrical
- PV 2.3 Equipment Yard Main Bldg.
- PV 2.4 String Assignment
- PV 4.0 Inverter
- PV 4.01 Inverter
- PV 4.1 PV Modules
- PV 4.x Racking Details

| DESIGN TEMPERATURES ( C ) |    |
|---------------------------|----|
| tmax selected             | 44 |
| tmin selected             | -8 |
| Assumed Trise C           | 30 |
| RECORD MAX last 20 yrs    | 44 |
| RECORD MIN last 20 yrs    | -8 |
| ASHRAE EXTREME HIGH       | 38 |
| ASHRAE 2% HIGH            | 36 |
| ASHRAE EXTREME MIN        | -6 |
| San Antonio Intl Airport  |    |



|  |   |
|--|---|
| DC SYSTEM NAMEPLATE CAPACITY (KW DC STC) | 31.545  |
| AC SYSTEM NAMEPLATE CAPACITY (KW)        | 30  |
| WIRING CONFIGURATION                     | 3φ, 4W GROUNDED WYE   |
| NEUTRAL GROUNDING                        | SOLID   |
| FREQUENCY (HZ)                           | 60  |
| AC VOLTAGE                               | 120Y/208  |
| NOMINAL OPERATING AMPS                   | 36.3 at 277/480, 83.8 at 120Y/208                           |
| NOMINAL POWER FACTOR                     | 1   |
| AC SYSTEM NAMEPLATE CAPACITY (KVA)       | 30  |
| ARRAY TYPE                               | FLUSH STANDING SEAM ATTACHED                                |
| ROOF TYPE                                | STANDING SEAM METAL   |
| SUPPORT RACKING                          | IRON RIDGE RACKING  |
| ARRAY TILT                               | 4.8 DEGREES   |
| ARRAY AZIMUTH                            | 168   |
| PV MODULE MFG                            | MISSION SOLAR   |
| MODULE MODEL #                           | MSE315MC1J, MSE320MC1J                                      |
| MODULE QTY                               | 99  |
| MODULES CEC-PTC RATING (W)               | 277.8, 282.4  |
| INVERTER MFG                             | KACO  |
| INVERTER MODEL #                         | BLUEPLANET 10.0 TL3   |
| INVERTER POWER RATING (AC KVA)           | 10  |
| INVERTER WEIGHTED CEC EFFICIENCY         | 97  |
| INVERTER QUANTITY                        | 3   |
| AC COMBINER PANEL (S)                    | one, 60AF/50AT 277/480V                                     |
| MAIN PV AC DISCONNECT                    | 240V, 175AF, 175AT, FUSIBLE, VISIBLE BLADE, LOCKABLE        |
| SITE SERVICE                             | 800A, 120Y/208VAC, 3φ, 4W GROUNDED WYE                      |
| POINT OF COMMON CONNECTION (POCC)        | LOAD-SIDE BACKFED 175A BREAKER AT MAIN SERVICE PANELBOARD C |
| POCC - MAIN DISCONNECT LOCATION          | EQUIPMENT YARD NEXT TO MAIN SERVICE PANEL                   |

| DESIGNED | Shannon Ware | REVISIONS  |            |
|----------|--------------|------------|------------|
| CHECKED  |              | 05/24/2017 | For Review |
| DRAWN    | Shannon Ware | 06/12/2017 | Revised    |
|          |              | 06/19/2017 | Revised    |



SHEET NAME  
Title Page  
ORIGINAL SHEET SIZE  
11" x 17"  
  
1502 S. Flores Street  
San Antonio TX 78204



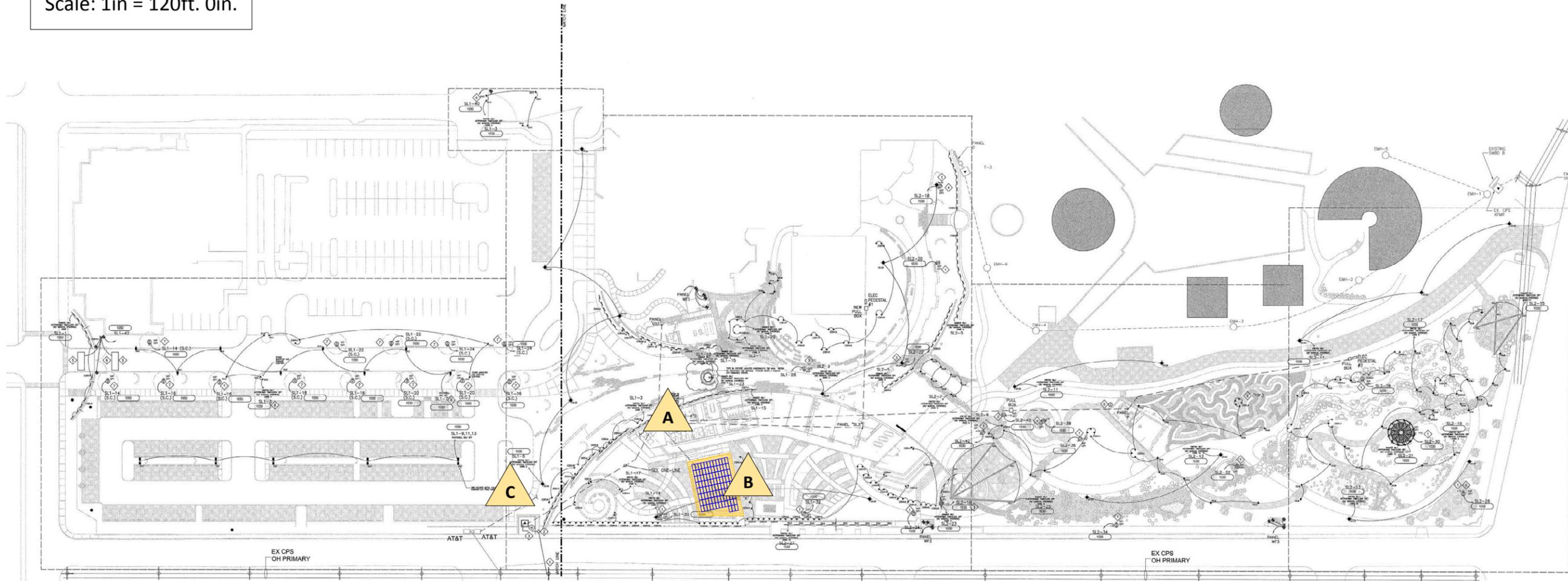
0.0 ft. 72.0 ft. 120.0 ft. 240.0 ft.

Array Solar Azimuth 168°

Scale: 1in = 120ft. 0in.



**Solar Photovoltaic Array**  
San Antonio Botanical Garden  
555 Funston Place, San Antonio TX 78209



1  
ELECTRICAL SITE PLAN  
SCALE: 1" = 120'

1  
ELECTRICAL SITE PLAN  
SCALE: 1" = 120'



480/208V step-down transformer, PV Meter, Main PV Disconnect in Equipment Yard at Welcome Center Main Building



PV Array installed on roof of Welcome Center Outdoor Classroom Structure, PV Inverters, PV AC Aggregator Panel, remote PV AC Disconnect



Pad Mounted Main utility Service Transformer and Utility Revenue Meter

REVISION NOTES:  
◇ NEW OVERHEAD 3 PHASE LINE.  
◇ NEW CPS RISER POLE.



|          |              |
|----------|--------------|
| DESIGNED | ML           |
| CHECKED  |              |
| DRAWN    | Shannon Ware |

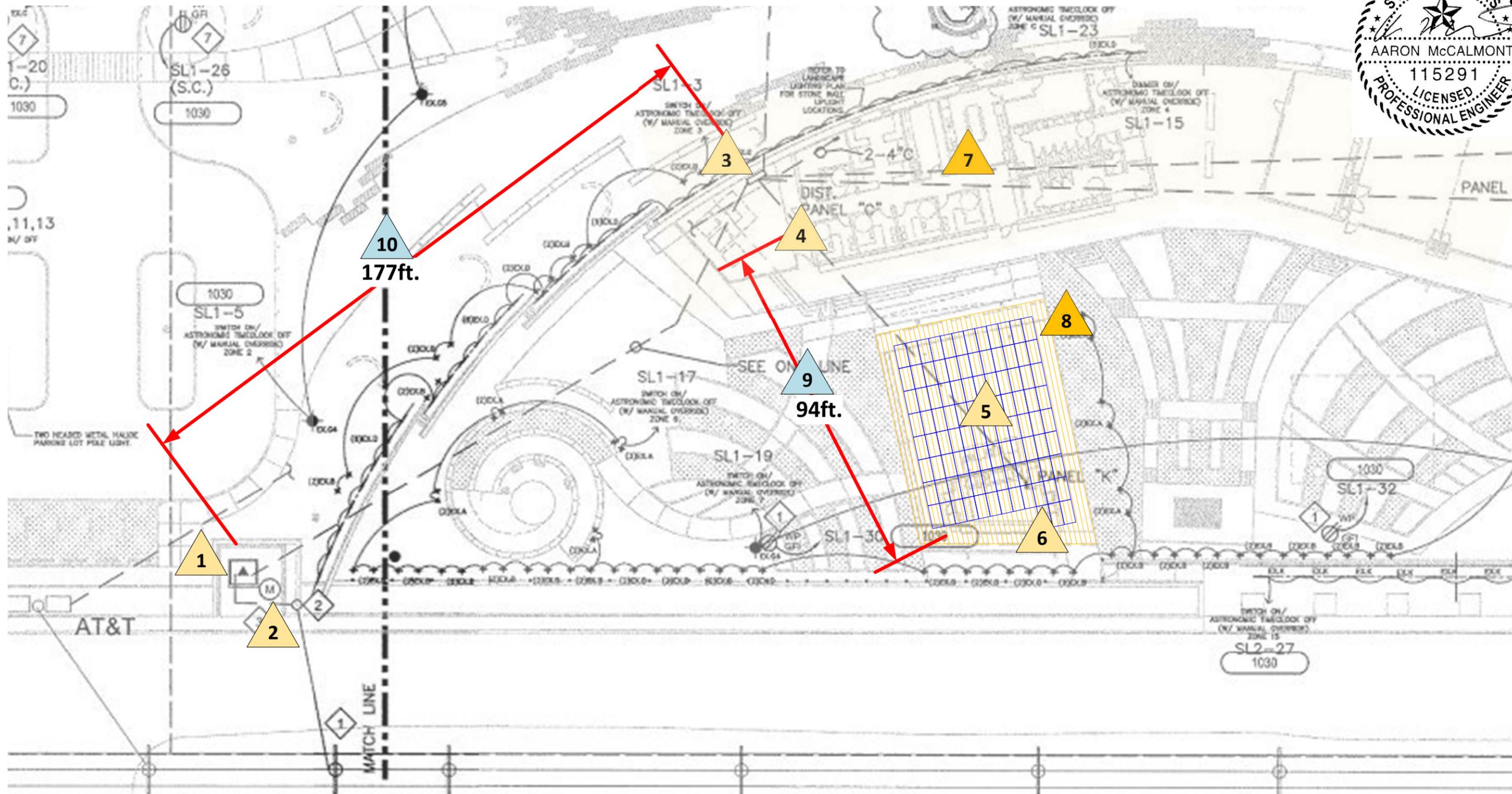
| REVISIONS  |            |
|------------|------------|
| 05/24/2017 | For Review |
| 06/19/2017 | Revised    |



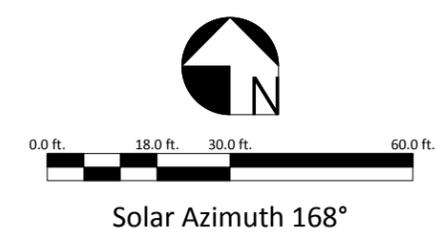
Scale: 1in = 120ft. 0in.  
SHEET NAME  
PV 1.1 Overall Site Plan  
ORIGINAL SHEET SIZE  
11" x 17"



**Solar Photovoltaic Array**  
 San Antonio Botanical Garden  
 555 Funston Place, San Antonio TX 78209



- |  |   |   |   |
|--|---|---|---|
| <b>1</b> Pad Mounted Main Utility Service Transformer  | <b>4</b> 480/120V step-down transformer, PV Meter, Main PV Disconnect in Equipment Yard at Welcome Center Main Building | <b>7</b> Welcome Center Main Building   | <b>10</b> Service Entrance Feeder from Utility Transformer to Main Distribution Panel C |
| <b>2</b> Main Utility Revenue Meter mounted at transformer   | <b>5</b> PV Array installed on roof of Welcome Center Outdoor Classroom Structure                                       | <b>8</b> Welcome Center Outdoor Classroom Structure   |   |
| <b>3</b> Main Distribution Panel C in Welcome Center Main Building Equipment Yard, Load Side POCC for PV Generation System | <b>6</b> PV Inverters, PV AC Aggregator Panel, remote PV AC Disconnect  | <b>9</b> 480V Inverter output circuits in UG concrete-encased duct bank from inverters in Kitcehn Electrical Room to PV Disconnect & transformer in Welcome Center Equipment Yard |   |



|          |              |
|----------|--------------|
| DESIGNED | Shannon Ware |
| CHECKED  |              |
| DRAWN    | Shannon Ware |



| REVISIONS  |            |
|------------|------------|
| 06/19/2017 | For Review |
|            |            |
|            |            |

Scale: 1in = 30ft. 0in.  
 SHEET NAME  
 PV 1.2 Local Site Plan  
 ORIGINAL SHEET SIZE  
 11" x 17"



|           |              |
|-----------|--------------|
| DESIGNED: | SHANNON WARE |
| CHECKED:  |              |
| DRAWN BY: | SHANNON WARE |

| REVISIONS |            |                        |
|-----------|------------|------------------------|
| #         | DATE       | DESCRIPTION            |
| 1         | 09/06/2016 | FOR PRELIMINARY REVIEW |
| 2         | 05/24/2017 | Revised                |
| 3         | 06/01/2017 | Revised                |
| 4         | 06/08/2017 | Revised                |
| 5         | 06/12/2017 | Revised                |
| 6         | 06/22/2017 | Major Revision         |

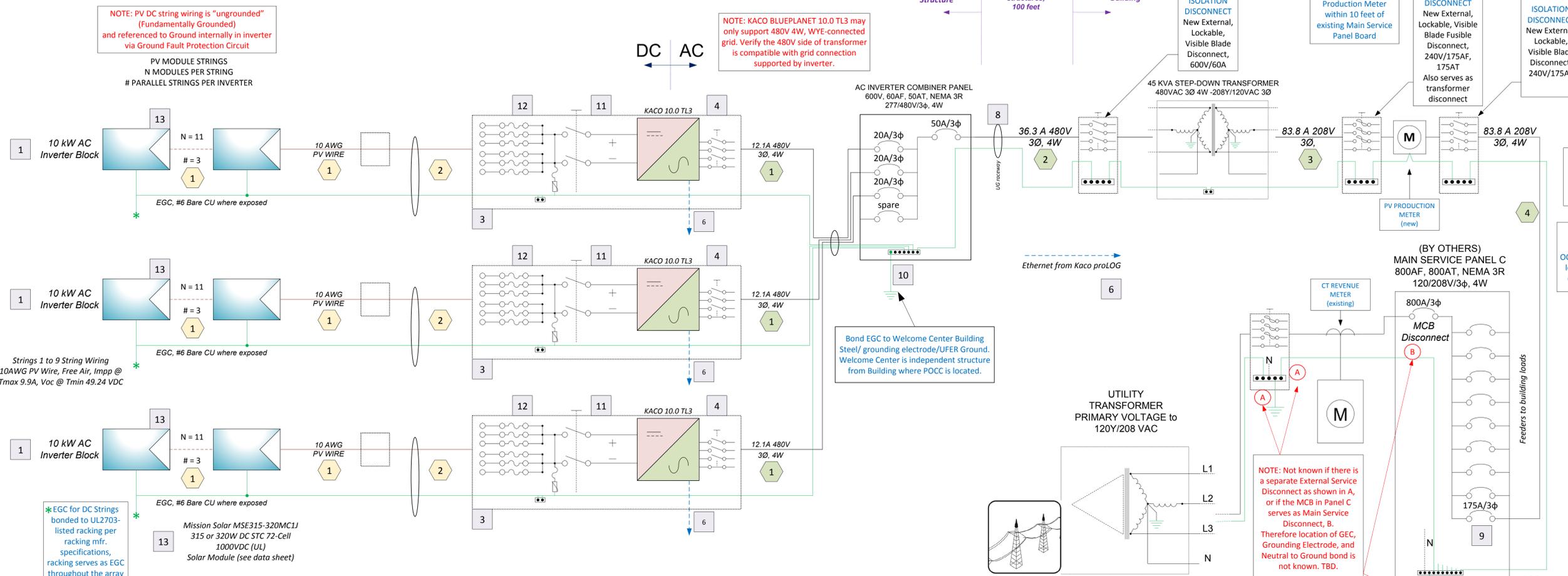
**30.195 kW DC STC / 30 kW AC**  
**Solar Array**  
San Antonio Botanical Garden - Expansion  
555 Funston, San Antonio TX 78209

SCALE: NO SCALE  
ONLY ONE PHASE SHOWN FOR CLARITY

SHEET NAME  
E.100 One Line V3  
ORIGINAL SHEET SIZE  
36" x 24"

**OUTDOOR CLASSROOM STRUCTURE & ROOF**

**EQUIPMENT YARD IN MAIN BUILDING**



**EXPOSED CONDUCTORS**  
Because the non-isolated inverter operates the modules in an ungrounded configuration, all exposed conductors (not in raceway), including any conductors attached to the modules or added by the installer must be listed to UL Standard 4703 and be labeled PV Cable, PV Wire, Photovoltaic Cable, or Photovoltaic Wire as required by NEC 690.35(D)

**1 NOTES**

- 3 strings of 11 modules on each inverter
- See Roof Layout, Racking Design, and Structural for detail
- See Mfr Data Sheet KACO Blueplanet 10.0 TL3 10 KW AC GRID-TIED INVERTER
- Inverter output AC Disconnect. In PSD Wiring Box, integral to inverter
- 
- RS485 Daisy-chain between inverters, to Kaco Ethernet Gateway, see comm detail
- To Be Detailed on Equipment Wall and Equipment Yard detail sheet.
- 480V Inverter Output circuit conductors plus EGC in 3/4" concrete-encase duct bank, approx. 100 ft.
- Backfed PV Breaker at end of panel buss
- EGC bonded to Welcome Center via dedicated Grounding Electrode or UFER ground
- String DC Disconnect, part of KACO PSD Wiring Box, integral to 10.0 TL3 inverter
- Fused String Wiring Box, KACO PSD, integral to 10.0 TL3 inverter
- Mission Solar MSE315-320MC1J DC STC 72-Cell 1000VDC (UL) PV Module (see data sheet)

**1 DC CONDUCTOR SCHEDULE**

**DC CONDUCTOR SPECIFICATIONS AND VOLTAGE DROP**

| TAG          | Description  | Conductors  | Raceway  | Voltage | Current | Phase | Distance Ft. | Vdrop | %     | Wire C | Terminal 1 C | Terminal 2 C | Adjusted Ampacity |  |
|--------------|--|-------------|----------|---------|---------|-------|--------------|-------|-------|--------|--------------|--------------|-------------------|--|
| 1            | Positive & Negative String Wiring on roof to roof junction box | #10 PV WIRE | Free Air | 600     | 10      | DC    | 50           | 1     | 0.17% | 90     | 90           | 90           |                   |  |
| 2            | Positive & Negative String Wiring interior to Inverter input   | #1 THWN-2   | 1/2" EMT | 600     | 10      | DC    | 5            | 0.1   | 0.02% | 90     | 90           | 90           |                   |  |
| <b>TOTAL</b> |  |             |          |         |         |       |              |       |       |        |              |              |                   |  |
|              |  |             |          |         |         |       |              | 1     | 0.18% |        |              |              |                   |  |

**1 AC CONDUCTOR SCHEDULE**

**AC CONDUCTOR SPECIFICATIONS AND VOLTAGE DROP**

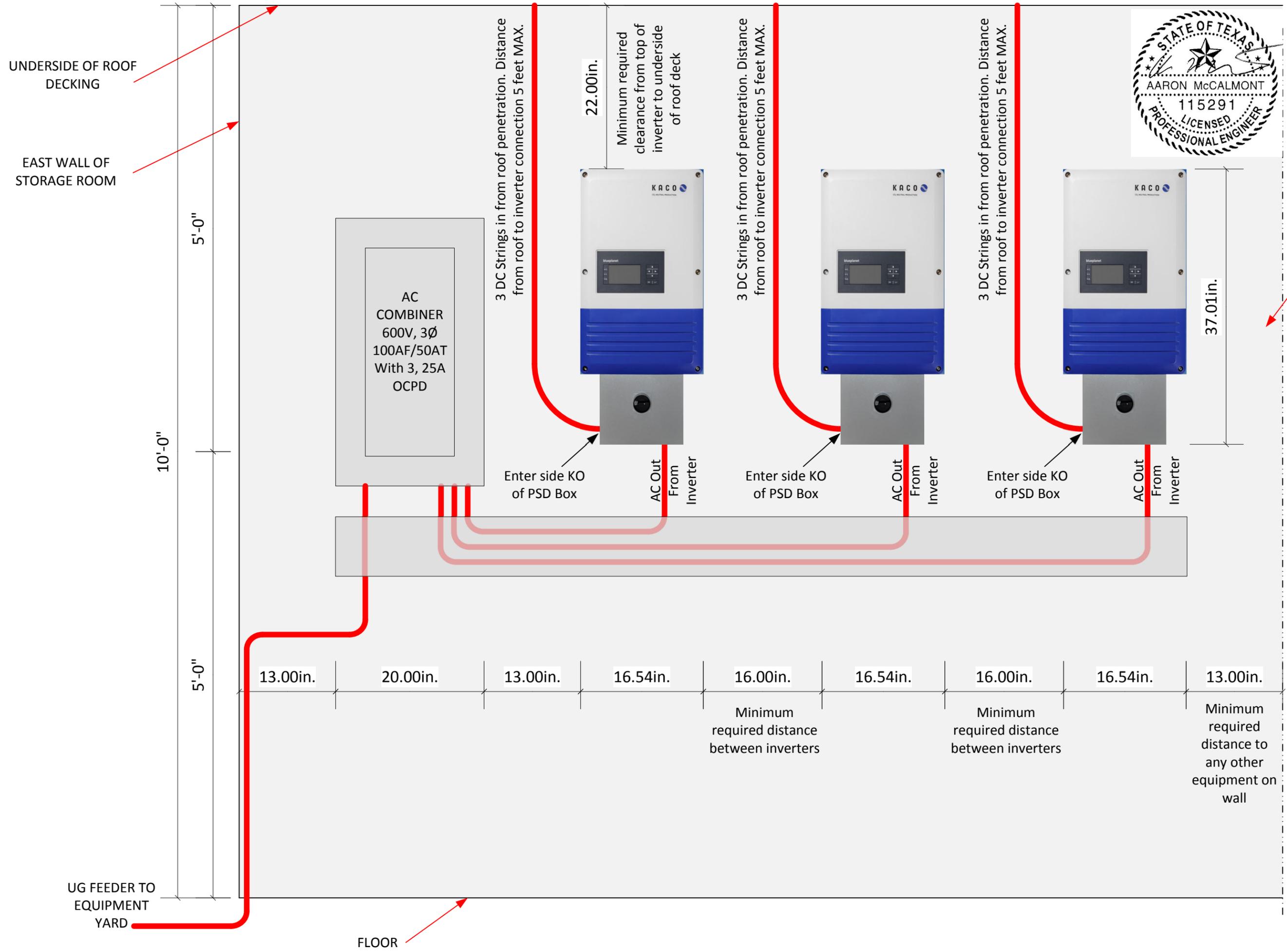
| TAG          | Description                                      | Conductors               | Raceway    | Voltage | Current | Phase | Distance Ft. | Vdrop  | %     | Wire C | Terminal 1 C | Terminal 2 C | Adjusted Ampacity |  |
|--------------|--|--------------------------|------------|---------|---------|-------|--------------|--------|-------|--------|--------------|--------------|-------------------|--|
| 1            | Inverter AC output to Inverter AC Combiner       | 4, #10 THWN-2, 1 #10 EGC | 1/2" RMC   | 480     | 12.1    | 3     | 10 ft.       | 0.2493 | 0.05% | 90     | 90           | 75           |                   |  |
| 2            | Inverter AC Combiner to Transformer 480V primary | 4, #4 THWN-2, 1 #6 EGC   | 1 1/4" RMC | 480     | 36.3    | 3     | 100 ft.      | 1.9971 | 0.42% | 90     | 75           | 75           |                   |  |
| 3            | 208V Transformer Secondary to PV Disconnect      | 4, 3/0 THWN-2, 1 #6 EGC  | 2 1/2" RMC | 208     | 83.8    | 3     | 10 ft.       | 0.1361 | 0.07% | 90     | 75           | 75           |                   |  |
| 4            | PV Disconnect to Main Service Panel              | 4, 3/0 THWN-2, 1 #6 EGC  | 2 1/2" RMC | 208     | 83.8    | 3     | 15 ft.       | 0.2401 | 0.12% | 90     | 75           | 75           |                   |  |
| <b>TOTAL</b> |  |                          |            |         |         |       |              |        |       |        |              |              |                   |  |
|              |  |                          |            |         |         |       |              | 2.6227 | 0.65% |        |              |              |                   |  |

| DESIGN TEMPERATURES ( C ) |    | INVERTER                              |       | KACO10.0 TL3        |             | MODULE |  | Mission MSE315MC1J |  |
|---------------------------|----|---------------------------------------|-------|---------------------|-------------|--------|--|--------------------|--|
| tmax selected             | 44 | MAX DC VOLTS                          | 600   | Voc STC             | 45.1        |        |  |                    |  |
| tmin selected             | -8 | MAX MPPT RANGE VOLTS                  | 600   | tvoc % per degree C | -0.308      |        |  |                    |  |
| Assumed Trise C           | 30 | MIN MPPT RANGE VOLTS                  | 200   | Voc-tmin            | 49.683964   |        |  |                    |  |
| RECORD MAX last 20 yrs    | 44 | MAX FULL POWER MPPT RANGE VOLTS       | 550   | Isc                 | 9.18        |        |  |                    |  |
| RECORD MIN last 20 yrs    | -8 | MIN FULL POWER MPPT RANGE VOLTS       | 280   | Vmpp                | 36.6        |        |  |                    |  |
| ASHRAE EXTREME HIGH       | 38 | START VOLTAGE                         | 250   | Vmpp-tmax           | 30.14376    |        |  |                    |  |
| ASHRAE 2% HIGH            | 36 | MAX DC Input Current ALLOWED AMPS     | 37.2  | Impmp               | 8.61        |        |  |                    |  |
| ASHRAE EXTREME MIN        | -6 | NUMBER OF MPPT                        | 2     | Impmp-tmax          | 10.128804   |        |  |                    |  |
| San Antonio Intl Airport  |    | BUILT-IN STRING COMBINER (per MPPT)   | 2     | Pmpp Watts          | 315         |        |  |                    |  |
|                           |    | RATED PEAK AC POWER AT STC - KVA      | 10000 | Pmpp-tmax Watts     | 305.3202369 |        |  |                    |  |
|                           |    | MAX DC INPUT POWER - W                | 15000 | tmpp % per degree C | -0.36       |        |  |                    |  |
|                           |    | MAX INVERTER LOAD RATIO (AC/DC RATIO) | 1.500 |                     |             |        |  |                    |  |

| STRING DESIGN                     |             | INPUT DC CURRENT AND POWER CHECK                                     |            | NUMBER OF INVERTERS |       |
|-----------------------------------|-------------|--|------------|---------------------|-------|
| MAX STRING LENGTH Voc-tmin        | 12.07633111 | NUMBER OF INPUT STRINGS PER INVERTER                                 | 3          | ARRAY SIZE DC STC   | 3     |
| MIN STRING LENGTH Vmpp-tmax       | 6.634872358 | MAX Isc (STC*1.25) ALL STRINGS PER INVERTER                          | 34.425     | ARRAY SIZE AC PEAK  | 31185 |
| MIN STRING LENGTH FULL POWER MPPT | 9.288821302 | MAX Isc ALL STRINGS LESS THAN MAX DC INPUT AMPS PER INVERTER?        | OKIE-DOKIE |                     | 30000 |
| STRING LENGTH SELECTED            | 11          | Inverter Load Ratio (AC/DC RATIO)                                    | 1.040      | NUMBER OF MODULES   | 99    |
|                                   |             | Inverter Load Ratio Less than MAX INVERTER LOAD RATIO?               | OKIE-DOKIE |                     |       |
|                                   |             | MAX Impmp-tmax ALL STRINGS PER INVERTER                              | 30.386412  |                     |       |
|                                   |             | MAX Impmp-tmax ALL STRINGS LESS THAN MAX DC INPUT AMPS PER INVERTER? | OKIE-DOKIE |                     |       |
|                                   |             | String Vmpp-STC  | 402.6      |                     |       |
|                                   |             | String Vmpp-tmax   | 331.58136  |                     |       |
|                                   |             | String Vmpp-tmax GREATER THAN MINIMUM FULL-POWER MPP Volts?          | OKIE-DOKIE |                     |       |





**Solar Photovoltaic Array**  
 San Antonio Botanical Garden  
 555 Funston Place, San Antonio TX  
 78209

|          |              |
|----------|--------------|
| DESIGNED | Shannon Ware |
| CHECKED  |              |
| DRAWN    | Shannon Ware |



| REVISIONS  |            |
|------------|------------|
| 06/19/2017 | For Review |
| 6/21/2017  | REVISED    |
|            |            |
|            |            |

Scale: 1in = 1ft. 0in.

SHEET NAME  
 PV 2.2 Kitchen Electrical  
 Room  
 ORIGINAL SHEET SIZE  
 11" x 17"

Connect to PV Breaker in Panel C at opposite end of buss from MCB

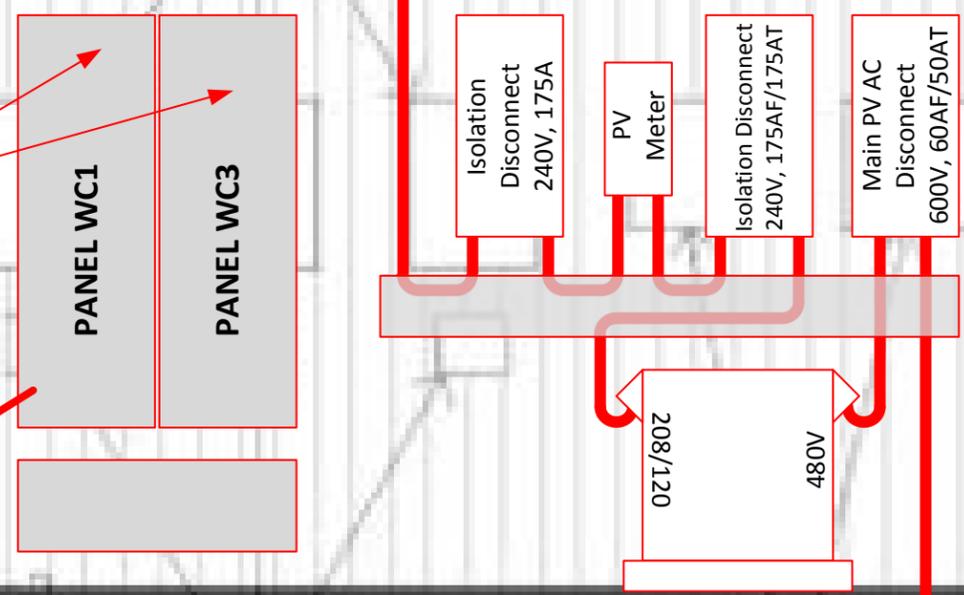


# EQUIPMENT YARD AT MAIN BUILDING



Connect to PV Breaker in Panel C at opposite end of buss from MCB

Existing Panels Already Installed



UG feeder from Outdoor Kitchen PV Array



Scale: 1in = 2ft.  
 SHEET NAME  
 PV 2.3 Equipment Yard Main Bldg.  
 ORIGINAL SHEET SIZE  
 11" x 17"

**Solar Photovoltaic Array**  
 San Antonio Botanical Garden  
 555 Funston Place, San Antonio TX 78209

| REVISIONS  |            | DESIGNED   | Shannon Ware |
|------------|------------|--|--------------|
| 06/19/2017 | For Review | CHECKED  |              |
|            |            | DRAWN  | Shannon Ware |
|            |            | <br>PV Installation Professional<br>Shannon Ware<br>Cert # PV-100414-003012 |              |

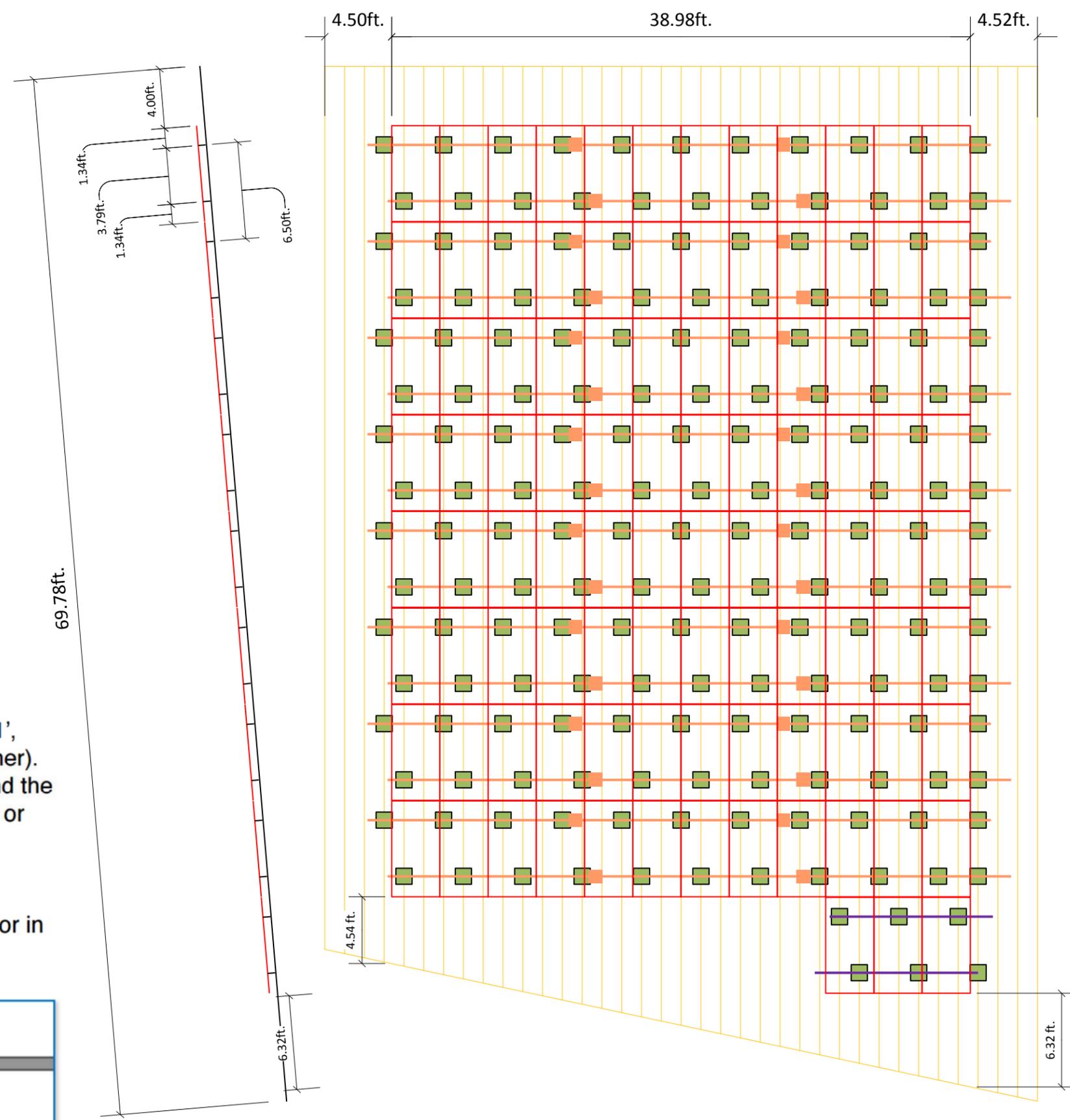
11' rail section w/ splice



14' rail section w/splice



L-foot + S-5 bracket



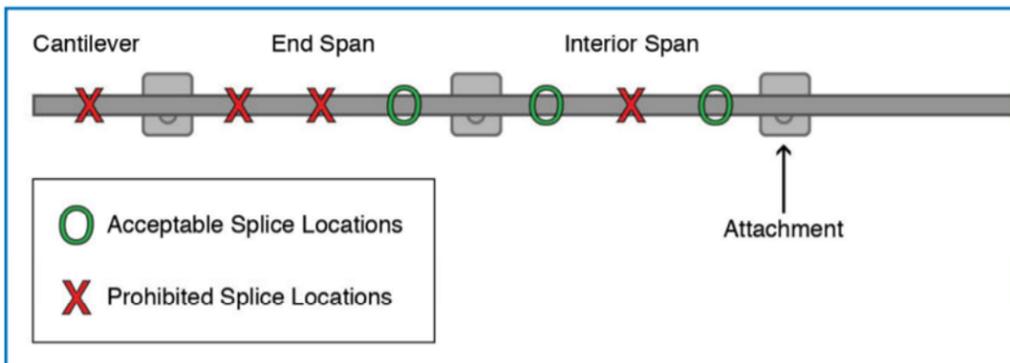
**RACKING NOTES**

Attachments shown at nominal 4 foot spacing. Alternating rows are staggered to better distribute the uplift load. Rails are shown at their nominal uncut length. It is ok to trim rails at outside edges to make the ends flush with appropriate cut-off saw, maintaining good workmanship. If it is necessary to place attachment at less than 4 foot spacing, that is ok, as long as no span exceeds 4 feet.

**Plan Splice Locations**

If you plan to have rows exceeding standard rail lengths (11', 14', and 17') you will need to splice rail (join two rails together). This enables you to extend the size of your overall array and the number of modules that fit in a single row without any gaps or breaks.

You will need to plan out the splice locations as the internal splices cannot be installed in the outer 2/3 of an end span, or in the middle 1/3 of an interior span (see diagram below).



**Solar Photovoltaic Array**  
San Antonio Botanical Garden  
555 Funston Place, San Antonio TX 78209

|          |              |
|----------|--------------|
| DESIGNED | Shannon Ware |
| CHECKED  |              |
| DRAWN    | Shannon Ware |



| REVISIONS  |            |
|------------|------------|
| 06/09/2017 | For Review |
| 06/14/2017 | Revised    |
| 06/21/2017 | Revised    |

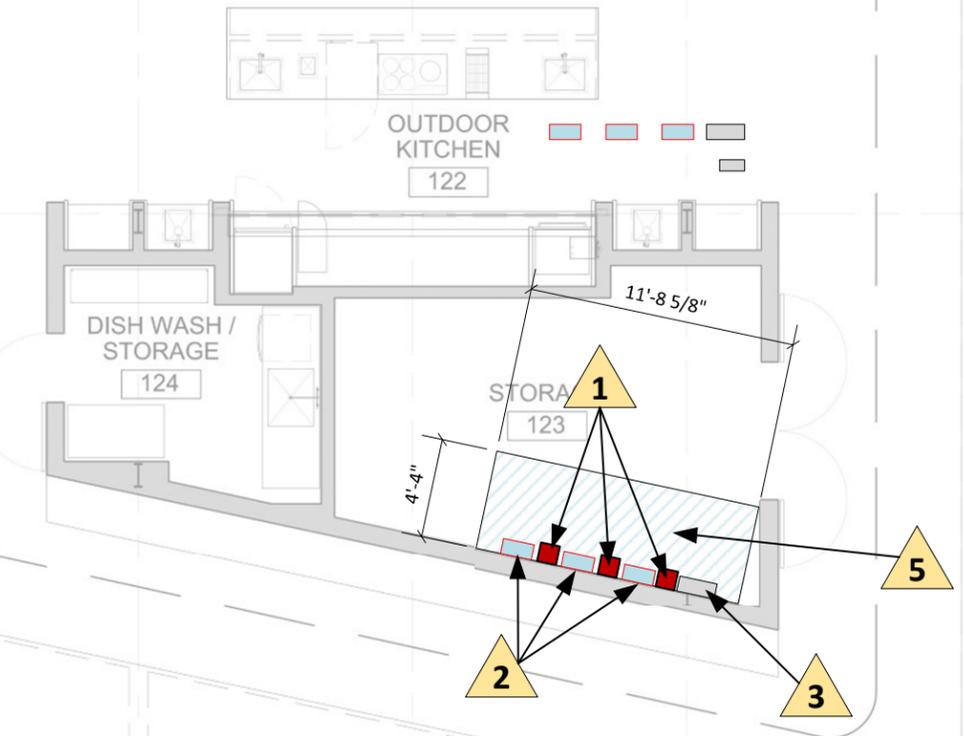
Scale: 1in = 8ft. 0in.  
SHEET NAME  
PV 1.3 Racking Layout  
ORIGINAL SHEET SIZE  
11" x 17"

**1** DC String Wiring through roof into Electrical room below. Weatherproof penetration should meet requirements of roof cladding manufacturer and maintain full roof warranty. Note: DC String wiring to penetrate roof less than 10 feet from area of array. Inverters inside and directly below, to be mounted on wall at height such that DC wiring in raceway inside building is less than 5 feet in length from roof to DC disconnect on inverter. Meets requirements of NEC 690.12(1)

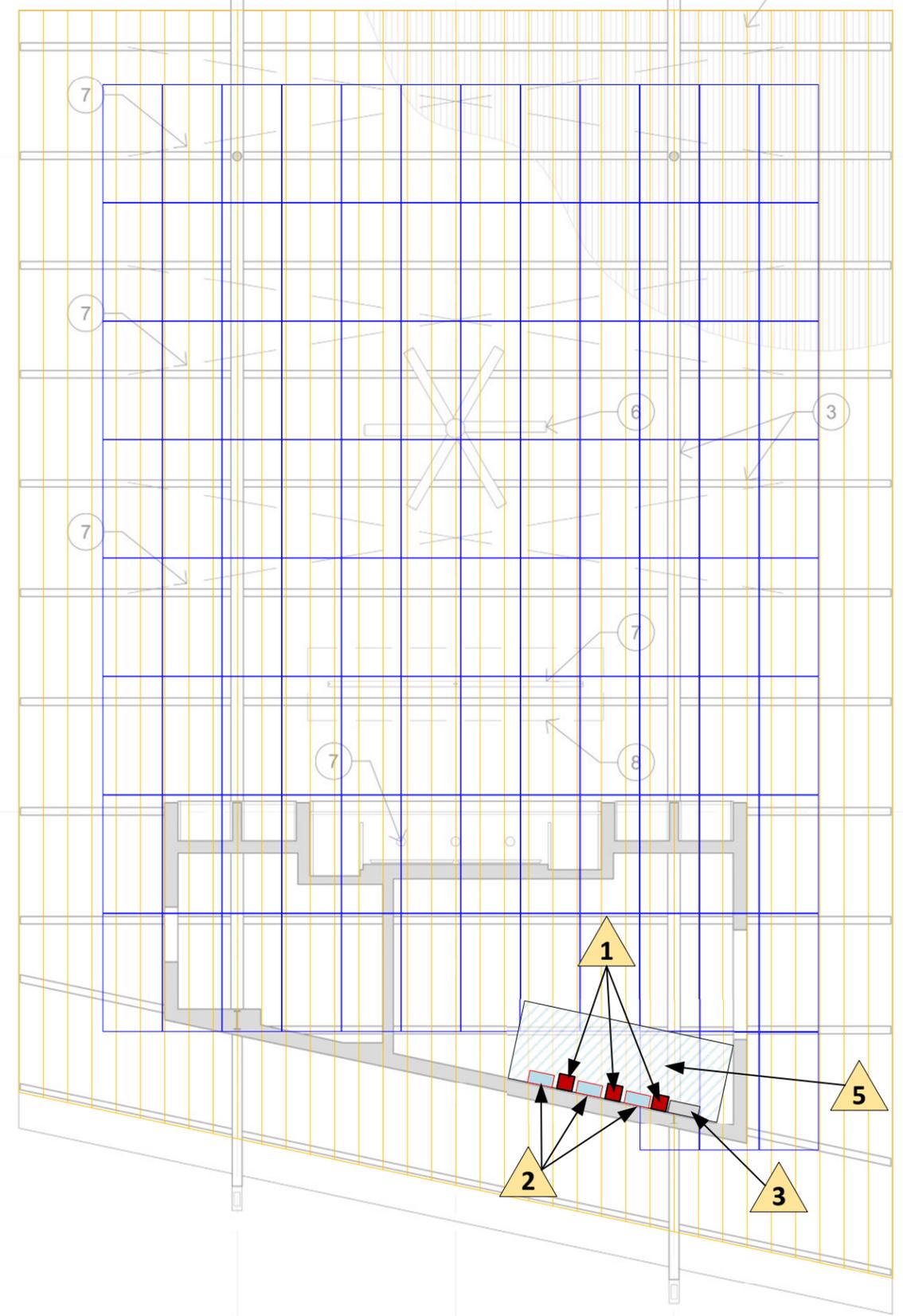
**2** Three KACO Inverters with PSD Option mounted on interior wall. Inverters have DC disconnect and 4-string combiner integral to inverter.

**3** 277/480V three-phase AC Combiner Load Center. 600V, 100AF/50AT. Mounted on interior wall.

**5** Required clear Working Space (NEC 110.26). Floor painted and marked "Keep Clear. No Storage"



**1** OUTDOOR KITCHEN . overall plan  
1/8" = 1'-0"



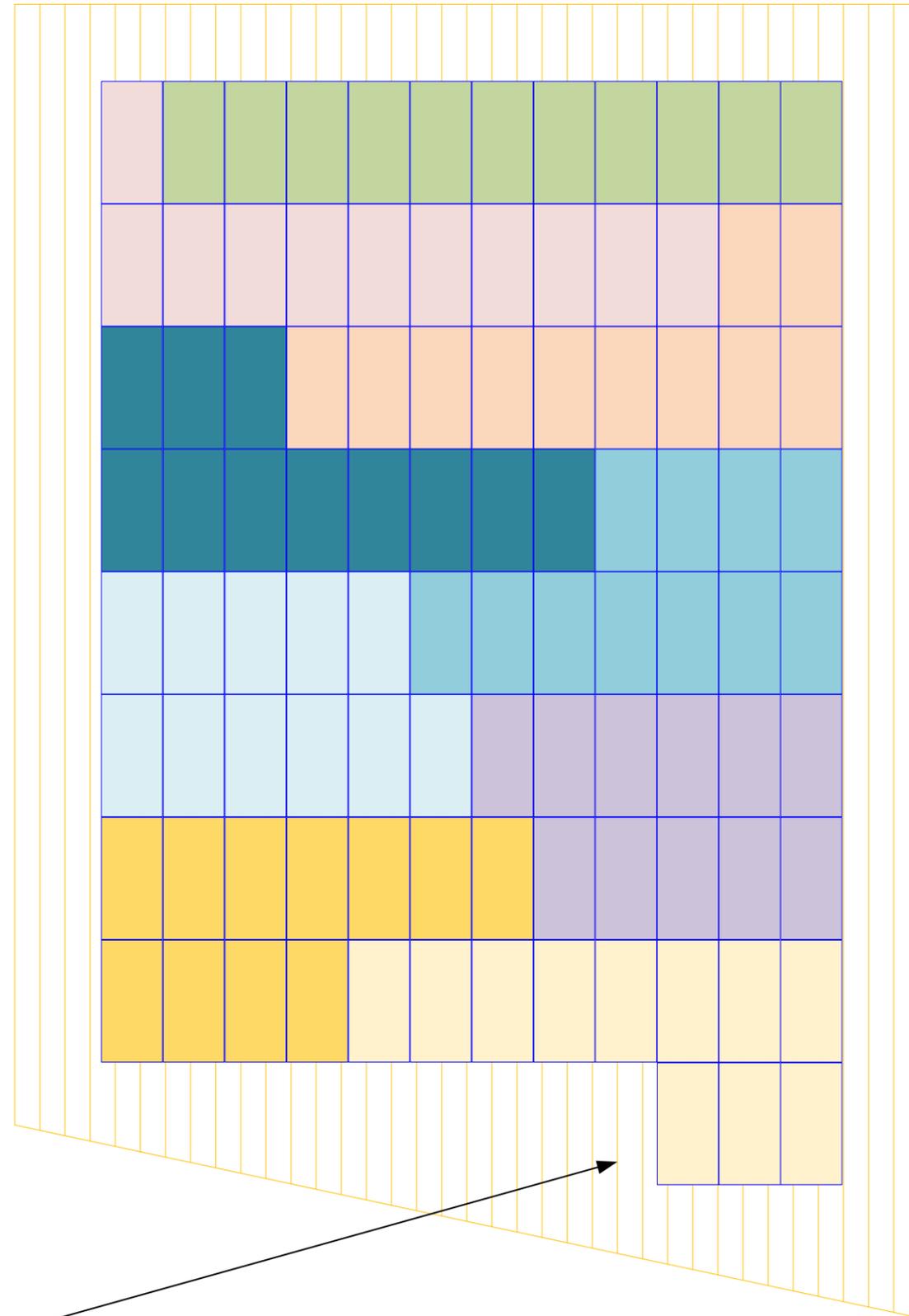
**2** OUTDOOR KITCHEN . rcp  
1/8" = 1'-0"

- NOTES**
- 1 EDGE OF CONCRETE HARD SCAPE
  - 2 PLANTER AREA, REF. LANDSCAPE DRAWINGS
  - 3 STEEL FRAMING, REF. STRUCT. DRAWINGS
  - 4 CONCRETE STEPS
  - 5 STEEL DECK
  - 6 CEILING FAN
  - 7 LIGHT FIXTURE
  - 8 LINE OF ISLAND BELOW

**Stringing Note:**

If Module Whips are long enough to run strings vertically in columns, and that makes string easier, advise engineer.

- String A1 11 modules, 320W
- String A2 11 modules, 320W
- String A3 11 modules, 320W
- String B1 11 modules, 320W
- String B2 11 modules, 320W
- String B3 11 modules, 320W
- String C1 9, 315W modules & 2, 320W Modules
- String C2 9, 315W modules & 2, 320W Modules
- String C3 9, 315W modules & 2, 320W Modules



All DC Strings penetrate roof in this area over the Inverter Electrical Room to land directly on Inverter string wiring box. Penetration housing/flashing method should be approved by roof cladding manufacturer and maintain roof cladding warranty.



**Solar Photovoltaic Array**  
San Antonio Botanical Garden  
555 Funston Place, San Antonio TX 78209

|          |              |
|----------|--------------|
| DESIGNED | Shannon Ware |
| CHECKED  |              |
| DRAWN    | Shannon Ware |



| REVISIONS  |            |
|------------|------------|
| 06/19/2017 | For Review |
|            |            |
|            |            |

Scale: 1in = 8ft. 0in.

SHEET NAME  
PV 2.4 String Assignment  
ORIGINAL SHEET SIZE  
11" x 17"