

VPC, LLC

PRELIMINARY PLAN REVIEW PROPOSED SOLAR DEVELOPMENT PROJECT

PLAT 275, LOTS 38 AND 52, KNIGHT STREET,
WARWICK RI 02886

JANUARY 03, 2024





January 03, 2024

City of Warwick Planning Board
c/o Kevin Flynn, Vice Chair
3275 Post Road
Warwick, RI 02886

**Subject: Preliminary Plan Review
Proposed Solar Development Project
Plat 275, Lots 38 and 52, Knight Street, Warwick RI 02886**

Dear Members of the Planning Board:

On behalf of VCP, LLC (Applicant), WSP USA Environment and Infrastructure Inc. (WSP) is pleased to submit this Preliminary Plan Application to the City of Warwick Planning Board for a proposed 998.4± kilowatt (KW) Direct Current (DC) solar development project (the Project) to be located on Knight Street in Warwick, Rhode Island (the Site).

The Project received approval on the application for Conditional Master Plan Approval of a Major Land Development with the following conditions of approval in a letter dated May 11, 2023. Language and numbering have been maintained per the initial letter for consistency, followed by WSP's comments in ***bold italics***.

Conditions of Approval

1. That all Plans shall comply with "Rules and Regulations for Professional Land Surveying in the State of Rhode Island", effective date November 25, 2015.

The Site Plans comply with "Rules and Regulations for Professional Land Surveying in the State of Rhode Island."

2. That the Applicant shall submit a Preliminary Land Development Plan that complies with Appendix C of the City's Development Review Regulations Governing Subdivisions, Land Development Projects, and Development Plan Review, last amendment dated March 14, 2001.

The Site Plans comply with the City's Development Review Regulations Governing Subdivisions, Land Development Projects, and Development Plan Review.

3. That a Storm Water Management Plan shall be submitted in accordance with the Rhode Island Storm Water Design and Installation Standards



Manual, dated December 2010, that is designed to demonstrate zero-net rate of runoff from the proposed development.

A Stormwater Management Plan is included as Attachment C.

4. That an Operation and Maintenance Plan for stormwater treatment be included with the Preliminary submission to the Planning Department.

An Operation and Maintenance Plan is included as Attachment E.

5. That, the Applicant shall submit an independent, pre-development sound study to establish a baseline of general background noise in perimeter areas adjacent to the property. The sound study shall be averaged over several weeks. A post startup sound study shall be executed to ensure no increase in noise occurs from the facility. Noise mitigation must be employed if there is an increased decibel level of 3dB.

A pre-development noise study is included as Attachment H.

6. That the Applicant shall provide a decommissioning plan and cost estimate with the Preliminary and Final Plan application, with surety funds to be provided to the City prior to the issuance of a building permit, to ensure adequate removal at the end of the useful life or abandonment.

A Decommissioning Plan and Cost Estimate is included as Attachment F.

7. That all RIDEM, RIDOT, and other related state permits must be obtained prior to the Preliminary phase submission.

All relevant state permits are included as Attachment G.

8. That an adequate number of fire hydrants be provided throughout the development spaced 300 Ft. apart and providing a minimum of 1000 GPM, or as determined by the Fire Marshall. In addition, the Fire Department shall review all plans for compliance with all life safety codes and issues.

WSP will submit a copy of the Site Plans to the Fire Marshall concurrently to this Planning Board submittal. There is an existing Fire Hydrant across Knight Street from the parcel.



9. All corners shall be negotiable by vehicles having an outer tire turning radius of 50 Feet, Left or Right.

All corners have been designed to be negotiable by vehicles having an outer tire turning radius of 50 feet.

10. A Clear Area of ten feet (10') around ground-mounted photovoltaic installations shall be provided.

A Clear Area of ten feet will be provided.

11. A noncombustible base acceptable to the Authority Having Jurisdiction (AHJ) shall be installed and maintained under and around the installation.

A noncombustible base acceptable to the Authority shall be installed and maintained.

12. As part of Preliminary Plan application, an updated narrative shall be submitted addressing project conformance with each required performance measures contained within Section 509 of the Warwick Zoning Ordinance.

A narrative addressing project conformance with the performance measures contained in Section 509 of the Warwick Zoning Ordinance is included below.

13. That the Preliminary phase submission include a landscape plan prepared by a registered landscape architect, approved by the City's Landscape Coordinator, that meets all requirements under Section 505 of the City's Zoning Ordinance, and includes the following.
 - a. Access gate shall be 7' Ht. black ornamental style with 2 'x2' brick pillars in place of steel gate posts. The remainder of exterior fencing shall be 7' Ht. black, coated, chain link and steel posts.
 - b. All proposed evergreen planting buffers shall be arranged in a tight 10' staggered layout not in a straight line.
 - c. All proposed evergreen plantings shall be 5' minimum at installation.
 - d. Western property line planting buffer shall extend south to the end of the proposed fencing.
 - e. A berm shall be installed along the Knight Street property line ending at the Knight St. and Bleachery Court intersection. The



berm shall be 5' in height from the top of the highest point of proposed grade on site. On top of the berm, a tight 10' staggered evergreen buffer shall be installed.

- f. The existing vegetation along Knight St. from the intersection of Knight St. and Bleachery Court to the eastern property line shall remain. If this vegetation is to be removed/cleared then the applicant must extend the berm and evergreen planting buffer to the end of the furthest property line on Knight Street.
- g. Pollinator mix is required, shall be supported by a maintenance plan with annual reports by the applicant's landscape architect until the pollinator mix approved by RIDEM is established. Disturbed topsoil shall remain onsite unless removal is required by remediation permits.
- h. The Landscape Plan shall include all existing trees (at the time of application), requiring removal that are of 20 inches in diameter or larger with a plan for 1 to 1 replacement.

Updated Landscape Plans and Details, including Planting Maintenance Specifications prepared by a registered landscape architect are included as Sheets L-1 and L-2 in the Site Plans, Attachment B. Proposed Gate to be Black Ornamental Style with Black Ornamental Posts as approved by the Historic District Commission - See Detail. The remainder of site security fencing to be black, color-coated chain link fence, see Engineer's Plans and Details.

- 14. That the Preliminary Plan submittal shall include a signage plan, to include all sign locations, sizes, and style. Signage and gate shall be subject to approval by the Historic District Commission. Signage shall include clearly marked procedures for shutting down the solar system. A sign shall be posted at the entry displaying the name of the owner and the operator of the system with a twenty-four (24) hour emergency contact number.

Signage information is included in the Site Plans per electrical codes and standards, Attachment B. The Applicant acknowledges the signage is subject to approval.

**Code of Ordinances City of Warwick Rhode Island Section 509. -
Administrative procedures for solar energy systems on contaminated sites.**



This Application, Site Plans, and supporting documentation were prepared in accordance with Section 509 of the Warwick Zoning Ordinance. Information required in Section 509.2 *Performance standards* is included in the attached Site Plans, supporting documentation and narrative below, followed by WSP's comments in ***bold italics***.

509.2 *Performance standards*. These standards shall be required in addition to the major land development review procedures set forth by RIGL 45-23 and the city's subdivision and land development regulations. The standards set forth herein will ensure that solar energy systems are compatible with the surrounding area, provide for public safety, and minimize impacts on wildlife; scenic, natural and historic resources, and abutting properties.

The Applicant acknowledges the purpose of these standards and regulations.

(A) The applicant is required to provide verification from a RI licensed landscape architect at the preliminary stage of review that the landscape buffer is adequate to thoroughly screen the solar energy facility year round. In addition, the required vegetated buffer/screening shall be maintained for the life of the solar energy facility. The property owner and/or facility owner shall be required to replant any section of the buffer/screening found not to meet the requirements of this section as determined by the zoning enforcement officer with consultation from the city planner.

A landscape plan prepared by a registered landscape architect is included as Sheets L-1 and L-2 in the Site Plans, Attachment B.

(B) All solar energy systems shall, at minimum, employ the zoning setback requirements in Table 2 A & B, entitled Dimensional Regulations. The planning board shall reserve the right to increase setbacks to minimize visibility of the system as a result of information learned through public hearings.

The Project complies with the zoning setback. The Site Plans are included in Attachment B.

(C) The maximum height of a ground-mounted solar energy system shall be ten feet.

The Project complies with the height requirements. The array panels will extend to a height of approximately 10 feet.



(D) To prevent glare on adjacent properties and mitigate public safety potential, only matte finish, and non-reflective panels shall be utilized.

The panels are equipped with anti reflective coating, First Solar modules.

(E) The applicant shall submit an independent, pre-development noise study for which a baseline shall be established indicating general background noise in perimeter areas adjacent to neighbors averaged over several weeks. A post startup noise study shall be executed to ensure no increase in noise occurs from the facility. Noise mitigation must be employed for solar energy systems responsible for an increased decibel level of 3dB.

A pre-development noise study is included as Attachment H.

(F) Accessibility for emergency service vehicles is required along with clearly-marked procedures for shutting down the solar energy system.

The proposed access road will be accessible for emergency service vehicles. The proposed signage is included in the Site Plans, Attachment B.

(G) A public safety preparedness and response plan detailing the standards, procedures, and communication protocol to be utilized for the system and in the event of an emergency shall be provided to the city's emergency management agency director, as well as documentation indicating that the plan has been distributed to the fire department.

A public safety preparedness and response plan will be submitted to the city and the fire department prior to construction.

(H) Contaminated sites shall be remediated and properly capped in accordance with state or federal remediation standards as part of the development.

An engineered (geomembrane) cap will be placed over areas of the Site that contain soil exceeding the GB leachability criteria for soils. The location of the cap is included in the Site Plans, Attachment B. The Remedial Decision Letter is included in Attachment C.



- (I) Unless required by ELUR, no substantial clearing or grading of the proposed project site shall have occurred five years prior to submission of the application for an SES based on a review of aerial photography provided by the applicant.

No substantial clearing or grading has occurred five years prior, the site has been undeveloped except for a small shed utilized for a landscaping company.

- (J) Clearcutting outside of the immediate array area is prohibited unless required by remediation permit. A reforestation plan prepared by a certified forester (CF) or registered landscape architect shall be required to minimize view shed nuisance from the perspective of abutters.
 - (1) A combination of natural vegetation, berms, fencing, walls, and other similar features shall be used to visually buffer the system(s) from the view of abutting properties, as well as mitigate noise, glare, or other potential nuisances.
 - (2) No chemicals, solvents, herbicides, or insecticides, excluding water, will be used in the operation and maintenance of the site landscaping requirements, (such as pollinator cover and buffer plantings).
 - (3) Buffer plantings shall be maintained for the life of the project by the owner, applicant, and or operator of the facility.
 - (4) A one to one tree replacement effort shall occur within the city for all trees requiring removal that are of 20 inches in diameter or larger. All newly-planted trees shall be a minimum of three-inch caliper at breast height.
 - (5) Soil erosion and sediment control systems shall be maintained at all times in accordance with RIDEM wetlands permit(s), and local regulations.
 - (6) Clearing, cutting, girdling, and any other form of disturbance to an old growth tree or old growth forest is prohibited.

A landscape plan prepared by a registered landscape architect is included as Sheet L-1 and L-2 in the Site Plans, Attachment B. A



Soil Erosion and Sediment Control Plan is included in Attachment D.

(K) Neither blasting nor removal of ledge by mechanical means is allowed.

No removal of ledge is required for the Project.

(L) Pollinator mix is required, shall be supported by a maintenance plan, and contain annual reports supplied by the applicant's landscape architect until the pollinator mix approved by RIDEM is established. Disturbed topsoil shall remain onsite unless removal is required by remediation permit(s).

The Seeding and Revegetation Plan is included in the Site Plans, Attachment B.

(M) Utility connections shall be underground, equipment screened from view with plantings or fencing, and approved by the utility company as part of the final plan application.

- (1) interconnection agreement shall be compliant with code of ordinance section 74-52, renewable energy system tax exemption, and submitted with the final plan application.
- (2) A comprehensive development pro forma including, but not limited to, land cost (lease or purchase, equipment cost, construction, decommission cost etc.) shall be submitted with final plan application.

The interconnection agreement and comprehensive development pro forma will be submitted with the final plan application.

(N) Perimeter fencing shall be raised a minimum of eight inches for wildlife passage and be comprised of black coated chain link fence.

The chain link fence will have an 8-inch critter gap. Fence details are included in the Site Plans, Attachment B.

(O) A sign shall be posted at the entry of the SES displaying the name of the owner and operator of the system and a 24-hour emergency contact number.

Signage information is included in the Site Plans, Attachment B.

(P) SES systems shall provide for motion detect lighting in maintenance areas and dark sky compliant lighting elsewhere.



There is no proposed lighting for the Project.

- (Q) Applicant shall provide a decommissioning plan and cost estimate with the preliminary application, and surety funds provided with the final plan application to ensure adequate removal at the end of useful life or abandonment.
- (1) Funds deposited shall be equal in amount to removal of the system, as verified by the city's peer review engineer, inclusive of two percent annual inflation over life of the system with funds deposited into an interest bearing escrow account under city control.
 - (2) The calculation of the decommissioning reserve shall be predicated upon the assumption that 100 percent of the retired solar panels will be recycled by an accredited solar panel waste recycler, without any credit on the financial guarantee amount for anticipated salvage value or reuse of and project components. City peer review engineers shall afford the city the right to evaluate the inflation rate every five years.
 - (3) A separate surety of an amount equal to the cost of repairing 100 percent of the pollinator mix, as established by the city's peer review engineer during preliminary application review, shall be submitted with the final plan application.
 - (4) Within one week after permanent shutdown, the owner, applicant, and or operator shall notify the building official and remove the system within six months of said notification. The city shall utilize escrow funds to remove all or remaining system components beyond six months, with owner, applicant, and or operator liable for all expenses beyond escrow, should escrow be exceeded. City shall retain the right to fine the owner in accordance with local ordinances.

A Decommissioning Plan and Cost Estimate is included as Attachment F.

- (R) Maintenance. The contaminated site solar energy system shall be maintained by the solar energy owner and/or operator and shall be cleared of debris, weeds, trash, etc. Maintenance shall include, but not be limited to, painting, structural repairs, maintenance of



the landscape buffers, care and replanting if necessary, of any vegetative screening, cleaning clearing and repairing of stormwater and drainage infrastructure, and integrity of security measures.

An Operation and Maintenance Plan is included as Attachment E.

(S) Enforcement. The building/zoning official and city engineering consultant a have the power to inspect any solar energy system at any time to ensure compliance with the provisions of this ordinance. Any entity who fails or refuses to adhere to all of the provisions of this ordinance or any other conditions imposed by the city, State of Rhode Island or federal government, shall be deemed to be in violation and liable to the City of Warwick for penalties not to exceed \$500.00 per day for each violation. Each day of existence of a violation shall be deemed a separate offense.

The Applicant understands the enforcement of this ordinance.

(T) Inspection. The city's engineer or designee shall inspect any contaminated site solar energy system at the expense of the applicant on a weekly basis during construction, and during the month of April each year after completion of construction. Said inspection will include a review of any and all reports as required by the State of Rhode Island, the City of Warwick and the federal government. The applicant and any successor shall reimburse the city for any cost incurred as specified in the stormwater facility maintenance agreement.

The Applicant acknowledges the inspection requirements.



Should you have any questions regarding this application, please do not hesitate to contact me at (978) 483-6771 or andrew.vardakis@wsp.com.

Sincerely,

WSP USA Environment & Infrastructure Inc.

A handwritten signature in black ink that reads "Andrew P. Vardakis".

Andrew P. Vardakis, P.E.
Vice President, Civil Engineer

A handwritten signature in blue ink that reads "Mykel D. Mendes".

Mykel Mendes
Senior Consultant, Environmental
Engineer

Attachments:

- Attachment A: Preliminary Plan Checklist
- Attachment B: Site Plans
- Attachment C: Stormwater Management Plan
- Attachment D: Soil Erosion and Sediment Control Plan
- Attachment E: Operation and Maintenance Plan
- Attachment F: Decommissioning Plan and Cost Estimate
- Attachment G: State Permits
- Attachment H: Pre-Development Noise Study

cc: Brad Parsons, PE, PMP- VPC, LLC

ATTACHMENT

A

PRELIMINARY PLAN
CHECKLIST

- D. An estimate of the approximate number of people, including school-aged children to be housed in the proposed or land development.
- E. Proposed phasing, if any.
- F. A vicinity map (which may be drawn or copied from the City of Warwick Assessors Plats or other such map at an appropriate scale) to show the area within one-half mile of the or land development parcel(s) depicting the locations of all streets, existing lot lines, and zoning district boundaries. Schools, parks, fire stations and other significant public facilities shall be indicated by shading and labelling the specific use.
- G. Initial written comments on the Master Plan from the following agencies:
 - City of Warwick: Building Official, Public Works, City Engineer, Sewer, Water and other department or commission as may be required by the Administrative Officer.
 - Adjacent communities: Only where the proposed subdivision or land development is within 2,000 feet of the City's borders.
 - State agencies, if applicable: Departments of Environmental Management, Transportation, Coastal Resources, and other _____ (specify).
 - Federal agencies, if applicable: U.S. Army Corps Engineers and Federal Emergency Management Agency if deemed appropriate by the Administrative Officer.
- H. The Administrative Officer shall determine whether or not the plans are complete prior to submitting them for Planning Board review. Incomplete plans shall be returned to the Applicant.
- I. Plans shall include a certification that all plans and improvements conform to all existing and amended standards of the State of Rhode Island, Board of Registration of Land Surveyors.
- J. Archaeological Assessment - When a proposed major subdivision is located within an area marked as archaeologically sensitive on the City's Archaeological Sensitivity Map, an archaeological assessment shall be required, if in the opinion of the Board, there is a likelihood that cultural resources or undetected human remains will be adversely impacted by construction activities associated with the proposed development.

To assist in reaching its decision to require an archaeological assessment, the Board may request an advisory pursuant to RIGL 42-45 and 45-22 from the Rhode Island Historical Preservation and Heritage Commission (RIHP&HC)

concerning the documented or potential archaeological importance of the area and whether archaeological studies are warranted.

When required, the archaeological assessment and any additional studies shall be conducted by a professional archaeologist according to standards outlined in the RIHP&HC's Standards for Archaeological Survey. (Note: The RIHP&HC maintains a list of archaeologists working in Rhode Island who meet the required professional qualification standards.)

When required by the Board, the applicant shall perform such measures necessary to identify, evaluate, protect or properly remove significant archaeological sites within the project area. The applicant shall submit a report to the Board prepared by a professional archaeologist that includes an assessment of the project's impact, recommendations regarding the need for additional archaeological studies, and recommended alternatives to avoid or mitigate adverse impacts from the project.

The Board may request an advisory from the RIHP&HC concerning the adequacy of the archaeological study, the need for additional archaeological studies, the impacts of the project to significant archaeological sites, and the adequacy of any recommended mitigation strategies.

Where the Board determines that the proposed subdivision will adversely impact a significant archaeological site, the Board shall not approve the subdivision unless the plan is revised or modified to protect significant resources and mitigate adverse impacts.

3. Preliminary Plan

Application Form for Submission of Major Subdivision Plan and Major Land Development (new copy not necessary, if Preapplication and Master Plan stages complete) and submit to the Administrative Officer with the following:

Required submissions are noted with a - in the Checklist under Column 3. In addition, the Preliminary Plan shall include items noted below:

- A. ~~One~~ (1) copy of the preliminary site plans drawn to a scale of one inch equals two hundred feet (1" = 200') with a radius of two hundred feet (200') or four hundred feet (400') (see section 8.5.3.a) drawn thereon.
- B. Six ~~(6)~~⁶ copies of the preliminary site plans drawn to a scale of one inch equals forty feet (1" = 40').
- C. Size of sheets shall be 16" X 22".
- D. Multiple sheets shall include Key Map and shall be numbered sequentially (e.g., sheet 1 of 3, 2 of 3, etc.).

- E. The Administrative Officer shall determine whether or not the plans are complete prior to submitting them for Planning Board review. Incomplete plans shall be returned to the Applicant. The Administrative Officer shall distribute complete copies of plans to appropriate agencies named in 2G above.
- F. Plans shall include a certification, with signature and seal, that all plans and improvements conform to all existing and amended standards of the State of Rhode Island, Board of Registration of Land Surveyors as follows:

This survey and plan conform to a Class 1 (or 2) standard as adopted by the Rhode Island Board of Registration for Professional Land Surveyors.

I hereby certify that this survey was actually made on the ground as per record description and is correct. There are no encroachments either way across property lines except as shown.

By: Registered Professional Land Surveyor (SEAL) / Date

Plans shall also include, prominently displayed with the certification, the following statement:

Lots depicted on this plat (or plan) shall not be altered dimensionally or in form, including the enlargement of lots or moving of any lot line for any purpose whatsoever, without first filing a new subdivision application in accordance with the City of Warwick Development Review Regulations of December 31, 1995. (as amended)

In addition, any plans requiring a landscape plan in accordance with these Regulations shall have such plans drawn by a registered landscape architect and shall be so noted on the plans.

4. Final Plan

Application Form for Submission of Major Subdivision Plan and Major Land Development (new copy not necessary, note any changes from Preliminary Plan stage) and submit to the Administrative Officer with the following:

Required submissions are noted with a • in the Checklist under Column 4. In addition, the Final Plan shall include items noted below:

- A. Plans to be Recorded - ~~One~~ ² (1) mylar, ~~plus two (2) linen, plus five (5) blue print~~ ² copies of the Final Plan, which shall be an approved version of the Preliminary Plan, showing all required elements thereon, drawn on mylar to a scale of one

- inch equals forty feet (1" = 40') on sheets measuring 16" X 22". 6
- B. Construction Drawings - ~~One~~ (1) original mylar (16" X 22"), plus five (5) blue print copies of construction plans drawn to a scale of no less than one inch equals forty feet (1" = 40').
- C. Any changes or requirements voted upon by the Planning Board at the Preliminary Plan stage.

CHECKLIST OF REQUIRED INFORMATION

	1	2	3	4	Required, if shown with a •
✓	1	•	•	•	Application Form with name and address of Applicant and/or property owner
✓	2		•	•	Date of plan preparation, with revision date(s) (if any).
✓	3		•	•	Graphic scale and true north arrow.
✓	4	•	•	•	Plat and lot number(s) of the parcel being subdivided.
✓	5	•	•	•	Zoning district(s) of the parcel being subdivided. If more than one district, zoning boundary lines must be shown.
✓	6		•	•	Deed Book and Page References must be shown.
✓	7		•	•	Perimeter boundary lines of the subdivision or land development, drawn so as to distinguish them from other property lines.
N/A	8		•	•	Perimeter boundary lines - Curves shall include radius, arc length, central angle, tangent and chord length.
✓	9		•		Location and dimensions of existing property lines within or adjacent to the subdivision or land development parcel.
✓	10		•	•	Existing property lines shall show interior angles and distances.
✓	11		•	•	Location and dimensions of existing easements and rights-of-way, including, buildings, water courses, railroads, utilities, and other similar features.
✓	12		•	•	Location, width and names of existing streets within and adjacent to the subdivision or land development parcel.

	1	2	3	4	Required, if shown with a •
✓	•	•	•	•	The names and addresses of abutting property owners, within a two hundred (200) foot radius or four hundred (400) foot (see Section 8.5.3.a) of the subject lot(s) to be subdivided or developed (taken from the most recent records of the City Assessor) and names and, addresses of agencies or communities requiring notification as required by these Regulations.
		•	•		Required Public Hearing: Certified mail receipts. Return receipts (green post-cards) to be addressed to the Planning Board, c/o the Administrative Officer. See Section 8.5.3.
✓		•	•	•	Location of wooded areas, if any, and notation of existing groundcover.
✓	•				Location of wetlands, watercourses or coastal features, if present on or within two hundred (200) feet of the property being subdivided to be generally identified on a plat map.
✓		•			Location of wetlands, watercourses or coastal features, if present on or within 200 feet of the property being subdivided to be identified and flagged by a biologist.
✓			•	•	Written confirmation from the Rhode Island Department of Environmental Management (RIDEM) pursuant to its Rules and Regulations Governing the Enforcement of the Freshwater Wetlands Act, and any subsequent amendments thereto, that plans of the proposed subdivision or land development, including any required off-site construction, have been reviewed and indicating that the Wetlands Act either does not apply to the proposed site alteration or that approval has been granted for the proposed site alteration.
✓			•	•	Location and dimension of all existing and proposed utilities within and immediately adjacent to the subdivision or land development, including sewer, water, gas, electric, telephone, cable TV, fire alarm, hydrants, existing utility poles, (including location and type of proposed poles and fixtures), stormwater drainage or other existing above or underground utilities.
N/A			•	•	If wells and/or ISDS are proposed, indicate stage of RIDEM approval: Preliminary suitability determination or receipt of final approval.

	1	2	3	4	Required, if shown with a •
✓	21	•			Location and approximate size of existing buildings or significant above-ground structures on or immediately adjacent to the subdivision or land development.
✓	22		•		Provisions for collecting and discharging stormwater.
N/A	23	•			Location of properties within the local historic zoning district and National Register District. Historic cemeteries and stone walls on or immediately adjacent to the subdivision or land development (if any).
N/A	24	•	•	•	Proposed improvements including streets, lots, lot lines, with lot areas and dimensions. Proposed lot lines shall be drawn so as to distinguish them from existing property lines.
X-FEMA Map	25		•	•	Base flood elevation data.
✓	26		•		Soil erosion and sediment control plan.
N/A	27	•			Conceptual Landscape Plan.
✓	28		•	•	Landscaping plan to show all significant proposed clearing of land, removal of existing vegetation, revegetation and/or landscaping on street rights-of-way and upon individual lots if part of proposed subdivision or land development improvements, signed and stamped by a registered landscape architect.
✓	29		•	•	Grading plan to show existing and proposed contours at two-foot intervals for all grading proposed for on and off-site street construction, sewer and water installations, drainage facilities and upon individual lots if part of proposed subdivision or land development improvements.
N/A	30		•		Proposed street plan, profiles and cross-sections drawn at a scale of not less than 1" = 40'.
N/A	31		•	•	Monuments - See Appendix D, Section D.5.a
N/A	32		•	•	Proposed street names.

	1	2	3	4	Required, if shown with a •
✓	33		•	•	Two (2) copies of a drainage plan and calculations showing the measures to be taken to control erosion and sedimentation during and following the development of the subdivision and the measures planned to provide for the control of stormwater runoff.
	34		•	•	Location, dimension and area of any land proposed to be dedicated to the City of Warwick or payment in lieu of such dedication.
N/A	35		•	•	Written approval of the proposed subdivision or land development, including any required off-site construction, from the Rhode Island Coastal Resources Management Council in the form of an Assent as provided in the Rhode Island Coastal Resources Management Program, (if necessary).
N/A	36		•	•	A Physical Alteration Permit issued by the RI Department of Transportation for any connection to or construction work within a State highway or other right-of-way (if necessary).
	37			•	Copies of all legal documents describing the property, proposed easements and rights-of-way, dedications, restrictions, or other required legal documents.
✓	38		•		Written comments on the Preliminary Plan - Referral Form and attachments.
N/A	39		•	•	Documents of incorporation of any homeowners' association for any cluster development.
	40			•	Compliance with any additional improvements or conditions as required by the Planning Board in the Preliminary Plan stage.
✓	41		•	•	Certification by a Registered Land Surveyor that a perimeter survey of the land being subdivided has been performed and conforms to the survey requirements of these Regulations.
	42			•	Deed or instrument transferring to the City all public streets and/or other public improvements.

	1	2	3	4	Required, if shown with a •
43				•	Deed transferring land proposed for dedication to the City or other qualified group or agency for open space purposes (if applicable). These might be private non-profit or homeowner associations for cluster developments.
44					Payment of Required Fees
a.	•				Preapplication Fee
b.			•		Filing Fee: See Section 7.4
c.		•			Application Filing Fee - See Section 7.4.1
d.				•	Engineering Inspection Fees - See Section 7.4.2
e.				•	Recording Fee
45				•	Either of the following: <ul style="list-style-type: none"> a. A letter stating it is the intent of the applicant to complete the required improvements; or, b. A letter requesting that security be set by the Board sufficient to cover the cost of required improvements:
46				•	Performance bond or other financial guarantees (Initial amount and date set by Planning Board)
47				•	Maintenance bond for acceptance of public improvements, if applicable.
48		•			If applicable, letter from the Rhode Island Historical Preservation & Heritage Commission for archaeological assessment.

N/A

ATTACHMENT

B

SITE PLANS

PROPRIETARY INFORMATION: THIS DRAWING IS THE PROPERTY OF WSP USA ENVIRONMENT & INFRASTRUCTURE, INC. AND IS NOT TO BE LOANED OR REPRODUCED IN ANY WAY WITHOUT THE PERMISSION OF WSP USA ENVIRONMENT & INFRASTRUCTURE, INC.

KNIGHT STREET SOLAR

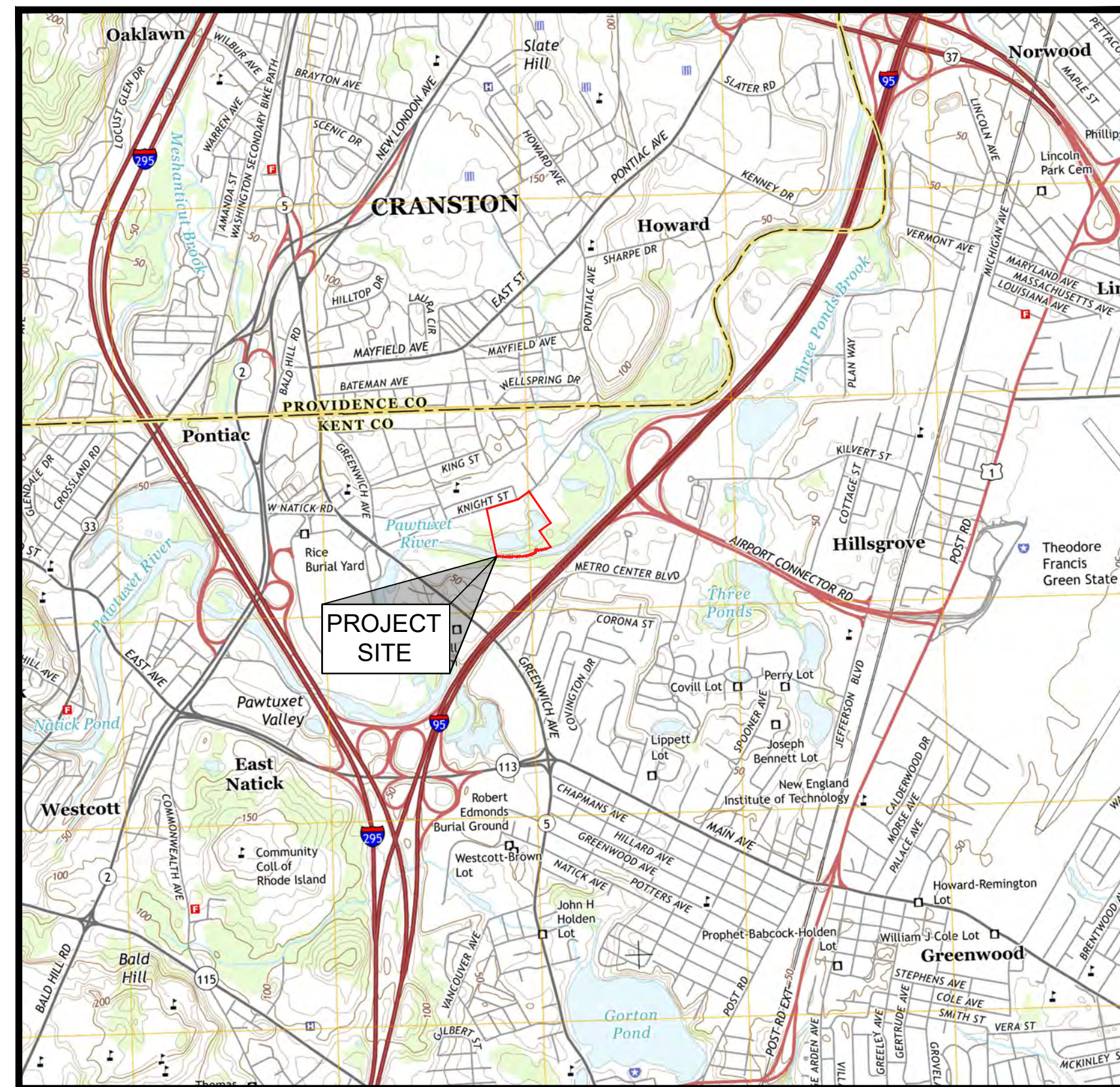
998.40 KW DC GROUND-MOUNT SOLAR PV DEVELOPMENT

240 KNIGHT STREET

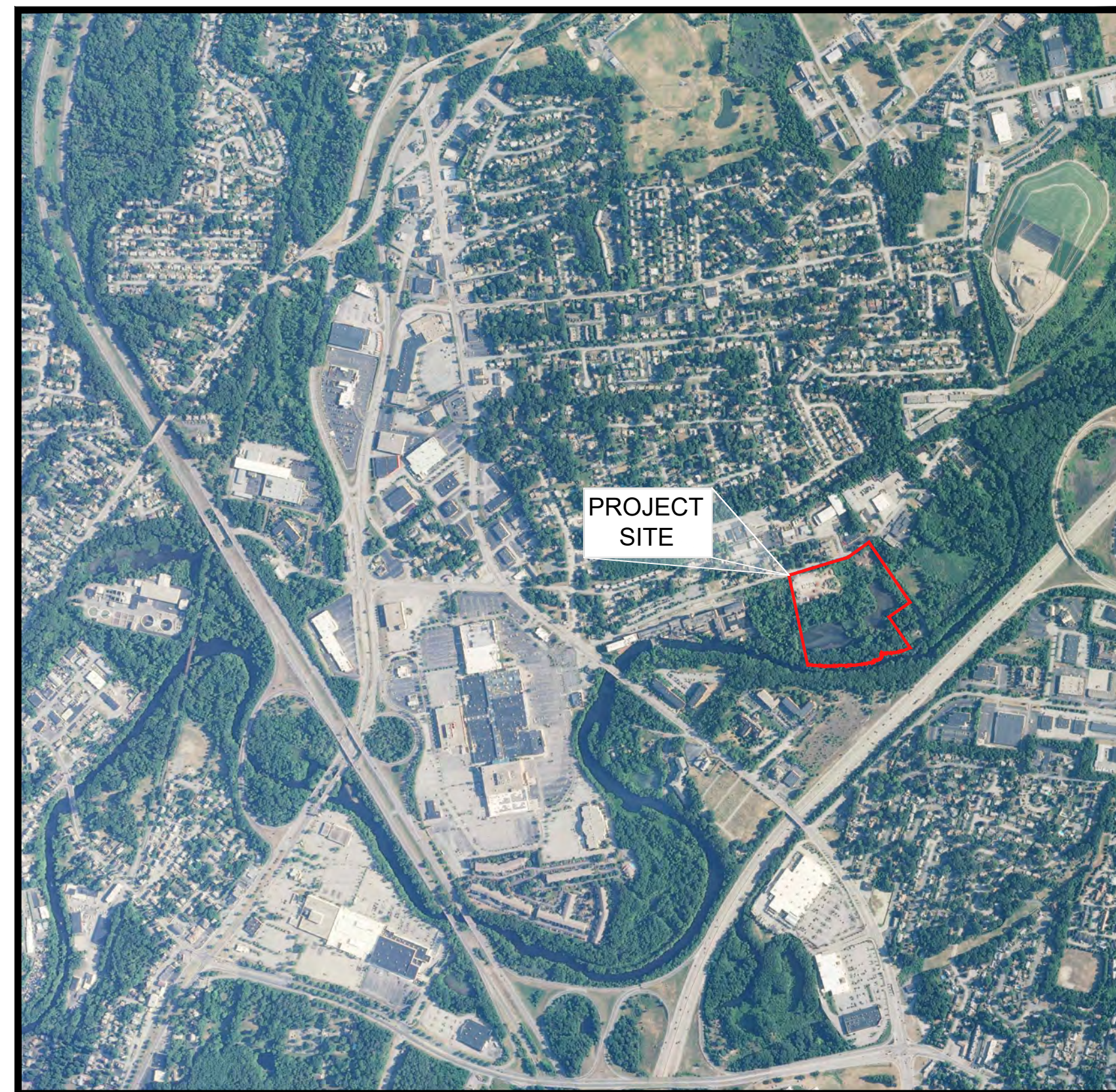
WARWICK, RHODE ISLAND

LAST ISSUED ON JANUARY 03, 2024

ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION



LOCUS MAP
1" = 2000'



AERIAL IMAGE
NOT TO SCALE

DRAWING INDEX

SHEET NUMBER	DRAWING TITLE	DRAWING NUMBER
	COVER SHEET	
1	EXISTING CONDITIONS PLAN	V-101
2	POST-TENANT EXISTING CONDITIONS PLAN	V-102
3	PROPOSED SITE PLAN	C-101
4	GRADING PLAN	C-102
5	CONSTRUCTION, EROSION, AND SEDIMENTATION CONTROL DETAILS AND NOTES	C-501
6	CONSTRUCTION, EROSION, AND SEDIMENTATION CONTROL DETAILS	C-502
-	LANDSCAPE PLAN	L-1
-	LANDSCAPE NOTES AND DETAILS	L-2
-	BOUNDARY & TOPOGRAPHIC SURVEY, PLAT 275 LOTS 38 & 52, KNIGHT STREET, WARWICK, RHODE ISLAND	N/A

PROPERTY OWNER

SUNSHINE PROPERTIES, LLC
181 KNIGHT ST.
WARWICK, RHODE ISLAND 02886

DEVELOPED BY

VCP, LLC

VEROGY

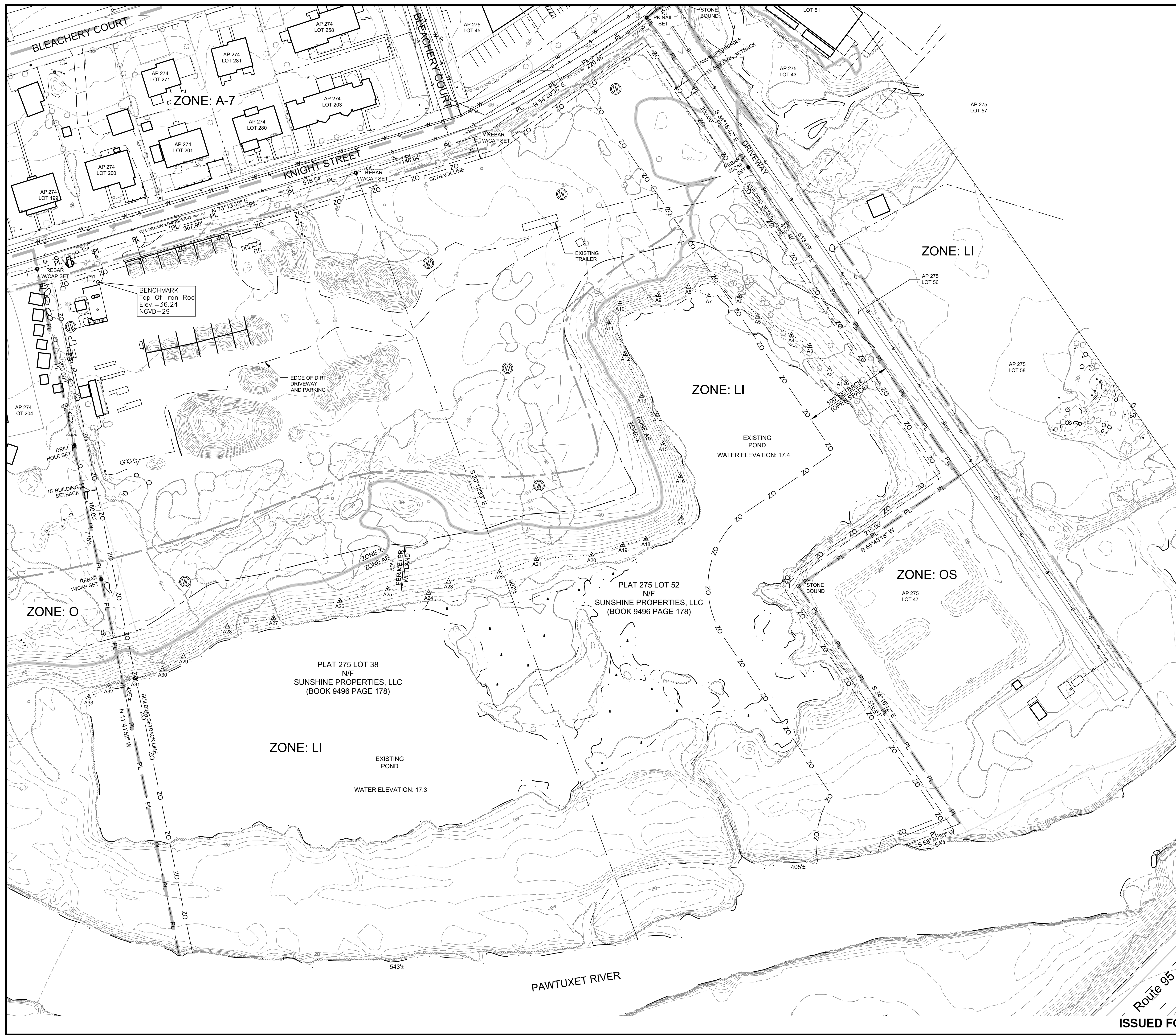
150 TRUMBULL ST.
HARTFORD, CONNECTICUT 06103

PREPARED BY



WSP USA ENVIRONMENT & INFRASTRUCTURE, INC.
275 PROMENADE STREET
PROVIDENCE, RHODE ISLAND 02908

D:\Vero\p\Knight Street\7.0 CAD\7.1 Design - Permitting\Sheets\0 - 8552020284 - 0400.dwg - Layout1 - Jan. 03, 2024 12:13pm - wds_morgan.mcdonald



GENERAL NOTES:

- RECORD OWNER OF THE PROPERTY: SUNSHINE PROPERTIES, LLC AS SHOWN ON THE CITY OF WARWICK PLAT 275, PARCELS 38 & 52. FOR FURTHER REFERENCES SEE DEED BOOK 9496, PAGE 178.
- HORIZONTAL DATUM IS BASED ON RHODE ISLAND STATE GRID COORDINATE SYSTEM NAD83 (2011) AND THE VERTICAL DATUM IS REFERENCED TO NAVD 29.
- WETLANDS SHOWN ON THIS PLAN WERE DELINEATED BY OTHERS. WETLAND FLAGS WERE LOCATED ON 2/4/2021 BY NATURAL RESOURCE SERVICES, INC., OF HARRISVILLE, RHODE ISLAND.
- FLOOD ZONE INFORMATION FROM FIRM FLOOD INSURANCE RATE MAP CITY OF WARWICK, RHODE ISLAND, KENT COUNTY, PANEL 2 OF 9, COMMUNITY - PANEL NUMBER 445409 0002 D, MAP REVISED APRIL 16, 1991.
- FLOOD ZONE AREA WAS REVISED FOR LOCUS PARCEL PER: FEDERAL EMERGENCY MANAGEMENT AGENCY, LETTER OF MAP REVISION FLOODWAY DETERMINATION DOCUMENT (REMOVAL), DATED MARCH 20, 2007, CASE NO. 07-01-0070A (100-YEAR FLOODPLAIN AT ELEVATION 29).
- WSP USA ENVIRONMENT & INFRASTRUCTURE, INC. HAS NOT INDEPENDENTLY VERIFIED THE LOCATION, EXISTENCE, AND SERVICEABILITY FOR ANY UTILITIES IN THIS VICINITY. WSP ALSO MAKES NO GUARANTEE TO THE COMPLETENESS - MISSING - ACCURACY - DAMAGES INCURRED OF ANY UTILITIES. ACTUAL LOCATIONS MUST BE FIELD DETERMINED PRIOR TO EXCAVATION OR OTHER CONSTRUCTION ACTIVITIES. CALL "DIG SAFE" AT 811.
- EXISTING CONDITIONS PLAN FROM BOUNDARY & TOPOGRAPHIC SURVEY, PREPARED FOR KNIGHT STREET GROUP, LLC, PLAT 275 LOTS 38 & 52, KNIGHT STREET, WARWICK, RHODE ISLAND, JOB NO. 208064, DATED MARCH 27, 2009, BY CHERENZIA & ASSOCIATES, LTD., OF PAWTUCKET, CONNECTICUT.
- LANDSCAPE MATERIAL STOCKPILES WILL BE REMOVED WHEN CURRENT TENANT VACATES THE SITE.

EXISTING LEGEND

-20-	MAJOR CONTOUR
- - - -	MINOR CONTOUR
PL PL	SITE PROPERTY LINE
---	PARCEL LINE
- - - -	OFF-SITE PROPERTY LINE
ZO ZO	ZONING SETBACK
---	FENCE LINE
⊖	SANITARY SEWER UTILITY
⊕	GAS UTILITY
⊖	WATER UTILITY
⊖	STORM DRAIN UTILITY
⊖	WETLAND LINE WITH FLAG AND ID
---	50' WETLAND BUFFER
---	DIRT DRIVEWAY
---	TREE LINE
---	SCRUB LINE
⊕	UTILITY POLE
⊖	MONITORING WELL
⊖	SHRUBS
⊖	ROCKS AND BOULDERS
AP 274 LOT 204	PARCEL ID
---	FEMA 100-YR FLOOD LINE WITH ZONE ID (LOCATED AT 29' ELEVATION)
---	APPROXIMATE LIMIT OF WASTE
---	WARWICK ZONING BOUNDARY WITH ID
---	ZONE: LI
---	ZONE: OS

WSP USA ENVIRONMENT AND INFRASTRUCTURE, INC.
100 APOLLO DRIVE, SUITE 302
CHELMSFORD, MA 01824
978-692-9090
WSP.COM

DATE	REVISION	ISSUE / REVISION DESCRIPTION
01/03/2024	7	ISSUED FOR CITY PRELIMINARY/FINAL PLAN REVIEW
01/03/2024	6	REVISED PER RIDEN COMMENTS
01/03/2024	5	REVISED PER CITY COMMENTS
01/03/2024	4	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION
01/03/2024	3	RESPONSE TO RIDEN COMMENTS
01/03/2024	2	RESPONSE TO RIDEN COMMENTS
01/03/2024	1	ADDRESS COMMENTS

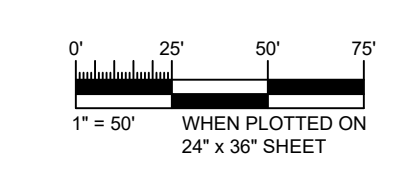
PROJECT: 998.40 KW DC GROUND-MOUNT SOLAR PV DEVELOPMENT
240 KNIGHT STREET
WARWICK, RHODE ISLAND

TITLE: EXISTING CONDITIONS PLAN

CLIENT: VCP, LLC
150 TRUMBULL ST.
HARTFORD, CT 06103

SEAL: ANDREW P. VARDAKIS
No. 12219
REGISTERED PROFESSIONAL ENGINEER (CIVIL)
01/03/2024

DESIGNED BY: MDM	DRAWN BY: MRM
CHECKED BY: APV	SCALE: AS SHOWN
PROJECT NUMBER: 3652200299	
DRAWING NUMBER: V-101	
SHEET NUMBER: 1 OF 6	



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REVISION	DATE	ISSUE / REVISION DESCRIPTION
7	01/03/2024	ISSUED FOR CITY PRELIMINARY/FINAL PLAN REVIEW
6	07/20/2023	REVISED PER RIDEM COMMENTS
5	2/08/2023	REVISED PER CITY COMMENTS
4	11/19/2023	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION
3	9/10/2021	RESPONSE TO RIDEM COMMENTS
2	8/20/2021	RESPONSE TO RIDEM COMMENTS
1	6/28/2021	ADRESSED COMMENTS

PROJECT: 998.40 KW DC GROUND-MOUNT
SOLAR PV DEVELOPMENT
240 KNIGHT STREET
WARWICK, RHODE ISLAND

TITLE: POST-TENANT
EXISTING CONDITIONS PLAN

VCP, LLC
150 TRUMBULL ST.
HARTFORD, CT 06103

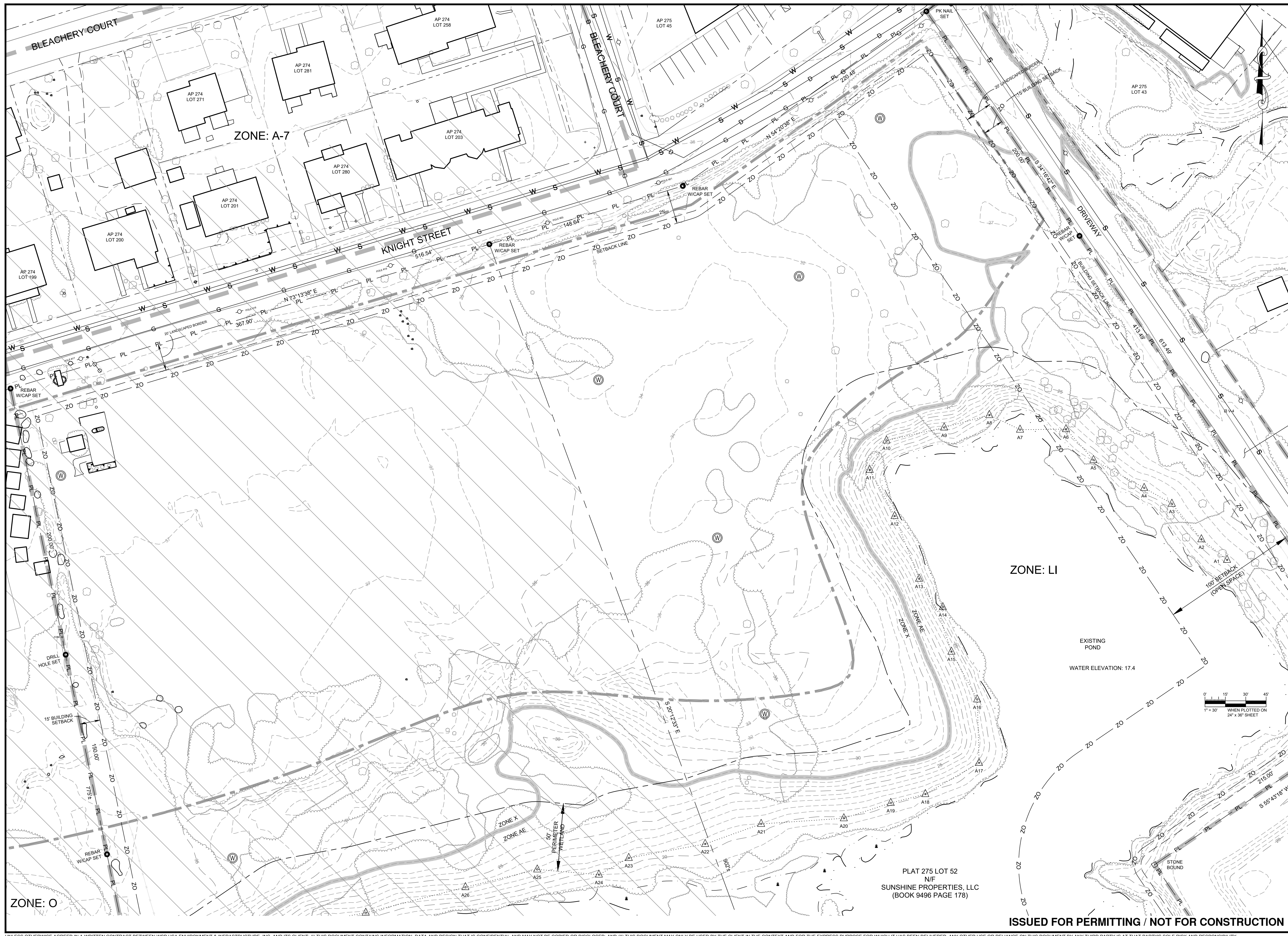
VEROGEY

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HARTFORD, CT 06103

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No. 12219
REGISTERED
PROFESSIONAL ENGINEER
(CIVIL)
01/03/2024

DESIGNED BY: MRM
CHECKED BY: APV
PROJECT NUMBER: 3652200299
DRAWING NUMBER: V-102
SHEET NUMBER: 2 OF 6

DRAWN BY: SCALE: AS SHOWN



PLAT 275 LOT 52
N/F
SUNSHINE PROPERTIES, LLC
(BOOK 9496 PAGE 178)

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PROPOSED LEGEND

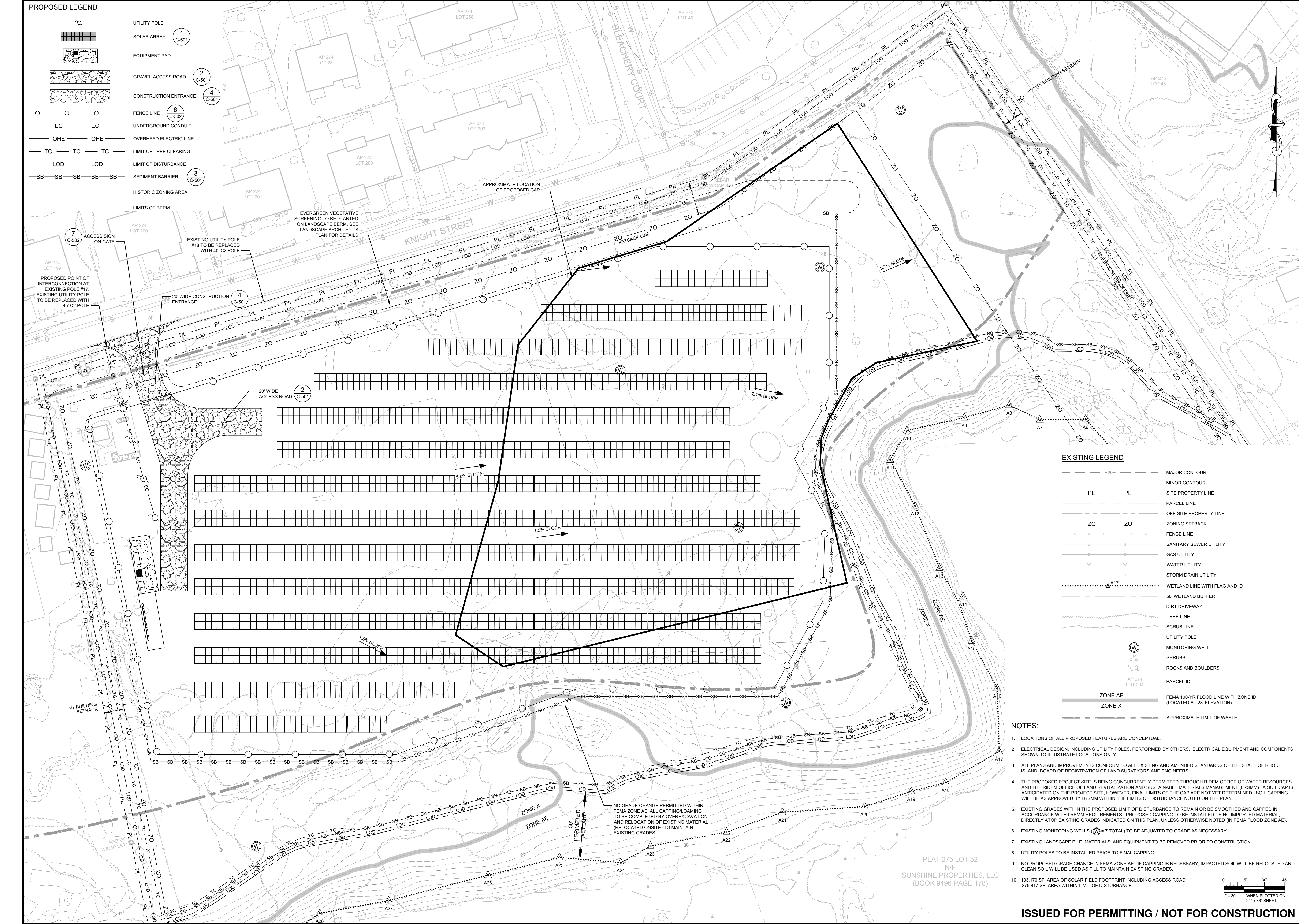
- UTILITY POLE
- SOLAR ARRAY (1 C-501)
- EQUIPMENT PAD
- GRAVEL ACCESS ROAD (2 C-501)
- CONSTRUCTION ENTRANCE (4 C-501)
- FENCE LINE (8 C-502)
- UNDERGROUND CONDUIT
- OHE OVERHEAD ELECTRIC LINE
- TC LIMIT OF TREE CLEARING
- LOD LIMIT OF DISTURBANCE
- SB SEDIMENT BARRIER (3 C-501)
- HISTORIC ZONING AREA
- LIMITS OF BERM

EXISTING LEGEND

- MAJOR CONTOUR
- MINOR CONTOUR
- PL SITE PROPERTY LINE
- PARCEL LINE
- ZO OFF-SITE PROPERTY LINE
- ZONING SETBACK
- FENCE LINE
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- GAS UTILITY
- WATER UTILITY
- STORM DRAIN UTILITY
- WETLAND LINE WITH FLAG AND ID
- 50' WETLAND BUFFER
- DIRT DRIVEWAY
- TREE LINE
- SCRUB LINE
- UTILITY POLE
- MONITORING WELL
- SHRUBS
- ROCKS AND BOULDERS
- PARCEL ID
- ZONE AE FEMA 100-YR FLOOD LINE WITH ZONE ID (LOCATED AT 28' ELEVATION)
- ZONE X
- APPROXIMATE LIMIT OF WASTE

NOTES:

1. LOCATIONS OF ALL PROPOSED FEATURES ARE CONCEPTUAL.
2. ELECTRICAL DESIGN, INCLUDING UTILITY POLES, PERFORMED BY OTHERS. ELECTRICAL EQUIPMENT AND COMPONENTS SHOWN TO ILLUSTRATE LOCATIONS ONLY.
3. ALL PLANS AND IMPROVEMENTS CONFORM TO ALL EXISTING AND AMENDED STANDARDS OF THE STATE OF RHODE ISLAND, BOARD OF REGISTRATION OF LAND SURVEYORS AND ENGINEERS.
4. THE PROPOSED PROJECT SITE IS BEING CONCURRENTLY PERMITTED THROUGH RIDEM OFFICE OF WATER RESOURCES AND THE RIDEM OFFICE OF LAND REVITALIZATION AND SUSTAINABLE MATERIALS MANAGEMENT (LRSM). A SOIL CAP IS ANTICIPATED ON THE PROJECT SITE, HOWEVER, FINAL LIMITS OF THE CAP ARE NOT YET DETERMINED. SOIL CAPPING WILL BE AS APPROVED BY LRSM WITHIN THE LIMITS OF DISTURBANCE NOTED ON THE PLAN.
5. EXISTING GRADES WITHIN THE PROPOSED LIMIT OF DISTURBANCE TO REMAIN OR BE SMOOTHED AND CAPPED IN ACCORDANCE WITH LRSM REQUIREMENTS. PROPOSED CAPPING TO BE INSTALLED USING IMPORTED MATERIAL, DIRECTLY ATOP EXISTING GRADES INDICATED ON THIS PLAN, UNLESS OTHERWISE NOTED (IN FEMA FLOOD ZONE AE).
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10. 103,170 SF: AREA OF SOLAR FIELD FOOTPRINT INCLUDING ACCESS ROAD
275,817 SF: AREA WITHIN LIMIT OF DISTURBANCE



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DATE	REVISION	ISSUE / REVISION DESCRIPTION	APPROVED
01/03/2024	7	ISSUED FOR CITY PRELIMINARY/FINAL PLAN REVIEW	APV
07/20/2023	6	REVISED PER RIDEM COMMENTS	APV
2/08/2023	5	REVISED PER CITY COMMENTS	APV
1/19/2023	4	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	APV
9/10/2021	3	RESPONSE TO RIDEM COMMENTS	CR
8/20/2021	2	RESPONSE TO RIDEM COMMENTS	CR
6/28/2021	1	ADDRESS COMMENTS	CR

PROJECT: 998.40 KW DC GROUND-MOUNT SOLAR PV DEVELOPMENT
 240 KNIGHT STREET
 WARWICK, RHODE ISLAND

CLIENT: VCP, LLC
 150 TRUMBULL ST.
 HARTFORD, CT 06103

TITLE: PROPOSED SITE PLAN

VEROGEY

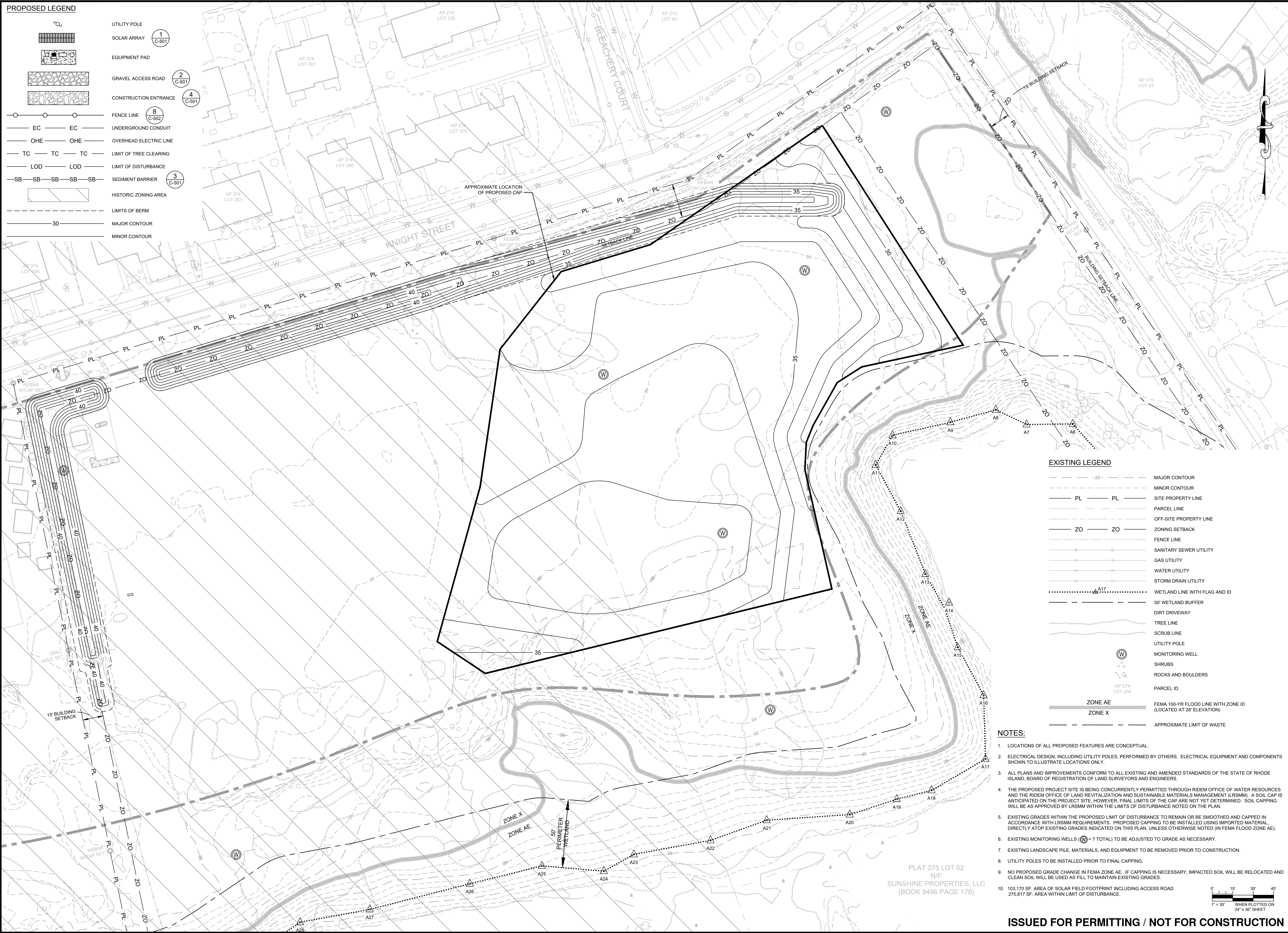
REGISTERED PROFESSIONAL ENGINEER (CIVIL)
 No. 12219
 01/03/2024

DESIGNED BY: MDM
 CHECKED BY: APV
 PROJECT NUMBER: 3652200299
 DRAWING NUMBER: C-101
 SHEET NUMBER: 3 OF 6

DRAWN BY: MRM
 SCALE: AS SHOWN

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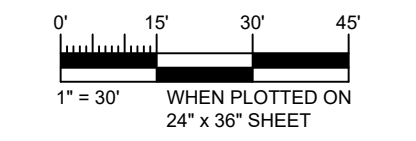
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DATE	ISSUE / REVISION DESCRIPTION	ISSUED
8/28/2021	ADDRESS COMMENTS	CR
9/10/2021	RESPONSE TO RIDEA COMMENTS	CR
11/19/2023	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	CA
2/08/2023	REVISED PER CITY COMMENTS	APV
6/07/2023	REVISED PER RIDEM COMMENTS	PDG
8/19/2024	ISSUED FOR CITY PRELIMINARY/FINAL PLAN REVIEW	APV

PROJECT: 998.40 KW DC GROUND-MOUNT SOLAR PV DEVELOPMENT
 240 KNIGHT STREET
 WARWICK, RHODE ISLAND

TITLE: GRADING PLAN

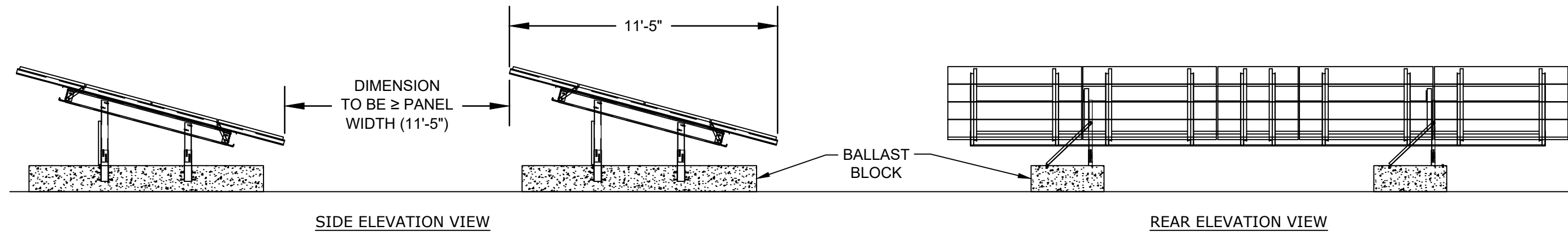
CLIENT: VCP, LLC
 150 TRUMBULL ST.
 HARTFORD, CT 06103

VEROGEY

ANDREW P. VARDAKIS
 No. 12219
 REGISTERED PROFESSIONAL ENGINEER (CIVIL)
 01/03/2024

DESIGNED BY: MDM
CHECKED BY: APV
DRAWN BY: MRM
SCALE: AS SHOWN

PROJECT NUMBER: 3652200299
DRAWING NUMBER: C-102
SHEET NUMBER: 4 OF 6



NOTES:

- DESIGN FOR FOUNDATIONS, RACKING, AND MODULES BY OTHERS. DETAILS SHOWN FOR ILLUSTRATION PURPOSES ONLY.
- SEE DETAIL 5 THIS SHEET FOR INTERIOR AND EXTERIOR BLOCK DIMENSIONS.
- ROW SPACING IS EQUAL TO OR GREATER THAN PANEL WIDTH.

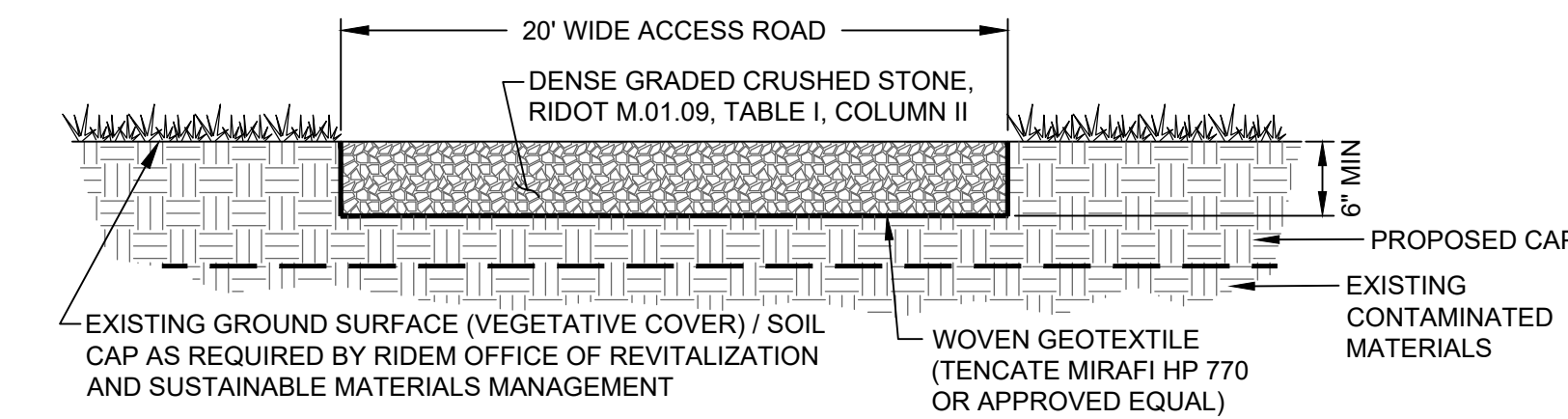
SOLAR PV ARRAY

NOT TO SCALE

1

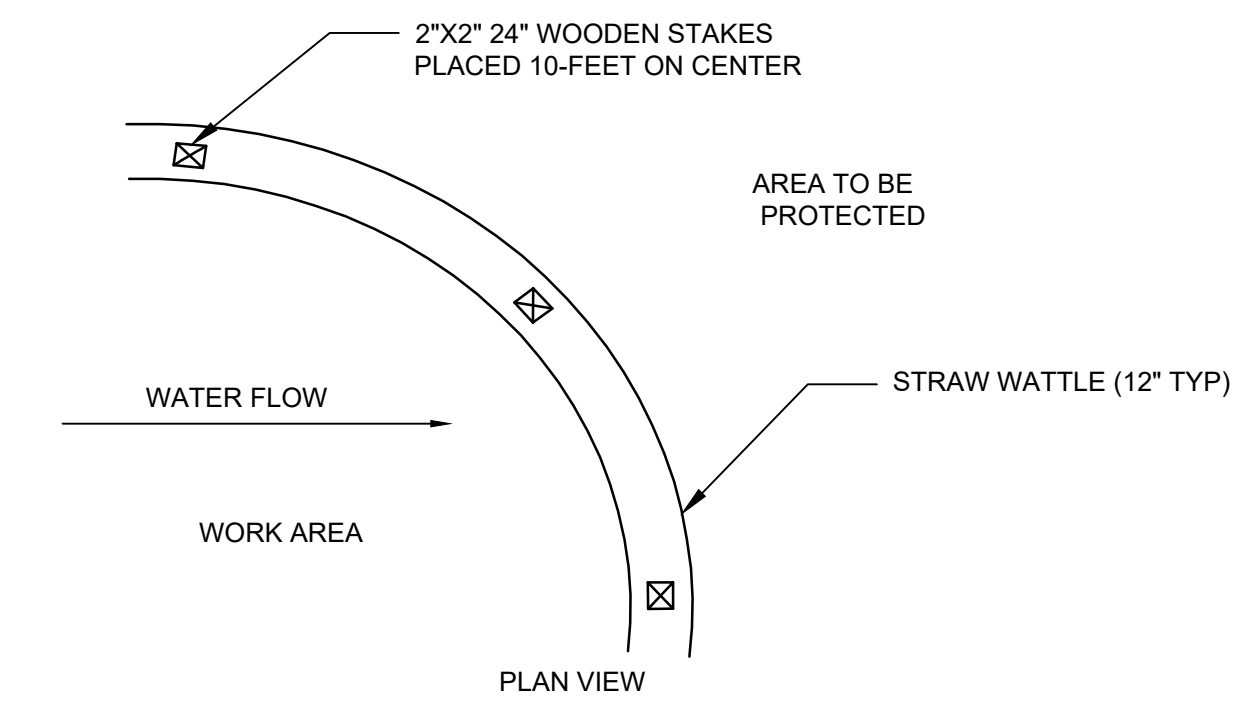
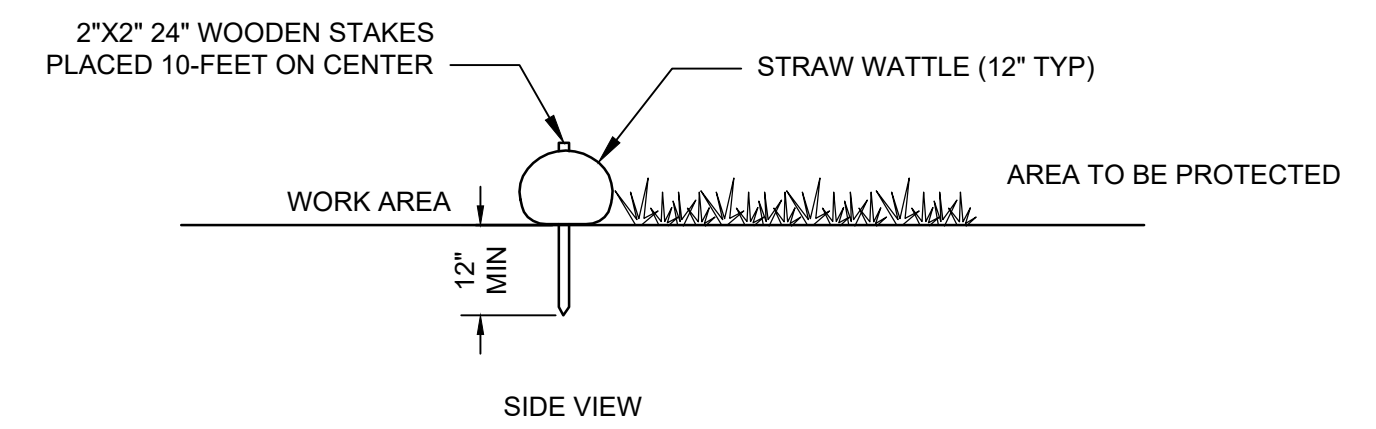
ACCESS ROAD

NOT TO SCALE



NOTES:

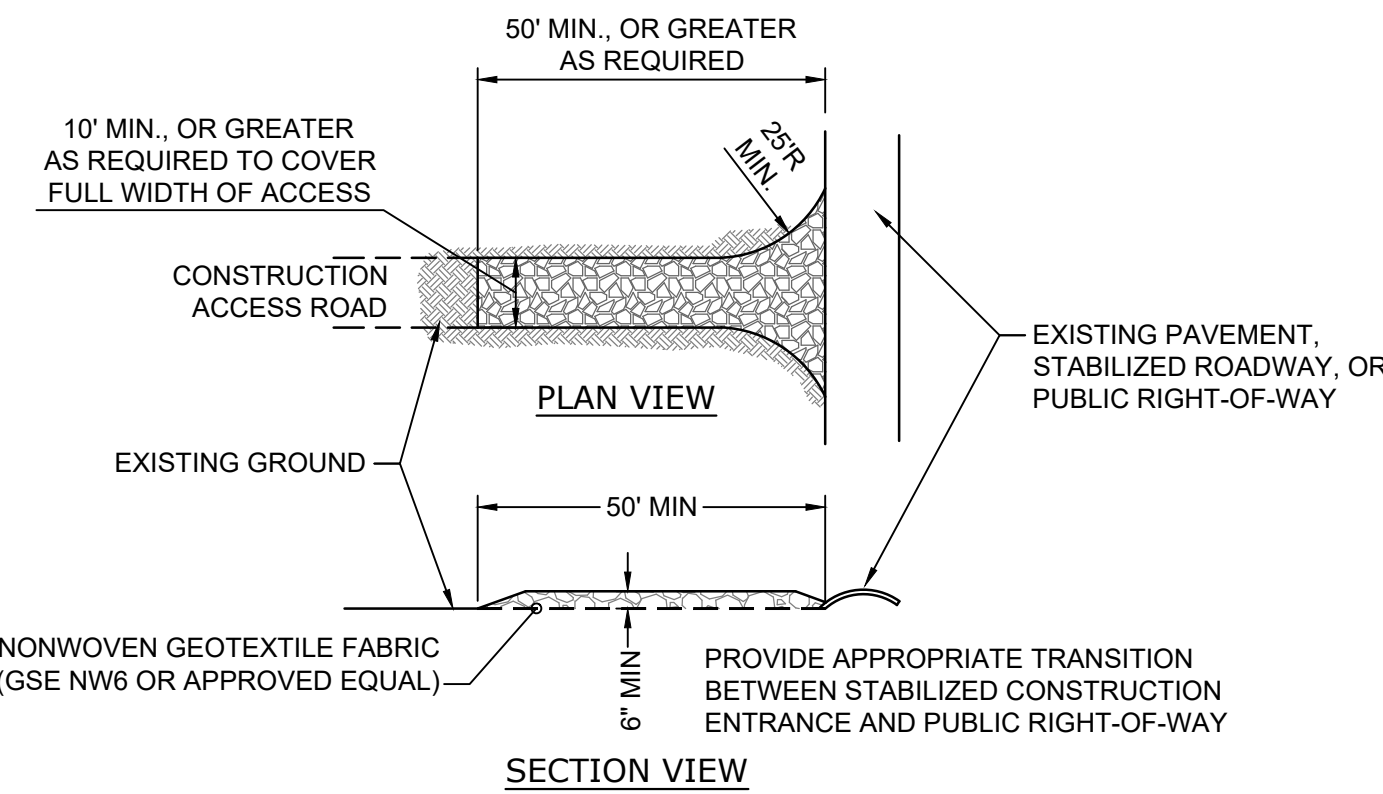
- ACCESS ROAD TO BE CONSTRUCTED OF A MINIMUM 6" OF DENSE GRADED CRUSHED STONE.
- WOVEN GEOTEXTILE TO BE PLACED BETWEEN THE GROUND SURFACE AND THE CRUSHED STONE.
- CRUSHED STONE SHALL BE COMPACTED TO A FIRM AND NON-YIELDING CONDITION.



SEDIMENT BARRIER (STRAW WATTLE)

NOT TO SCALE

3



NOTES:

- STONE TO BE 1"-3" STONE, RECLAIMED STONE, OR RECYCLED CONCRETE EQUIVALENT.
- LENGTH - AS REQUIRED, BUT NOT LESS THAN 50 FT.
- THICKNESS - NOT LESS THAN SIX (6) INCHES.
- WIDTH - TEN (10) FT. MIN, BUT NOT LESS THAN THE FULL TRAVELED WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS.
- FILTER CLOTH - SHALL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING OF STONE.
- SURFACE WATER - ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ENTRANCE SHALL BE PIPED ACROSS OR BENEATH THE ENTRANCE.
- MAINTENANCE - THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY.
- WASHING - WHEELS SHALL BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTRANCE ONTO PUBLIC RIGHTS-OF-WAY. IF WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.
- PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED AFTER EACH RAIN.

STABILIZED CONSTRUCTION ENTRANCE

NOT TO SCALE

4

EROSION AND SEDIMENTATION CONTROL PLAN:

THIS PLAN HAS BEEN DEVELOPED TO PROVIDE A STRATEGY FOR CONTROLLING SOIL EROSION AND SEDIMENTATION DURING AND AFTER CONSTRUCTION OF THE PROPOSED PROJECT.

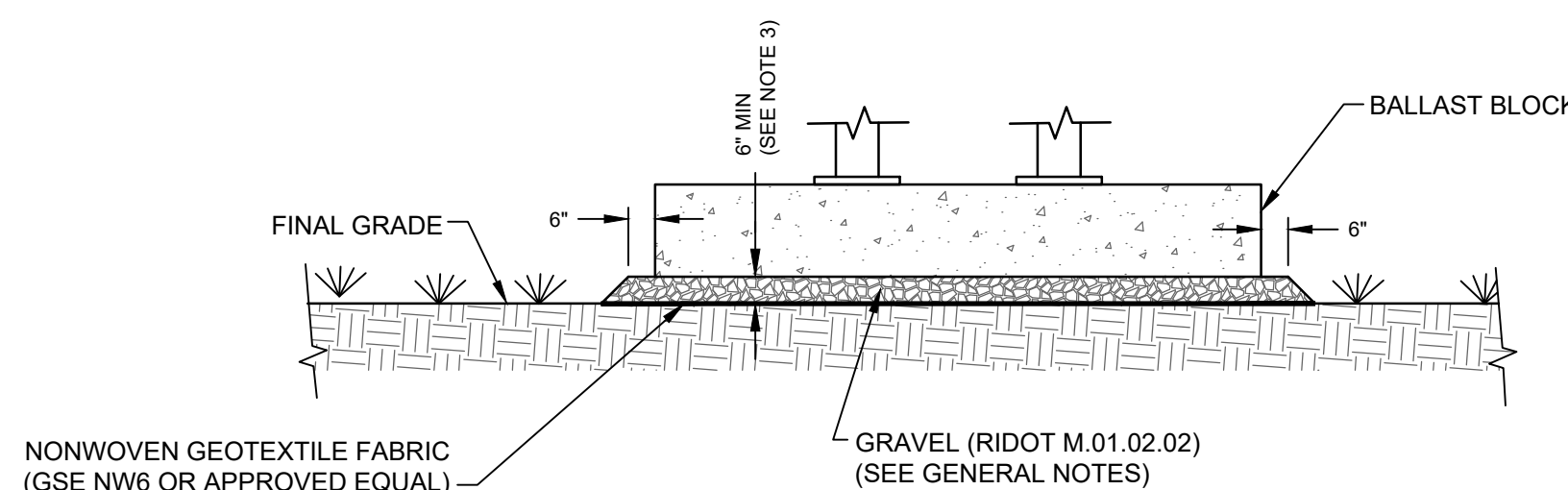
GENERAL EROSION AND SEDIMENTATION CONSTRUCTION DETAIL NOTES:

DURING CONSTRUCTION, THE CONTRACTOR SHALL TAKE ALL REASONABLE MEASURES TO SCHEDULE EARTHWORK OPERATIONS SUCH THAT THE AREA OF EXPOSED AND DISTURBED SOIL IS MINIMIZED. CONSTRUCTION SHALL BE PHASED TO MINIMIZE THE AREA OF DISTURBED SOIL THAT IS EXPOSED AT ANY ONE TIME. UPGRADIENT STORMWATER DIVERSION AND DISPERSION MEASURES SHALL BE INSTALLED WHERE APPROPRIATE. ALL CUT AND FILL SLOPES SHALL BE STABILIZED UPON COMPLETION. THE FOLLOWING MEASURES WILL BE UNDERTAKEN TO PROVIDE MAXIMUM PROTECTION TO THE SOIL, WATER, AND ADJUTING LANDS:

- PRIOR TO GRUBBING OR ANY EARTH MOVING OPERATION, SEDIMENT BARRIERS, OR OTHER APPROPRIATE PERIMETER CONTROL BEST MANAGEMENT PRACTICES (BMPs) SHALL BE INSTALLED ACROSS THE SLOPE ON THE CONTOUR AT THE DOWNHILL LIMIT OF THE WORK AS PROTECTION AGAINST CONSTRUCTION RELATED EROSION. INSTALL ALL NECESSARY STORMWATER DIVERSIONS AND DISPERSION MEASURES.
- PERMANENT SOIL STABILIZATION MEASURES FOR ALL SLOPES, OR ANY DISTURBED LAND AREA SHALL BE COMPLETED WITHIN FOURTEEN CALENDAR DAYS AFTER FINAL GRADING HAS BEEN COMPLETED. WHEN IT IS NOT POSSIBLE OR PRACTICAL TO PERMANENTLY STABILIZE DISTURBED LAND, TEMPORARY EROSION CONTROL MEASURES SHALL BE IMPLEMENTED ON DISTURBED AREAS (INCLUDING STOCKPILES) WITHIN FOURTEEN CALENDAR DAYS OF EXPOSURE OF SOIL OR FORMATION OF PILES. UNLESS THESE AREAS ARE TO BE SUBSEQUENTLY SURFACED WITH PERMANENT STRUCTURES. ALL DISTURBED AREAS SHALL BE MULCHED FOR EROSION CONTROL UPON COMPLETION OF ROUGH GRADING.
- ANY EXPOSED SLOPES 3:1 OR GREATER SHALL BE STABILIZED WITH EROSION CONTROL BLANKETS (ERONET C125 BY NORTH AMERICAN GREEN, OR APPROVED EQUAL) TO PREVENT EROSION DURING CONSTRUCTION AND TO FACILITATE REVEGETATION AFTER TOPSOILING AND SEEDING.
- IF MATERIAL STOCKPILES ARE NEEDED, SEDIMENT BARRIER SHALL BE INSTALLED AT THE BASE OF STOCKPILES AT THE DOWNHILL LIMIT TO PROTECT AGAINST EROSION. STOCKPILES ANTICIPATED TO REMAIN FOR MORE THAN FOURTEEN CALENDAR DAYS SHALL BE STABILIZED BY SEEDING AND MULCHING UPON FORMATION OF THE PILES. UPGRADIENT OF THE STOCKPILES, STABILIZED DITCHES AND/OR BERMS SHALL BE CONSTRUCTED TO DIVERT STORMWATER RUNOFF AWAY FROM THE PILES.
- INTERCEPTED SEDIMENT SHALL BE REMOVED WHEN IT REACHES ONE-HALF THE HEIGHT OF THE SEDIMENT BARRIER, OR AS DIRECTED IN THE DRAWING DETAILS FOR OTHER BMPs, AND SHALL BE DEPOSITED IN AN AREA THAT SHALL NOT CONTRIBUTE TO SEDIMENT OFF-SITE AND CAN BE PERMANENTLY STABILIZED. ALL DAMAGED EROSION CONTROL DEVICES SHALL BE REPAIRED AND/OR REPLACED IMMEDIATELY. DEVICES NO LONGER SERVICEABLE DUE TO SEDIMENT ACCUMULATION SHALL ALSO BE REPAIRED AND/OR REPLACED AS REQUIRED.
- SOIL CUTTINGS GENERATED DURING THE DRILLING OF PILOT HOLES FOR FOUNDATION POSTS SHALL BE REMOVED AND COLLECTED. SOIL CUTTINGS MAY BE STOCKPILED TEMPORARILY, BUT ULTIMATELY SHALL BE DISPOSED AND SPREAD IN AN AREA THAT SHALL NOT CONTRIBUTE TO OFF-SITE SEDIMENTATION, AND PERMANENTLY STABILIZED.
- ADDITIONAL EROSION CONTROL METHODS SHALL BE IMPLEMENTED IF CONSTRUCTION OCCURS AFTER DECEMBER 15TH. ALL DISTURBED AREAS SHALL BE MINIMIZED TO THE EXTENT POSSIBLE. PRIOR TO FREEZING, ADDITIONAL EROSION CONTROL DEVICES SHALL BE INSTALLED AS APPROPRIATE. INSPECTION OF THESE EROSION CONTROL ITEMS SHALL BE FREQUENT, WITH PARTICULAR ATTENTION PAID TO WEATHER PREDICTIONS TO ENSURE THAT THESE MEASURES ARE PROPERLY IN PLACE TO HANDLE LARGE QUANTITIES OF RUNOFF RESULTING FROM HEAVY RAINS OR EXCESSIVE THAWS.
- GENERAL EROSION AND SEDIMENTATION CONTROL ACTIONS SHALL INCLUDE THE FOLLOWING:
 - MARK SOIL DISTURBANCE LIMITS
 - INSTALL SEDIMENT BARRIERS BEFORE DISTURBING ANY SOILS
 - DIVERT AND DISPERSE STORMWATER RUNOFF TO UNDISTURBED AREAS WHEREVER POSSIBLE
 - MULCH DISTURBED AREAS
 - PROTECT STEEP SLOPES
 - INSPECT AND REPAIR EROSION CONTROLS AND SEDIMENT BARRIERS

DUST CONTROL:

- CONSTRUCTION ACTIVITIES SHALL BE SCHEDULED TO MINIMIZE THE AREA OF DISTURBED SOIL THAT IS EXPOSED AT ONE TIME.
- DUST CONTROL SHALL BE USED ON CONSTRUCTION ROUTES AND OTHER DISTURBED AREAS SUBJECT TO SURFACE DUST MOVEMENT AND DUST BLOWING.
- MAINTAIN DUST CONTROL MEASURES PROPERLY THROUGH DRY WEATHER PERIODS UNTIL ALL DISTURBED AREAS HAVE BEEN PERMANENTLY STABILIZED.
- DUST CONTROL METHODS SHALL BE APPROVED BY THE ENGINEER AND MAY INCLUDE VEGETATIVE COVER, MULCH (INCLUDING GRAVEL MULCH), SPRAY-ON-ADHESIVE, CALCIUM CHLORIDE, SPRINKLING, STONE, AND BARRIERS.
- VEGETATIVE COVER - FOR DISTURBED AREAS NOT SUBJECT TO TRAFFIC, VEGETATION PROVIDES THE MOST PRACTICAL METHOD OF DUST CONTROL.
- MULCH (INCLUDING GRAVEL MULCH) - WHEN PROPERLY APPLIED, MULCH OFFERS A FAST, EFFECTIVE MEANS OF CONTROLLING DUST. SEE MANUFACTURER'S RECOMMENDATIONS OR THE RHODE ISLAND SOIL EROSION AND SEDIMENT CONTROL HANDBOOK FOR APPLICATION RATES.
- SPRAY-ON ADHESIVE - LATEX EMULSIONS OR RESIN IN WATER CAN BE SPRAYED ONTO MINERAL SOIL TO PREVENT PARTICLES FROM BLOWING AWAY.
- CALCIUM CHLORIDE - CALCIUM CHLORIDE MAY BE APPLIED BY MECHANICAL SPREADER AS LOOSE, DRY GRANULES OR FLAKES AT A RATE THAT KEEPS THE SURFACE MOIST BUT NOT SO HIGH AS TO CAUSE WATER POLLUTION OR PLANT DAMAGE.
- SPRINKLING - EXPOSED SOILS MAY BE SPRINKLED UNTIL THE SURFACE IS WET. SPRINKLING IS ESPECIALLY EFFECTIVE FOR DUST CONTROL ON HAUL ROADS AND OTHER TRAFFIC ROUTES.
- STONE - USED TO STABILIZE CONSTRUCTION ROADS; CAN ALSO BE EFFECTIVE FOR DUST CONTROL.
- BARRIERS - A BOARD FENCE, WIND FENCE, SEDIMENT FENCE, OR SIMILAR BARRIER CAN CONTROL AIR CURRENTS AND BLOWING SOIL. ALL OF THESE FENCES ARE NORMALLY CONSTRUCTED OF WOOD AND THEY PREVENT EROSION BY OBSTRUCTING THE WIND NEAR THE GROUND AND PREVENTING THE SOIL FROM BLOWING OFFSITE.



NOTES:

- MINIMUM 6" GRAVEL TO BE PLACED 6" BEYOND ALL SIDES OF THE BLOCK.
- CONTRACTOR SHALL INSTALL A MINIMUM OF 6" OF GRAVEL ON TOP OF THE EXISTING VEGETATIVE SUPPORT LAYER AFTER CUTTING EXISTING VEGETATION AS SHORT AS POSSIBLE.
- ACTUAL BALLAST BLOCK DIMENSIONS MAY CHANGE; TOTAL BALLAST BLOCK AREA SHALL NOT EXCEED 6,000 SQFT.

BALLAST INSTALLATION

NOT TO SCALE

5

MONITORING PROGRAM:

- EROSION AND SEDIMENTATION CONTROLS SHALL BE INSPECTED AT LEAST ONCE EVERY 7 CALENDAR DAYS AND WITHIN 24 HOURS OF THE END OF A STORM EVENT OF 0.25 INCHES OR GREATER. DAILY RAINFALL SHALL BE MONITORED AND RECORDED BY THE CONTRACTOR. ALL STRUCTURES DAMAGED BY CONSTRUCTION EQUIPMENT, VANDALS, OR THE ELEMENTS SHALL BE REPAIRED OR REPLACED IMMEDIATELY, PRIOR TO CONTINUING THE CONSTRUCTION.
- FOLLOWING THE FINAL SEEDING, THE SITE SHALL BE INSPECTED IN ACCORDANCE WITH THE SCHEDULE OUTLINED IN #1 ABOVE, TO ENSURE THAT THE VEGETATION HAS BEEN ESTABLISHED (70% COVER ACHIEVED). IN THE EVENT OF ANY UNSATISFACTORY GROWTH, RESEEDING WILL BE CARRIED OUT, WITH FOLLOW-UP INSPECTION.
- AFTER THE CONSTRUCTION INSPECTOR HAS DETERMINED THAT THE PROJECT AREA HAS BEEN PERMANENTLY STABILIZED (70% COVER HAS BEEN ACHIEVED OR NON-VEGETATED MEASURES HAVE BEEN IMPLEMENTED), THE CONTRACTOR SHALL REMOVE ALL SEDIMENT BARRIERS, TEMPORARY SEDIMENTATION CONTROL RISERS AND ANY OTHER TEMPORARY EROSION CONTROL MEASURES.

SEEDING AND REVEGETATION PLAN:

UPON COMPLETION OF SITE CONSTRUCTION, ALL AREAS PREVIOUSLY DISTURBED SHALL BE TREATED AS STATED BELOW. THESE AREAS WILL BE CLOSELY MONITORED BY THE CONTRACTOR UNTIL SUCH TIME AS A SATISFACTORY GROWTH OF VEGETATION IS ESTABLISHED. SATISFACTORY GROWTH SHALL MEAN A MINIMUM OF 70% OF THE AREA IS VEGETATED WITH VIGOROUS GROWTH.

- TOPSOIL WILL BE SPREAD OVER ALL DISTURBED AREAS TO BE REVEGETATED AND SHALL BE GRADED TO A UNIFORM DEPTH OF FOUR (4) TO SIX (6) INCHES.
- APPLY SEED AS DIRECTED BELOW:

(APRIL 1ST THROUGH OCTOBER 1ST)

 - SEED DISTURBED AREAS AT THE RATE OF 4 LBS PER 1,000 SQ. FT. OF THE FOLLOWING MIXTURE:
 - ERNST SEEDS ERNMX-105 OR APPROVED EQUAL
 - APPLY WOOD FIBER MULCH AT A RATE OF 2,000 LBS PER ACRE FOR MAXIMUM MOISTURE RETENTION.
 - (NOVEMBER 1ST THROUGH DECEMBER 15TH)
 - SEED DISTURBED AREAS AT THE RATE OF 8 LBS PER 1,000 SQ. FT. OF THE FOLLOWING MIXTURE:
 - ERNST SEEDS ERNMX-105 OR APPROVED EQUAL
 - APPLY HAY MULCH AT THE RATE OF 100 LBS PER 1,000 SQ. FT.
 - (AFTER DECEMBER 15TH)
 - DO NOT SEED.
 - APPLY HAY MULCH AT THE RATE OF 100 LBS PER 1,000 SQ. FT.
 - FERTILIZER AND LIME SELECTIONS BASED ON SOIL TESTING IS RECOMMENDED. IN ABSENCE OF A SOIL TEST, APPLY LIME AT A RATE OF 2.5 TONS PER ACRE AND 10-20-20 FERTILIZER AT A RATE OF 500 POUNDS PER ACRE. 40% OF THE NITROGEN SHALL BE IN AN ORGANIC OR SLOW-RELEASED FORM. THE TARGET PH FOR LIMED SOIL IS 5.5 - 6.0. LIME AND FERTILIZER SHALL BE INCORPORATED INTO THE TOP 2-3 INCHES OF SOIL. FERTILIZER WILL ONLY BE USED AS NECESSARY TO ESTABLISH INITIAL VEGETATIVE GROWTH.
 - SEEDING METHODS MAY BE DRILL SEEDINGS, BROADCASTS AND ROLLED, CULTPACKED, OR TRACKED WITH A SMALL TRACK PIECE OF CONSTRUCTION EQUIPMENT, OR HYDRO-SEEDING, WITH SUBSEQUENT TRACKING.
 - WATERING MAY BE REQUIRED DURING DRY PERIODS CONSULT SEED MANUFACTURER'S INSTRUCTIONS.
 - STEEP SLOPES (3:1 AND STEEPER) SHALL BE STABILIZED BY INSTALLING EROSION CONTROL BLANKET (ERONET C125 BY NORTH AMERICAN GREEN, OR APPROVED EQUAL).
 - INSPECT SEEDED AREAS FOR FAILURE AND MAKE NECESSARY REPAIRS AND RESEED IMMEDIATELY. CONDUCT A FOLLOW-UP SURVEY AFTER ONE YEAR AND RESEED WHERE NECESSARY.
 - IF THERE ARE AREAS WITH LESS THAN 40% COVER, REEVALUATE CHOICE OF PLANT MATERIALS AND QUANTITIES OF LIME AND FERTILIZER. IF THE SEASON PREVENTS RESOWING, MULCH OR JUTE NETTING IS AN EFFECTIVE TEMPORARY COVER.
 - SEEDED AREAS SHOULD BE FERTILIZED DURING THE SECOND GROWING SEASON.
 - LIME AND FERTILIZE THEREAFTER AT PERIODIC INTERVALS, AS NEEDED. HERBICIDES SHALL NOT BE USED.
 - ALL SEDIMENT CONTROL STRUCTURES LOCATED DOWN GRADIENT OF SOILS STABILIZED BY VEGETATIVE MEASURES SHALL REMAIN IN PLACE UNTIL VEGETATION IS ESTABLISHED. ESTABLISHED MEANS A MINIMUM OF 85% OF THE AREA IS VEGETATED WITH VIGOROUS GROWTH.
 - THE USE OF FUNGICIDES, PESTICIDES, HERBICIDES, INSECTICIDES, CHEMICALS, OR SOLVENTS SHALL BE PROHIBITED.



ISSUED FOR CITY PRELIMINARY/FINAL PLAN REVIEW	ISSUED FOR PERMITS / NOT FOR CONSTRUCTION	ISSUED FOR PERMITS / NOT FOR CONSTRUCTION	ISSUED FOR PERMITS / NOT FOR CONSTRUCTION	ISSUED FOR PERMITS / NOT FOR CONSTRUCTION	ISSUED FOR PERMITS / NOT FOR CONSTRUCTION	ISSUED FOR PERMITS / NOT FOR CONSTRUCTION	ISSUED FOR PERMITS / NOT FOR CONSTRUCTION	ISSUED FOR PERMITS / NOT FOR CONSTRUCTION	ISSUED FOR PERMITS / NOT FOR CONSTRUCTION	ISSUED FOR PERMITS / NOT FOR CONSTRUCTION	ISSUED FOR PERMITS / NOT FOR CONSTRUCTION
APV	APV	APV	APV	CA	CA	CA	CA	CA	CA	CA	APPROVED
MRM	PDG	PDG	PDG	CR	CR	CR	CR	CR	CR	CR	ISSUED
7	6	5	4	3	2	1	REVISION	DATE	01/03/2024	01/03/2024	01/03/2024

PROJECT: 998.40 KW DC GROUND-MOUNT SOLAR PV DEVELOPMENT
240 KNIGHT STREET
WARWICK, RHODE ISLAND

TITLE: CONSTRUCTION, EROSION, AND SEDIMENTATION CONTROL DETAILS AND NOTES

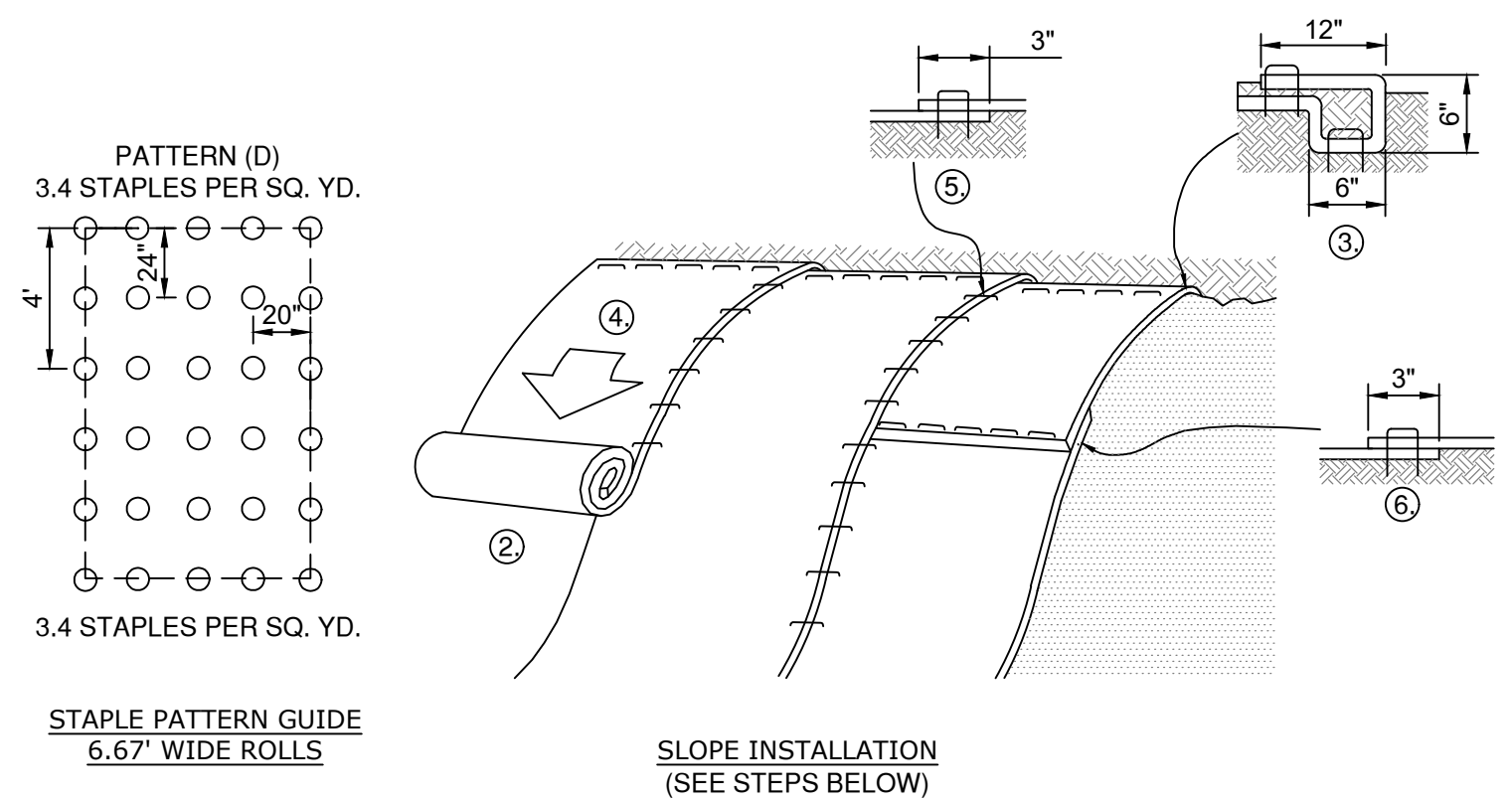
CLIENT: VCP, LLC
150 TRUMBULL ST.
HARTFORD, CT 06103

VEROGEY

SEAL: ANDREW P. VARDAKIS
No. 12219
REGISTERED PROFESSIONAL ENGINEER (CIVIL)
01/03/2024

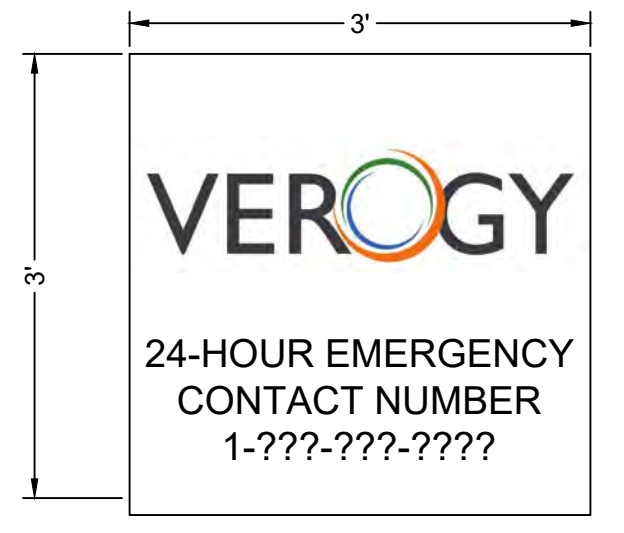
DESIGNED BY: MDM
CHECKED BY: APV
PROJECT NUMBER: 3652200299
DRAWING NUMBER: C-501
SHEET NUMBER: 5 OF 6

ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION



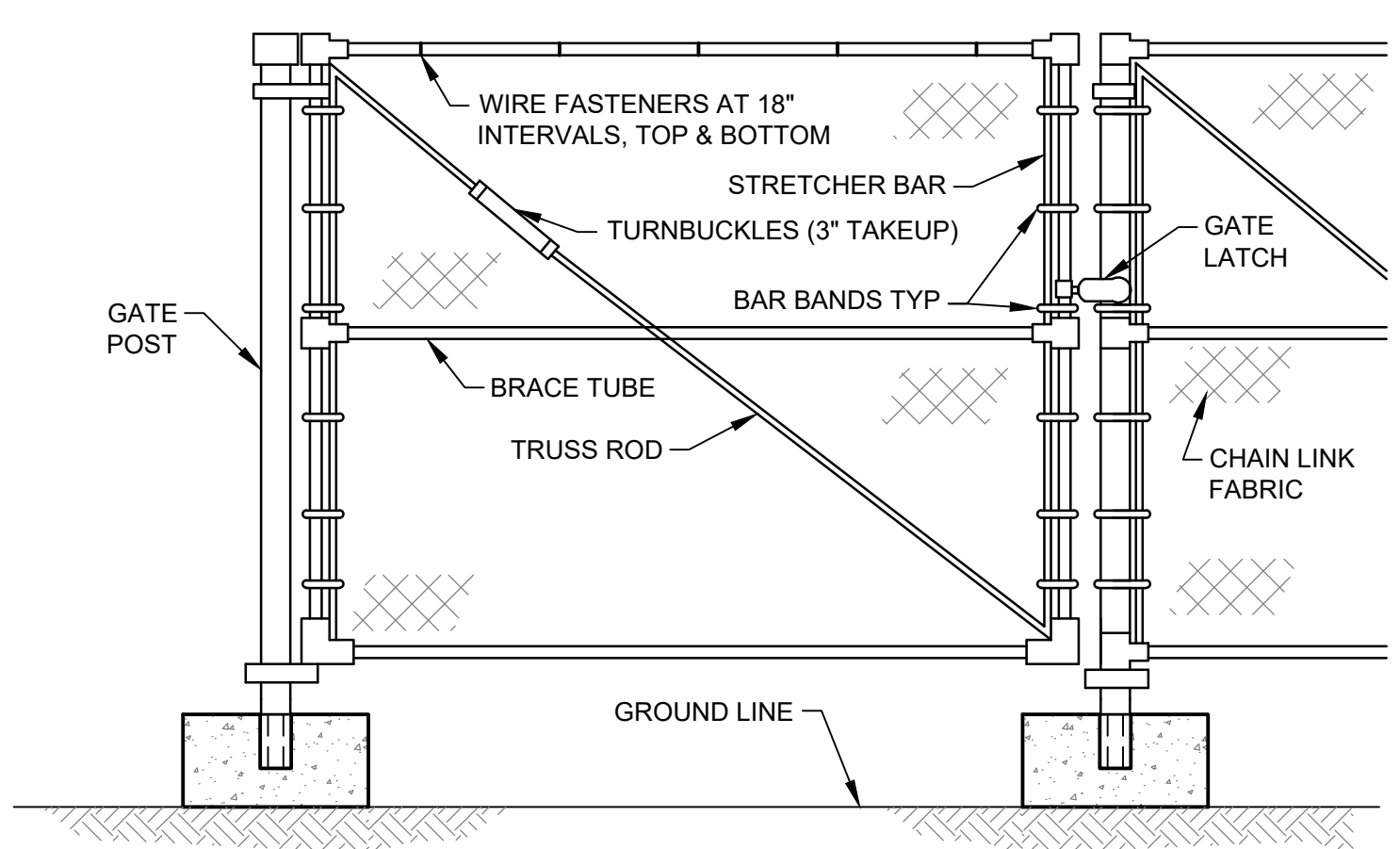
- NOTES:**
- THIS DETAIL REFERENCES PRODUCTS BY NORTH AMERICAN GREEN. EQUIVALENT PRODUCTS MAY BE USED AS APPROVED BY THE ENGINEER. EROSION CONTROL BLANKETS TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS AND INSTRUCTIONS.
1. EROSION CONTROL MATTING TO BE NORTH AMERICAN GREEN S75BN OR APPROVED EQUAL. INSTALL USING STAPLE PATTERN D.
 2. PREPARE SOIL BEFORE INSTALLING ROLLED EROSION CONTROL PRODUCTS (RECPs), INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED (SEE DRAWING G-001).
 3. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE RECPs IN A 6" DEEP X 6" WIDE TRENCH WITH APPROXIMATELY 12" OF RECPs EXTENDED BEYOND THE UP-SLOPE PORTION OF THE TRENCH. ANCHOR THE RECPs WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" PORTION OF RECPs BACK OVER SEED AND COMPACTED SOIL. SECURE RECPs OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" APART ACROSS THE WIDTH OF THE RECPs.
 4. ROLL THE RECPs DOWN THE SLOPE. RECPs WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL RECPs MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE. WHEN USING THE DOT SYSTEM, STAPLES/STAKES SHOULD BE PLACED THROUGH EACH OF THE COLORED DOTS CORRESPONDING TO THE APPROPRIATE STAPLE PATTERN.
 5. THE EDGES OF PARALLEL RECPs MUST BE STAPLED WITH AN APPROXIMATE 3" OVERLAP.
 6. CONSECUTIVE RECPs SPLICED DOWN THE SLOPE MUST BE PLACED END OVER END (SHINGLE STYLE) WITH AN APPROXIMATE 3" OVERLAP. STAPLE THROUGH OVERLAPPED AREA, APPROXIMATELY 12" APART ACROSS ENTIRE RECPs WIDTH.
 7. STAPLES LONGER THAN 6 INCHES SHALL NOT BE USED WITHIN THE LIMIT OF WASTE TO AVOID PENETRATION INTO THE LANDFILL CAP.

EROSION CONTROL BLANKET INSTALLATION
NOT TO SCALE 6



- NOTES:**
1. CONTACT NUMBER TO BE FINALIZED PRIOR TO CONSTRUCTION.
 2. SIGN TO BE MADE OF WOOD AND MOUNTED TO THE GATE.

ACCESS SIGN DETAIL
NOT TO SCALE 7



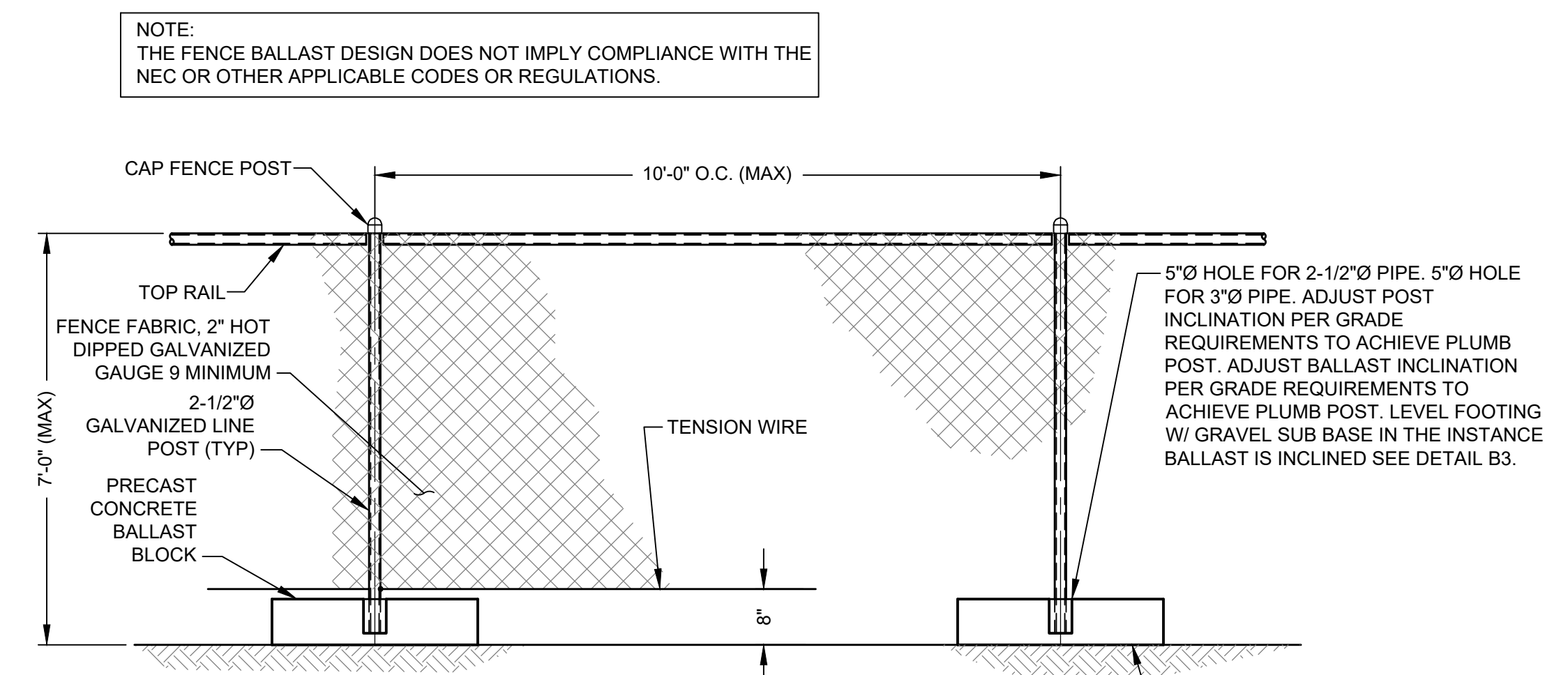
- NOTE:**
1. BALLAST AND FINAL FENCE DESIGN TO BE FINALIZED PRIOR TO CONSTRUCTION.

PEDESTRIAN CHAIN LINK FENCE GATE
NOT TO SCALE

BALLASTED FENCE DETAIL
NOT TO SCALE

SEE LANDSCAPE ARCHITECT'S PLAN FOR FENCE GATE DETAIL

FENCE GATE DETAIL
NOT TO SCALE



- NOTE:**
1. ALL SECURITY FENCING TO BE BLACK, COLOR-COATED CHAINLINK FENCE.

FENCE ELEVATION
NOT TO SCALE

8

ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION

NO.	DATE	ISSUE / REVISION DESCRIPTION	ISSUED	APPROVED
7	01/03/2024	ISSUED FOR CITY PRELIMINARY/FINAL PLAN REVIEW	MRM	APV
6	01/07/2023	REVISED PER RIEMEN COMMENTS	PDG	APV
5	2/09/2023	REVISED PER CITY COMMENTS	PDG	APV
4	1/19/2023	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	PDG	APV
3	9/10/2021	RESPONSE TO RIEMEN COMMENTS	CR	GA
2	8/20/2021	RESPONSE TO RIEMEN COMMENTS	CR	GA
1	8/28/2021	ADDRESSED COMMENTS	CR	GA

PROJECT: 998.40 KW DC GROUND-MOUNT SOLAR PV DEVELOPMENT
240 KNIGHT STREET
WARWICK, RHODE ISLAND

TITLE: CONSTRUCTION, EROSION, AND SEDIMENTATION CONTROL DETAILS 1

CLIENT: VCP, LLC
150 TRUMBULL ST.
HARTFORD, CT 06103

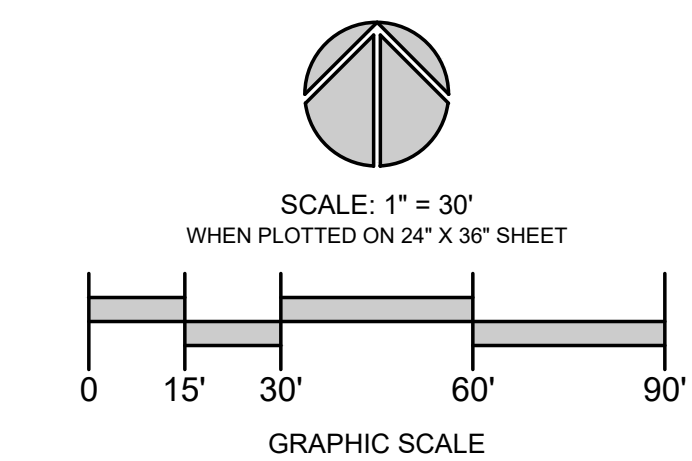
SEAL:

DESIGNED BY: MDM
CHECKED BY: APV
PROJECT NUMBER: 3652200299
DRAWING NUMBER: C-502
SHEET NUMBER: 6 OF 6

2,341,336 KnightStreetSolar_WarwickRI.dwg

PROPOSED LEGEND

- UTILITY POLE
- GRAVEL ACCESS ROAD
- CONSTRUCTION ENTRANCE
- FENCE LINE
- EC UNDERGROUND CONDUIT
- OHE OVERHEAD ELECTRIC LINE
- TC LIMIT OF TREE CLEARING
- LOD LIMIT OF DISTURBANCE
- SB SEDIMENT BARRIER
- 30 EXISTING CONTOUR
- 30 PROPOSED CONTOUR
- APPROXIMATE LIMIT OF EXISTING VEGETATION



REVISION HISTORY:

DATE	REVISION
6/5/23	Revised per HDC Comments: Plant Installation Size, Berm Extension, and Gate Height
1/3/24	Issued for City Preliminary/Final Plan Review: Revised per City Comments and Adjusted Array Layout

- REFERENCES:
- Plan Entitled, "PROPOSED SITE PLAN", Drawing Number: C-101, Sheet 3 of 6; Prepared for: VCP, LLC; Prepared By: WSP USA Environment and Infrastructure, Inc.; Dated with Revisions Through 1/3/24, as amended.
 - Site Observations made by Kevin M. Alverson, LA, March 1, 2023

Knight Street Solar

998.4 KW DC Ground-Mount Solar PV Development

Plat 275, Lots 38 and 52
240 Knight Street
Warwick, RI 02886

Property Owner:
Sunshine Properties, LLC
181 Knight Street
Warwick, RI 02886

Developed By:
VCP, LLC
VEROGY
150 TRUMBULL ST.
HARTFORD, CONNECTICUT 06103



Kevin M. Alverson
360 Annaquatucket Road Wickford, RI 02852 401.338.0044 KevinMAlverson@LA.com



LANDSCAPE PLANTING ONLY

GENERAL NOTES:

- SEE ENGINEER'S PLANS FOR ALL SITE LAYOUT, GRADING, DRAINAGE, AND UTILITY DESIGNS (SEE REFERENCES).
- ALL WORK AND MATERIALS SHALL BE IN CONFORMANCE WITH THE RHODE ISLAND STANDARD SPECIFICATIONS, AS AMENDED.
- CONTRACTOR SHALL VERIFY ACTUAL AS-BUILT ON-SITE CONDITIONS PRIOR TO COMMENCING CONSTRUCTION PROCEDURES.
- UTILITIES ARE PLOTTED FROM BEST AVAILABLE INFORMATION AND SITE OBSERVATIONS. CONTRACTOR SHALL VERIFY UTILITY LOCATIONS BY CONTACTING DIG SAFE (888-DIG-SAFE (344-7233) or Dial 811), IN ACCORDANCE WITH THE LAWS OF THE STATE OF RI. CONTRACTOR SHALL PROTECT EXISTING UTILITIES DURING CONSTRUCTION. DAMAGE TO ANY ABOVE OR BELOW-GROUND UTILITIES SHALL BE REPAIRED BY THE CONTRACTOR AT HIS OR HER OWN EXPENSE.
- STOCKPILING: CONTRACTOR SHALL COORDINATE WITH OWNER FOR STOCKPILE LOCATIONS, CONSTRUCTION STAGING AREAS, AND SITE ACCESS. ALL STOCKPILE LOCATIONS SHALL BE PROTECTED FROM EROSION AND MIGRATION OF SEDIMENTS BY APPROPRIATE SILTATION AND SEDIMENTATION CONTROL DEVICES, SUCH AS COMPOST SILT SOCK OR APPROVED EQUIAL.
- CONTRACTOR SHALL COORDINATE WITH OWNER FOR STOCKPILE LOCATIONS, CONSTRUCTION STAGING AREAS, AND SITE ACCESS.
- ALL EXCESS SOILS, BOULDERS, STUMPS AND OTHER MATERIALS SHALL BE DISCARDED OFF SITE IN AN ACCEPTABLE MANNER TO ALL STATE, AND MUNICIPAL REGULATIONS. ALL MATERIALS THAT ARE REMOVED AND DISPOSED SHALL BE DONE SO IN A LEGAL MANNER.
- CONTRACTOR TO PERFORM DAILY HOUSEKEEPING ONSITE. CONTRACTOR SHALL SWEEP DAILY ANY TRACKING ONTO EXISTING PAVED AREAS TO PREVENT MIGRATION OF SEDIMENTS TO OFF-SITE LOCATIONS.
- SOIL EROSION AND SILTATION CONTROL: REFER TO ENGINEER'S PLANS FOR ALL SOIL EROSION AND SILTATION CONTROL DETAILS/SPECIFICATIONS. CONTRACTOR SHALL MAINTAIN APPROPRIATE SILTATION AND SEDIMENTATION CONTROL IN ACCORDANCE WITH THE RI STORMWATER DESIGN AND INSTALLATION MANUAL AND THE RI SOIL EROSION AND SEDIMENT CONTROL HANDBOOK OR AS DIRECTED BY OWNER'S REPRESENTATIVE DURING CONSTRUCTION PROCEDURES TO PREVENT MIGRATION OF SEDIMENTS TO OFF-SITE LOCATIONS.
- CHEMICAL, HERBICIDE, FUNGICIDE, AND PESTICIDE USE: USE OF PESTICIDES, FUNGICIDES, AND HERBICIDES ARE PROHIBITED ON SITE WITHOUT EXPRESS AUTHORIZATION BY LOCAL ENVIRONMENTAL REGULATORY AGENCIES, SHOULD THEY BE REQUIRED AND/OR DIRECTED BY SUCH AGENCY(IES) FOR THE PUBLIC GOOD TO CONTROL DAMAGING, INVASIVE SPECIES OF FLORA AND/OR FAUNA.

PLANT SCHEDULE:

KEY	Scientific Name Common Name	QTY	Size Comment	Spacing
CA'RS'	Clethra alnifolia 'Ruby Spice' Ruby Spice Sweet Pepperbush	6	#7 (7 Gal.) Container	As Shown
INS'	Ilex 'Nellie Stevens' Nellie Stevens Holly	8	6'-7" B&B	As Shown
JV'H'	Juniperus virginiana 'Hillspire' Hillspire Eastern Red Cedar	14	6'-7" B&B	As Shown
PA	Picea abies Norway Spruce	10	6'-7" B&B	As Shown
PG	Picea glauca White Spruce	20	6'-7" B&B	As Shown
PL'S'	Prunus laurocerasus 'Schipkaensis' Schip's Laurel	20	#7 (7 Gal.) Container	As Shown
TP'GG'	Thuja plicata 'Green Giant' Green Giant Western Red Cedar	33	6'-7" B&B	As Shown

Notes:
1. Final Locations of any proposed plantings shall be field adjusted to maximize site buffering and minimize any conflicts with existing vegetation to remain & as-built improvements, including utility locations.

Landscape Plan

Project #: 2.261.319 Sheet 1 of 2
Scale: As Shown
Drawn By: KMA
Checked By: KMA
Date: April 26, 2023

L-1

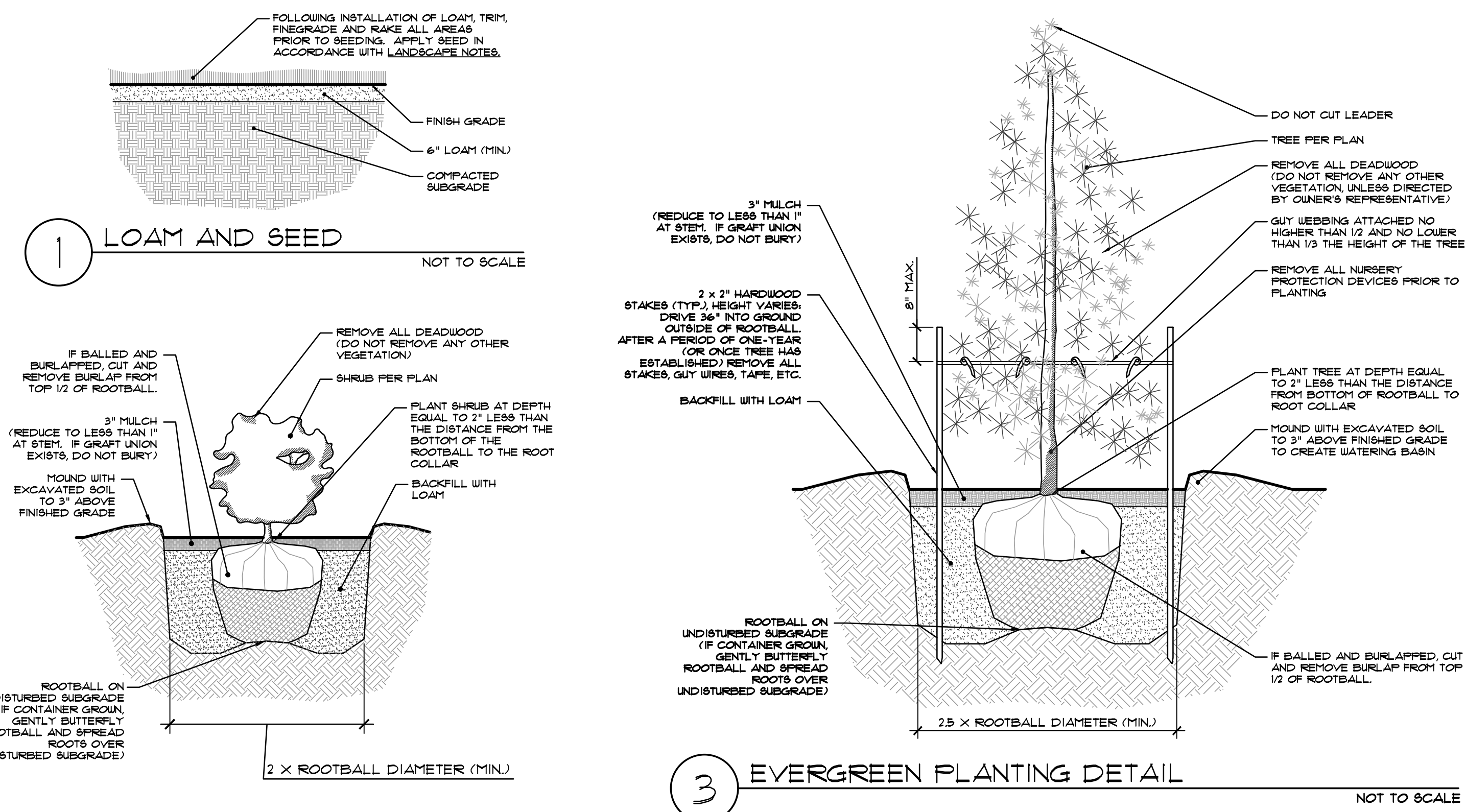
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2.341.336 KnightStreetSolar_WarwickRI.dwg

LANDSCAPE NOTES:

- THE CONTRACTOR SHALL INSTALL ALL PLANT MATERIAL IN CONFORMANCE WITH THE RHODE ISLAND DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, LATEST EDITION, AND THE CURRENT PLANTING PROCEDURES ESTABLISHED BY THE AMERICAN NURSERY & LANDSCAPE ASSOCIATION, FORMERLY THE AMERICAN ASSOCIATION OF NURSERYMEN.
- ALL NEW SPECIFIED PLANT MATERIAL SHALL MEET THE AMERICAN NURSERY & LANDSCAPE ASSOCIATION, FORMERLY THE AMERICAN ASSOCIATION OF NURSERYMEN, STANDARDS FOR NURSERY STOCK, LATEST EDITION, AND ITS AMENDMENTS. PLANT ONLY DURING SEASONS NORMAL TO THE PARTICULAR VARIETY.
- SPECIFIED PLANT VARIETIES, QUANTITIES, AND SIZES ARE SUBJECT TO AVAILABILITY AT TIME OF ORDERING AND INSTALLATION. ALL PLANT SUBSTITUTIONS AND/OR CHANGES IN PLANT LOCATION OR SIZE MUST BE APPROVED BY THE PROJECT OWNER OR OPERATOR, OR THEIR REPRESENTATIVE.
- ALL PLANTINGS SHALL BE SIZED IN ACCORDANCE WITH THE SIZES INDICATED, UNLESS OTHERWISE APPROVED BY THE PROJECT OWNER OR OPERATOR, OR THEIR REPRESENTATIVE.
- THE CONTRACTOR IS RESPONSIBLE FOR KEEPING THE SITE CLEAN OF MISCELLANEOUS DEBRIS THROUGHOUT THE CONSTRUCTION PERIOD. ALL WASTE MATERIAL IS TO BE DISPOSED OF IMMEDIATELY TO AN OFF-SITE LOCATION, UNLESS OTHERWISE INDICATED ON THE PLANS.
- THE CONTRACTOR SHALL PERFORM ALL WORK IN ACCORDANCE WITH ALL LOCAL, STATE, AND FEDERAL REGULATIONS, AND SHALL OBTAIN ALL NECESSARY PERMITS FOR THE PROJECT.
- MAINTENANCE AND WARRANTY:**
 - ALL PROPOSED PLANTINGS SHALL BE MAINTAINED BY THE OWNER'S REPRESENTATIVE FOLLOWING INSTALLATION. MAINTENANCE SHALL INCLUDE WATERING OF TREES AS NECESSARY TO ENSURE PROPER ESTABLISHMENT OF PLANTINGS, AND SUPPLEMENTAL WATERING IF NECESSARY DURING PERIODS OF EXTREME DROUGHT.
 - CONTRACTOR SHALL PROVIDE A ONE (1) YEAR WARRANTY ON ALL NEW PLANTINGS. SHOULD NEW PLANT MATERIAL DIE (OR DECLINE TO THE POINT WHERE PLANT IS EXPECTED TO DIE) WITHIN THIS WARRANTY PERIOD (OTHER THAN DUE TO NATURAL FACTORS, NATURAL DISASTER, OR NEGLIGENCE), CONTRACTOR SHALL REMOVE THE PLANT AND REPLACE SAID PLANT MATERIAL WITH NEW PLANTINGS IN ACCORDANCE WITH THE SIZE AND VARIETY SPECIFIED. ALL REPLACEMENT PLANT MATERIAL SHALL CARRY A NEW ONE (1) YEAR WARRANTY STARTING FROM THE DATE OF REPLACEMENT.
 - PROPOSED PLANTINGS AND SUPPLEMENTAL BUFFERING SHALL BE MAINTAINED FOR THE LIFE OF THE SOLAR ENERGY FACILITY BY THE OWNER. IF REQUIRED DURING THIS PERIOD, OWNER SHALL BE RESPONSIBLE TO REPAIR SECTION(S) OF THE BUFFER/SCREENING FOUND NOT TO MEET THE INTENT OF THE DESIGNED PROJECT BUFFERING.
 - FINAL LOCATIONS OF ALL NEW PLANTINGS SHALL BE ADJUSTED AS NECESSARY BASED ON FINAL AS-BUILT LOCATIONS OF ALL NEW AND EXISTING UTILITIES, EXISTING VEGETATION TO REMAIN, AND OTHER SITE IMPROVEMENTS.
- PROTECTION OF EXISTING PLANTINGS:**
 - WITHIN EXISTING WOODED BUFFERS TO REMAIN, ALL TREES, SHRUBS, AND UNDERSTORY VEGETATION WILL BE RETAINED AND PROTECTED TO THE GREATEST EXTENT PRACTICABLE. WITHIN THESE AREAS, CONTRACTOR WILL SELECTIVELY REMOVE ONLY THOSE TREES DEEMED TO BE A FALL HAZARD OR SAFETY RISK BY THE OWNER'S REPRESENTATIVE AND CERTIFIED ARBORIST.
 - EXISTING VEGETATION PROTECTION LINE: WHEN REQUIRED TO PROTECT VEGETATION TO REMAIN, PROTECTIVE BARRIERS ARE TO BE INSTALLED ALONG THE LIMIT OF DISTURBANCE ABUTTING SAID EXISTING VEGETATION TO REMAIN. BARRIERS SHALL NOT BE SUPPORTED BY THE PLANTS THEY ARE PROTECTING, BUT SHALL BE SELF-SUPPORTING. THEY SHALL BE A MINIMUM OF THREE-FOUR FEET (3'-4') HIGH AND CONSTRUCTED OF A DURABLE MATERIAL, SUCH AS SNOW OR SILT FENCE, THAT WILL LAST UNTIL CONSTRUCTION IS COMPLETED.
 - NO KNOWN TREES 20" IN DIA OR LARGER ARE WITHIN THE SUBJECT LIMIT OF DISTURBANCE. SHOULD TREES OF THIS SIZE BE FOUND AND REQUIRE REMOVAL, THEY WILL BE REPLACED WITH NEW NATIVE TREE PLANTINGS(S), SIZED 3"-3.5" MIN. CAL. AT TIME OF INSTALLATION AT A 1:1 REPLACEMENT RATIO. FINAL PLACEMENT AND VARIETY OF ANY REQUIRED REPLACEMENT TREE(S) TO BE DETERMINED BY PROJECT LANDSCAPE ARCHITECT. IF SIGNIFICANT TREES ARE FOUND WITHIN THE SUBJECT PROJECT AREA, A LICENSED ARBORIST MAY BE CONSULTED TO ASSIST IN DEVISING ANY SPECIAL PROTECTION AND PRESERVATION STRATEGIES THAT MAY BE REQUIRED BASED ON ANY SPECIAL TREE SPECIES OR STATUS.
 - PRUNING OF ANY DAMAGED ROOTS SHALL BE DONE IN ACCORDANCE WITH GOOD HORTICULTURAL PRACTICES, UTILIZING ONLY CLEAN SHARP TOOLS - NO AXES TO BE USED FOR PRUNING. CARE SHALL BE TAKEN NOT TO DISPOSE OF PAINT OR ANY OTHER SOLVENTS THAT MAY CHANGE THE SOIL STRUCTURE IN OR AROUND THE ROOTZONE OF VEGETATION SPECIFIED TO REMAIN.
 - ALL EXISTING VEGETATION TO REMAIN WILL BE MONITORED DURING CONSTRUCTION AND RE-ASSESSED ONE-YEAR FOLLOWING COMPLETION OF CONSTRUCTION PROCEDURES BY OWNER'S REPRESENTATIVE.
- TOPSOIL PRESERVATION AND PLANTABLE SOIL:**
 - TOPSOIL MOVED DURING THE COURSE OF CONSTRUCTION SHALL BE RETAINED AND REDISTRIBUTED WITHIN THE SITE IN ACCORDANCE WITH LOAMING AND SEEDING NOTES BELOW.
 - ALL LOAM USED AS PLANTABLE SOIL SHALL HAVE A SANDY LOAM TEXTURE RELATIVELY FREE OF SUBSOIL MATERIAL, STONES, ROOTS, LUMPS OF SOIL, TREE LIMBS, TRASH, CONSTRUCTION DEBRIS, OR OTHER OBJECTIONABLE MATERIAL. NEW PLANTING BEDS SHALL BE AMENDED WITH WELL-AGED COMPOST.
 - COMPOST SHALL BE A WELL DECOMPOSED, STABLE, WEED FREE ORGANIC MATTER SOURCE. IT SHALL BE DERIVED FROM AGRICULTURAL, FOOD, AND/OR YARD TRIMMINGS. THE PRODUCT SHALL CONTAIN NO SUBSTANCES TOXIC TO PLANTS AND SHALL BE REASONABLY FREE (LESS THAN 1 PERCENT BY DRY WEIGHT) OF MAN-MADE FOREIGN MATTER.
 - THOROUGHLY WATER ALL PLANTS WHEN 2/3 OF BACKFILL HAS BEEN PLACED TO ENSURE ALL AIR POCKETS ARE REMOVED. FIRMLY TAMP SOIL AROUND PLANT. ENSURE PROPER WATERING OF PLANT MATERIAL UNTIL ESTABLISHMENT.
- PRUNING:** PRUNE ALL PLANT MATERIAL TO REMOVE ANY AND ALL DEADWOOD. ALL PLANT MATERIAL SHALL BE PRUNED IN ACCORDANCE WITH GOOD HORTICULTURAL PRACTICES, AND IN SUCH A MANNER AS TO MAINTAIN THE NATURAL FORM OF THE PLANT. PRUNING SHALL BE COMPLETED UTILIZING ONLY CLEAN SHARP TOOLS. USE OF AXES FOR PRUNING IS UNACCEPTABLE.
- FERTILIZER:** UTILIZE ONLY SLOW AND/OR CONTROLLED RELEASE FERTILIZER, APPLIED AT THE MINIMUM APPLICATION RATES NEEDED TO ESTABLISH NEW VEGETATIVE GROWTH. APPLICATION RATES SHALL BE IN STRICT ACCORDANCE WITH FERTILIZER MANUFACTURER'S SPECIFICATIONS, ALL LOCAL, STATE, AND FEDERAL REGULATIONS, AND WITH ANY SECURED ENVIRONMENTAL PERMITTING.
- MULCH:** ALL PLANTINGS SHALL BE MULCHED AS INDICATED ON DRAWINGS. PLANTINGS INSTALLED IN CLUSTERS, OR WITHIN PLANTING BEDS SHALL BE MULCHED AS SUCH, INSTALLING MULCH THROUGHOUT THE ENTIRE PLANTING BED. MULCH TO BE 3"-4", OR AS OTHERWISE NOTED, IN DEPTH AND REDUCED TO LESS THAN 1" AT ROOT FLARE OF EACH PLANT.
 - MULCH SHALL BE WELL-AGED, SHREDED BARK MULCH, NATURAL DARK BROWN IN COLOR AND NON-DYED.
- LOAM AND SEED:**
 - LOAM AND SEED ALL DISTURBED AREAS, IN ACCORDANCE WITH THE PROJECT SOIL EROSION AND SEDIMENTATION CONTROL PLAN AND AS OUTLINED IN THE PROJECT STORMWATER OPERATION AND MAINTENANCE PLAN PREPARED BY THE PROJECT ENGINEER (SEE REFERENCES). ALL NEW LAWN/SEEDED AREAS SUBJECT TO EROSION SHALL BE STABILIZED UTILIZING EXCELSIOR BLANKET, JUTE MESH OR APPROVED EQUAL EROSION CONTROL FABRIC.
 - LOAM UTILIZED OR RETAINED FOR LAWN AREAS SHALL BE SANDY LOAM, 4"-6" IN DEPTH, AND CONFORMING TO THE REQUIREMENTS OF THE USDA FOR LAWN PLANTINGS. ON-SITE NATIVE LOAM MAY BE UTILIZED FOR LAWN AREAS, BUT SHALL BE AMENDED AND RAKED AS NECESSARY TO CONFORM TO THE REQUIREMENTS OF ANY OFF-SITE LOAM.
 - SEED MIX:**
 - UNLESS OTHERWISE SPECIFIED, SEED MIX UTILIZED SHALL BE SIMILAR TO 'LOW-GROWING WILDFLOWER AND GRASS MIX', AS SUPPLIED BY ERNST SEEDS, OR APPROVED EQUAL:
 - 66.9% Festuca ovina, Variety Not Stated (Sheep Fescue, Variety Not Stated)
 - 17.0% Lolium multiflorum (Annual Ryegrass)
 - 6.0% Linum perenne (Perennial Blue Flax)
 - 2.5% Chrysanthemum maximum (Shasta Daisy)
 - 2.0% Coreopsis lanceolata (Lanceleaf Coreopsis)
 - 2.0% Rudbeckia hirta (Blackeyed Susan)
 - 1.0% Chamaecrista fasciculata, PA Ecotype (Partridge Pea, PA Ecotype)
 - 1.0% Papaver rhoeas, Red (Corn Poppy, Red)
 - 0.4% Achillea millefolium (Common Yarrow)
 - 0.4% Asclepias tuberosa (Butterfly Milkweed)
 - 0.3% Aster oblongifolius, PA Ecotype (Aromatic Aster, PA Ecotype)
 - 0.2% Pycnanthemum tenuifolium (Narrowleaf Mountaintop)
 - 0.1% Penstemon canaliculatus (Common Gray Beardtongue)
 - 0.1% Penstemon hirsutus (Hairy Beardtongue)
 - SEEDING RATE FOR THIS MIX SHALL BE 20-40LB PER ACRE
 - SEED MIX IN DESIGNATED STORMWATER FACILITIES, BASINS, ETC., SHALL BE AS NOTED ON ENGINEER'S PLANS AND OPERATIONS AND MAINTENANCE MANUAL.
 - IF INSTALLING SEED UTILIZING HYDROSEEDER DEVICE, PROVIDE FIBER HYDRO MULCH AND STARTER FERTILIZER MIX. IF BROADCAST SEEDING, APPLY STARTER FERTILIZER PRIOR TO SEEDING AND TOPDRESS WITH 2" STRAW OR FIBER HYDRO MULCH (NO SEED) FOLLOWING SPREADING OF SEED.
 - ALL FERTILIZER SHOULD BE APPLIED IN THE MINIMUM RECOMMENDED APPLICATION RATE TO ENSURE GERMINATION AND ESTABLISHMENT OF SEEDING. APPLICATION RATES SHALL BE IN STRICT ACCORDANCE WITH FERTILIZER MANUFACTURER'S SPECIFICATIONS, ALL LOCAL, STATE, AND FEDERAL REGULATIONS, AND WITH ANY SECURED ENVIRONMENTAL PERMITTING.
 - MAINTENANCE AND MONITORING OF SEEDED AREAS:** SEEDED AREAS WILL BE REVIEWED AND MONITORED ON AN ANNUAL BASIS BY THE OWNER'S REPRESENTATIVE (LANDSCAPE ARCHITECT OR OTHER QUALIFIED ALLIED PROFESSIONAL) UNTIL SEED IS ESTABLISHED.
 - DURING THIS PERIOD, REPORTS SHALL BE PROVIDED TO THE OWNER, AND MUNICIPALITY IF REQUIRED, FOLLOWING EACH SITE REVIEW. IF REPAIR OR OTHER TREATMENTS TO SEEDED AREAS ARE REQUIRED DURING THIS PERIOD TO FURTHER THE PROGRESS OF SEEDED AREAS TO REACH ESTABLISHMENT, REPRESENTATIVE SHALL PROVIDE OWNER WITH SUGGESTED REPAIRS OR TREATMENT OPTIONS TO BE CARRIED OUT BY OWNER'S MAINTENANCE PERSONNEL.
 - POLLINATOR MEADOW GRASSES TO BE MOWED ONCE ANNUALLY IN LATE FALL AFTER FIRST FROST OR BEFORE PLANT GROWTH BEGINS IN LATE WINTER OR EARLY SPRING. ADDITIONAL MOWINGS ARE DISCOURAGED UNLESS WHEN REQUIRED FOR MAINTENANCE SUCH AS REPAIR OF EROSION OR REQUIRED MAINTENANCE OF SOLAR ARRAY EQUIPMENT, OR AS DIRECTED BY OWNER'S REPRESENTATIVE.
- LANDSCAPE BUFFER VERIFICATION BY OWNER'S REPRESENTATIVE LANDSCAPE ARCHITECT:** THE DESIGN INTENT FOR PROJECT BUFFERING IS TO PROVIDE A YEAR-ROUND ADEQUATE SCREENING OF THE PROPOSED FACILITY FROM ADJACENT PROPERTIES AND PUBLIC ROADWAYS, BASED ON ANTICIPATED FINAL SOLAR ARRAY AND DRAINAGE DESIGN LAYOUT. TOTAL QUANTITIES AND PLACEMENT OF PLANTINGS WILL BE AS NEEDED TO SUPPLEMENT EXISTING WOODED BUFFER FOLLOWING SITE CLEARING PROCEDURES AND TO ENSURE THAT SOLAR ARRAY IS SUITABLY OBSCURED FROM ADJACENT PROPERTIES AND PUBLIC ROADWAYS.
- FINAL LOCATIONS OF ANY SUPPLEMENTAL PLANTINGS SHALL BE REVIEWED AND VERIFIED BY LANDSCAPE ARCHITECT AND FIELD ADJUSTED AS-NEEDED PRIOR TO COMPLETION OF CONSTRUCTION PROCEDURES TO MAXIMIZE BUFFERING OF THE ARRAY, TO MINIMIZE ANY CONFLICTS WITH EXISTING WOODED BUFFER VEGETATION TO REMAIN AND FINAL AS-BUILT LOCATION OF ALL EXISTING AND PROPOSED PROJECT ELEMENTS, AND TO INFILL GAPS IN EXISTING VEGETATION, WHEN NEEDED, TO SUITABLY AND ADEQUATELY BUFFER SOLAR ARRAY AND ASSOCIATED EQUIPMENT FROM ADJUTING PROPERTIES AND PUBLIC ROADWAYS.



REVISION HISTORY:	
DATE	REVISION
6/5/23	Revised per HDC Comments: Plant Installation Size, Berm Extension, and Gate Height
1/3/24	Issued for City Preliminary/Final Plan Review: Revised per City Comments and Adjusted Array Layout

- REFERENCES:**
- Plan Entitled, "PROPOSED SITE PLAN", Drawing Number: C-101, Sheet 3 of 6; Prepared for: VCP, LLC; Prepared By: WSP USA Environment and Infrastructure, Inc.; Dated with Revisions Through 1/3/24, as amended.
 - Site Observations made by Kevin M. Alverson, LA, March 1, 2023

Knight Street Solar

998.4 KW DC Ground-Mount Solar PV Development

Plat 275, Lots 38 and 52
240 Knight Street
Warwick, RI 02886

Property Owner:
Sunshine Properties, LLC
181 Knight Street
Warwick, RI 02886

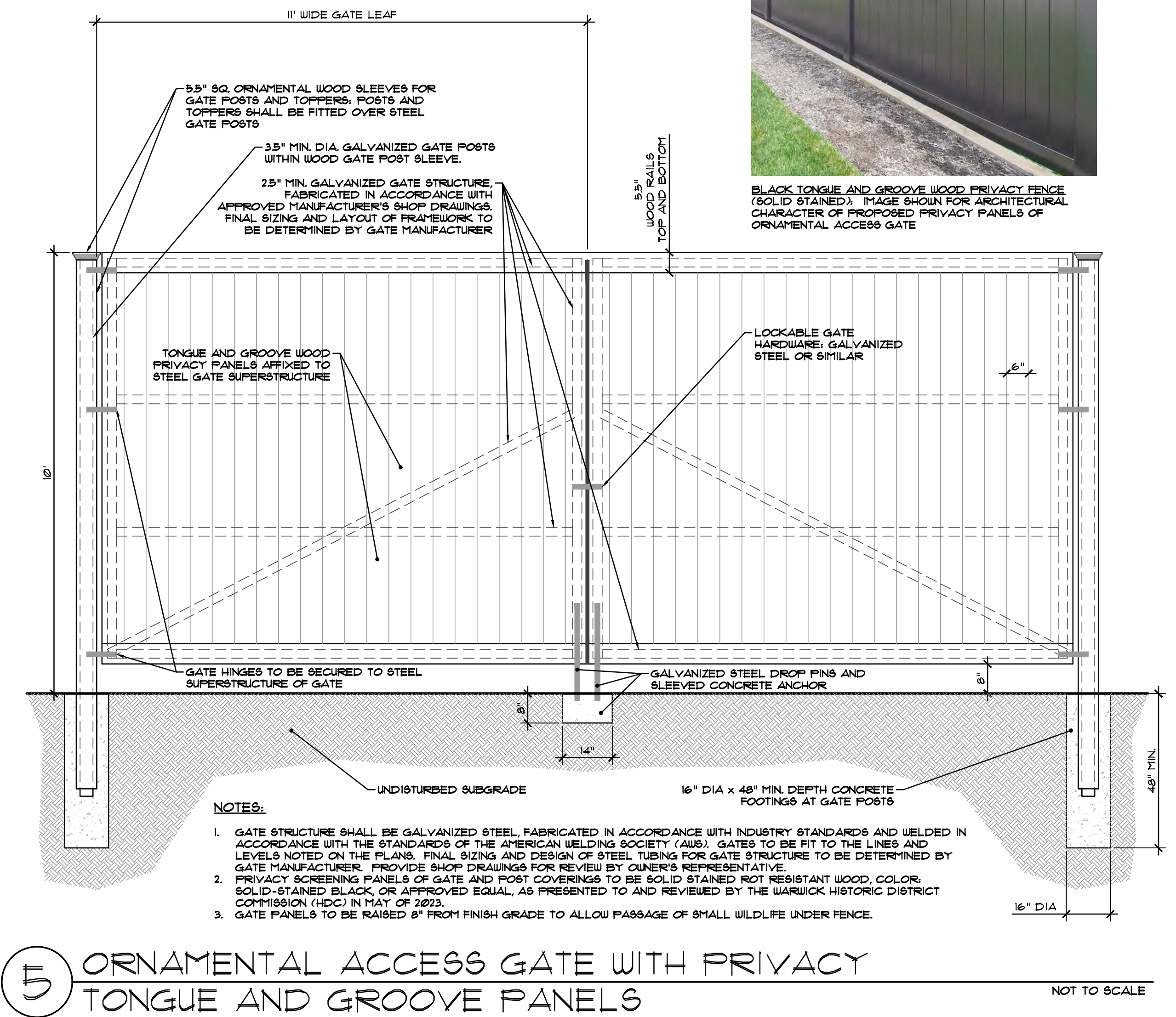
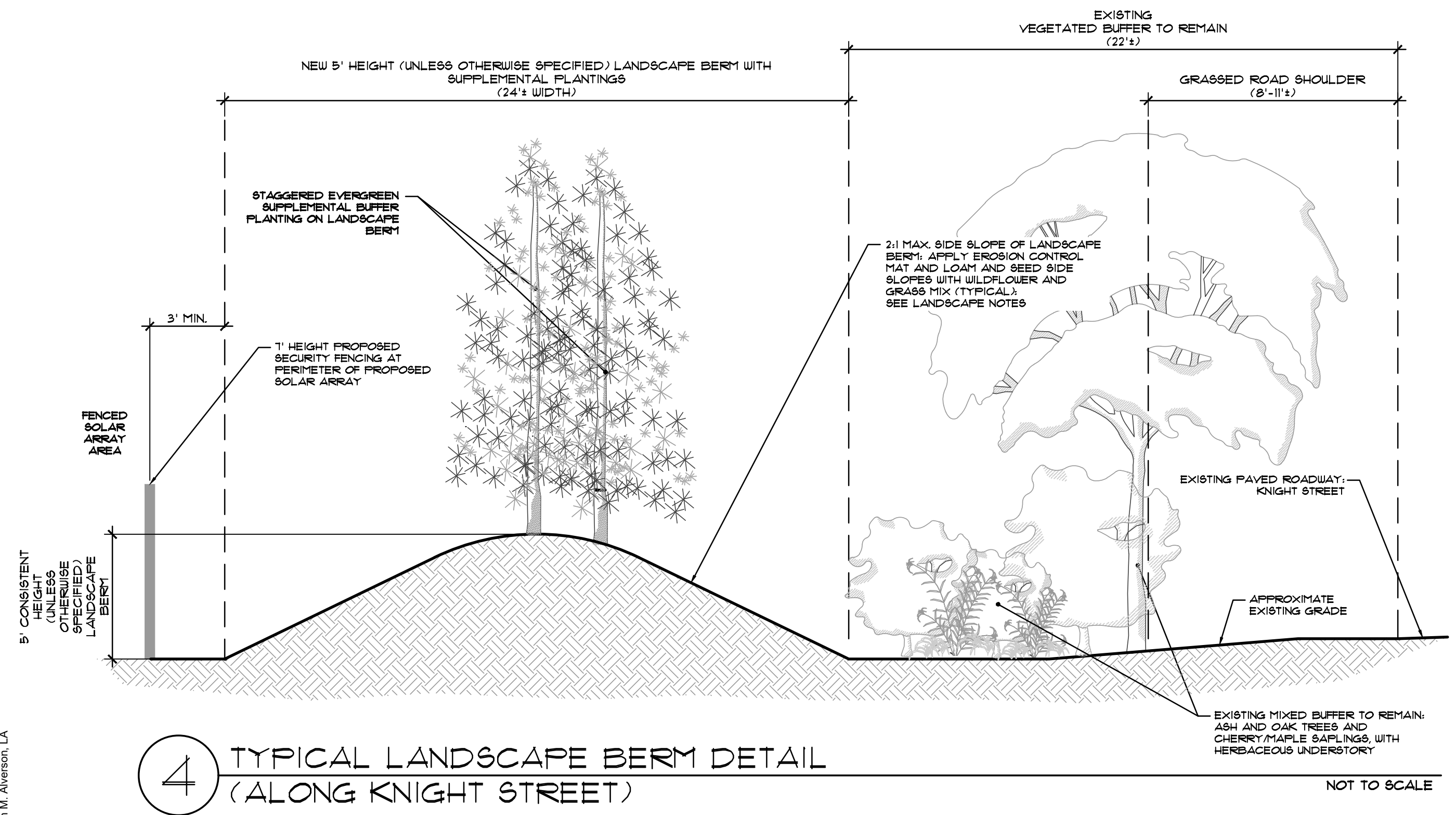
Developed By:
VCP, LLC
VEROGY
150 TRUMBULL ST.,
HARTFORD, CONNECTICUT 06103


Kevin M. Alverson
360 Annanquacket Road
Wickford, RI 02852
401.338.0044
KevinMAlversonLA.com

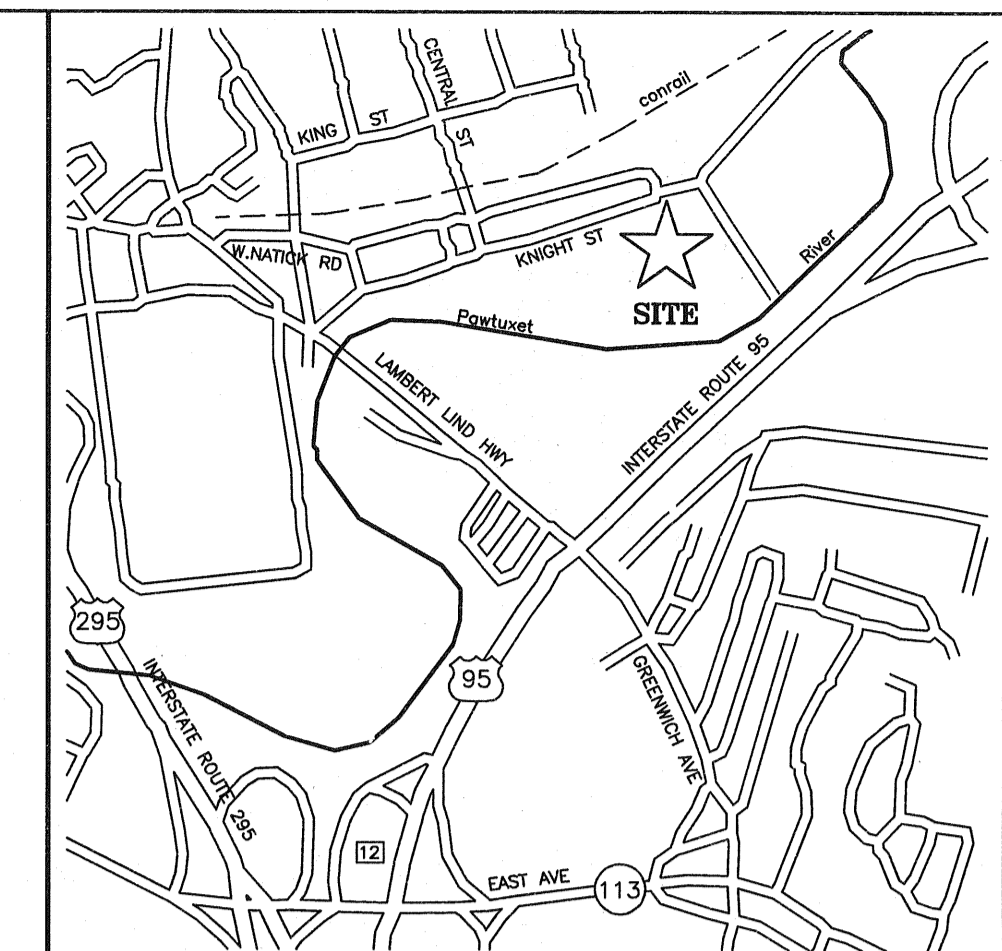
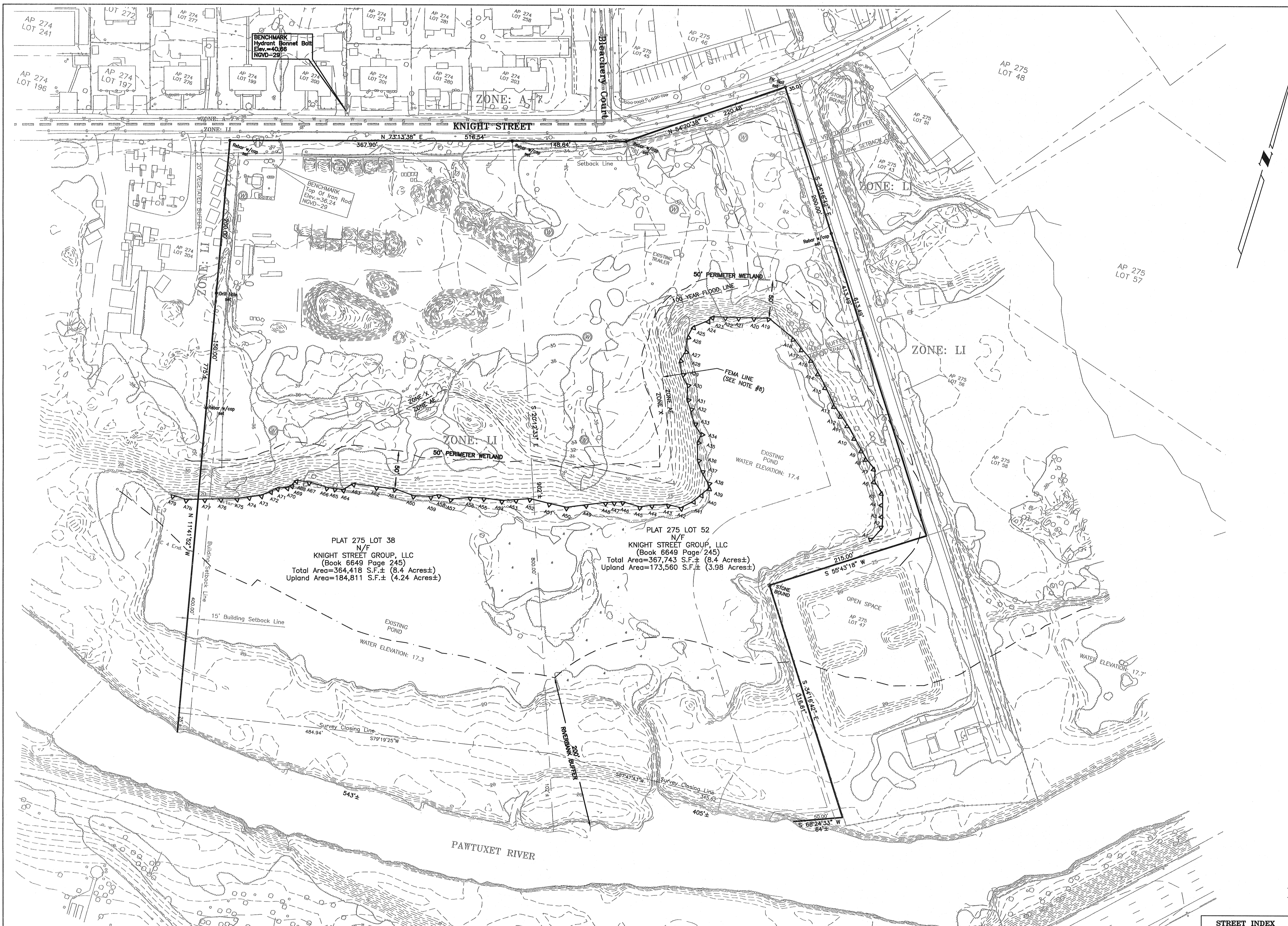


Landscape Notes and Details

Project #: 2.261.319	Sheet 2 of 2
Scale: As Shown	L-2
Drawn By: KMA	
Checked By: KMA	
Date: April 26, 2023	ISSUED FOR PERMITTING



© Kevin M. Alverson, LA



LOCATION MAP Scale: 1" = 1,200'±

DISTRICT DIMENSIONAL REGULATIONS

District	LI
Use	Non-Residential
Min. Lot Area	6,000 Sq. Ft.
Min. Frontage	60 feet
Min. Lot Width	60 feet
Min. Front Yard Depth	25 feet
Min. Cor. Side Yard Depth	25 feet
Min. Side Yard Depth	15 feet **
Min. Rear Yard Depth	20 feet **
Max. Structure Height	45 feet
Min. Landscaped Open Space	10%

** A commercial building or use shall be setback a minimum of 40 feet from an Open Space district parcel of 5,000 square feet or more.
 An industrial building or use shall be setback a minimum of 40 feet from an abutting commercial district and 100 feet from an Open Space district parcel of 5,000 square feet or more.
 A 20 foot wide landscaped buffer shall be provided along any property line that abuts a residence district, PDR overlay district, residential PUD overlay district, or an open space district where such lot contains at least 5,000 square feet including any coastal or freshwater wetlands.
 Parking requirements for wholesale business, storage space and warehouses: 1 per 500 sq.ft. of gross floor area.

- NOTES:**
- Reference is made to the following deed:
 A) A Warranty Deed from Towanda Associates, Inc. granted to Knight Street Group, LLC recorded August 16, 2007 in the City of Warwick Land Evidence Book 6649 Page 245.
 - Reference is made to the following plan:
 A) Existing Conditions Plan Figure 2 Site Investigation Report Former Pontiac Mills Property Plat 275 Lots 38 & 52 Warwick, Rhode Island Date 1-07-2008 Scale 1"=125' EA Engineering, Warwick, RI.
 - The planimetric features and topography was compiled from the plan referenced in Note #2A.
 The bearings and north arrow orientation depicted hereon are based upon NAD-83 per plan reference #2A.
 The topographic features depicted hereon are based upon NGVD-29 per plan reference #2A.
 - The utility information depicted hereon was compiled from information provided by the City of Warwick Department of Public Works and the City of Warwick Water Department July, 2008.
 - The gas line location depicted hereon was compiled from information provided by National Grid.
 - The wetlands depicted hereon were field survey located July 30, 2008 by Cherenzia & Associates, Ltd.
 - Flood Zone information from FIRN Flood Insurance Rate Map City of Warwick, Rhode Island Kent County Panel 2 of 9 Community-Panel Number 445409 0002 D Map Revised: April 16, 1991.
 - Flood Zone area was revised for locus parcel per:
 Federal Emergency Management Agency
 Letter Of Map Revision Floodway Determination Document (Removal)
 Date: March 20, 2007 Case No.: 07-01-0070A
 (100-year floodplain at elevation 29)

PLAT 275 LOT 38
 N/F
 KNIGHT STREET GROUP, LLC
 (Book 6649 Page 245)
 Total Area=364,418 S.F.± (8.4 Acres±)
 Upland Area=184,811 S.F.± (4.24 Acres±)

PLAT 275 LOT 52
 N/F
 KNIGHT STREET GROUP, LLC
 (Book 6649 Page 245)
 Total Area=367,743 S.F.± (8.4 Acres±)
 Upland Area=173,560 S.F.± (3.98 Acres±)

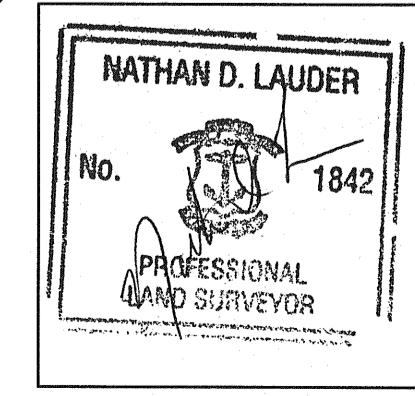
LEGEND

	EXISTING CONTOURS
	UTILITY POLE
	FENCE LINE
	SANITARY SEWER LINE
	STORM SEWER LINE
	GAS LINE
	WETLAND FLAG

This survey and plan conform to the following standards as adopted by the Rhode Island Board of Registration for Professional Surveyors.

Horizontal Classification: Class: I
 Vertical Classification: Topography & Benchmark: Class: Compiled
 (See Note #3)

By:
 Registered Professional Land Surveyor



STREET INDEX

KNIGHT STREET

PLAN REVISIONS

DATE	DESCRIPTION	DWN BY	CHK BY

CHERENZIA & ASSOCIATES, LTD.
 Raymond F. Cherenzia, P.E., L.S.
 Civil Engineers
 Land Surveyors
 Land Use Planners
 Environmental Consultants
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 Pawtucket, RI 02860
 Tel (800) 829-8500
 Fax (860) 899-8000
 P.O. Box 619
 Westerly, RI 02891
 Mailing Address
 Web Site: www.Cherenzia.com

BOUNDARY & TOPOGRAPHIC SURVEY
 PREPARED FOR
KNIGHT STREET GROUP, LLC
 PLAT 275 LOTS 38 & 52
 KNIGHT STREET
 WARWICK, RHODE ISLAND
 SCALE: 1"=60'
 MARCH 27, 2009
 DRAWN BY: TWS
 CHECK BY: NDL
 SHEET: 1 OF 1
 JOB NO.: 208064

ATTACHMENT

C

STORMWATER
MANAGEMENT PLAN

VPC, LLC

STORMWATER MANAGEMENT REPORT

PROPOSED SOLAR DEVELOPMENT

KNIGHT STREET

PLAT 275 LOTS 38 AND 52

KNIGHT STREET

WARWICK, RI





STORMWATER MANAGEMENT REPORT

PROPOSED SOLAR
DEVELOPMENT – KNIGHT
STREET

PLAT 275 LOTS 38 AND 52
KNIGHT STREET
WARWICK, RI

VPC, LLC

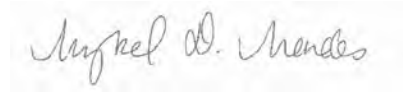
PROJECT NO.: 3652-200299
DATE: NOVEMBER 30, 2022

WSP
100 APOLLO DRIVE, SUITE 302
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PREPARED BY



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Project Engineer

APPROVED BY



Andrew Vardakis, PE
Project Manager

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1.0 INTRODUCTION

On behalf of VCP, LLC, WSP USA Environment & Infrastructure, Inc. (WSP) has prepared this Stormwater Management Report in support of a proposed solar development project (roughly 998.4 kW DC) to be located on Knight Street in Warwick, Rhode Island.

The proposed solar facility (the “Site” or the “Project”) will be located on a portion of the property defined by the City of Warwick as Assessor’s Plat (AP) 275 Lot 38 and 52 (16.3± acres). The subject parcels are located more than 1,500 feet south of the municipal boundary between the Cities of Cranston and Warwick. The Site is located in a developed area that currently contains trailers utilized for material and equipment storage, retaining walls used to contain landscaping material stockpiles, and a small shed utilized as an office for a landscaping company.



Figure 1: Site Location

The Site is bounded by wetlands and the Pawtuxet River to the South; forest, wetlands, and commercial properties to the east; industrial, commercial, and higher elevation residential properties to the north; and industrial properties including the former Pontiac Mills property and wetlands to the west.

The City of Warwick allows the use of an “Electric Power Plant” with a Special Use Permit in Zone GI General Industrial zoning district only. The entirety of the project site is zoned “LI”, Limited Industrial; therefore, a zone petition application and special use permit will be submitted to the City Council.

Access to the site is from Knight Street. The proposed access road to the site will be a minimum of 15 feet wide with a 24-foot-wide gate at the fence line and designed to conform to all City requirements. The entire project will be fenced and gated for safety.

2.0 EXISTING CONDITIONS

The site is currently vacant land that was formerly an undeveloped portion of the Pontiac Mill Property. The Site is currently developed with a small shed utilized as an office for a landscaping company, and is occupied by equipment and material storage, as well as retaining walls used to contain landscaping materials such as stone and mulch. Based on the City of Warwick Web GIS Maps and RIGIS 2011 Land Use Data, surrounding land uses include industrial properties, water, wetlands, mixed forest, and high density residential. There are no structural best management practices in place for controlling stormwater runoff under existing conditions. Overall topography indicates surface stormwater flows from the northwest corner towards the southeast portion of the Site.

2.1 Wetlands

A letter titled, “Freshwater Wetland Delineations” was provided by Natural Resource Services, Inc. (NRS) for the Project. Based on NRS’ report, the property contains wetland resource areas within the jurisdiction of the Rhode Island Department of Environmental Management (RIDEM). These include a swamp contiguous to a pond and the Pawtuxet River which borders the southern edge of the property. The RIDEM jurisdictional areas associated with these wetlands are as follows:

- Swamps: 50-foot perimeter wetland
- River > 10 feet in width: 200-foot riverbank wetland

All work is proposed in upland areas.

2.2 Historic Contamination and Proposed Remediation

The Site is currently considered a brownfield based on contamination identified from historic operations that occurred between 1800s to 1996 by textile manufacturers, artisans, craftsmen, and retailers. From 1995 to 2008, multiple site inspections and site investigations identified the presence of contaminants such as polychlorinated biphenyls (PCBs), metals, volatile organic compounds (VOCs) through soil and groundwater sampling.

In addition to filing a Preliminary Determination Application with the (RIDEM) Freshwater Wetlands (FWW) Section and Rhode Island Pollutant Discharge Elimination System (RIPDES) Permit with the RIPDES Section for the Project, VCP, LLC and WSP are coordinating with with RIDEM’s Office of Revitalization and Sustainable Materials Management to remediate and redevelop the Site. The preferred remedial alternative includes an engineered cap designed in accordance with RIDEM’s Site Remediation and Landfill Closure Programs. Following remediation, the Site will be redeveloped by placing the proposed solar development above the engineered cap.

2.3 Watersheds

The project site ultimately drains to the Pawtuxet River (ID Number: RI0006017R-03). According to the report titled, “State of Rhode Island 2016 Impaired Waters Report, Final, March 2018” published by the RIDEM Office of Water Resources and RIDEM mapping, Pawtuxet River is an Integrated Report Category 5, Class B1 waterbody and listed with a TMDL schedule for Cadmium, Enterococcus, Non-Native Aquatic Plants, Total Phosphorus, and Mercury in Fish Tissue.

2.4 Groundwater and Soil Evaluation

The Natural Resources Conservation Services (NRCS) Web Soil Survey mapping identified the soils on-site as follow: **See Appendix A.1** for NRCS Web Soil Survey Map – Hydrologic Soil Group.

Table 1: Soils

Map Unit	Map Unit Name	Hydrologic Soil Group
MmB	Merrimac fine sandy loam, 3 to 8 percent slopes	A
Ur	Urban Land	n/a
UD	Udorthents-Urban land complex	n/a
W	Water	n/a
RU	Rippowam fine sandy loam	B/D

The development area of the Site is predominantly Udorthents- Urban land complex (UD), which is defined as human transported material. The areas in the immediate vicinity of the proposed development include water, merrimac fine sandy loam, rippowam fine sandy loam, and urban land.

Based on RIDEM's Environmental Resource Map, groundwater at the site is classified as GB. From the NRCS online database, the groundwater table within the parcel boundary ranges from 1 to >6.5. The groundwater table for the proposed solar development area is approximately 4± feet. According to the report titled, "Site Investigation Report Former Pontiac Mills Property Plat 275, Lots 38 and 52 Warwick, Rhode Island, Final, March 2008" prepared by EA Engineering Science and Technology, Inc., groundwater has been measured at depths ranging from 6 feet to 16 feet below ground surface at the Site.

2.5 Natural Heritage Area

Based on RIDEM's Environmental Resource Map, there no Natural Heritage Areas located within the project site.

2.6 FEMA

Based on the most recent Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Maps (FIRM) 44003C0127H, dated 10/02/2015 for the City of Warwick, Kent County, Rhode Island, most of the Site is located within Flood Zone X (areas determined to be inside of the 0.2% annual chance floodplain). An area designated as "Flood Zone AE" (areas determined to be inside of the 1% annual chance floodplain and Regulatory Floodway) are located along the southern boundary; however, all currently proposed development areas are located within Zone X; therefore, there are no anticipated flood zone issues. See **Appendix A.3** for FEMA Flood Maps.

2.7 Design Points

WSP conducted an evaluation of the existing site conditions and topography to determine the most-suitable Design Point for analysis of pre- and post-development peak development flow rates, as described in the following sections of this Stormwater Management Report. The stormwater runoff generated by the area of contribution flows to the same Design Point in both pre- and post-development conditions. One design point was analyzed:

- Design Point 1 "DP-1" is a wetland, which spans adjacent to the southern portion of the Site.

2.8 Pre-development Analysis

Under pre-development conditions, the Site was divided into one (1) sub-watershed (total area = 8.4± acres) which contribute to the above-referenced Design Point. Peak discharge rates were evaluated for the 1-year, 2-year, 10-year, 25-year and 100-year storm events. See **Appendix B.1** for Pre-Development HydroCAD Calculations and Appendix I for a 24"x36" sheet Pre-development Drainage Figure.

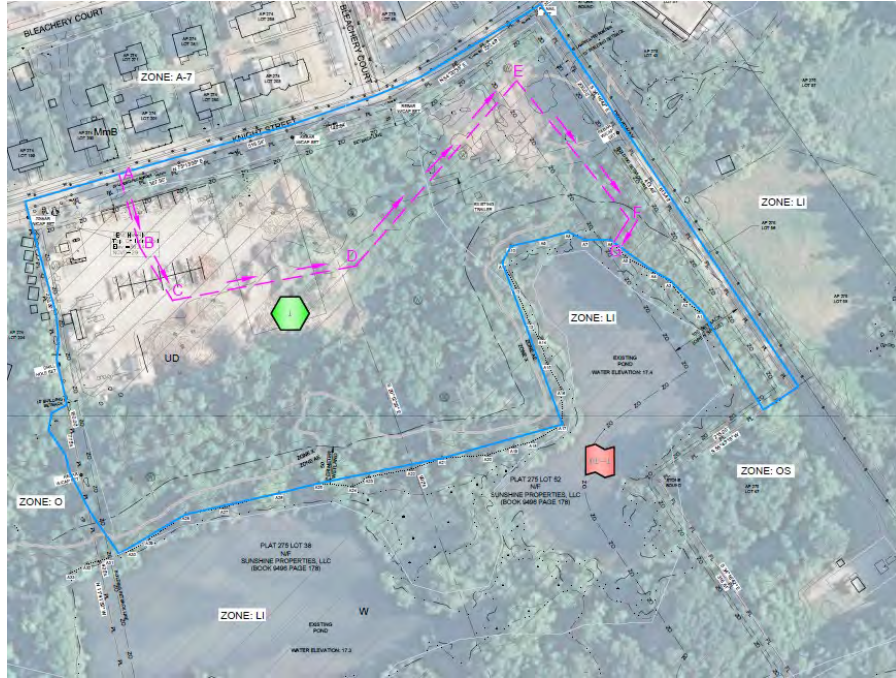


Figure 2: Pre-Development Drainage Figure

- Sub-watershed "DA-1" is 8.4± acres and encompasses the entire the Site. It is comprised of pervious surface including woods and grass combination in good condition, bare soil, and a small area of impervious cover (driveway and roadway). Runoff flows overland to the south directly to the wetland (DP-1) as described above.

3.0 PROPOSED CONDITIONS

Under proposed conditions, a proposed 998.4 kW DC solar array will occupy approximately 3.9± acres (within perimeter fence) of the 16.3± acre property. The proposed solar development project will be sited predominantly within the cleared developed open area. Earthwork operations are anticipated as part of the preferred remedial alternative to bring the Site into compliance with RIDEM Rules and Regulations for the Investigation and Remediation of Hazardous Materials Releases (250-RICR-140-30-1). The proposed solar development will emulate existing drainage patterns, with stormwater runoff from the project flowing towards the southern portion of the Site.

The proposed solar panels will be placed on a ballasted racking system set at a tilt angle above finished grade (see an example in Figure 3). Panel rows will be oriented due south, separated by grass strips.

The proposed access road will conform to Town and RIDOT requirements and will be composed of angular crushed stone for the purpose of maintaining infiltration capacity. The project will also include one equipment pad and a 7-foot chain link fence.



Figure 3: Sample Installed Solar Array
Note: proposed site will be mounted on ballast blocks rather than embedded posts.

3.1 Proposed Conditions Contributing Areas

Under post-development conditions, the Site was divided into one (1) sub-watershed (total area = 8.4± acres) contributing to the previously described Design Point, where peak discharge rates were evaluated for the 1-year, 2-year, 10-year, 25-year, and 100-year storm events. See **Appendix B.2** for Proposed HydroCAD calculations and Appendix C for a 24" x 36" Proposed Drainage Figure.



Figure 4: Post Development Drainage Figure

- Sub-watershed “DA-1” is 8.4± acres and includes the entire Site. It is comprised of pervious surface including woods and grass in good condition and meadow grass, paved roads, one concrete equipment pad, ballast blocks, gravel pads, and a pervious crushed stone access drive. Runoff flows overland to the south directly to the adjacent wetland (DP-1) as described above.

4.0 Hydrologic Analysis

The hydrologic analysis was performed using HydroCAD software for a 24-hour, Type III rainfall event for for Kent County (1-year: 2.7 inches; 2-year: 3.3 inches; 10-year: 4.8 inches; 25-year: 6.2 inches; 100-year: 8.7 inches) and one overall points of analysis, “Design Point 1” (DP-1) to the wetlands. The point of analysis was previously described as the wetlands along the southern border of the site. Table 2 and Table 3 provides a summary of this analysis, which shows that post-development peak discharge rates will be less than or equal to pre-development peak discharge rates for the 1-, 2-, 10-, 25- and 100-year events.

Table 2: Hydrologic Analysis Summary – Peak Discharge Rates

Design point	Description	Design Storm	Peak Flow (CFS)	
			Existing	Proposed
DP-1 Wetlands		1-Year	2.61	0.01
		2-Year	4.74	0.06
		10-Year	11.26	0.90
		25-Year	18.24	3.15
		100-Year	31.75	9.57

5.0 CONCLUSIONS

This project has been designed in accordance with the latest edition of the RISDISM, Section 3.2 Minimum Stormwater Management Standards, as summarized below and provided in other submission documents.

5.1 Minimum Standard 1: LID Site Planning and Design Strategies

“LID Site planning and design strategies must be used to the maximum extent practicable in order to reduce the generation of the water runoff volume for both new and redevelopment projects.”

Standard Met

LID site planning and design strategies have been employed on this project to the maximum extent practicable. The Stormwater Management Plan checklist from “Appendix A” of the (RISDISM) has been prepared and is provided under separate cover. This document provides data to show compliance with this standard.

5.2 Minimum Standard 2: Groundwater Recharge

“Stormwater must be recharged within the same sub-watershed to maintain base flow at pre-development recharge levels to the maximum extent practicable.”

Standard Met

The proposed development introduces a negligible amount of new impervious area to the site. Furthermore, proposed loaming and seeding of the existing bare soil provides additional groundwater recharge to ensure pre-development base flow is maintained to the maximum extent practicable; therefore, the requirements of Minimum Standard 2 have been met.

5.3 Minimum Standard 3: Water Quality

“Stormwater runoff must be treated before discharge.”

Standard Not Applicable

The proposed development introduces a negligible amount of impervious area to the site and the area designated for the solar PV array installation will be utilized and maintained similarly to the surrounding meadow. No discernable changes to runoff patterns are anticipated because of the proposed development. Therefore, Minimum Standard 3 is not applicable.

5.4 Minimum Standard 4: Conveyance and Natural Channel Protection

“Protection for natural channels downstream must be supplied by providing 24-hour extended detention of the one-year, 24-hour Type III design storm event runoff volume.”

Standard Waived

In accordance with 3.3.4 of the RISDISM, the proposed development will introduce less than one acre of impervious area (0.163 acre) and therefore Minimum Standard 4 is waived.

5.5 Minimum Standard 5: Overbank Flood Protection

“Downstream overbank flood protection must be provided by attenuating the post-development peak discharge rate to the pre-development levels for the 10-year and 100-year, 24-hour Type III design storm

events. In addition, designers must demonstrate that runoff from the Site for storms up to the 100-year, 24-hour Type III design storm events actually reach proposed structural practices designed to meet this criterion

Standard Met

The proposed site has been designed to attenuate the post-development peak discharge rates to pre-development levels for the 10- and 100-year storm events in accordance with the requirements of Minimum Standard 5.

5.6 Minimum Standard 6: Redevelopment and Infill Projects

“The purpose of this minimum standard is to establish the alternative requirements for projects or portions of a project where existing impervious areas will be redeveloped or where the Site qualifies as infill.”

Standard Not Applicable

This project is not considered a redevelopment of existing impervious areas or infill project; therefore, Minimum Standard 6 is not applicable to this project.

5.7 Minimum Standard 7: Pollution Prevention

“All development Sites require the use of source control and pollution prevention measures to minimize the impact that the land use may have on stormwater runoff quality.”

Standard Met

Pollution prevention is addressed in the Soil Erosion and Sedimentation Control Plan provided under separate cover, which confirms that the requirements of Minimum Standard 7 have been met.

5.8 Minimum Standard 8: LUHPPLs

“Stormwater discharges from land uses with higher potential pollutant loads (LUHPPLs) require the use of specific source control and pollution prevention measures and the specific stormwater BMPs approved for such use.”

Standard Not Applicable

Prior to construction of the solar array, the existing Site contamination will be remediated with an engineered cap. No BMPs are proposed because post-development peak discharge rates will be less than pre-development peak discharge rates for the 1-, 2-, 10-, 25- and 100-year events. The stormwater discharge reduction is due to ground cover change from the existing bare soil to a capped loamed and seeded surface; Therefore, Minimum Standard 8 is not applicable to this project.

5.9 Minimum Standard 9: Illicit Discharges

“All illicit discharges to stormwater management systems are prohibited.”

Standard Met

There are no existing or proposed illicit discharges from the Site; therefore, Minimum Standard 9 has been met.

5.10 Minimum Standard 10: Construction ESC

“Erosion and sedimentation control (ESC) practices must be utilized during the construction phase as well as during any land disturbing activities. ESC practices must meet the following minimum design criteria: temporary sediment trapping practices must be sized to store 1 inch of runoff from the contributing area or per the sediment volume method (Rhode Island Soil Erosion and Sediment Control Handbook), whichever is greater; and temporary conveyance practices must be sized to handle the peak flow from the 10-year, 24-hour Type III design storm.”

Standard Met

Soil erosion and sedimentation controls have been incorporated into the proposed site design. A Soil Erosion and Sediment Control Plan has been developed and is provided under separate cover. This document demonstrates compliance with Minimum Standard 10.

5.11 Minimum Standard 11: Stormwater Management O&M

“The stormwater management system, including all structural stormwater controls and conveyances, must have an operation and maintenance plan to ensure that it continues to function as designed.”

Standard Met

An Operations and Maintenance Plan has been developed and is provided under separate cover. This document demonstrates compliance with Minimum Standard 11.

APPENDIX

A

BACKGROUND
INFORMATION

APPENDIX

A.1 NRCS SOILS MAP



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 State of Rhode Island: Bristol, Kent, Newport, Providence, and Washington Counties



Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

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scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

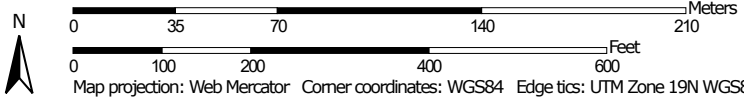
Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report Soil Map



Map Scale: 1:2,590 if printed on A landscape (11" x 8.5") sheet.



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)




















Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines


 Soil Map Unit Points

Special Point Features

-  Blowout
-  Borrow Pit
-  Clay Spot
-  Closed Depression
-  Gravel Pit
-  Gravelly Spot
-  Landfill
-  Lava Flow
-  Marsh or swamp
-  Mine or Quarry
-  Miscellaneous Water
-  Perennial Water
-  Rock Outcrop
-  Saline Spot
-  Sandy Spot
-  Severely Eroded Spot
-  Sinkhole
-  Slide or Slip
-  Sodic Spot

-  Spoil Area
-  Stony Spot
-  Very Stony Spot
-  Wet Spot
-  Other
-  Special Line Features

Water Features

 Streams and Canals

Transportation

-  Rails
-  Interstate Highways
-  US Routes
-  Major Roads
-  Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

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 map measurements.

Source of Map: Natural Resources Conservation Service
 Web Soil Survey URL:
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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

Soil Survey Area: State of Rhode Island: Bristol, Kent, Newport, Providence, and Washington Counties
 Survey Area Data: Version 20, Jun 9, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 24, 2020—Jul 18, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
MmB	Merrimac fine sandy loam, 3 to 8 percent slopes	0.3	1.7%
Ru	Rippowam fine sandy loam	4.7	27.7%
UD	Udorthents-Urban land complex	7.1	42.2%
Ur	Urban land	0.2	1.4%
W	Water	4.6	27.0%
Totals for Area of Interest		16.9	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate

Custom Soil Resource Report

pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

State of Rhode Island: Bristol, Kent, Newport, Providence, and Washington Counties

MmB—Merrimac fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyqs
Elevation: 0 to 1,290 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Merrimac and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Outwash plains, kames, eskers, moraines, outwash terraces
Landform position (two-dimensional): Backslope, footslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand
2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Maximum salinity: Nonsaline (0.0 to 1.4 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water capacity: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A

Custom Soil Resource Report

Ecological site: F145XY008MA - Dry Outwash
Hydric soil rating: No

Minor Components

Sudbury

Percent of map unit: 5 percent
Landform: Outwash plains, terraces, deltas
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent
Landform: Kames, deltas, outwash plains, eskers
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

Windsor

Percent of map unit: 3 percent
Landform: Outwash terraces, outwash plains, deltas, dunes
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Agawam

Percent of map unit: 2 percent
Landform: Outwash terraces, outwash plains, kames, eskers, stream terraces, moraines
Landform position (three-dimensional): Rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Ru—Rippowam fine sandy loam

Map Unit Setting

National map unit symbol: 9lx2
Elevation: 0 to 810 feet
Mean annual precipitation: 44 to 50 inches
Mean annual air temperature: 48 to 50 degrees F
Frost-free period: 115 to 190 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Rippowam and similar soils: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rippowam

Setting

Landform: Flood plains

Down-slope shape: Linear

Across-slope shape: Concave

Parent material: Coarse-loamy alluvium over sandy and gravelly alluvium derived from granite and gneiss

Typical profile

A - 0 to 5 inches: fine sandy loam

Bg1 - 5 to 12 inches: fine sandy loam

Bg2 - 12 to 19 inches: fine sandy loam

BCg1 - 19 to 24 inches: sandy loam

BCg2 - 24 to 27 inches: sandy loam

Cg1 - 27 to 31 inches: loamy sand

Cg2 - 31 to 65 inches: stratified very gravelly coarse sand to loamy fine sand

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Poorly drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)

Depth to water table: About 0 to 18 inches

Frequency of flooding: FrequentNone

Frequency of ponding: None

Available water capacity: Low (about 5.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4w

Hydrologic Soil Group: B/D

Ecological site: F144AY014CT - Wet Sandy Low Floodplain

Hydric soil rating: Yes

Minor Components

Swansea

Percent of map unit: 8 percent

Landform: Kettles, depressions, bogs, swamps, marshes

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Talf

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: Yes

Pootatuck

Percent of map unit: 7 percent

Landform: Flood plains

Custom Soil Resource Report

Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

UD—Udorthents-Urban land complex

Map Unit Setting

National map unit symbol: 9lxj
Elevation: 0 to 670 feet
Mean annual precipitation: 44 to 50 inches
Mean annual air temperature: 48 to 50 degrees F
Frost-free period: 120 to 211 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 70 percent
Urban land: 20 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Setting

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Human transported material

Typical profile

A - 0 to 12 inches: sandy loam
C1 - 12 to 25 inches: sandy loam
C2 - 25 to 60 inches: stratified sand to very gravelly coarse sand

Properties and qualities

Slope: 0 to 15 percent
Depth to restrictive feature: More than 80 inches
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 42 to 54 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.5 inches)

Description of Urban Land

Setting

Parent material: Human transported material

Typical profile

R - 0 to 6 inches: variable

Custom Soil Resource Report

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 8s

Hydric soil rating: No

Minor Components

Quonset

Percent of map unit: 5 percent

Landform: Outwash terraces, terraces, outwash plains, eskers

Down-slope shape: Convex

Across-slope shape: Convex

Hydric soil rating: No

Merrimac

Percent of map unit: 5 percent

Landform: Kames, outwash plains, terraces

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Ur—Urban land

Map Unit Setting

National map unit symbol: 9lxx

Elevation: 0 to 810 feet

Mean annual precipitation: 44 to 50 inches

Mean annual air temperature: 48 to 50 degrees F

Frost-free period: 100 to 211 days

Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Parent material: Human transported material

Minor Components

Udorthents

Percent of map unit: 5 percent

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Canton

Percent of map unit: 2 percent
Landform: Hills
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Charlton

Percent of map unit: 2 percent
Landform: Hills
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Pittstown

Percent of map unit: 2 percent
Landform: Drumlins
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Merrimac

Percent of map unit: 1 percent
Landform: Kames, outwash plains, terraces
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Sudbury

Percent of map unit: 1 percent
Landform: Outwash plains, terraces
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Newport

Percent of map unit: 1 percent
Landform: Drumlins
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

Sutton

Percent of map unit: 1 percent
Landform: Depressions, drainageways
Down-slope shape: Linear, concave
Across-slope shape: Concave
Hydric soil rating: No

W—Water

Map Unit Setting

National map unit symbol: 9lxl

Mean annual precipitation: 44 to 50 inches

Mean annual air temperature: 48 to 50 degrees F

Farmland classification: Not prime farmland

Map Unit Composition

Water: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

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Custom Soil Resource Report

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APPENDIX

A.2 FLOOD INSURANCE RATE MAP (FIRM)



FLOOD HAZARD INFORMATION
SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR DRAFT FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) Zone A, V, A99
	With BFE or Depth Zone AE, AO, AH, VE, AR
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
	Future Conditions 1% Annual Chance Flood Hazard Zone X
	Area with Reduced Flood Risk due to Levee See Notes Zone X
	Area with Flood Risk due to Levee Zone D
OTHER AREAS	NO SCREEN Area of Minimal Flood Hazard Zone X
	Effective LOMRs
	Area of Undetermined Flood Hazard Zone D
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
	20.2 Cross Sections with 1% Annual Chance
	17.5 Water Surface Elevation
	Coastal Transect
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
OTHER FEATURES	Base Flood Elevation Line (BFE)
	Limit of Study
	Jurisdiction Boundary

NOTES TO USERS

For information and questions about this Flood Insurance Rate Map (FIRM), available products associated with this FIRM, including historic versions, the current map date for each FIRM panel, how to order products, or the National Flood Insurance Program (NFIP) in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-6627) or visit the FEMA Flood Map Service Center website at <https://msc.fema.gov>. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates, refer to the Flood Insurance Study Report for this jurisdiction.

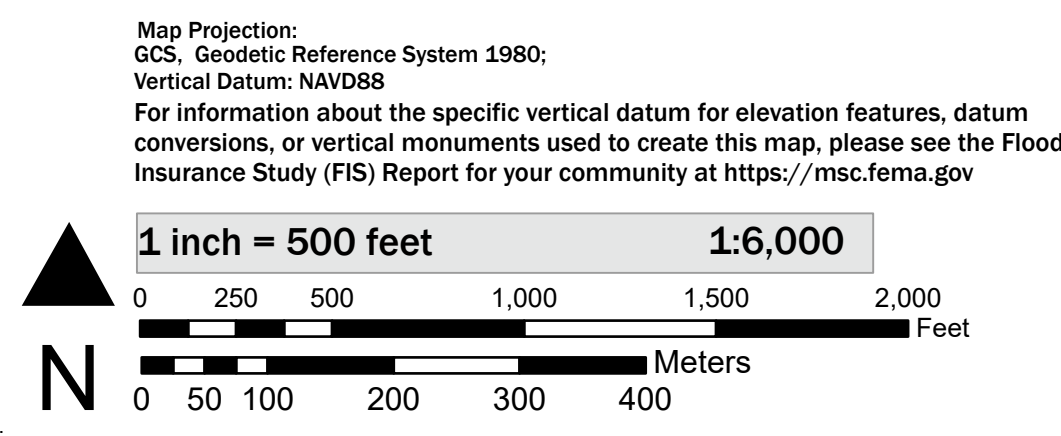
To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Basemap information shown on this FIRM was provided in digital format by the United States Geological Survey (USGS). The basemap shown is the USGS National Map: Orthoimagery. Last refreshed October, 2020.

This map was exported from FEMA's National Flood Hazard Layer (NFHL) on 2/18/2021 2:04 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time. For additional information, please see the Flood Hazard Mapping Updates Overview Fact Sheet at <https://www.fema.gov/media-library/assets/documents/118418>

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The map complies with FEMA's standards for the use of digital flood maps if it is not void as described below.

SCALE



NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP
KENT COUNTY, RHODE ISLAND
ALL JURISDICTIONS
PANEL 127 OF 251

Panel Contains:

COMMUNITY	NUMBER	PANEL
CITY OF CRANSTON	445396	0127
CITY OF WARWICK	445409	0127

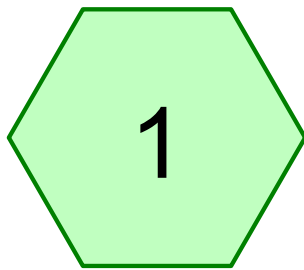
APPENDIX

B

HYDROCAD ANALYSES

APPENDIX

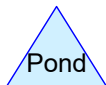
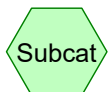
B.1 EXISTING HYDROCAD ANALYSIS



DA-1



Wetland



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Page 2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
184,717	77	Fallow, bare soil, HSG A (1)
68,183	94	Fallow, bare soil, HSG D (1)
7,318	98	Paved roads w/curbs & sewers, HSG A (1)
4,115	98	Paved roads w/curbs & sewers, HSG D (1)
93,777	32	Woods/grass comb., Good, HSG A (1)
9,121	79	Woods/grass comb., Good, HSG D (1)
367,231	69	TOTAL AREA

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Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
285,812	HSG A	1
0	HSG B	
0	HSG C	
81,419	HSG D	1
0	Other	
367,231		TOTAL AREA

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Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
184,717	0	0	68,183	0	252,900	Fallow, bare soil
7,318	0	0	4,115	0	11,433	Paved roads w/curbs & sewers
93,777	0	0	9,121	0	102,898	Woods/grass comb., Good
285,812	0	0	81,419	0	367,231	TOTAL AREA

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Type III 24-hr 1-yr Rainfall=2.70"

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Time span=5.00-24.00 hrs, dt=0.05 hrs, 381 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: DA-1

Runoff Area=367,231 sf 3.11% Impervious Runoff Depth>0.51"
Flow Length=1,034' Tc=21.8 min CN=69 Runoff=2.61 cfs 15,668 cf

Link DP-1: Wetland

Inflow=2.61 cfs 15,668 cf
Primary=2.61 cfs 15,668 cf

Total Runoff Area = 367,231 sf Runoff Volume = 15,668 cf Average Runoff Depth = 0.51"
96.89% Pervious = 355,798 sf 3.11% Impervious = 11,433 sf

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Page 6

Summary for Subcatchment 1: DA-1

Runoff = 2.61 cfs @ 12.38 hrs, Volume= 15,668 cf, Depth> 0.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-yr Rainfall=2.70"

Area (sf)	CN	Description
93,777	32	Woods/grass comb., Good, HSG A
7,318	98	Paved roads w/curbs & sewers, HSG A
184,717	77	Fallow, bare soil, HSG A
9,121	79	Woods/grass comb., Good, HSG D
4,115	98	Paved roads w/curbs & sewers, HSG D
68,183	94	Fallow, bare soil, HSG D
367,231	69	Weighted Average
355,798		96.89% Pervious Area
11,433		3.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	100	0.0100	0.30		Sheet Flow, AB Fallow n= 0.050 P2= 3.00"
1.3	85	0.0120	1.10		Shallow Concentrated Flow, BC Nearly Bare & Untilled Kv= 10.0 fps
7.6	251	0.0030	0.55		Shallow Concentrated Flow, CD Nearly Bare & Untilled Kv= 10.0 fps
3.9	325	0.0190	1.38		Shallow Concentrated Flow, DE Nearly Bare & Untilled Kv= 10.0 fps
3.3	237	0.0140	1.18		Shallow Concentrated Flow, EF Nearly Bare & Untilled Kv= 10.0 fps
0.2	36	0.1470	3.83		Shallow Concentrated Flow, FG Nearly Bare & Untilled Kv= 10.0 fps
21.8	1,034	Total			

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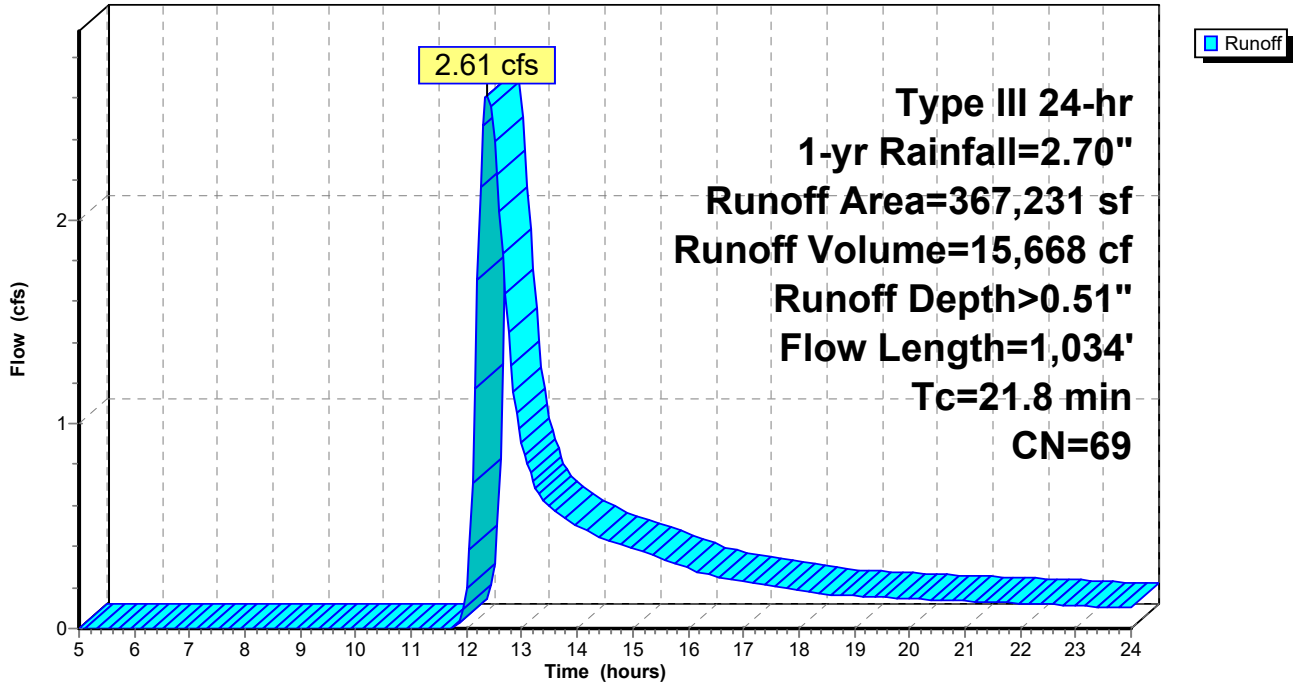
Type III 24-hr 1-yr Rainfall=2.70"

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Subcatchment 1: DA-1

Hydrograph



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Type III 24-hr 1-yr Rainfall=2.70"

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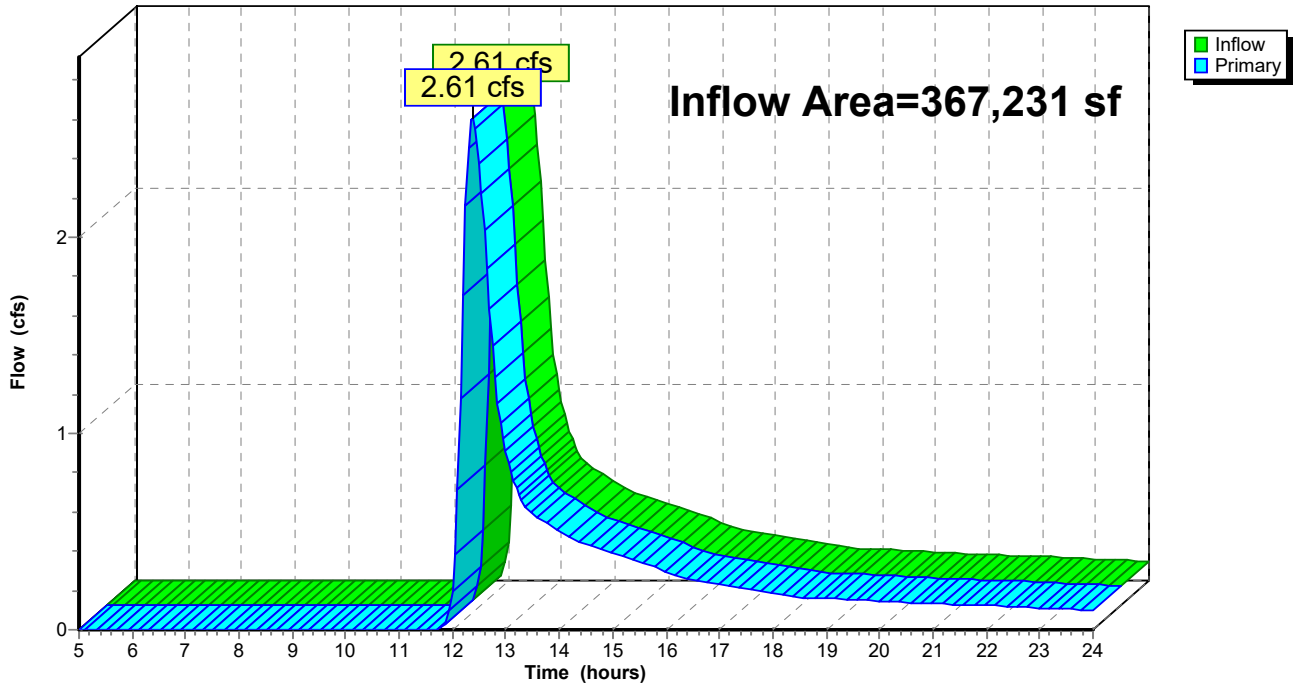
Summary for Link DP-1: Wetland

Inflow Area = 367,231 sf, 3.11% Impervious, Inflow Depth > 0.51" for 1-yr event
Inflow = 2.61 cfs @ 12.38 hrs, Volume= 15,668 cf
Primary = 2.61 cfs @ 12.38 hrs, Volume= 15,668 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs

Link DP-1: Wetland

Hydrograph



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Type III 24-hr 2-yr Rainfall=3.30"

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Time span=5.00-24.00 hrs, dt=0.05 hrs, 381 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: DA-1

Runoff Area=367,231 sf 3.11% Impervious Runoff Depth>0.83"
Flow Length=1,034' Tc=21.8 min CN=69 Runoff=4.74 cfs 25,441 cf

Link DP-1: Wetland

Inflow=4.74 cfs 25,441 cf
Primary=4.74 cfs 25,441 cf

Total Runoff Area = 367,231 sf Runoff Volume = 25,441 cf Average Runoff Depth = 0.83"
96.89% Pervious = 355,798 sf 3.11% Impervious = 11,433 sf

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Type III 24-hr 2-yr Rainfall=3.30"

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Summary for Subcatchment 1: DA-1

Runoff = 4.74 cfs @ 12.35 hrs, Volume= 25,441 cf, Depth> 0.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.30"

Area (sf)	CN	Description
93,777	32	Woods/grass comb., Good, HSG A
7,318	98	Paved roads w/curbs & sewers, HSG A
184,717	77	Fallow, bare soil, HSG A
9,121	79	Woods/grass comb., Good, HSG D
4,115	98	Paved roads w/curbs & sewers, HSG D
68,183	94	Fallow, bare soil, HSG D
367,231	69	Weighted Average
355,798		96.89% Pervious Area
11,433		3.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	100	0.0100	0.30		Sheet Flow, AB Fallow n= 0.050 P2= 3.00"
1.3	85	0.0120	1.10		Shallow Concentrated Flow, BC Nearly Bare & Untilled Kv= 10.0 fps
7.6	251	0.0030	0.55		Shallow Concentrated Flow, CD Nearly Bare & Untilled Kv= 10.0 fps
3.9	325	0.0190	1.38		Shallow Concentrated Flow, DE Nearly Bare & Untilled Kv= 10.0 fps
3.3	237	0.0140	1.18		Shallow Concentrated Flow, EF Nearly Bare & Untilled Kv= 10.0 fps
0.2	36	0.1470	3.83		Shallow Concentrated Flow, FG Nearly Bare & Untilled Kv= 10.0 fps
21.8	1,034	Total			

Existing Conditions Knight Street

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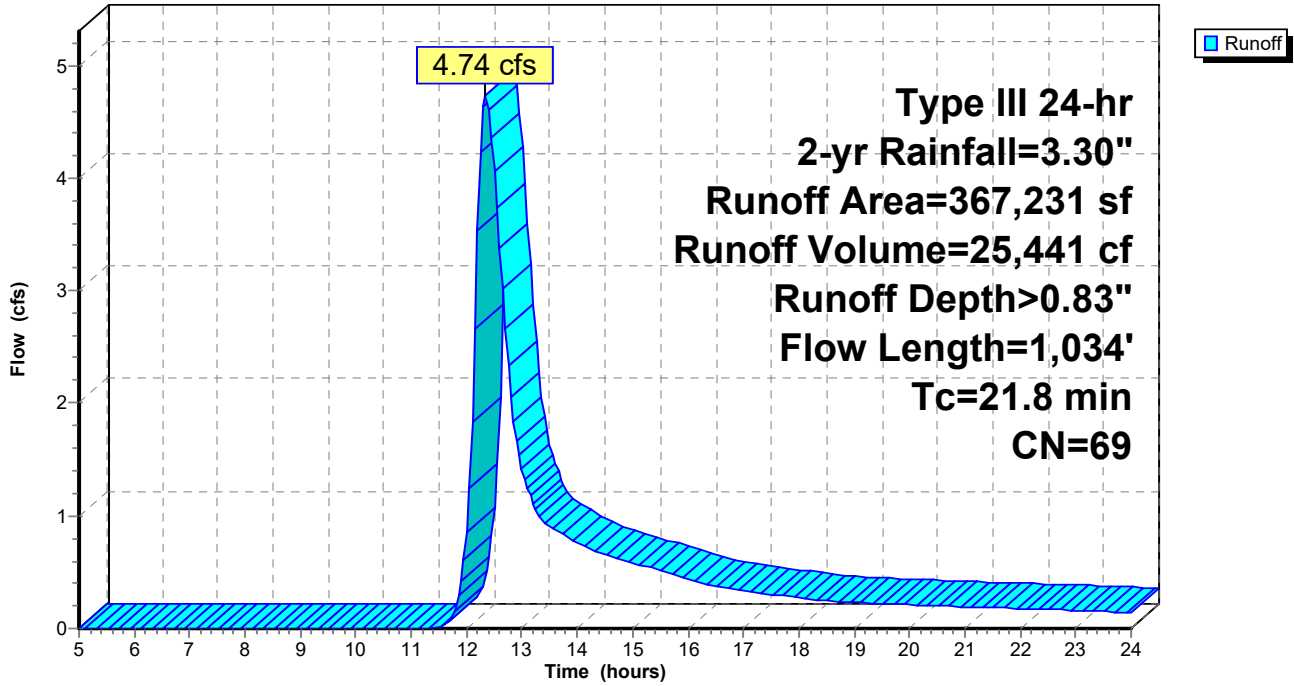
Type III 24-hr 2-yr Rainfall=3.30"

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Subcatchment 1: DA-1

Hydrograph



Existing Conditions Knight Street

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Type III 24-hr 2-yr Rainfall=3.30"

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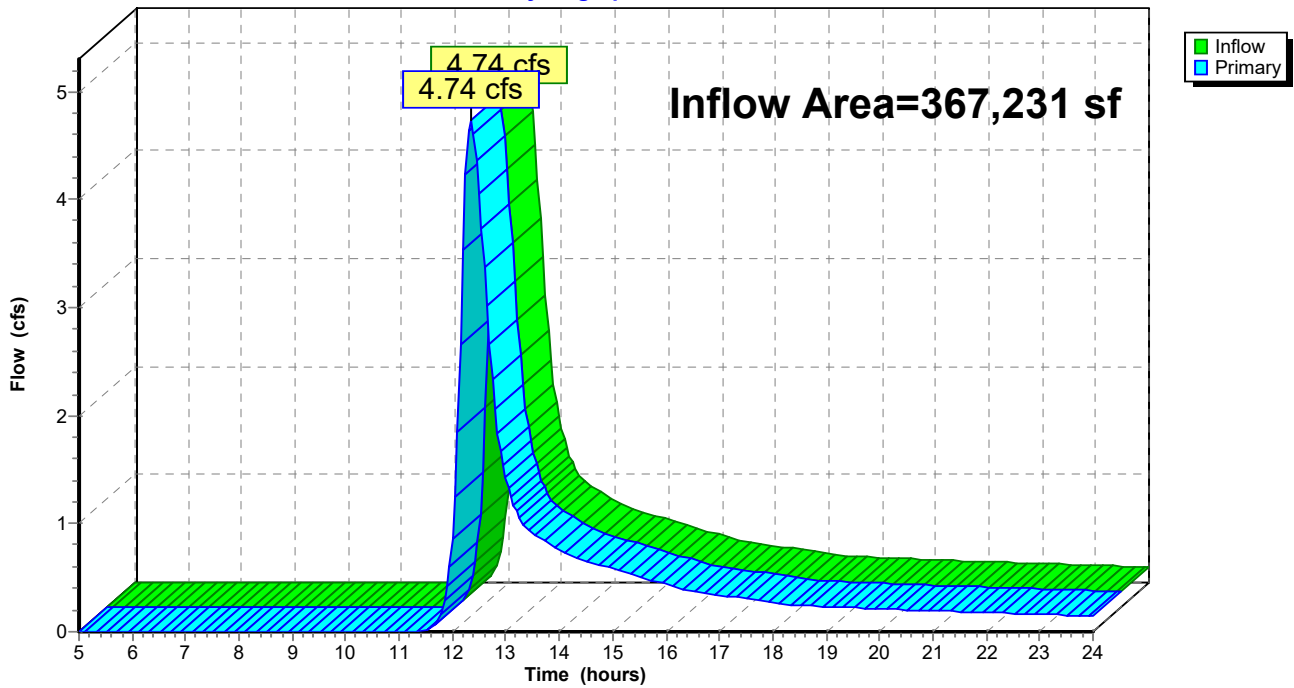
Summary for Link DP-1: Wetland

Inflow Area = 367,231 sf, 3.11% Impervious, Inflow Depth > 0.83" for 2-yr event
Inflow = 4.74 cfs @ 12.35 hrs, Volume= 25,441 cf
Primary = 4.74 cfs @ 12.35 hrs, Volume= 25,441 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs

Link DP-1: Wetland

Hydrograph



Existing Conditions Knight Street

Type III 24-hr 10-yr Rainfall=4.80"

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Time span=5.00-24.00 hrs, dt=0.05 hrs, 381 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: DA-1

Runoff Area=367,231 sf 3.11% Impervious Runoff Depth>1.80"
Flow Length=1,034' Tc=21.8 min CN=69 Runoff=11.26 cfs 55,207 cf

Link DP-1: Wetland

Inflow=11.26 cfs 55,207 cf
Primary=11.26 cfs 55,207 cf

Total Runoff Area = 367,231 sf Runoff Volume = 55,207 cf Average Runoff Depth = 1.80"
96.89% Pervious = 355,798 sf 3.11% Impervious = 11,433 sf

Existing Conditions Knight Street

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Type III 24-hr 10-yr Rainfall=4.80"

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Summary for Subcatchment 1: DA-1

Runoff = 11.26 cfs @ 12.32 hrs, Volume= 55,207 cf, Depth> 1.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.80"

Area (sf)	CN	Description
93,777	32	Woods/grass comb., Good, HSG A
7,318	98	Paved roads w/curbs & sewers, HSG A
184,717	77	Fallow, bare soil, HSG A
9,121	79	Woods/grass comb., Good, HSG D
4,115	98	Paved roads w/curbs & sewers, HSG D
68,183	94	Fallow, bare soil, HSG D
367,231	69	Weighted Average
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11,433		3.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	100	0.0100	0.30		Sheet Flow, AB Fallow n= 0.050 P2= 3.00"
1.3	85	0.0120	1.10		Shallow Concentrated Flow, BC Nearly Bare & Untilled Kv= 10.0 fps
7.6	251	0.0030	0.55		Shallow Concentrated Flow, CD Nearly Bare & Untilled Kv= 10.0 fps
3.9	325	0.0190	1.38		Shallow Concentrated Flow, DE Nearly Bare & Untilled Kv= 10.0 fps
3.3	237	0.0140	1.18		Shallow Concentrated Flow, EF Nearly Bare & Untilled Kv= 10.0 fps
0.2	36	0.1470	3.83		Shallow Concentrated Flow, FG Nearly Bare & Untilled Kv= 10.0 fps
21.8	1,034	Total			

Existing Conditions Knight Street

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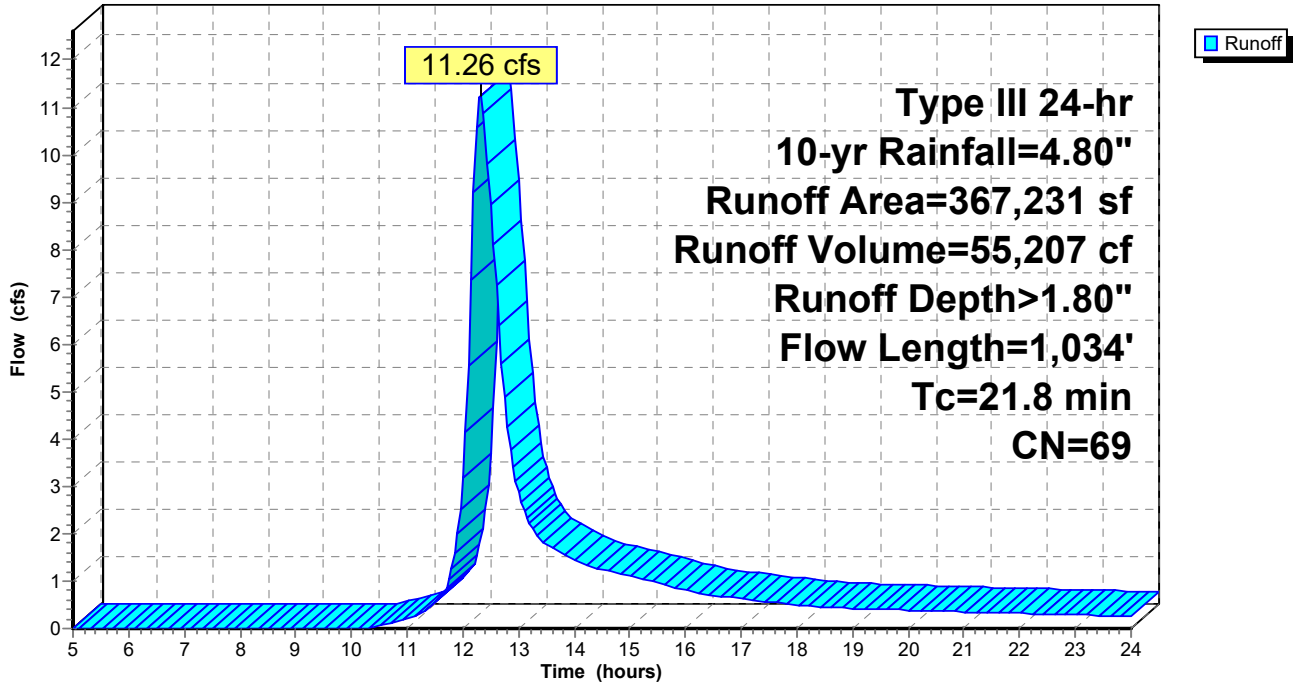
Type III 24-hr 10-yr Rainfall=4.80"

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Subcatchment 1: DA-1

Hydrograph



Existing Conditions Knight Street

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Type III 24-hr 10-yr Rainfall=4.80"

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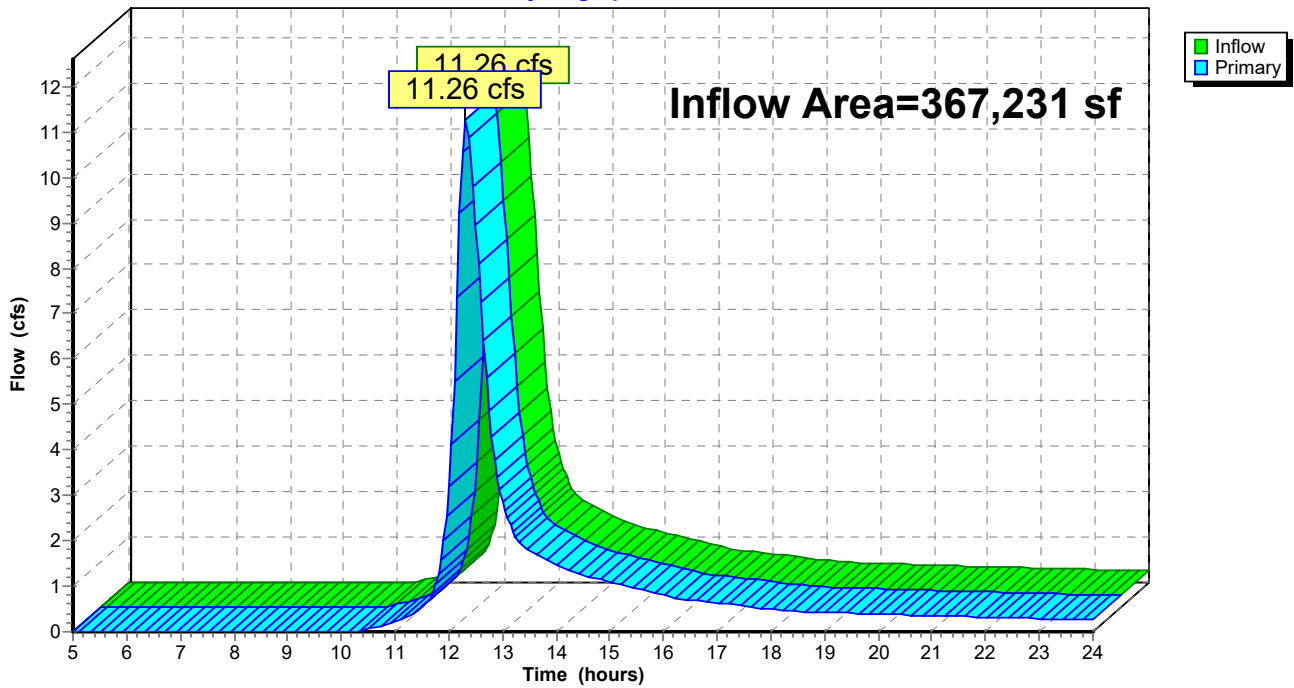
Summary for Link DP-1: Wetland

Inflow Area = 367,231 sf, 3.11% Impervious, Inflow Depth > 1.80" for 10-yr event
Inflow = 11.26 cfs @ 12.32 hrs, Volume= 55,207 cf
Primary = 11.26 cfs @ 12.32 hrs, Volume= 55,207 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs

Link DP-1: Wetland

Hydrograph



Existing Conditions Knight Street

Type III 24-hr 25-yr Rainfall=6.20"

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Time span=5.00-24.00 hrs, dt=0.05 hrs, 381 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: DA-1

Runoff Area=367,231 sf 3.11% Impervious Runoff Depth>2.86"
Flow Length=1,034' Tc=21.8 min CN=69 Runoff=18.24 cfs 87,410 cf

Link DP-1: Wetland

Inflow=18.24 cfs 87,410 cf
Primary=18.24 cfs 87,410 cf

Total Runoff Area = 367,231 sf Runoff Volume = 87,410 cf Average Runoff Depth = 2.86"
96.89% Pervious = 355,798 sf 3.11% Impervious = 11,433 sf

Existing Conditions Knight Street

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Type III 24-hr 25-yr Rainfall=6.20"

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Summary for Subcatchment 1: DA-1

Runoff = 18.24 cfs @ 12.31 hrs, Volume= 87,410 cf, Depth> 2.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.20"

Area (sf)	CN	Description
93,777	32	Woods/grass comb., Good, HSG A
7,318	98	Paved roads w/curbs & sewers, HSG A
184,717	77	Fallow, bare soil, HSG A
9,121	79	Woods/grass comb., Good, HSG D
4,115	98	Paved roads w/curbs & sewers, HSG D
68,183	94	Fallow, bare soil, HSG D
367,231	69	Weighted Average
355,798		96.89% Pervious Area
11,433		3.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	100	0.0100	0.30		Sheet Flow, AB Fallow n= 0.050 P2= 3.00"
1.3	85	0.0120	1.10		Shallow Concentrated Flow, BC Nearly Bare & Untilled Kv= 10.0 fps
7.6	251	0.0030	0.55		Shallow Concentrated Flow, CD Nearly Bare & Untilled Kv= 10.0 fps
3.9	325	0.0190	1.38		Shallow Concentrated Flow, DE Nearly Bare & Untilled Kv= 10.0 fps
3.3	237	0.0140	1.18		Shallow Concentrated Flow, EF Nearly Bare & Untilled Kv= 10.0 fps
0.2	36	0.1470	3.83		Shallow Concentrated Flow, FG Nearly Bare & Untilled Kv= 10.0 fps
21.8	1,034	Total			

Existing Conditions Knight Street

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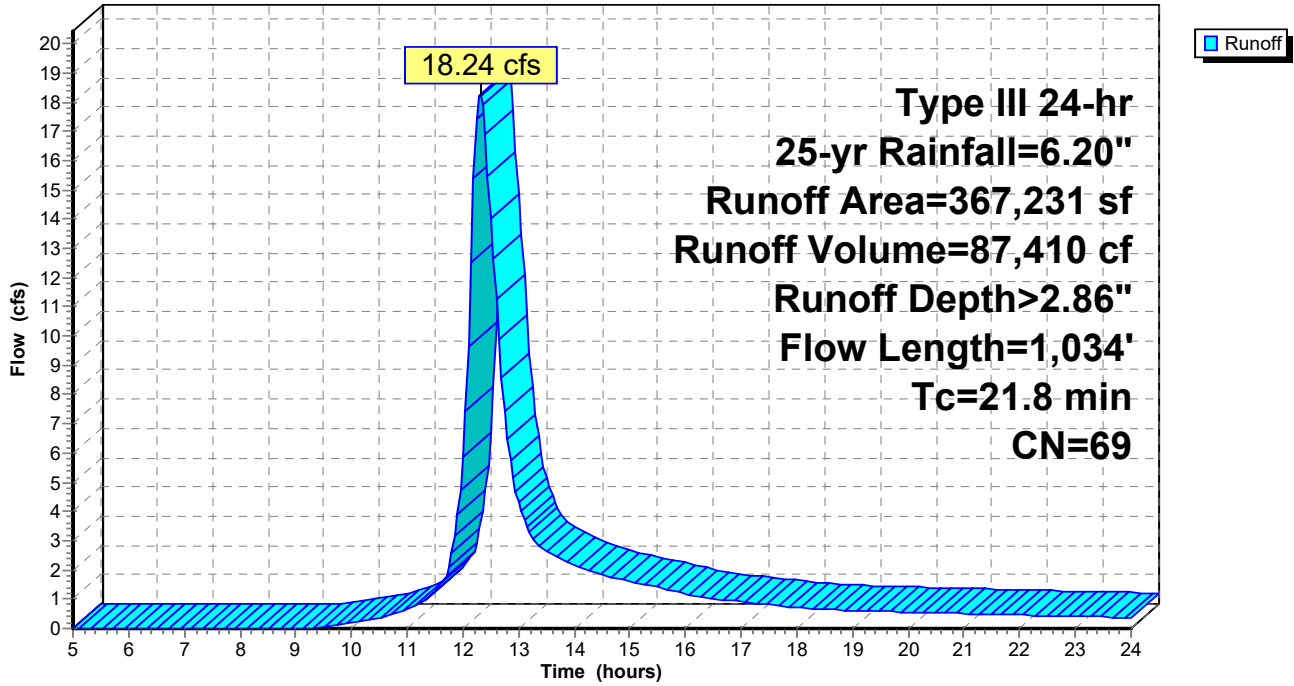
Type III 24-hr 25-yr Rainfall=6.20"

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Subcatchment 1: DA-1

Hydrograph



Existing Conditions Knight Street

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Type III 24-hr 25-yr Rainfall=6.20"

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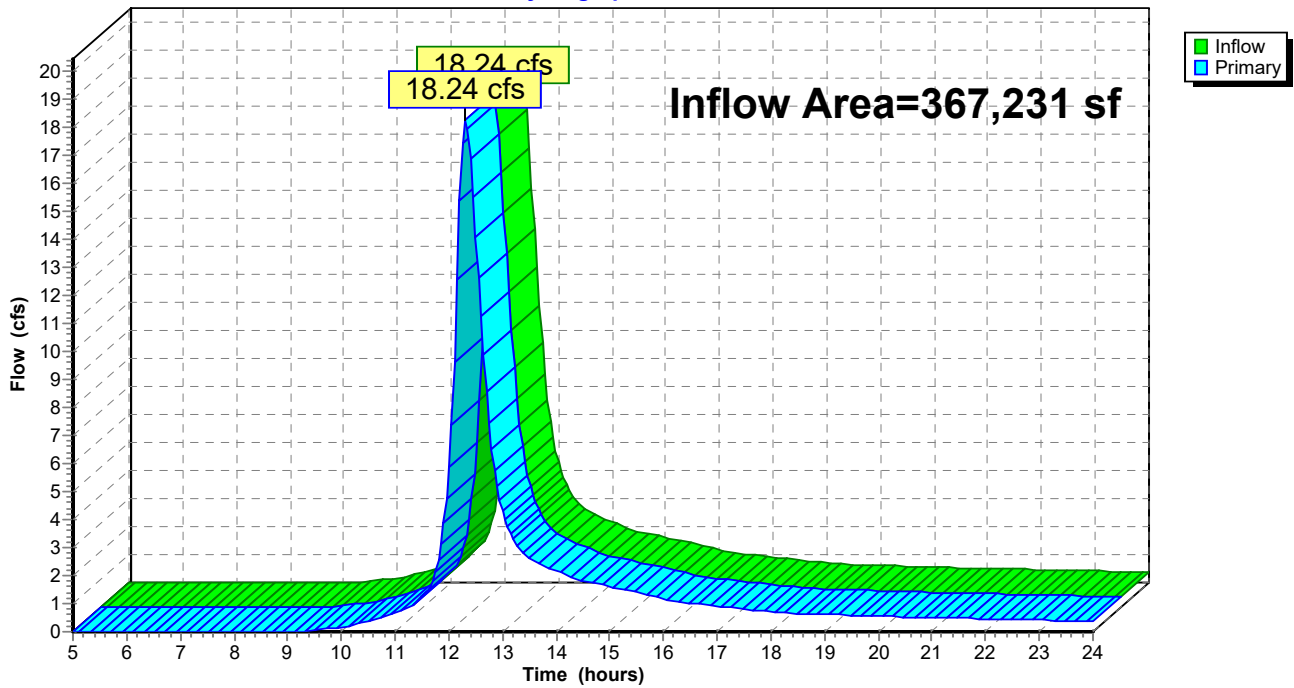
Summary for Link DP-1: Wetland

Inflow Area = 367,231 sf, 3.11% Impervious, Inflow Depth > 2.86" for 25-yr event
Inflow = 18.24 cfs @ 12.31 hrs, Volume= 87,410 cf
Primary = 18.24 cfs @ 12.31 hrs, Volume= 87,410 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs

Link DP-1: Wetland

Hydrograph



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Type III 24-hr 100-yr Rainfall=8.70"

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Time span=5.00-24.00 hrs, dt=0.05 hrs, 381 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: DA-1

Runoff Area=367,231 sf 3.11% Impervious Runoff Depth>4.93"
Flow Length=1,034' Tc=21.8 min CN=69 Runoff=31.75 cfs 150,871 cf

Link DP-1: Wetland

Inflow=31.75 cfs 150,871 cf
Primary=31.75 cfs 150,871 cf

Total Runoff Area = 367,231 sf Runoff Volume = 150,871 cf Average Runoff Depth = 4.93"
96.89% Pervious = 355,798 sf 3.11% Impervious = 11,433 sf

Existing Conditions Knight Street

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Type III 24-hr 100-yr Rainfall=8.70"

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Summary for Subcatchment 1: DA-1

Runoff = 31.75 cfs @ 12.30 hrs, Volume= 150,871 cf, Depth> 4.93"

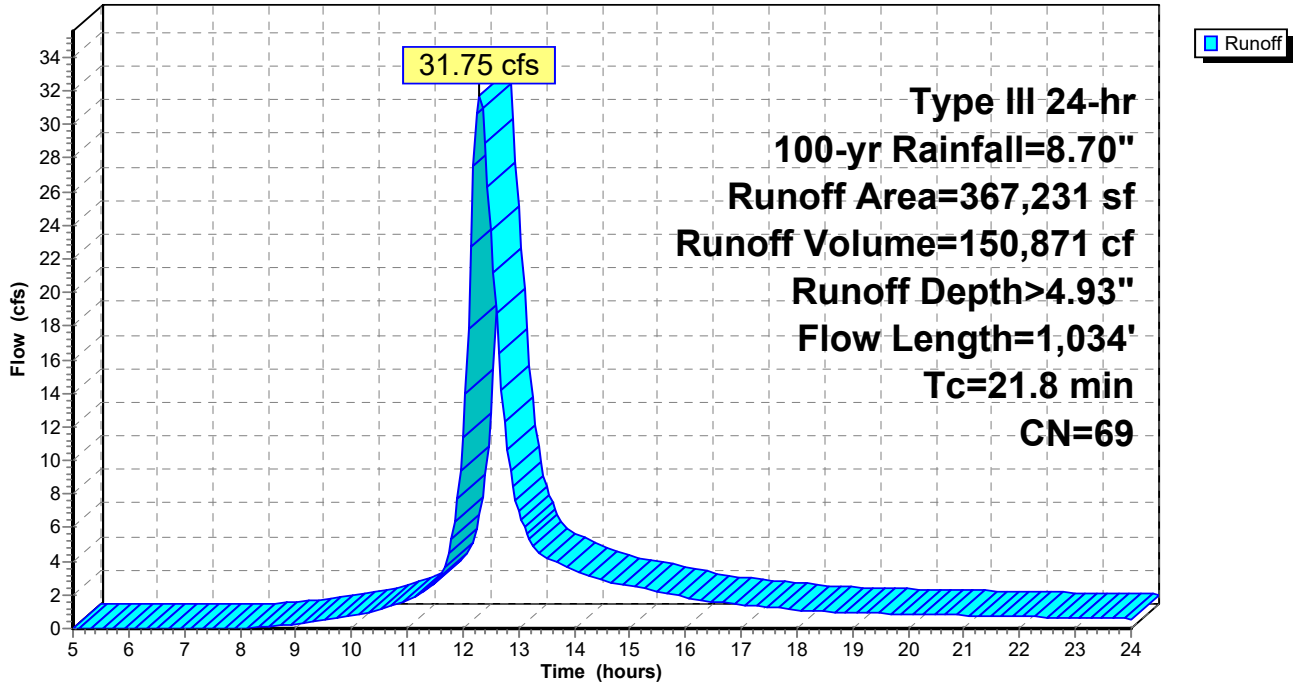
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.70"

Area (sf)	CN	Description
93,777	32	Woods/grass comb., Good, HSG A
7,318	98	Paved roads w/curbs & sewers, HSG A
184,717	77	Fallow, bare soil, HSG A
9,121	79	Woods/grass comb., Good, HSG D
4,115	98	Paved roads w/curbs & sewers, HSG D
68,183	94	Fallow, bare soil, HSG D
367,231	69	Weighted Average
355,798		96.89% Pervious Area
11,433		3.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.5	100	0.0100	0.30		Sheet Flow, AB Fallow n= 0.050 P2= 3.00"
1.3	85	0.0120	1.10		Shallow Concentrated Flow, BC Nearly Bare & Untilled Kv= 10.0 fps
7.6	251	0.0030	0.55		Shallow Concentrated Flow, CD Nearly Bare & Untilled Kv= 10.0 fps
3.9	325	0.0190	1.38		Shallow Concentrated Flow, DE Nearly Bare & Untilled Kv= 10.0 fps
3.3	237	0.0140	1.18		Shallow Concentrated Flow, EF Nearly Bare & Untilled Kv= 10.0 fps
0.2	36	0.1470	3.83		Shallow Concentrated Flow, FG Nearly Bare & Untilled Kv= 10.0 fps
21.8	1,034	Total			

Subcatchment 1: DA-1

Hydrograph



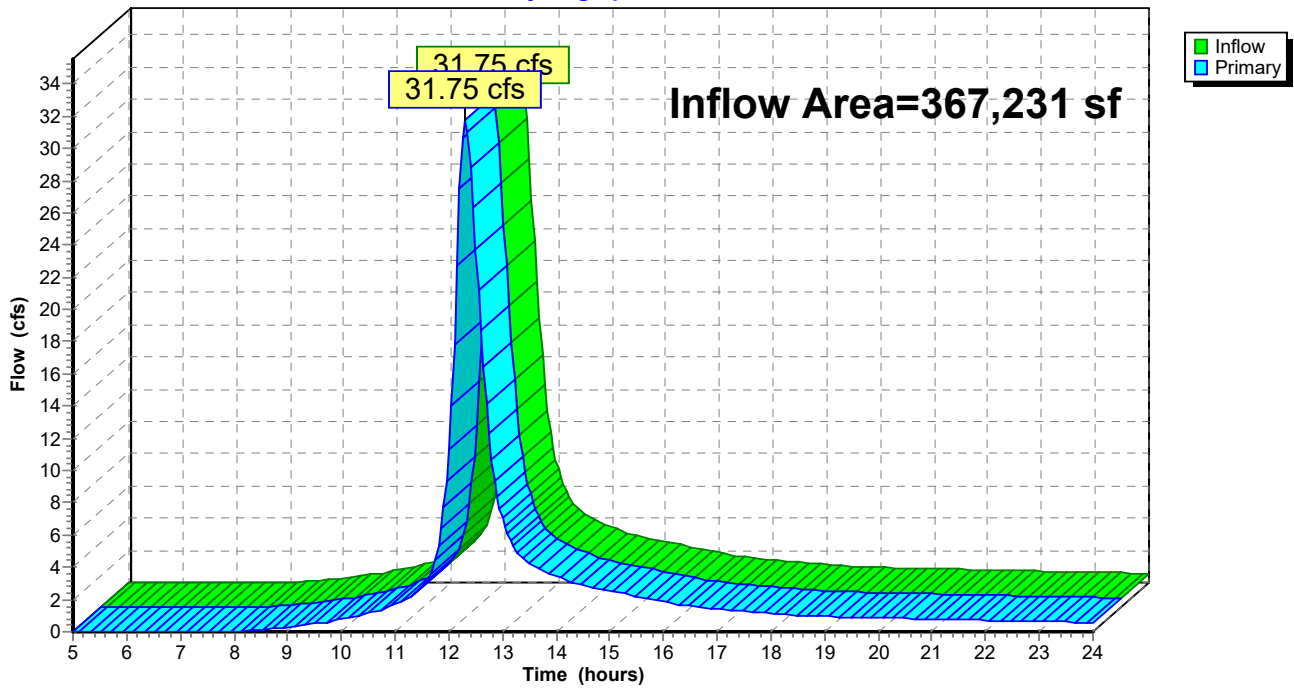
Summary for Link DP-1: Wetland

Inflow Area = 367,231 sf, 3.11% Impervious, Inflow Depth > 4.93" for 100-yr event
Inflow = 31.75 cfs @ 12.30 hrs, Volume= 150,871 cf
Primary = 31.75 cfs @ 12.30 hrs, Volume= 150,871 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-24.00 hrs, dt= 0.05 hrs

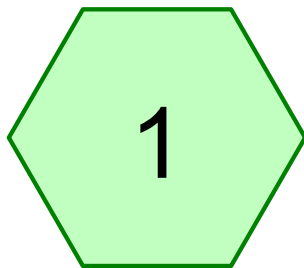
Link DP-1: Wetland

Hydrograph



APPENDIX

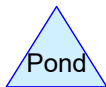
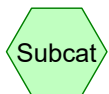
B.2 PROPOSED HYDROCAD ANALYSIS



DA-1



Wetland



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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
31	98	Ballast Block,Unconnected pavement, HSG D (1)
5,969	98	Ballast Blocks, Unconnected pavement, HSG A (1)
1,111	98	Equipment Pad,Unconnected pavement, HSG A (1)
14	96	Gravel surface, HSG D, Gravel Pad (1)
193,573	30	Meadow, non-grazed, HSG A (1)
68,138	78	Meadow, non-grazed, HSG D (1)
7,318	98	Paved roads w/curbs & sewers, HSG A (1)
4,115	98	Paved roads w/curbs & sewers, HSG D (1)
2,626	76	Pervious Pavemnt, 6" Gravel Pad, HSG A (1)
10,466	76	Pervious Pavemnt, 6"Crushed stone access (1)
64,749	32	Woods/grass comb., Good, HSG A (1)
9,121	79	Woods/grass comb., Good, HSG D (1)
367,231	46	TOTAL AREA

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Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
275,346	HSG A	1
0	HSG B	
0	HSG C	
81,419	HSG D	1
10,466	Other	1
367,231		TOTAL AREA

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Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
0	0	0	31	0	31	Ballast Block, Unconnecte d pavement
5,969	0	0	0	0	5,969	Ballast Blocks, Unconnected pavement
1,111	0	0	0	0	1,111	Equipment Pad, Unconnected pavement
0	0	0	14	0	14	Gravel surface
193,573	0	0	68,138	0	261,711	Meadow, non-grazed
7,318	0	0	4,115	0	11,433	Paved roads w/curbs & sewers
2,626	0	0	0	0	2,626	Pervious Pavemnt, 6" Gravel Pad
0	0	0	0	10,466	10,466	Pervious Pavemnt, 6"Crushed stone access
64,749	0	0	9,121	0	73,870	Woods/grass comb., Good
275,346	0	0	81,419	10,466	367,231	TOTAL AREA

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Type III 24-hr 1-yr Rainfall=2.70"

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Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: DA-1

Runoff Area=367,231 sf 5.05% Impervious Runoff Depth=0.01"
Flow Length=1,013' Tc=35.8 min UI Adjusted CN=45 Runoff=0.01 cfs 160 cf

Link DP-1: Wetland

Inflow=0.01 cfs 160 cf
Primary=0.01 cfs 160 cf

Total Runoff Area = 367,231 sf Runoff Volume = 160 cf Average Runoff Depth = 0.01"
94.95% Pervious = 348,687 sf 5.05% Impervious = 18,544 sf

Proposed Conditions Knight Street

Type III 24-hr 1-yr Rainfall=2.70"

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Summary for Subcatchment 1: DA-1

Runoff = 0.01 cfs @ 23.35 hrs, Volume= 160 cf, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 1-yr Rainfall=2.70"

Area (sf)	CN	Adj	Description
64,749	32		Woods/grass comb., Good, HSG A
7,318	98		Paved roads w/curbs & sewers, HSG A
193,573	30		Meadow, non-grazed, HSG A
9,121	79		Woods/grass comb., Good, HSG D
4,115	98		Paved roads w/curbs & sewers, HSG D
68,138	78		Meadow, non-grazed, HSG D
* 10,466	76		Pervious Pavemnt, 6"Crushed stone access
* 1,111	98		Equipment Pad,Unconnected pavement, HSG A
* 5,969	98		Ballast Blocks, Unconnected pavement, HSG A
* 31	98		Ballast Block,Unconnected pavement, HSG D
* 2,626	76		Pervious Pavemnt, 6" Gravel Pad, HSG A
* 14	96		Gravel surface, HSG D, Gravel Pad
367,231	46	45	Weighted Average, UI Adjusted
348,687			94.95% Pervious Area
18,544			5.05% Impervious Area
7,111			38.35% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.4	100	0.0100	0.12		Sheet Flow, AB Grass: Short n= 0.150 P2= 3.00"
1.8	85	0.0120	0.77		Shallow Concentrated Flow, BC Short Grass Pasture Kv= 7.0 fps
10.0	230	0.0030	0.38		Shallow Concentrated Flow, CD Short Grass Pasture Kv= 7.0 fps
5.6	325	0.0190	0.96		Shallow Concentrated Flow, DE Short Grass Pasture Kv= 7.0 fps
4.8	237	0.0140	0.83		Shallow Concentrated Flow, EF Short Grass Pasture Kv= 7.0 fps
0.2	36	0.1470	2.68		Shallow Concentrated Flow, FG Short Grass Pasture Kv= 7.0 fps
35.8	1,013	Total			

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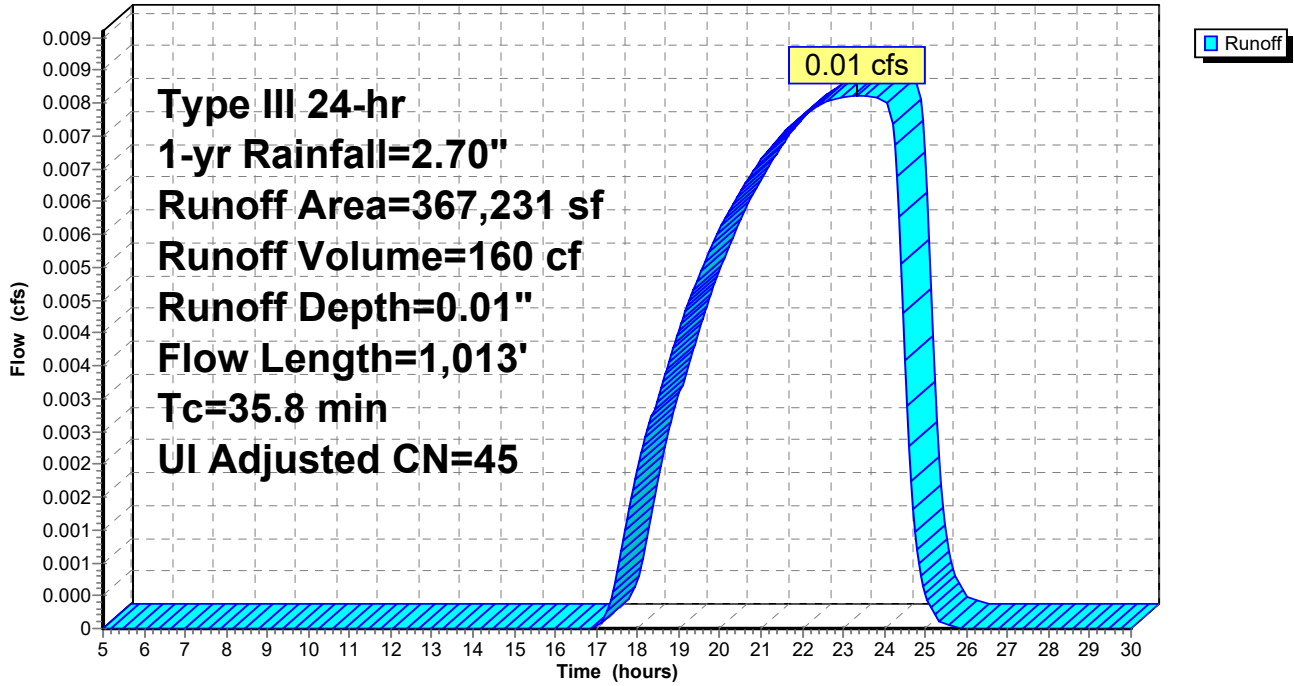
Type III 24-hr 1-yr Rainfall=2.70"

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Subcatchment 1: DA-1

Hydrograph



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Type III 24-hr 1-yr Rainfall=2.70"

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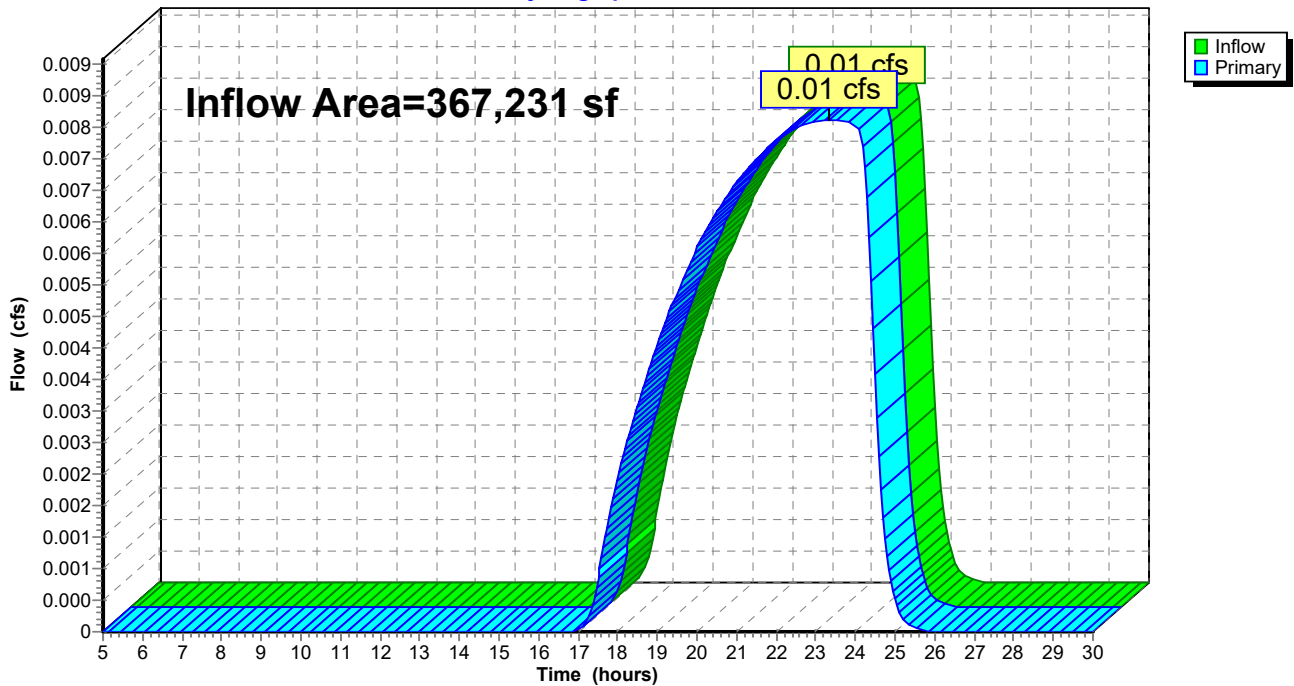
Summary for Link DP-1: Wetland

Inflow Area = 367,231 sf, 5.05% Impervious, Inflow Depth = 0.01" for 1-yr event
Inflow = 0.01 cfs @ 23.35 hrs, Volume= 160 cf
Primary = 0.01 cfs @ 23.35 hrs, Volume= 160 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Link DP-1: Wetland

Hydrograph



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Type III 24-hr 2-yr Rainfall=3.30"

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Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: DA-1

Runoff Area=367,231 sf 5.05% Impervious Runoff Depth=0.06"
Flow Length=1,013' Tc=35.8 min UI Adjusted CN=45 Runoff=0.06 cfs 1,713 cf

Link DP-1: Wetland

Inflow=0.06 cfs 1,713 cf
Primary=0.06 cfs 1,713 cf

Total Runoff Area = 367,231 sf Runoff Volume = 1,713 cf Average Runoff Depth = 0.06"
94.95% Pervious = 348,687 sf 5.05% Impervious = 18,544 sf

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Type III 24-hr 2-yr Rainfall=3.30"

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Summary for Subcatchment 1: DA-1

Runoff = 0.06 cfs @ 15.57 hrs, Volume= 1,713 cf, Depth= 0.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.30"

Area (sf)	CN	Adj	Description
64,749	32		Woods/grass comb., Good, HSG A
7,318	98		Paved roads w/curbs & sewers, HSG A
193,573	30		Meadow, non-grazed, HSG A
9,121	79		Woods/grass comb., Good, HSG D
4,115	98		Paved roads w/curbs & sewers, HSG D
68,138	78		Meadow, non-grazed, HSG D
* 10,466	76		Pervious Pavemnt, 6"Crushed stone access
* 1,111	98		Equipment Pad,Unconnected pavement, HSG A
* 5,969	98		Ballast Blocks, Unconnected pavement, HSG A
* 31	98		Ballast Block,Unconnected pavement, HSG D
* 2,626	76		Pervious Pavemnt, 6" Gravel Pad, HSG A
* 14	96		Gravel surface, HSG D, Gravel Pad
367,231	46	45	Weighted Average, UI Adjusted
348,687			94.95% Pervious Area
18,544			5.05% Impervious Area
7,111			38.35% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.4	100	0.0100	0.12		Sheet Flow, AB Grass: Short n= 0.150 P2= 3.00"
1.8	85	0.0120	0.77		Shallow Concentrated Flow, BC Short Grass Pasture Kv= 7.0 fps
10.0	230	0.0030	0.38		Shallow Concentrated Flow, CD Short Grass Pasture Kv= 7.0 fps
5.6	325	0.0190	0.96		Shallow Concentrated Flow, DE Short Grass Pasture Kv= 7.0 fps
4.8	237	0.0140	0.83		Shallow Concentrated Flow, EF Short Grass Pasture Kv= 7.0 fps
0.2	36	0.1470	2.68		Shallow Concentrated Flow, FG Short Grass Pasture Kv= 7.0 fps
35.8	1,013	Total			

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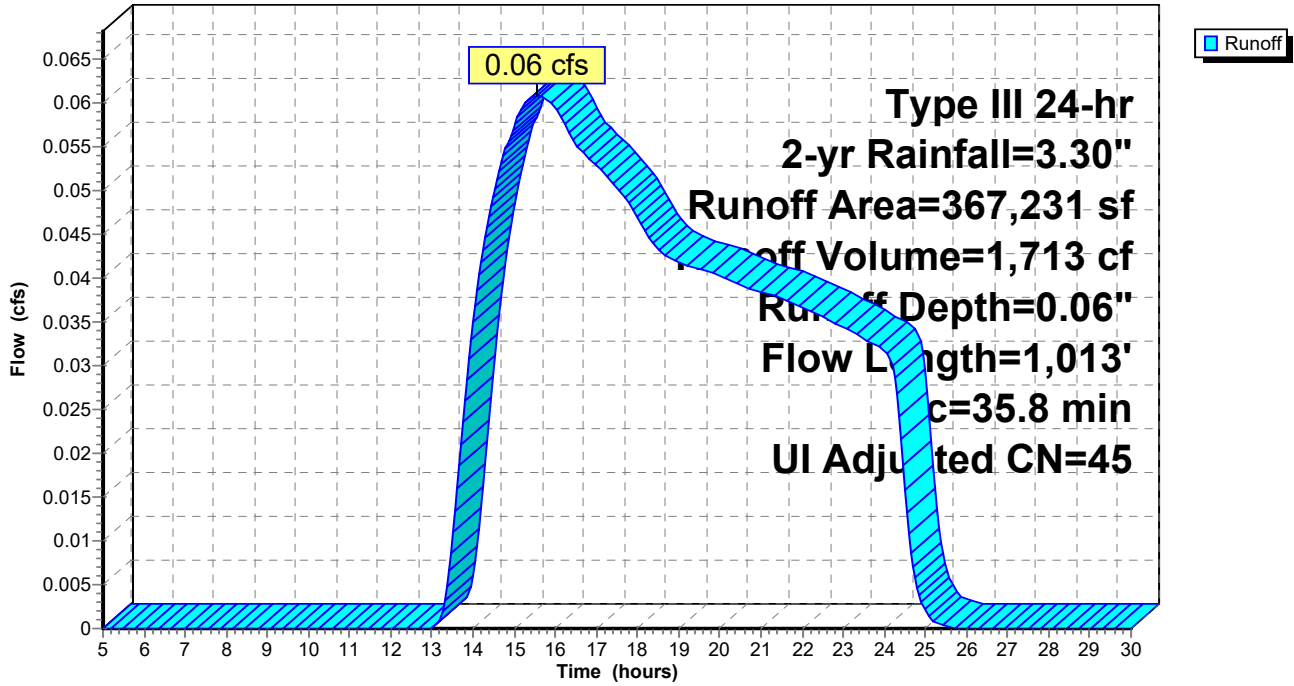
Type III 24-hr 2-yr Rainfall=3.30"

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Subcatchment 1: DA-1

Hydrograph



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Type III 24-hr 2-yr Rainfall=3.30"

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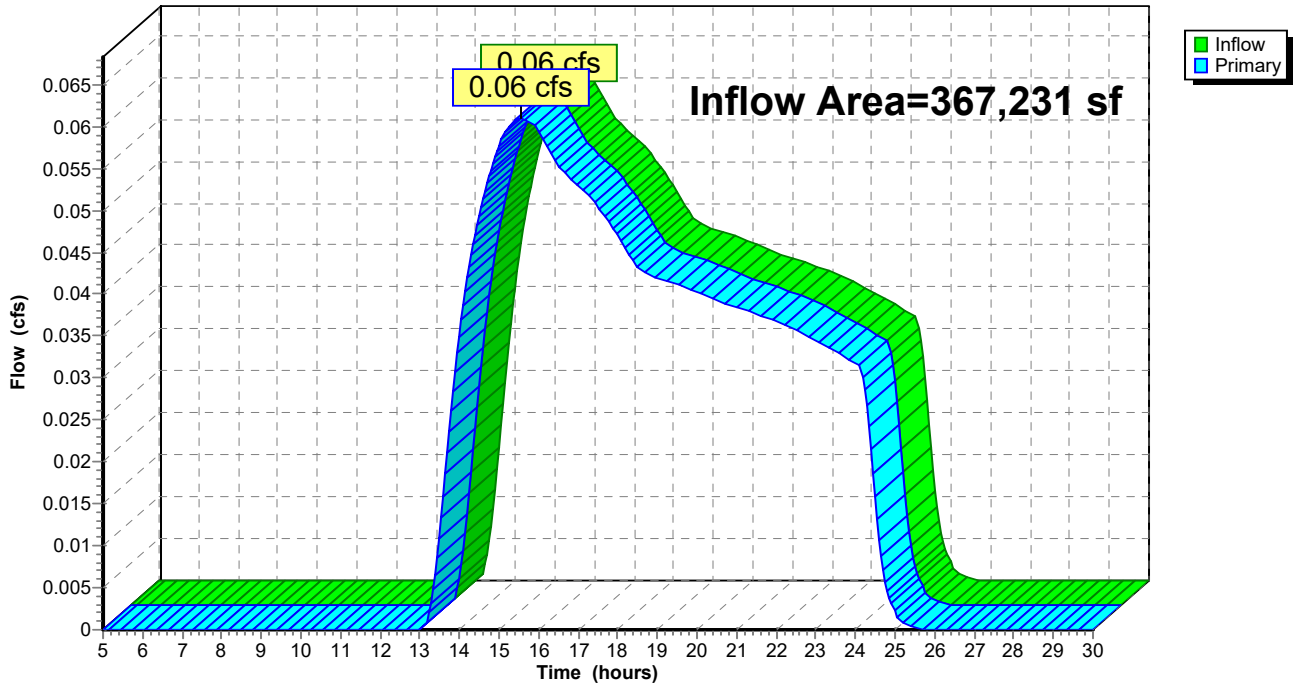
Summary for Link DP-1: Wetland

Inflow Area = 367,231 sf, 5.05% Impervious, Inflow Depth = 0.06" for 2-yr event
Inflow = 0.06 cfs @ 15.57 hrs, Volume= 1,713 cf
Primary = 0.06 cfs @ 15.57 hrs, Volume= 1,713 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Link DP-1: Wetland

Hydrograph



Proposed Conditions Knight Street

Type III 24-hr 10-yr Rainfall=4.80"

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Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: DA-1

Runoff Area=367,231 sf 5.05% Impervious Runoff Depth=0.38"
Flow Length=1,013' Tc=35.8 min UI Adjusted CN=45 Runoff=0.90 cfs 11,648 cf

Link DP-1: Wetland

Inflow=0.90 cfs 11,648 cf
Primary=0.90 cfs 11,648 cf

Total Runoff Area = 367,231 sf Runoff Volume = 11,648 cf Average Runoff Depth = 0.38"
94.95% Pervious = 348,687 sf 5.05% Impervious = 18,544 sf

Proposed Conditions Knight Street

Type III 24-hr 10-yr Rainfall=4.80"

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Summary for Subcatchment 1: DA-1

Runoff = 0.90 cfs @ 12.77 hrs, Volume= 11,648 cf, Depth= 0.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.80"

Area (sf)	CN	Adj	Description
64,749	32		Woods/grass comb., Good, HSG A
7,318	98		Paved roads w/curbs & sewers, HSG A
193,573	30		Meadow, non-grazed, HSG A
9,121	79		Woods/grass comb., Good, HSG D
4,115	98		Paved roads w/curbs & sewers, HSG D
68,138	78		Meadow, non-grazed, HSG D
* 10,466	76		Pervious Pavemnt, 6"Crushed stone access
* 1,111	98		Equipment Pad,Unconnected pavement, HSG A
* 5,969	98		Ballast Blocks, Unconnected pavement, HSG A
* 31	98		Ballast Block,Unconnected pavement, HSG D
* 2,626	76		Pervious Pavemnt, 6" Gravel Pad, HSG A
* 14	96		Gravel surface, HSG D, Gravel Pad
367,231	46	45	Weighted Average, UI Adjusted
348,687			94.95% Pervious Area
18,544			5.05% Impervious Area
7,111			38.35% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.4	100	0.0100	0.12		Sheet Flow, AB Grass: Short n= 0.150 P2= 3.00"
1.8	85	0.0120	0.77		Shallow Concentrated Flow, BC Short Grass Pasture Kv= 7.0 fps
10.0	230	0.0030	0.38		Shallow Concentrated Flow, CD Short Grass Pasture Kv= 7.0 fps
5.6	325	0.0190	0.96		Shallow Concentrated Flow, DE Short Grass Pasture Kv= 7.0 fps
4.8	237	0.0140	0.83		Shallow Concentrated Flow, EF Short Grass Pasture Kv= 7.0 fps
0.2	36	0.1470	2.68		Shallow Concentrated Flow, FG Short Grass Pasture Kv= 7.0 fps
35.8	1,013	Total			

Proposed Conditions Knight Street

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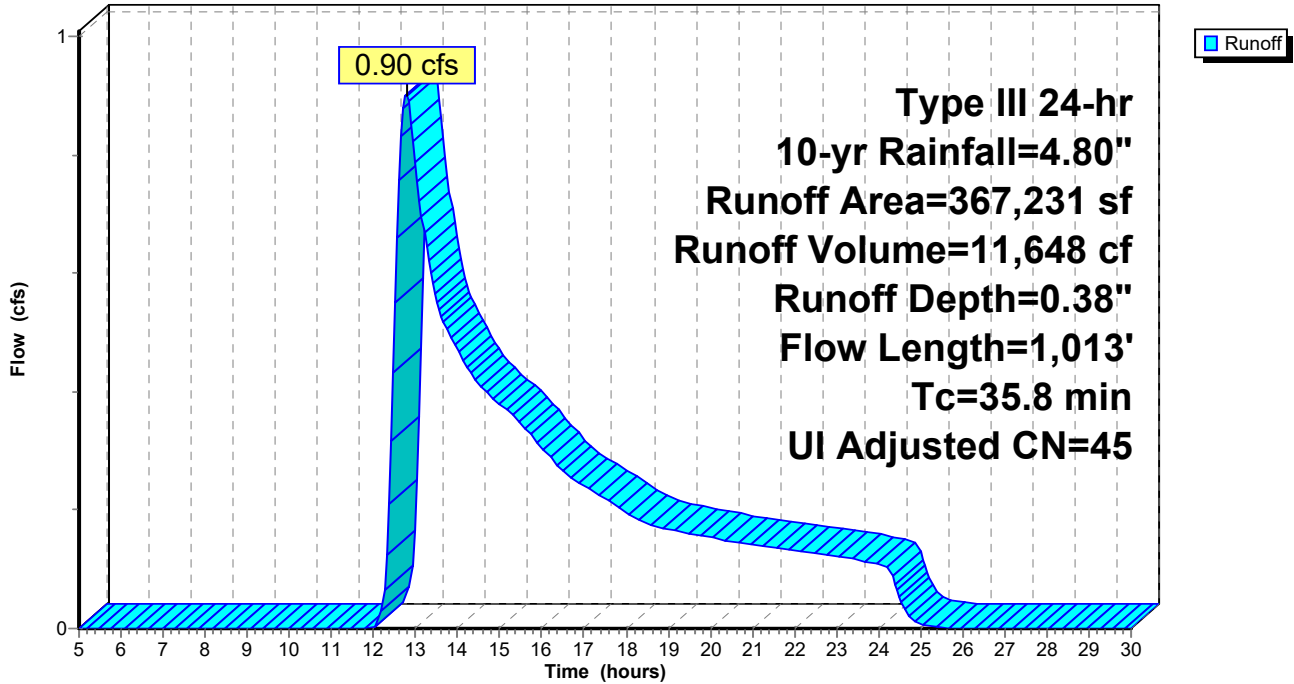
Type III 24-hr 10-yr Rainfall=4.80"

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Subcatchment 1: DA-1

Hydrograph



Proposed Conditions Knight Street

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Type III 24-hr 10-yr Rainfall=4.80"

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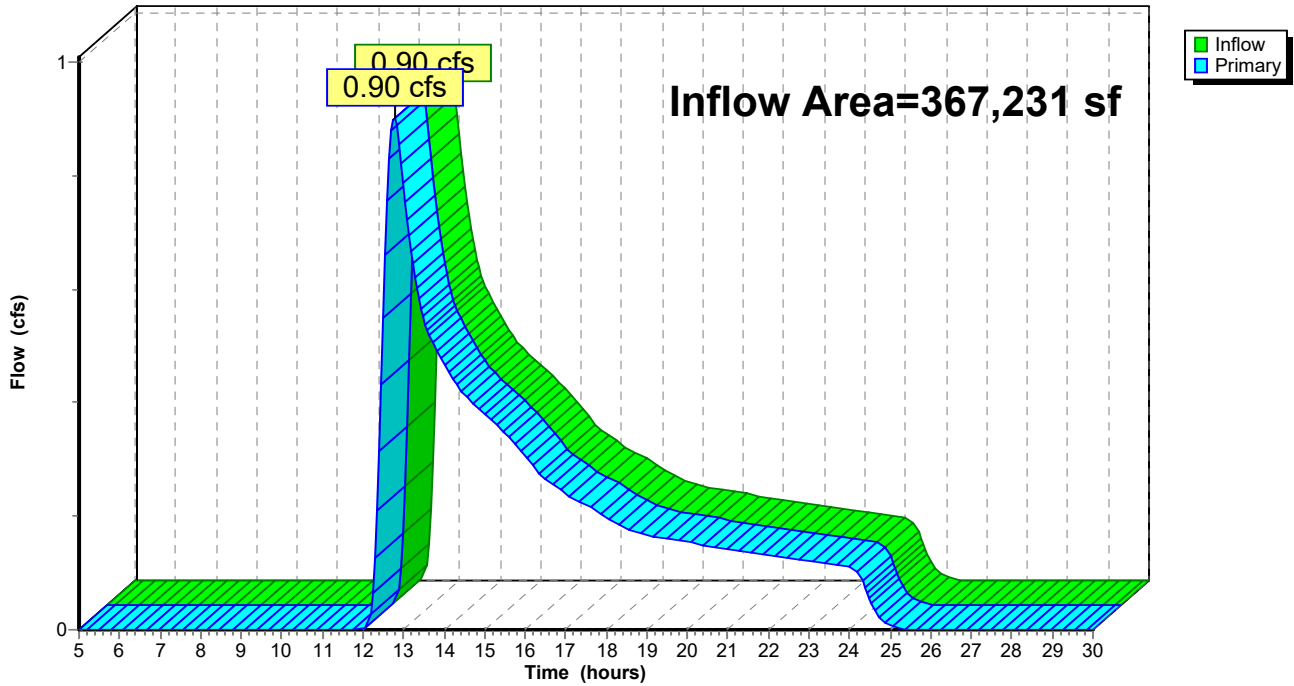
Summary for Link DP-1: Wetland

Inflow Area = 367,231 sf, 5.05% Impervious, Inflow Depth = 0.38" for 10-yr event
Inflow = 0.90 cfs @ 12.77 hrs, Volume= 11,648 cf
Primary = 0.90 cfs @ 12.77 hrs, Volume= 11,648 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Link DP-1: Wetland

Hydrograph



Proposed Conditions Knight Street

Type III 24-hr 25-yr Rainfall=6.20"

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Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: DA-1

Runoff Area=367,231 sf 5.05% Impervious Runoff Depth=0.88"
Flow Length=1,013' Tc=35.8 min UI Adjusted CN=45 Runoff=3.15 cfs 27,014 cf

Link DP-1: Wetland

Inflow=3.15 cfs 27,014 cf
Primary=3.15 cfs 27,014 cf

Total Runoff Area = 367,231 sf Runoff Volume = 27,014 cf Average Runoff Depth = 0.88"
94.95% Pervious = 348,687 sf 5.05% Impervious = 18,544 sf

Proposed Conditions Knight Street

Type III 24-hr 25-yr Rainfall=6.20"

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Summary for Subcatchment 1: DA-1

Runoff = 3.15 cfs @ 12.65 hrs, Volume= 27,014 cf, Depth= 0.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=6.20"

Area (sf)	CN	Adj	Description
64,749	32		Woods/grass comb., Good, HSG A
7,318	98		Paved roads w/curbs & sewers, HSG A
193,573	30		Meadow, non-grazed, HSG A
9,121	79		Woods/grass comb., Good, HSG D
4,115	98		Paved roads w/curbs & sewers, HSG D
68,138	78		Meadow, non-grazed, HSG D
* 10,466	76		Pervious Pavemnt, 6"Crushed stone access
* 1,111	98		Equipment Pad,Unconnected pavement, HSG A
* 5,969	98		Ballast Blocks, Unconnected pavement, HSG A
* 31	98		Ballast Block,Unconnected pavement, HSG D
* 2,626	76		Pervious Pavemnt, 6" Gravel Pad, HSG A
* 14	96		Gravel surface, HSG D, Gravel Pad
367,231	46	45	Weighted Average, UI Adjusted
348,687			94.95% Pervious Area
18,544			5.05% Impervious Area
7,111			38.35% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.4	100	0.0100	0.12		Sheet Flow, AB Grass: Short n= 0.150 P2= 3.00"
1.8	85	0.0120	0.77		Shallow Concentrated Flow, BC Short Grass Pasture Kv= 7.0 fps
10.0	230	0.0030	0.38		Shallow Concentrated Flow, CD Short Grass Pasture Kv= 7.0 fps
5.6	325	0.0190	0.96		Shallow Concentrated Flow, DE Short Grass Pasture Kv= 7.0 fps
4.8	237	0.0140	0.83		Shallow Concentrated Flow, EF Short Grass Pasture Kv= 7.0 fps
0.2	36	0.1470	2.68		Shallow Concentrated Flow, FG Short Grass Pasture Kv= 7.0 fps
35.8	1,013	Total			

Proposed Conditions Knight Street

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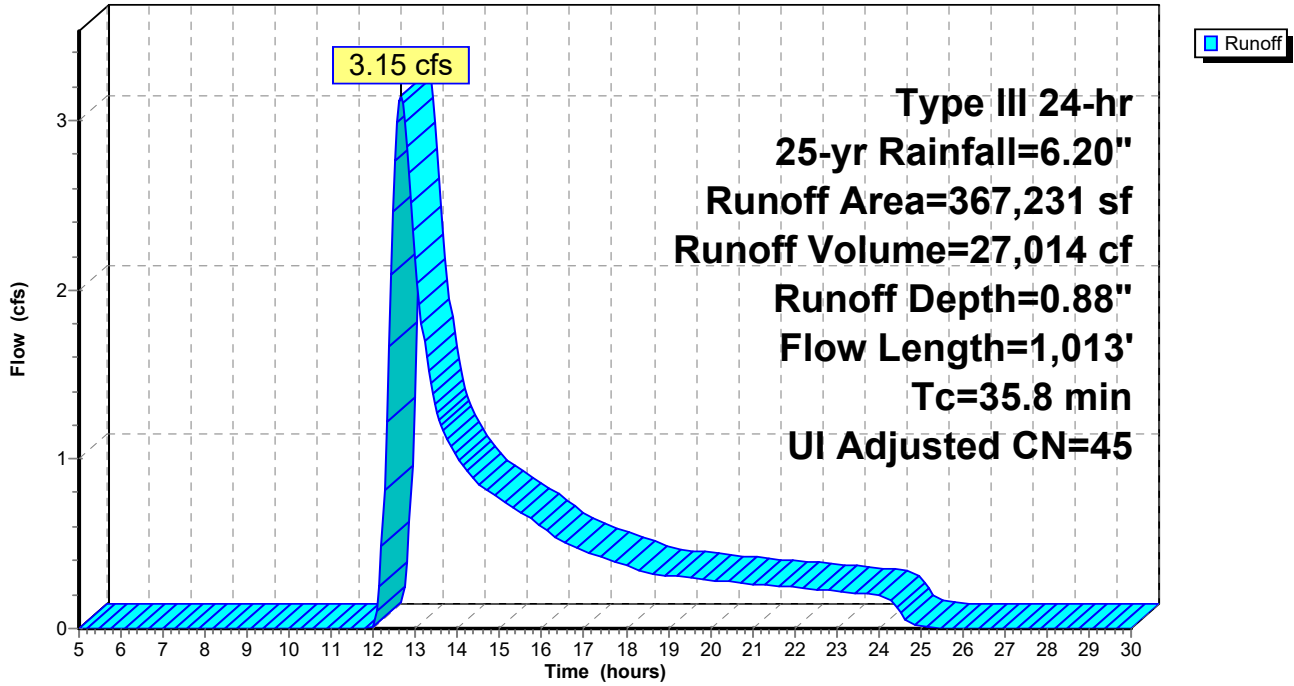
Type III 24-hr 25-yr Rainfall=6.20"

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Subcatchment 1: DA-1

Hydrograph



Proposed Conditions Knight Street

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Type III 24-hr 25-yr Rainfall=6.20"

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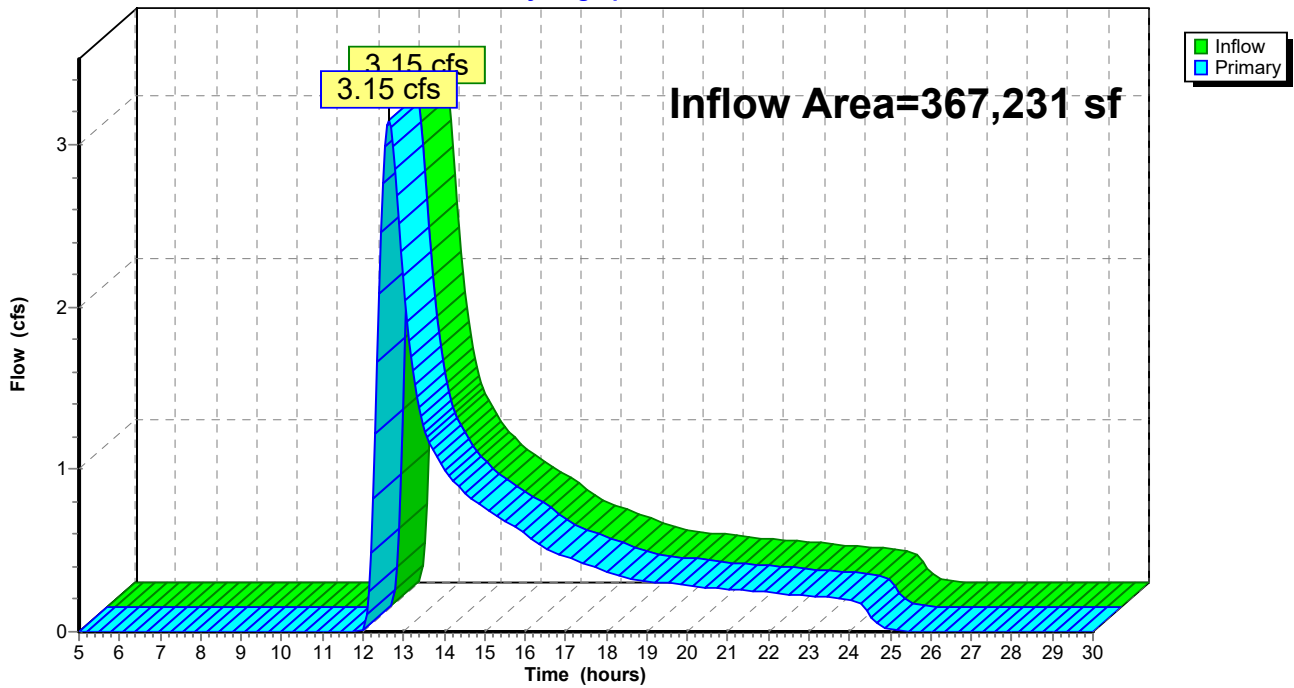
Summary for Link DP-1: Wetland

Inflow Area = 367,231 sf, 5.05% Impervious, Inflow Depth = 0.88" for 25-yr event
Inflow = 3.15 cfs @ 12.65 hrs, Volume= 27,014 cf
Primary = 3.15 cfs @ 12.65 hrs, Volume= 27,014 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Link DP-1: Wetland

Hydrograph



Proposed Conditions Knight Street

Type III 24-hr 100-yr Rainfall=8.70"

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Time span=5.00-30.00 hrs, dt=0.05 hrs, 501 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1: DA-1

Runoff Area=367,231 sf 5.05% Impervious Runoff Depth=2.12"
Flow Length=1,013' Tc=35.8 min UI Adjusted CN=45 Runoff=9.57 cfs 64,810 cf

Link DP-1: Wetland

Inflow=9.57 cfs 64,810 cf
Primary=9.57 cfs 64,810 cf

Total Runoff Area = 367,231 sf Runoff Volume = 64,810 cf Average Runoff Depth = 2.12"
94.95% Pervious = 348,687 sf 5.05% Impervious = 18,544 sf

Proposed Conditions Knight Street

Type III 24-hr 100-yr Rainfall=8.70"

Prepared by Wood

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Summary for Subcatchment 1: DA-1

Runoff = 9.57 cfs @ 12.57 hrs, Volume= 64,810 cf, Depth= 2.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=8.70"

Area (sf)	CN	Adj	Description
64,749	32		Woods/grass comb., Good, HSG A
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10.0	230	0.0030	0.38		Shallow Concentrated Flow, CD Short Grass Pasture Kv= 7.0 fps
5.6	325	0.0190	0.96		Shallow Concentrated Flow, DE Short Grass Pasture Kv= 7.0 fps
4.8	237	0.0140	0.83		Shallow Concentrated Flow, EF Short Grass Pasture Kv= 7.0 fps
0.2	36	0.1470	2.68		Shallow Concentrated Flow, FG Short Grass Pasture Kv= 7.0 fps
35.8	1,013	Total			

Proposed Conditions Knight Street

Prepared by Wood

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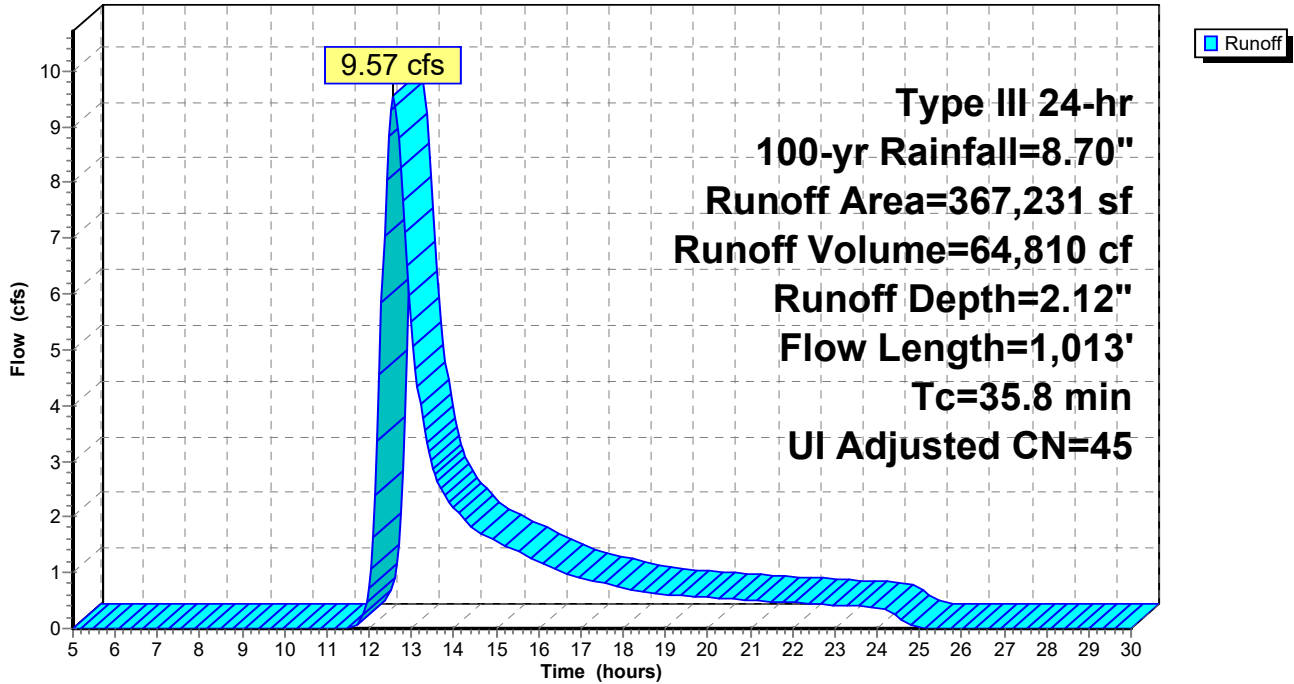
Type III 24-hr 100-yr Rainfall=8.70"

Printed 9/9/2021

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Subcatchment 1: DA-1

Hydrograph



Proposed Conditions Knight Street

Prepared by Wood

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Type III 24-hr 100-yr Rainfall=8.70"

Printed 9/9/2021

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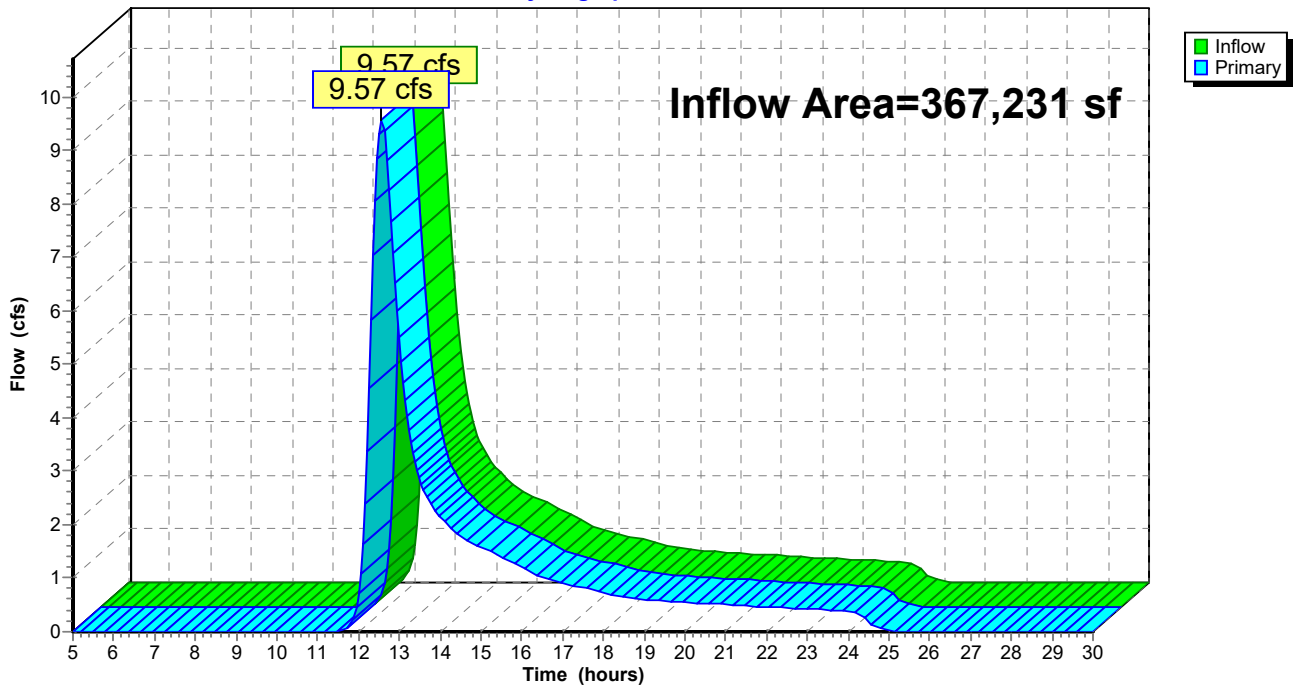
Summary for Link DP-1: Wetland

Inflow Area = 367,231 sf, 5.05% Impervious, Inflow Depth = 2.12" for 100-yr event
Inflow = 9.57 cfs @ 12.57 hrs, Volume= 64,810 cf
Primary = 9.57 cfs @ 12.57 hrs, Volume= 64,810 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.05 hrs

Link DP-1: Wetland

Hydrograph



APPENDIX

C

EXISTING AND PROPOSED DEVELOPMENT DRAINAGE FIGURES

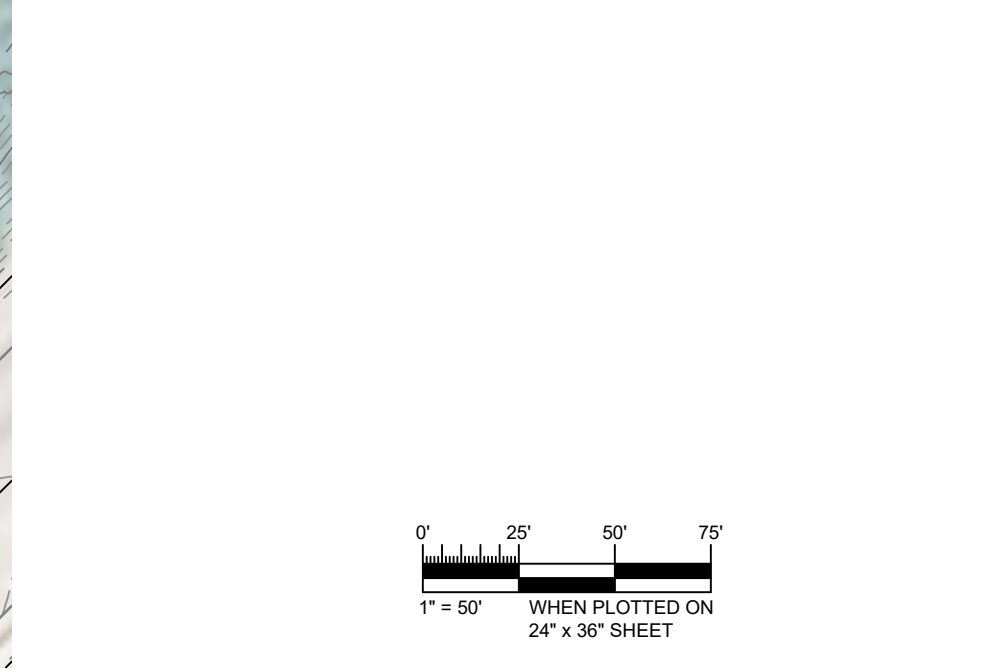


EXISTING LEGEND

---	MAJOR CONTOUR
---	MINOR CONTOUR
PL	SITE PROPERTY LINE
---	PARCEL LINE
---	OFF-SITE PROPERTY LINE
ZO	ZONING SETBACK
---	FENCE LINE
---	SANITARY SEWER UTILITY
---	GAS UTILITY
---	WATER UTILITY
---	STORM DRAIN UTILITY
---	WETLAND LINE WITH FLAG AND ID
---	50' WETLAND BUFFER
---	DIRT DRIVEWAY
---	TREE LINE
---	SCRUB LINE
---	UTILITY POLE
---	MONITORING WELL
---	SHRUBS
---	ROCKS AND BOULDERS
---	PARCEL ID
---	ZONE AE FEMA 100-YR FLOOD LINE WITH ZONE ID (LOCATED AT 28' ELEVATION)
---	ZONE X APPROXIMATE LIMIT OF WASTE
---	ZONE: LI ZONE: OS WARWICK ZONING BOUNDARY WITH ID

PROPOSED LEGEND

---	UTILITY POLE
---	SOLAR ARRAY (1 C-501)
---	EQUIPMENT PAD
---	GRAVEL ACCESS ROAD (2 C-501)
---	CONSTRUCTION ENTRANCE (4 C-501)
---	FENCE LINE (8 C-502)
---	FENCE LINE WITH PRIVACY SLATS
---	UNDERGROUND CONDUIT
---	OVERHEAD ELECTRIC LINE
---	LIMIT OF TREE CLEARING
---	LIMIT OF DISTURBANCE
---	SEDIMENT BARRIER (3 C-501)
---	AREA OF PROPOSED ZONE CHANGE FROM ZONE LI TO ZONE GI
---	SUBCATCHMENT AREA
---	TIME OF CONCENTRATION
---	FLOW DIRECTION
---	SOIL MAP UNIT ID
---	SUBCATCHMENT
---	DESIGN POINT



ISSUE / REVISION DESCRIPTION	DATE	REVISION	DATE	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	CR	GA	APPROVED
		0	06/28/2021				

PROJECT: 998.40 KW DC GROUND-MOUNT SOLAR PV DEVELOPMENT
 275 KNIGHT STREET
 WARWICK, RHODE ISLAND

TITLE: EXISTING DRAINAGE ANALYSIS

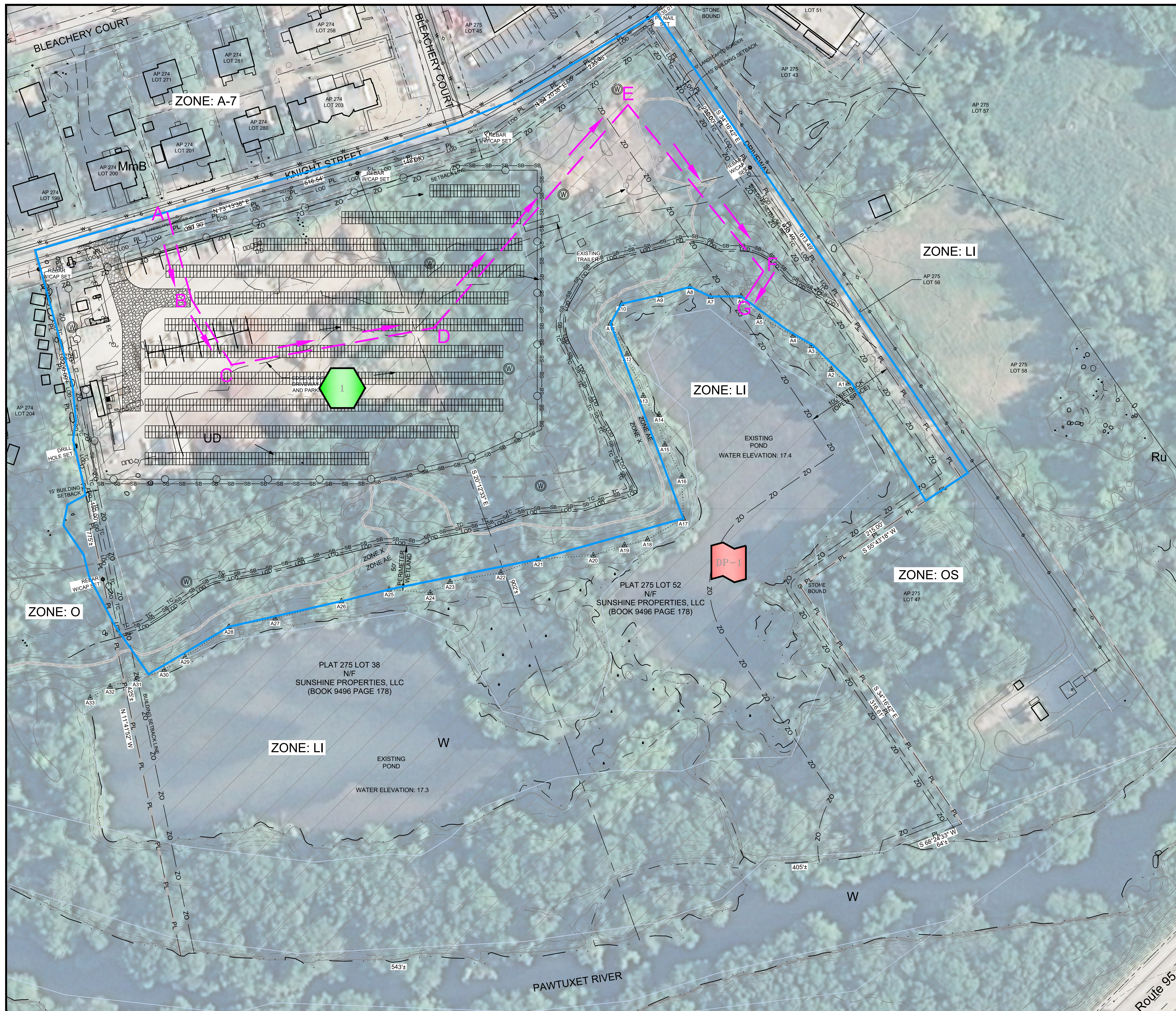
CLIENT: VCP, LLC
 150 TRUMBULL ST.
 HARTFORD, CT 06103

VEROLOGY

DESIGNED BY: CR	DRAWN BY: BEG
CHECKED BY: GAA	SCALE: AS SHOWN
PROJECT NUMBER: 3652200299	
DRAWING NUMBER: DA-1	
SHEET NUMBER: 1 OF 2	

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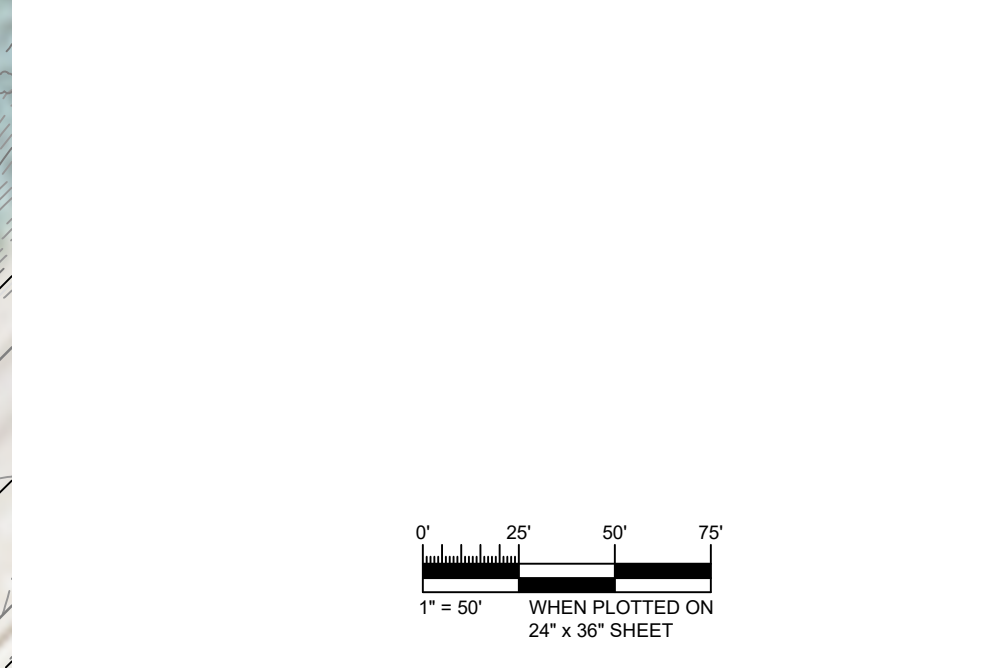


EXISTING LEGEND

---	MAJOR CONTOUR
---	MINOR CONTOUR
PL	SITE PROPERTY LINE
---	PARCEL LINE
---	OFF-SITE PROPERTY LINE
ZO	ZONING SETBACK
---	FENCE LINE
---	SANITARY SEWER UTILITY
---	GAS UTILITY
---	WATER UTILITY
---	STORM DRAIN UTILITY
---	WETLAND LINE WITH FLAG AND ID
---	50' WETLAND BUFFER
---	DIRT DRIVEWAY
---	TREE LINE
---	SCRUB LINE
---	UTILITY POLE
⊙	MONITORING WELL
○	SHRUBS
⊕	ROCKS AND BOULDERS
AP 274 LOT 204	PARCEL ID
---	ZONE AE FEMA 100-YR FLOOD LINE WITH ZONE ID (LOCATED AT 28' ELEVATION)
---	ZONE X APPROXIMATE LIMIT OF WASTE
---	ZONE: LI WARWICK ZONING BOUNDARY WITH ID
---	ZONE: OS

PROPOSED LEGEND

⊙	UTILITY POLE
⊙ 1 C-501	SOLAR ARRAY
⊙	EQUIPMENT PAD
⊙ 2 C-501	GRAVEL ACCESS ROAD
⊙ 4 C-501	CONSTRUCTION ENTRANCE
⊙ 8 C-502	FENCE LINE
⊙	FENCE LINE WITH PRIVACY SLATS
EC	UNDERGROUND CONDUIT
OHE	OVERHEAD ELECTRIC LINE
TC	LIMIT OF TREE CLEARING
LOD	LIMIT OF DISTURBANCE
SB	SEDIMENT BARRIER
⊙ 3 C-501	AREA OF PROPOSED ZONE CHANGE FROM ZONE LI TO ZONE GI
---	SUBCATCHMENT AREA
A---B	TIME OF CONCENTRATION
→	FLOW DIRECTION
Ru	SOIL MAP UNIT ID
⊙ 3	SUBCATCHMENT
DP-1	DESIGN POINT



ISSUE / REVISION DESCRIPTION	DATE	REVISION	DATE	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	CR	GA	APPROVED
0	06/28/2021						

PROJECT: 998.40 KW DC GROUND-MOUNT SOLAR PV DEVELOPMENT 275 KNIGHT STREET WARWICK, RHODE ISLAND

TITLE: PROPOSED DRAINAGE ANALYSIS

CLIENT: VCP, LLC 150 TRUMBULL ST. HARTFORD, CT 06103

VEROLOGY

DESIGNED BY: CR	DRAWN BY: BEG
CHECKED BY: GAA	SCALE: AS SHOWN
PROJECT NUMBER: 3652200299	
DRAWING NUMBER: DA-2	
SHEET NUMBER: 2 OF 2	

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APPENDIX

D

BALLAST BLOCK
AND GRAVEL PAD
AREA
CALCULATIONS

Ballast Block & Gravel Base Calculations

Ballast Block Calculations:

Ballast Block Length	= 7.75 ft.
Ballast Block Width	= 4 ft.
Ballast Block Area	= 7.75 * 4 = 31 sq.ft.
Ballast Block Count	= 192
Total Ballast Block Area	= 31 sq. ft * 192 = 5,952 sq.ft.

Actual ballast block length and width may change; Ballast block area shall not exceed 6,000 sq.ft. An area of 6,000 sq.ft is used in the HydroCAD analysis.

Gravel Ballast Block Pads:

Gravel Pads are approximately 8.75 ft. X 5 ft. which provides 6" perimeter skirt around the ballast block. See Detail 5 on Sheet C-501 of the Site Plans.

Gravel Pad Area for Sides along length of Ballast Block	= (0.5 ft. * 8.75 ft) x 2 sides = 8.75 sq. ft.
Gravel Pad Area for Sides along width of Ballast Block	= (0.5 ft. * 5 ft) x 2 sides = 5 sq. ft.
Gravel Pad Area per Pad	= 5 sq.ft. +8.75 sq. ft. = 13.75 sq.ft.
Gravel Pad Count	= 192
Total Gravel Pad Area	= 13.75 sq. ft * 192 = 2,640 sq.ft.

ATTACHMENT

D

SOIL EROSION AND
SEDIMENT
CONTROL PLAN

Soil Erosion and Sediment Control Plan

For:

Proposed Solar Development Project

Knight Street
Plat 275 Lot 38 & 52
Warwick, RI

Owner: Sunshine Properties, LLC
181 Knight Street
Warwick, Rhode Island 02886

Operator: VCP, LLC
150 Trumbull Street
Hartford, CT 06103
(860) 288-7215
info@verogy.com

Estimated Project Dates: Start Date: TBD
Completion Date: TBD

SESC Plan Prepared By: WSP USA Environmental & Infrastructure, Inc.
c/o Andrew Vardakis, PE
100 Apollo Drive St. Suite 302
Chelmsford, MA 01824
Phone: 1.978.483.6771
Email Address: Andrew.Vardakis@wsp.com
RI Registered Professional Engineer: License 12219

SESC Plan Preparation Date: June 2021

SESC Plan Revision Date: December 2022

OWNER CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under the direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete.

I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. I am aware that it is the responsibility of the site owner and operator to implement and amend the Soil Erosion and Sediment Control Plan as appropriate in accordance with the requirements of the RIPDES Construction General Permit.

Owner Signature:

Date

Owner Name: Sunshine Properties, LLC

Address: 181 Knight Street, Warwick, Rhode Island, 02886

Phone Number:

Email Address:

OPERATOR CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under the direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete.

I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. I am aware that it is the responsibility of the owner/operator to implement and amend the Soil Erosion and Sediment Control Plan as appropriate in accordance with the requirements of the RIPDES Construction General Permit.

Operator Signature:

Date

Contractor Representative:

Contractor Title: Developer

Contractor Company Name: VCP, LLC

Address: 150 Trumbull Street

Hartford, CT 06103

Phone Number: (860) 288-7215

Email Address: info@verogy.com

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OPERATOR CERTIFICATION	iii
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Soil Erosion and Sediment Control Plan
Proposed Solar Development Project
Knight Street, Warwick, RI

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Soil Erosion and Sediment Control Plan
Proposed Solar Development Project
Knight Street, Warwick, RI

INTRODUCTION

This Construction Site Soil Erosion and Sediment Control Plan (SESC Plan) has been prepared for VCP, LLC for the Proposed Solar Development Project on Knight Street, Warwick, Rhode Island. In accordance with the RIDEM Rhode Island Pollutant Discharge Elimination System (RIPDES) General Permit for Stormwater Discharge Associated with Construction Activity (RIPDES Construction General Permit (“CGP”)), projects that disturb one (1) or more acres require the preparation of a SESC Plan. This SESC Plan provides guidance for complying with the terms and conditions of the RIPDES Construction General Permit and Minimum Standard 10 of the RI Stormwater Design and Installation Standards Manual. In addition, this SESC Plan is also consistent with Part D of the *RI SESC Handbook* entitled “Soil Erosion and Sediment Control Plans”. This document does not negate or eliminate the need to understand and adhere to all applicable RIPDES regulations.

The purpose of erosion, runoff, and sedimentation control measures is to prevent pollutants from leaving the construction site and entering waterways or environmentally sensitive areas during and after construction. This SESC Plan has been prepared prior to the initiation of construction activities to address anticipated worksite conditions. The control measures depicted on the site plan and described in this narrative should be considered the minimum measures required to control erosion, sedimentation, and stormwater runoff at the site. Since construction is a dynamic process with changing site conditions, it is the operator’s responsibility to manage the site during each construction phase so as to prevent pollutants from leaving the site. This may require the operator to revise and amend the SESC Plan during construction to address varying site and/or weather conditions, such as by adding or realigning erosion or sediment controls to ensure the SESC Plan remains compliant with the RIPDES Construction General Permit. Records of these changes must be added to the amendment log attached to the SESC Plan, and to the site plans as “red-lined” drawings. Please Note: **Even if practices are correctly installed on a site according to the approved plan, the site is only in compliance when erosion, runoff, and sedimentation are effectively controlled throughout the entire site.**

It is the responsibility of the site owner and the site operator to maintain the SESC Plan at the site, including all attachments, amendments and inspection records, and to make all records available for inspection by RIDEM during and after construction. (RIPDES CGP - Part III.G)

The site owner, the site operator, and the designated site inspector are required to review the SESC Plan and sign the Party Certification pages (Section 8). The primary contractor (if different) and all subcontractors (if applicable) involved in earthwork or exterior construction activities are also required to review the SESC Plan and sign the certification pages before construction begins.

Any questions regarding the SESC Plan, control measures, inspection requirements, or any other facet of this document may be addressed to the RIDEM Office of Water Resources, at 401-222-4700 or via email: water@dem.ri.gov.

ADDITIONAL RESOURCES

Rhode Island Department of Environmental Management
Office of Water Resources
235 Promenade Street
Providence, RI 02908-5767
phone: 401-222-4700
email: water@dem.ri.gov

RIDEM *RI Stormwater Design and Installation Standards Manual* (RISDISM) (as amended)
<http://www.dem.state.ri.us/programs/benviron/water/permits/ripdes/stwater/t4guide/desman.htm>

RI Soil Erosion and Sediment Control Handbook
<http://www.dem.state.ri.us/soilerosion2014final.pdf>

RIDEM 2013 RIPDES Construction General Permit
<http://www.dem.ri.gov/pubs/regs/regs/water/ripdesca.pdf>

Rhode Island Department of Transportation *Standard Specifications for Road and Bridge Design and Other Specifications* and *Standard Details*
<http://www.dot.ri.gov/business/bluebook.php>

RIDEM Office of Water Resources Coordinated Stormwater Permitting website
<http://www.dem.state.ri.us/programs/benviron/water/permits/swcoord/index.htm>

RIDEM RIPDES Stormwater website
<http://www.dem.state.ri.us/programs/benviron/water/permits/ripdes/stwater/index.htm>

RIDEM Water Quality website (for 303(d) and TMDL listings)
<http://www.dem.ri.gov/programs/benviron/water/quality/index.htm>

RIDEM Rhode Island Natural Heritage Program
<http://www.dem.ri.gov/programs/bpoladm/plandev/heritage/index.htm>

RIDEM Geographic Data Viewer – Environmental Resource Map
<http://www.dem.ri.gov/maps/index.htm>

Natural Resources Conservation Service - Rhode Island Soil Survey Program
<http://www.ri.nrcs.usda.gov/technical/soils.html>

EPA NPDES – Stormwater Discharges from Construction Activities webpage:
<http://water.epa.gov/polwaste/npdes/stormwater/Stormwater-Discharges-From-Construction-Activities.cfm>

EPA Construction Site Stormwater Runoff Control BMP Menu
<http://water.epa.gov/polwaste/npdes/swbmp/Construction-Site-Stormwater-Run-Off-Control.cfm>

SECTION 1: SITE DESCRIPTION

1.1 Project/Site Information

Project/Site Name:

- Proposed Solar Development Project.
- The proposed solar facility (the "Site" or the "Project") will be located on the property defined by the City of Warwick as Assessor's Plat (AP) 275 Lots 38 and 52 (16.3± acres).
- Under proposed conditions, earthwork operations will be required to remediate the site with an engineered cap. With the exception of crushed stone access roads and an equipment pad, the entire site will be loamed and seeded and maintained as meadow grass for the life of the project.

Project Street/Location:

- Knight Street, Warwick, RI
- See **Attachment A** for Site Location Map.

The following are estimates of the construction site area:

- Total Project Area 16.3 ± acres
- Total Project Area to be Disturbed 3.9± acres

1.2 Receiving Waters

RIPDES CGP - Parts IV.A.7 & IV.A.8

List/description of separate storm sewer systems or drainage systems that may be impacted during construction and the water bodies that receive discharges from each storm sewer or drainage system:

- Runoff from the project flows overland and into existing wetland areas associated with Pawtuxet River. There are no closed drainage systems down-gradient of the project.

List/description of receiving waters that may be impacted during construction:

- Pawtuxet River Main Stem
- (Water Body ID: RI0006017R-03)

Are any of the receiving waters in the vicinity of the proposed construction project listed as being impaired or subject to a TMDL?

Yes No

If yes, List/provide description of 303(d)/TMDL waters and applicable TMDL requirements that must be addressed during construction:

- Total Phosphorous, non-native aquatic plants, mercury in fish tissue, enterococcus.

1.3 Natural Heritage Area Information

RIPDES CGP - Part III.H

Are there any Natural Heritage Areas being disturbed by the construction activity or will discharges be directed to the Natural Heritage Area as a result of the construction activity?

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Yes No

If yes, describe or refer to documentation which determines the likelihood of an impact on this area and the steps that will be taken to address any impacts.

1.4 *Historic Preservation/Cultural Resources*

Are there any historic properties, historic cemeteries or cultural resources on or near the construction site?

Yes No

Describe how this determination was made and summarize state or tribal review comments:

Based on RIDEM's Environmental Resource Map, there no Natural Heritage Areas located within the project site.

If yes, describe or refer to documentation which determines the likelihood of an impact on this historic property, historic cemetery or cultural resource and the steps taken to address that impact including any conditions or mitigation measures that were approved by other parties.

- No work is proposed within the limits of historic resources.

1.5 *Site Features and Constraints*

List All Site Constraints and Sensitive Areas that require avoidance and protection through the implementation of control measures:

- There are no other known site constrains or sensitive areas.

SECTION 2: EROSION, RUNOFF, AND SEDIMENT CONTROL

RIPDES Construction General Permit – Part III.J.1

The purpose of erosion controls is to prevent sediment from being detached and moved by wind or the action of raindrop, sheet, rill, gully, and channel erosion. Properly installed and maintained erosion controls are the primary defense against sediment pollution.

Runoff controls are used to slow the velocity of concentrated water flows. By intercepting and diverting stormwater runoff to a stabilized outlet or treatment practice or by converting concentrated flows to sheet flow erosion and sedimentation are reduced.

Sediment controls are the last line of defense against moving sediment. The purpose is to prevent sediment from leaving the construction site and entering environmentally sensitive areas.

This section describes the set of control measures that will be installed before and during the construction project to avoid, mitigate, and reduce impacts associated with construction activity. Specific control measures and their applicability are contained in Section Four: Erosion Control Measures, Section Five: Runoff Control Measures, and Section Six: Sediment Control Measures of the *RI SESC Handbook*. The *RI SESC Handbook* can be found at the following address:

<http://www.dem.ri.gov/soilerosion2014final.pdf>.

2.1 Avoid and Protect Sensitive Areas and Natural Features

Areas of existing and remaining vegetation and areas that are to be protected as identified in the Section 1.6 of the SESC Plan must be clearly identified on the SESC Site Plans for each Phase of Construction. Prior to any land disturbance activities commencing on the site, the Contractor shall physically mark limits of disturbance (LOD) on the site and any areas to be protected within the site, so that workers can clearly identify the areas to be protected.

Feature Requiring Protection	Construction Phase #	Method of Protection	Sheet #
Down Gradient	All	Straw wattle	C-101

2.2 Minimize Area of Disturbance

Will >5 acres be disturbed in order to complete this project?

Yes No

Will <5 acres be disturbed or will disturbance activities be completed within a six (6) month window?

Yes No

- Due to the size of the project area, the earthwork and final stabilization (loam and seed) may take more than one construction season to complete;
- Due to the size of the project area, the installation of the solar development components will take more than one construction season to complete. The goal will be to complete the solar installation in one construction season.

Based on the answers to the above questions will phasing be required for this project?

Yes No

2.3 Minimize the Disturbance of Steep Slopes

Are steep slopes (>15%) present within the proposed project area?

Yes No

2.4 Preserve Topsoil

Site owners and operators must preserve existing topsoil on the construction site to the maximum extent feasible and as necessary to support healthy vegetation, promote soil stabilization, and increase stormwater infiltration rates in the post-construction phase of the project.

Will existing topsoil be preserved at the site?

Yes No

- Topsoil will be stockpiled and re-used for vegetative stabilization on the solar development project. Once final grades have been established, the loam stockpiles across the site and seeded with meadow grass.
- Soil compaction must be minimized by maintaining limits of disturbance throughout construction. In instances where site soils are compacted the site owner and operator must restore infiltration capacity of the compacted soils by tilling or scarifying compacted soils and amending soils as necessary to ensure a minimum depth of topsoil is available in these areas. In areas where infiltrating stormwater treatment practices are located compacted soils must be amended such that they will comply the design infiltration rates established in the *RI Stormwater Design and Installation Standards Manual*.
- Notes for erosion controls and infiltration areas are located on Drawing C-501 and C-502. Site grading and installation of the solar array are anticipated to be installed with tracked, low ground-pressure equipment, such as bulldozers, excavators, or skid steer.
- In areas of site soiling capping, existing topsoil will not be preserved (it will be capped).

2.5 Stabilize Soils

Upon completion and acceptance of site preparation and initial installation of erosion, runoff, and sediment controls and temporary pollution prevention measures, the operator shall initiate appropriate temporary or permanent stabilization practices during all phases of construction on all disturbed areas as soon as possible, but not more than fourteen (14) days after the construction activity in that area has temporarily or permanently ceased.

Any disturbed areas that will not have active construction activity occurring within 14 days must be stabilized using the control measures depicted in the SESC Site Plans, in accordance with the *RI SESC Handbook*, and per manufacturer product specifications.

Only areas that can be reasonably expected to have active construction work being performed within 14 days of disturbance will be cleared/grubbed at any one time. It is NOT acceptable to clear and grub the entire construction site if portions will not be active within the 14-day time frame. Proper phasing of clearing and grubbing activities shall include temporary stabilization techniques for areas cleared and grubbed that will not be active within the 14-day time frame.

All disturbed soils exposed prior to October 15 of any calendar year shall be seeded by that date if vegetative measures are the intended soil stabilization method. Any such areas that do not have adequate vegetative stabilization, as determined by the site operator or designated inspector, by November 15, must be stabilized through the use of non-vegetative erosion control measures. If work continues within any of these areas during the period from October 15 through April 15, care must be taken to ensure that only the area required for that day's work is exposed, and all erodible soil must be restabilized within 5 working days. In limited circumstances, stabilization may not be required if the

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intended function of a specific area of the site necessitates that it remain disturbed (i.e. construction of a motocross track).

Temporary Vegetative Control Measures

- Because the project is anticipated to be completed in one construction season, no temporary vegetative control measures are proposed for the Project. Should land disturbing activities extend beyond one season, temporary vegetative measures may be installed as warranted.

Temporary Non-Vegetative Control Measures

- Straw wattle shall be installed and maintained where shown on the Drawings.
- Prior to starting any earthwork operations, Straw wattle shall be installed along the limit-of-disturbance, down-gradient of the project.
- Accumulated sediment shall be removed when its depth reaches 50% of the height of the wattle. This sediment control structure will remain in place until vegetation is established. Established means approximately 85% (as determined by construction inspector) of the area is vegetated with vigorous growth.
- A stabilized construction entrance shall be installed as shown on the Drawings. This entrance shall remain in place for the duration of the project and will be removed within 30 days after final site stabilization is achieved or after temporary BMP's are no longer needed.
- Erosion control matting shall be installed in other areas of erosion concern if necessary.

Permanent Vegetative Control Measures

- Upon completion of construction, all areas previously disturbed shall be permanently vegetated with loam and seed (with the exception of the proposed crushed stone access road) per the Rhode Island Soil Erosion and Sediment Control Handbook (RI SESC). These areas will be closely monitored by the contractor until such time as a satisfactory growth of vegetation is established. Satisfactory growth shall mean approximately 85% of the area is vegetated with vigorous growth.

Permanent Non-Vegetative Control Measures

- Erosion control matting shall be installed in other areas of erosion concern if necessary.

2.6 Protect Storm Drain Outlets

Temporary or permanent outlet protection must be used to prevent scour and erosion at discharge points through the protection of the soil surface, reduction in discharge velocities, and through the promotion of infiltration. Outlets often have high velocity, high volume flows, and require strong materials that will withstand the forces of stormwater. Storm drain outlet control measures also offer a last line of protection against sediment entering environmentally sensitive areas.

All stormwater outlets that may discharge sediment-laden stormwater flow from the construction site must be protected using the control practices depicted on the approved plan set and in accordance with the *RI SESC Handbook*.

Will temporary or permanent point source discharges be generated at the site as the result of construction of sediment traps or basins, diversions, and conveyance channels?

Yes No

2.7 Establish Temporary Controls for the Protection of Post-Construction Stormwater Treatment Practices

Temporary measures shall be installed to protect permanent or long-term stormwater control and treatment measures as they are installed and throughout the construction phase of the project so that they will function properly when they are brought online.

Will long-term stormwater treatment practices be installed at the site?

Yes No

- Long-term stormwater treatment practices include pervious pavement (crushed stone access drive).

2.8 Divert or Manage Run-on from Up-gradient Areas

Is stormwater from off-site areas anticipated to flow onto the project area or onto areas where soils will be disturbed?

Yes No

Structural control measures will be used to limit stormwater flow from coming onto the project area, and to divert and slow on-site stormwater flow that is expected to impact exposed soils for the purpose of minimizing erosion, runoff, and the discharge of pollutants from the site.

Control measures shall be installed as depicted on the approved plan set and in accordance with the <i>RI SESC Handbook</i> or the <i>RI Department of Transportation Standard Specifications for Road and Bridge Construction</i> . Run-on and Run-off Management				
Construction Phase #	On-site or Off-site Run-on?	Control measure	Identified on Sheet #	Detail(s) is/are on Sheet #
All	On-site	Straw wattle	C-101	C-502

- There is run-on from the project site to the wetland. This flow is accounted for in the proposed stormwater management system design.

2.9 Retain Sediment Onsite through Structural and Non-Structural Practices

SEDIMENT BARRIERS must be installed along the perimeter areas of the site that will receive stormwater from disturbed areas. This also may include the use of sediment barriers along the contour of disturbed slopes to maintain sheet flow and minimize rill and gully erosion during construction. Installation and maintenance of sediment barriers must be completed in accordance with the maintenance requirements specified by the product manufacturer or the *RI SESC Handbook*.

Will sediment barriers be utilized at the toe of slopes and other downgradient areas subject to stormwater impacts and erosion during construction?

Yes No

- As noted in previous sections of this SESC plan, Straw wattle will be installed along the downgradient portions of the project limits as shown on the Drawings. Straw wattle will remain in place until vegetation is well established.

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Will sediment barriers be utilized along the contour of slopes to maintain sheet flow and minimize rill and gully erosion during construction?

Yes No

SEDIMENT BARRIERS			
Construction Phase #	Sediment Barrier Type	Sediment Barrier is Labeled on Sheet #	Detail is on Sheet #
All	Straw wattle	C-101	C-502

INLET PROTECTION will be utilized to prevent soil and debris from entering storm drain inlets. These measures are usually temporary and are implemented before a site is disturbed. ALL stormwater inlets &/or catch basins that are operational during construction and have the potential to receive sediment-laden stormwater flow from the construction site must be protected using control measures outlined in the *RI SESC Handbook*.

For more information on inlet protection refer to the *RI SESC Handbook*, Inlet Protection control measure.

Maintenance

The operator must clean, or remove and replace the inlet protection measures as sediment accumulates, the filter becomes clogged, and/or as performance is compromised. Accumulated sediment adjacent to the inlet protection measures should be removed by the end of the same work day in which it is found or by the end of the following work day if removal by the same work day is not feasible.

Do inlets exist adjacent to or within the project area that require temporary protection?

Yes No

- There are no storm drain inlets down-gradient in the vicinity of the project that require inlet protection.

CONSTRUCTION ENTRANCE will be used in conjunction with the stabilization of the construction road to reduce the amount of sediment tracking off the project. This project has avoided placing the construction entrance on poorly drained soils where possible.

Any construction site access point must employ the control measures on the approved SESC site plans and in accordance with the *RI SESC Handbook*. Construction entrances shall be used in conjunction with the stabilization of construction roads to reduce the amount of mud picked up by construction vehicles. All construction access roads shall be constructed prior to any roadway accepting construction traffic.

The site owner and operator must:

1. Restrict vehicle use to properly designated exit points.
2. Use properly designed and constructed construction entrances at all points that exit onto paved roads so that sediment removal occurs prior to vehicle exit.
3. When and where necessary, use additional controls to remove sediment from vehicle tires prior to exit (i.e. wheel washing racks, rumble strips, and rattle plates).
4. Where sediment has been tracked out from the construction site onto the surface of off-site streets, other paved areas, and sidewalks, the deposited sediment must be removed by the end of the same work day in which the track out occurs. Track-out must be removed by sweeping, shoveling, or vacuuming these surfaces, or by using other similarly effective means of sediment removal.

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Will construction entrances be utilized at the proposed construction site?

Yes No

CONSTRUCTION ENTRANCE			
Construction Phase #	Soil Type at the Entrance	Entrance is located on Sheet #	Detail is on Sheet #
All	Stone	C-101	C-502

STOCKPILE CONTAINMENT will be used onsite to minimize or eliminate the discharge of soil, topsoil, base material or rubble, from entering drainage systems or surface waters. All stockpiles must be located within the limit of disturbance, protected from run-on with the use of temporary sediment barriers and provided with cover or stabilization to avoid contact with precipitation and wind where and when practical.

Stock pile management consists of procedures and practices designed to minimize or eliminate the discharge of stockpiled material (soil, topsoil, base material, rubble) from entering drainage systems or surface waters.

For any stockpiles or land clearing debris composed, in whole or in part, of sediment or soil, you must comply with the following requirements:

1. Locate piles within the designated limits of disturbance.
2. Protect from contact with stormwater (including run-on) using a temporary perimeter sediment barrier.
3. Where practicable, provide cover or appropriate temporary vegetative or structural stabilization to avoid direct contact with precipitation or to minimize sediment discharge.
4. **NEVER** hose down or sweep soil or sediment accumulated on pavement or other impervious surfaces into any stormwater conveyance, storm drain inlet, or surface water.
5. To the maximum extent practicable, contain and securely protect from wind.

2.10 Properly Design Constructed Stormwater Conveyance Channels

Are temporary stormwater conveyance practices required in order to properly manage runoff within the proposed construction project?

Yes No

- No temporary stormwater conveyance is proposed for this site.

2.11 Erosion, Runoff, and Sediment Control Measure List

It is expected that this table and corresponding Inspection Reports will be amended as needed throughout the construction project as control measures are added or modified.

All Phases		
Location/Station	Control Measure Description/Reference	Maintenance Requirement

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<p>Along down-gradient limit-of-disturbance/site perimeter</p>	<p>Straw wattle (RI SESC Handbook, Section Six: Sediment Control Measures)</p>	<p>Accumulated sediment shall be removed when its depth reaches 50% of the height of the sediment barrier. Damaged sediment barriers shall be replaced as required.</p>
<p>Site entrance</p>	<p>Stabilized Construction Entrance (RI SESC Handbook, Section Six: Sediment Control Measures)</p>	<p>The entrance shall be maintained in a condition which will prevent tracking or flowing of sediment onto pave surfaces. Provide periodic top dressing with additional stone or additional length as conditions demand.</p> <p>Periodic inspection and required maintenance shall be provided after each rain event.</p> <p>If maintenance alone is not enough to prevent excessive track out, increase length of entrance, modify construction access road surface, or install washrack or mudrack.</p>

SECTION 3: CONSTRUCTION ACTIVITY POLLUTION PREVENTION

The purpose of construction activity pollution prevention is to prevent day to day construction activities from causing pollution.

This section describes the key pollution prevention measures that must be implemented to avoid and reduce the discharge of pollutants in stormwater. Example control measures include the proper management of waste, material handling and storage, and equipment/vehicle fueling/washing/maintenance operations.

Where applicable, include *RI SESC Handbook* or the *RI Department of Transportation Standard Specifications for Road and Bridge Construction* (as amended) specifications.

3.1 Existing Data of Known Discharges from Site

Are there known discharges from the project area?

Yes No

Describe how this determination was made:

- Per discussions between the Operator and the Property Owner and from visual observation of the site.

If yes, list discharges and locations:

- Not applicable

Is there existing data on the quality of the known discharges?

Yes No

If yes, provide data:

- Not applicable

3.2 Prohibited Discharges

The following discharges are prohibited at the construction site:

- Contaminated groundwater, unless specifically authorized by the DEM. These types of discharges may only be authorized under a separate DEM RIPDES permit.
- Wastewater from washout of concrete, unless the discharge is contained and managed by appropriate control measures.
- Wastewater from washout and cleanout of stucco, paint, form release oils, curing compounds, and other construction materials.
- Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance. Proper storage and spill prevention practices must be utilized at all construction sites.
- Soaps or solvents used in vehicle and equipment washing.
- Phosphate-based fertilizers
- Fungicides and pesticides
- Toxic or hazardous substances from a spill or other release.

All types of waste generated at the site shall be disposed of in a manner consistent with State Law and/or regulations.

Will any of the above listed prohibited discharges be generated at the site?

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Yes No

- No washing will occur on-site and vehicles will not be stored or maintained on-site; therefore, no prohibited discharge control measures are required.

3.3 Proper Waste Disposal

Building materials and other construction site wastes must be properly managed and disposed of in a manner consistent with State Law and/or regulations.

- A waste collection area shall be designated on the site that does not receive a substantial amount of runoff from upland areas and does not drain directly to a waterbody or storm drain.
- All waste containers shall be covered to avoid contact with wind and precipitation.
- Waste collection shall be scheduled frequently enough to prevent containers from overflowing.
- All construction site wastes shall be collected, removed, and disposed of in accordance with applicable regulatory requirements and only at authorized disposal sites.
- Equipment and containers shall be checked for leaks, corrosion, support or foundation failure, or other signs of deterioration. Those that are found to be defective shall be immediately repaired or replaced.

Is waste disposal a significant element of the proposed project?

Yes No

- Waste disposal is anticipated to be minimal in the form of boxes and shipping materials for the solar PV materials; dumpsters will be provided throughout construction for disposal of shipping materials and dumpsters materials will be removed and disposed in accordance with all applicable state and federal regulations.

3.4 Spill Prevention and Control

All chemicals and/or hazardous waste material must be stored properly and legally in covered areas, with containment systems constructed in or around the storage areas. Areas must be designated for materials delivery and storage. All areas where potential spills can occur and their accompanying drainage points must be described. The owner and operator must establish spill prevention and control measures to reduce the chance of spills, stop the source of spills, contain and clean-up spills, and dispose of materials contaminated by spills. The operator must establish and make highly visible location(s) for the storage of spill prevention and control equipment and provide training for personnel responsible for spill prevention and control on the construction site.

Are spill prevention and control measures required for this particular project?

Yes No

- No chemicals or hazardous waste material will be used in the installation of the solar PV array; therefore, no spill prevention and control plan is required.

3.5 Control of Allowable Non-Stormwater Discharges

Are there allowable non-Stormwater discharges present on or near the project area?

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Yes No

Are there any known or proposed contaminated discharges, including anticipated contaminated dewatering operations, planned on or near the project area?

Yes No

3.6 Control Dewatering Practices

Site owners and operators are prohibited from discharging groundwater or accumulated stormwater that is removed from excavations, trenches, foundations, vaults, or other similar points of accumulation, unless such waters are first effectively managed by appropriate control measures.

Examples of appropriate control measures include, but are not limited to, temporary sediment basins or sediment traps, sediment socks, dewatering tanks and bags, or filtration systems (e.g. bag or sand filters) that are designed to remove sediment. Uncontaminated, non-turbid dewatering water can be discharged without being routed to a control.

At a minimum the following discharge requirements must be met for dewatering activities:

1. Do not discharge visible floating solids or foam.
2. To the extent feasible, utilize vegetated, upland areas of the site to infiltrate dewatering water before discharge. In no case will surface waters be considered part of the treatment area.
3. At all points where dewatering water is discharged, utilize velocity dissipation devices.
4. With filter backwash water, either haul it away for disposal or return it to the beginning of the treatment process.
5. Replace and clean the filter media used in dewatering devices when the pressure differential equals or exceeds the manufacturer's specifications.
6. Dewatering practices must involve the implementation of appropriate control measures as applicable (i.e. containment areas for dewatering earth materials, portable sediment tanks and bags, pumping settling basins, and pump intake protection.)

Is it at all likely that the site operator will need to implement construction dewatering in order to complete the proposed project?

Yes No

- It is not expected that any construction dewatering will be required for the project due to a relatively deep seasonal high groundwater table.

3.7 Establish Proper Building Material Staging Areas

All construction materials that have the potential to contaminate stormwater must be stored properly and legally in covered areas, with containment systems constructed in or around the storage areas. Areas must be designated for materials delivery and storage. Designated areas shall be approved by the site owner/engineer. Minimization of exposure is not required in cases where the exposure to precipitation and to stormwater will not result in the discharge of pollutants, or where exposure of a specific material or product poses little risk of stormwater contamination (such as final products and materials intended for outdoor use).

- Construction materials expected to be stored on-site are steel racking materials and solar panel modules. The potential for stormwater contamination due to material exposure is not anticipated.

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3.8 Minimize Dust

Dust control procedures and practices shall be used to suppress dust on a construction site during the construction process, as applicable. Precipitation, temperature, humidity, wind velocity and direction will determine amount and frequency of applications. However, the best method of controlling dust is to prevent dust production. This can best be accomplished by limiting the amount of bare soil exposed at one time. Dust Control measures outlined in the *RI SESC Handbook* shall be followed. Other dust control methods include watering, chemical application, surface roughening, wind barriers, walls, and covers.

- Dust will be controlled by scheduling construction activities so that a minimum of disturbed soil is exposed at one time. Dust shall be controlled on construction routes and other disturbed areas subject to surface dust movement and dust blowing. Dust control methods shall include vegetative cover, mulch (including gravel mulch), water sprinkling, stone, and barriers.

3.9 Designate Washout Areas

At no time shall any material (concrete, paint, chemicals) be washed into storm drains, open ditches, streets, streams, wetlands, or any environmentally sensitive area. The site operator must ensure that construction waste is properly disposed of, to avoid exposure to precipitation, at the end of each working day.

Will washout areas be required for the proposed project?

Yes No

- The use of any paint, chemicals, or any other pollutants that would require washout on-site are not anticipated. One concrete pad and concrete ballasts for the solar racking are proposed. No vehicles will be washed on-site.

3.10 Establish Proper Equipment/Vehicle Fueling and Maintenance Practices

Vehicle fueling shall not take place within regulated wetlands or buffer zone areas, or within 50-feet of the storm drain system. Designated areas shall be depicted on the SESC Site Plans, or shall be approved by the site owner.

Vehicle maintenance and washing shall occur off-site, or in designated areas depicted on the SESC Site Plans or approved of by the site owner. Maintenance or washing areas shall not be within regulated wetlands or buffer zone areas, or within 50-feet of the storm drain system. Maintenance areas shall be clearly designated, and barriers shall be used around the perimeter of the maintenance area to prevent stormwater contamination.

Construction vehicles shall be inspected frequently for leaks. Repairs shall take place immediately. Disposal of all used oil, antifreeze, solvents and other automotive-related chemicals shall be according to applicable regulations; at no time shall any material be washed down the storm drain or in to any environmentally sensitive area.

- Vehicles that require to be fueled or maintained on-site shall contain spill kits. All fueling activity in the vicinity of wetland setbacks shall be avoided.

3.11 Chemical Treatment for Erosion and Sediment Control

Chemical stabilizers, polymers, and flocculants are readily available on the market and can be easily applied to construction sites for the purposes of enhancing the control of erosion, runoff, and sedimentation. The following guidelines should be adhered to for construction sites that plan to use treatment chemicals as part of their overall erosion, runoff, and sedimentation control strategy.

The U.S. Environmental Protection Agency has conducted research into the relative toxicity of chemicals commonly used for the treatment of construction stormwater discharges. The research conducted by the

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EPA focused on different formulations of chitosan, a cationic compound, and both cationic and anionic polyacrylamide (PAM). In summary, the studies found significant toxicity resulting from the use of chitosan and cationic PAM in laboratory conditions, and significantly less toxicity associated with using anionic PAM. EPA's research has led to the conclusion that the use of treatment chemicals for erosion, runoff, and sedimentation control requires proper operator training and appropriate usage to avoid risk to aquatic species. In the case of cationic treatment chemicals additional safeguards may be necessary.

Application/Installation Minimum Requirements

If a site operator plans to use polymers, flocculants, or other treatment chemicals during construction the SESC plan must address the following:

1. Treatment chemicals shall not be applied directly to or within 100 feet of any surface water body, wetland, or storm drain inlet.
2. Use conventional erosion, runoff, and sedimentation controls prior to and after the application of treatment chemicals. Use conventional erosion, runoff, and sedimentation controls prior to chemical addition to ensure effective treatment. Chemicals may only be applied where treated stormwater is directed to a sediment control (e.g. temporary sediment basin, temporary sediment trap or sediment barrier) prior to discharge.
3. Sites shall be stabilized as soon as possible using conventional measures to minimize the need to use chemical treatment.
4. Select appropriate treatment chemicals. Chemicals must be selected that are appropriately suited to the types of soils likely to be exposed during construction and to the expected turbidity, pH, and flow rate of stormwater flowing into the chemical treatment system or treatment area. **Soil testing is essential. Using the wrong form of chemical treatment will result in some form of performance failure and unnecessary environmental risk.**
5. Minimize discharge risk from stored chemicals. Store all treatment chemicals in leak-proof containers that are kept under storm-resistant cover and surrounded by secondary containment structures (e.g., spill berms, decks, spill containment pallets), or provide equivalent measures, designed and maintained to minimize the potential discharge of treatment chemicals in stormwater or by any other means (e.g., storing chemicals in covered areas or having a spill kit available on site).
6. Use chemicals in accordance with good engineering practices and specifications of the chemical provider/supplier. You must also use treatment chemicals and chemical treatment systems in accordance with good engineering practices, and with dosing specifications and sediment removal design specifications provided by the supplier of the applicable chemicals, or document specific departures from these practices or specifications and how they reflect good engineering practice.

Will chemical stabilizers, polymers, flocculants or other treatment chemicals be utilized on the proposed construction project?

- Yes No

Treatment Chemical SESC Plan Weekly Inspection Report Documentation Requirements

1. Document the type and quantity of treatment chemicals applied.
2. List the date, duration of discharge, and estimated discharge rate.
3. Provide an estimate of the volume of water treated.

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4. Provide an estimate of the concentration of treatment chemicals in the discharge, with supporting calculations.

3.12 Construction Activity Pollution Prevention Control Measure List

It is expected that this table will be amended as needed throughout the construction project.

All Phases		
Location/Station	Control Measure Description/Reference	Maintenance Requirement
Concrete ballasts, footings, and equipment pads – SESC Plan C-6	<p>Prefabricated Concrete Washout Container with Ramp. Used to contain concrete washout during concrete pouring operations.</p> <p>(RI SESC Handbook Section Three: Pollution Prevention and Good Housekeeping, Concrete Washouts)</p>	<p>Verify that concrete washout container(s) are in place prior to pouring concrete. Inspect daily to verify continued proper performance. Check remaining capacity during pouring operations. Check for leaks periodically.</p>
Staging Area	<p>Waste Management</p> <p>(RI SESC Handbook Section Three: Pollution Prevention and Good Housekeeping, Concrete Washouts)</p>	<p>All waste containers will be covered to avoid contact with wind and precipitation. Waste collection will be scheduled frequently enough to prevent containers from overflowing. All construction site wastes will be collected, removed, and disposed of in accordance with applicable regulatory requirements and only at authorized disposal sites.</p> <p>Inspect storage and use areas and identify containers or equipment that could malfunction and cause leaks or spills. Check equipment and containers for leaks, corrosion, support or foundation failure, or other signs of deterioration, and test them for soundness. Immediately repair or replace any that are found to be defective.</p>

SECTION 4: CONTROL MEASURE INSTALLATION, INSPECTION, and MAINTENANCE

4.1 Installation

Complete the installation of temporary erosion, runoff, sediment, and pollution prevention control measures by the time each phase of earth-disturbance has begun. All stormwater control measures must be installed in accordance with good judgment, including applicable design and manufacturer specifications. Installation techniques and maintenance requirements may be found in manufacturer specifications and/or the *RI SESC Handbook*.

- Straw wattle shall be installed at locations specified on the Drawings prior to earthwork activities.
- While not anticipated, erosion control matting, if required, shall have the ends of matting stapled with at least 6" of material overlap.

4.2 Monitoring Weather Conditions

Anticipating Weather Events - Care will be taken to the best of the operator's ability to avoid disturbing large areas prior to anticipated precipitation events. Weather forecasts must be routinely checked, and in the case of an expected precipitation event of over 0.25-inches over a 24-hour period, it is highly recommended that all control measures should be evaluated and maintained as necessary, prior to the weather event. In the case of an extreme weather forecast (greater than one-inch of rain over a 24-hour period), additional erosion/sediment controls may need to be installed.

Storm Event Monitoring For Inspections - At a minimum, storm events must be monitored and tracked in order to determine when post-storm event inspections must be conducted. Inspections must be conducted and documented at least once every seven (7) calendar days and within twenty-four (24) hours after any storm event, which generates at least 0.25 inches of rainfall per twenty-four (24) hour period and/or after a significant amount of runoff or snowmelt.

The weather gauge station and website that will be utilized to monitor weather conditions on the construction site is as follows:

- The Warwick, RI weather gauge station, Greenwood Proper 18 Station, shall be used via the Weather Underground website (wunderground.com) to monitor weather conditions at the site.

4.3 Inspections

Minimum Frequency - Each of the following areas must be inspected by or under the supervision of the owner and operator at least once every seven (7) calendar days and within twenty-four (24) hours after any storm event, which generates at least 0.25 inches of rainfall per twenty-four (24) hour period and/or after a significant amount of runoff or snowmelt:

- a. All areas that have been cleared, graded, or excavated and where permanent stabilization has not been achieved;
- b. All stormwater erosion, runoff, and sediment control measures (including pollution prevention control measures) installed at the site;
- c. Construction material, unstabilized soil stockpiles, waste, borrow, or equipment storage, and maintenance areas that are covered by this permit and are exposed to precipitation;

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- d. All areas where stormwater typically flows within the site, including temporary drainage ways designed to divert, convey, and/or treat stormwater;
- e. All points of discharge from the site;
- f. All locations where temporary soil stabilization measures have been implemented;
- g. All locations where vehicles enter or exit the site.

Reductions in Inspection Frequency - If earth disturbing activities are suspended due to frozen conditions, inspections may be reduced to a frequency of once per month. The owner and operator must document the beginning and ending dates of these periods in an inspection report.

Qualified Personnel – The site owner and operator are responsible for designating personnel to conduct inspections and for ensuring that the personnel who are responsible for conducting the inspections are “qualified” to do so. A “qualified person” is a person knowledgeable in the principles and practices of erosion, runoff, sediment, and pollution prevention controls, who possesses the skills to assess conditions at the construction site that could impact stormwater quality, and the skills to assess the effectiveness of any stormwater controls selected and installed to meet the requirements of the permit.

Recordkeeping Requirements - All records of inspections, including records of maintenance and corrective actions must be maintained with the SESC Plan. Inspection records must include the date and time of the inspection, and the inspector’s name, signature, and contact information.

General Notes

- A separate inspection report will be prepared for each inspection.
- The Inspection Reference Number shall be a combination of the RIPDES Construction General Permit No - consecutively numbered inspections. ex: Inspection reference number for the 4th inspection of a project would be: RIR10####-4
- Each report will be signed and dated by the Inspector and must be kept onsite.
- Each report will be signed and dated by the Site Operator.
- The corrective action log contained in each inspection report must be completed, signed, and dated by the site operator once all necessary repairs have been completed.
- It is the responsibility of the site operator to maintain a copy of the SESC Plan, copies of all completed inspection reports, and amendments as part of the SESC Plan documentation at the site during construction.

Failure to make and provide documentation of inspections and corrective actions under this part constitutes a violation of your permit and enforcement actions under 46-12 of R.I. General Laws may result.

4.4 Maintenance

Maintenance procedures for erosion and sedimentation controls and stormwater management structures/facilities are described on the SESC Site Plans and in the *RI SESC Handbook*.

Site owners and operators must ensure that all erosion, runoff, sediment, and pollution prevention controls remain in effective operating condition and are protected from activities that would reduce their effectiveness. Erosion, runoff, sedimentation, and pollution prevention control measures must be maintained throughout the course of the project.

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Note: It is recommended that the site operator designates a full-time, on-site contact person responsible for working with the site owner to resolve SESC Plan-related issues.

4.5 Corrective Actions

If, in the opinion of the designated site inspector, corrective action is required, the inspector shall note it on the inspection report and shall inform the site operator that corrective action is necessary. The site operator must make all necessary repairs whenever maintenance of any of the control measures instituted at the site is required.

In accordance with the *RI SESC Handbook*, the site operator shall initiate work to fix the problem immediately after its discovery, and complete such work by the close of the next work day, if the problem does not require significant repair or replacement, or if the problem can be corrected through routine maintenance.

When installation of a new control or a significant repair is needed, site owners and operators must ensure that the new or modified control measure is installed and made operational by no later than seven (7) calendar days from the time of discovery where feasible. If it is infeasible to complete the installation or repair within seven (7) calendar days, the reasons why it is infeasible must be documented in the SESC Plan along with the schedule for installing the control measures and making it operational as soon as practicable after the 7-day timeframe. Such documentation of these maintenance procedures and timeframes should be described in the inspection report in which the issue was first documented. If these actions result in changes to any of the control measures outlined in the SESC Plan, site owners and operators must also modify the SESC Plan accordingly within seven (7) calendar days of completing this work.

SECTION 5: AMENDMENTS

This SESC Plan is intended to be a working document. It is expected that amendments will be required throughout the active construction phase of the project. **Even if practices are installed on a site according to the approved plan, the site is only in compliance when erosion, runoff, and sedimentation are effectively controlled throughout the entire site for the entire duration of the project.**

The SESC Plan shall be amended within seven (7) days whenever there is a change in design, construction, operation, maintenance or other procedure which has a significant effect on the potential for the discharge of pollutants, or if the SESC Plan proves to be ineffective in achieving its objectives (i.e. the selected control measures are not effective in controlling erosion or sedimentation).

In addition, the SESC Plan shall be amended to identify any new operator that will implement a component of the SESC Plan.

All revisions must be recorded in the Record of Amendments Log Sheet, which is contained in Attachment G of this SESC Plan and dated red-lined drawings and/or a detailed written description must be appended to the SESC Plan. Inspection Forms must be revised to reflect all amendments. Update the Revision Date and the Version # in the footer of the Report to reflect amendments made.

All SESC Plan Amendments, except minor non-technical revisions, must be approved by the site owner and operator. Any amendments to control measures that involve the practice of engineering must be reviewed, signed, and stamped by a Professional Engineer registered in the State of RI.

The amended SESC plan must be kept on file at the site while construction is ongoing and any modifications must be documented.

Attach a copy of the Amendment Log.

SECTION 6: RECORDKEEPING

RIPDES Construction General Permit – Parts III.D, III.G, III.J.3.b.iii, & V.O

It is the site owner and site operator's responsibility to have the following documents available at the construction site and immediately available for RIDEM review upon request:

- A copy of the fully signed and dated SESC Plan, which includes:
 - A copy of the Site Location Maps
INCLUDED AS ATTACHMENT A
 - A copy of all SESC Site Plans
INCLUDED AS ATTACHMENT B
 - A copy of the RIPDES Construction General Permit (*Operator copy only*)
INCLUDED AS ATTACHMENT C
 - A copy of any regulatory permits (RIDEM Freshwater Wetlands Permit, CRMC Assent, RIDEM Water Quality Certification, RIDEM Groundwater Discharge Permit, RIDEM RIPDES Construction General Permit authorization letter, etc.) (*Not Applicable*)
INCLUDED AS ATTACHMENT D
 - The signed and certified NOI form or permit application form (*Not Applicable*)
INCLUDED AS ATTACHMENT E
 - Completed Inspection Reports w/Completed Corrective Action Logs
INCLUDED AS ATTACHMENT F
 - SESC Plan Amendment Log
INCLUDED AS ATTACHMENT G

SECTION 7: PARTY CERTIFICATIONS

RIPDES Construction General Permit – Part V.G

All parties working at the project site are required to comply with the Soil Erosion and Sediment Control Plan (SESC Plan including SESC Site Plans) for any work that is performed on-site. The site owner, site operator, contractors and sub-contractors are encouraged to advise all employees working on this project of the requirements of the SESC Plan. A copy of the SESC Plan may be obtained by contacting the site owner or site operator.

The site owner and site operator and each subcontractor engaged in activities at the construction site that could impact stormwater must be identified and sign the following certification statement.

I acknowledge that I have read and understand the terms and conditions of the Soil Erosion and Sediment Control (SESC) Plan for the above designated project and agree to follow the control measures described in the SESC Plan and SESC Site Plans.

Site Owner:

Sunshine Properties, LLC
181 Knight Street
Warwick, RI, 02886

signature/date

Site Operator:

VCP, LLC.
150 Trumbull Street, 4th Floor
Hartford, CT 06103
(860) 288-7215
info@verogy.com

signature/date

Designated Site Inspector:

Insert Company or Organization Name
Insert Name & Title
Insert Address
Insert City, State, Zip Code
Insert Telephone Number, Insert Fax/Email

signature/date

Subcontractor SESC Plan Contact:

Insert Company or Organization Name
Insert Name & Title
Insert Address
Insert City, State, Zip Code
Insert Telephone Number, Insert Fax/Email

signature/date

LIST OF ATTACHMENTS

Attachment A – Site Location Maps

Attachment B - SESC Site Plans

*Attachment C - Copy of RIPDES Construction General Permit and Authorization to Discharge
(Operator copy only)*

Attachment D - Copy of Other Regulatory Permits (Not Applicable)

Attachment E - Copy of RIPDES NOI

Attachment F - Inspection Reports w/ Corrective Action Log

Attachment G - SESC Plan Amendment Log

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ATTACHMENT A
SITE LOCATION MAP



AERIAL MAP
Ground-Mount Solar Development
Knight Street Solar
Parcel ID 275-0038 and 275-0052


Verogy, Inc.
150 Trumbull Street, 4th Floor
Hartford, CT 06103

Legend


 Site Property Line

Notes & Sources

0 0.1 Miles



WSP Environment & Infrastructure, Inc.
275 Promenade Street, Suite 100
Providence, RI 02908
(401) 648-9240

N

FIGURE
1

Soil Erosion and Sediment Control Plan
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ATTACHMENT B
SESC SITE PLANS

(See Permitting Set)

Soil Erosion and Sediment Control Plan
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ATTACHMENT C
COPY OF RIPDES CONSTRUCTION GENERAL
PERMIT AND AUTHORIZATION TO DISCHARGE
(Operator copy only)

Link: <http://www.dem.ri.gov/programs/water/permits/ripdes/stormwater/construction.php>

Soil Erosion and Sediment Control Plan
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ATTACHMENT D
COPY OF OTHER REGULATORY PERMITS
(Not Applicable)

Soil Erosion and Sediment Control Plan
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ATTACHMENT E
COPY OF RIPDES NOI

Soil Erosion and Sediment Control Plan
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ATTACHMENT F
INSPECTION REPORTS W/ CORRECTIVE ACTION LOG

SESC Plan Inspection Report

Project Information			
Name			
Location			
DEM Permit No.			
Site Owner	Name	Phone	Email
Site Operator	Name	Phone	Email
Inspection Information			
Inspector Name	Name	Phone	Email
Inspection Date		Start/End Time	
Inspection Type <input type="checkbox"/> Weekly <input type="checkbox"/> Pre-storm event <input type="checkbox"/> During storm event <input type="checkbox"/> Post-storm event <input type="checkbox"/> Other			
Weather Information			
Last Rain Event Date: Duration (hrs): Approximate Rainfall (in):			
Rain Gauge Location & Source:			
Weather at time of this inspection:			

Check statement that applies then sign and date below:

I, as the designated Inspector, certify that this site has been inspected as required by regulation and I have determined that maintenance and corrective actions are not required at this time.

I, as the designated Inspector, certify that this site has been inspected as required by regulation and I have made the determination that the site requires corrective actions. The required corrective actions are noted within this inspection report.

Inspector:	Print Name	Signature	Date
<p>The Site Operator acknowledges by his/her signature, the receipt of this SESC Plan inspection report and its findings. He/she acknowledges that all recommended corrective actions must be completed and documentation of all such corrective actions must be made in this inspection report per applicable regulations.</p>			
Operator:	Print Name	Signature	Date

Site-specific Control Measures

Number the structural and non-structural stormwater control measures identified in the SESC Plan and on the SESC Site Plans and list them below (add as necessary). Bring a copy of this inspection form and any applicable SESC Site Plans with you during your inspections. This list will assist you to inspect all control measures at your site.

FILL THIS TABLE USING THE SESC PLAN TABLES 2.11 & 3.12.

	Location/Station	Control Measure Description	Installed & Operating Properly?	Assoc. Photo/ Figure #	Corrective Action Needed (Yes or No; if 'Yes', please detail action required)
1	Perimeter	Straw Wattle, Compost Tubes. Section Six, Sediment Control Measures, Straw Wattles, Compost Tubes and Fiber Rolls – RI SESC Handbook.	<input type="checkbox"/> Yes <input type="checkbox"/> No		
2	Construction Entrance	Stone Stabilized Pad. Section Six: Sediment Control Measures – Construction Entrances – RI SESC Handbook.	<input type="checkbox"/> Yes <input type="checkbox"/> No		
3	Attention Operator:	You must modify this inspection form as the project progresses, control measure locations change, and amendments to the SESC Plan are instituted in the field.	<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		

PROJECT:

INSPECTION DATE:

	Location/Station	Control Measure Description	Installed & Operating Properly?	Assoc. Photo/ Figure #	Corrective Action Needed (Yes or No; if 'Yes', please detail action required)
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		
			<input type="checkbox"/> Yes <input type="checkbox"/> No		

(add more as necessary)

General Site Issues

Below are some general site issues that should be assessed during inspections. Please **customize** this list as needed for conditions at the site.

	Compliance Question		Assoc. Photo/ Figure #	Corrective Action Needed (If 'Yes', please detail action required and include location/station)
1	Have all control measures been installed as specified in the RISESC Handbook and prior to any earth disturbing activities?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
2	Are appropriate limits of disturbance (LOD) established?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
3	Are controls that limit runoff from exposed soils by diverting, retaining, or detaining flows (such as check dams, sediment basins, etc.) in place?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
4	Are all temporary conveyance practices installed correctly and functioning as designed?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
5	Has maintenance been performed as required to ensure continued proper function of all temporary conveyances practices?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
6	Were all exposed soils seeded by October 15 th ?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
7	Have soils been stabilized where earth disturbance activities have permanently or temporarily ceased on any portion of the site and will not resume for more than 14 days?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
8	In instances where adequate vegetative stabilization was not established by November 15 th , have non-vegetative erosion control measures must be employed?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
9	If work is to continue from October 15 th through April 15 th , are steps taken to ensure that only the day's work area will be exposed and all erodible soil is stabilized within 5 working days?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
10	Have inlet protection measures (such as fabric drop inlet protection, curb drop inlet protection, etc.) been properly installed?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
11	Has the operator cleaned and maintained inlet protection measures when needed?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
12	Has the operator removed accumulated sediment adjacent to inlet protection measures within 24 hours of detection?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		

	Compliance Question		Assoc. Photo/ Figure #	Corrective Action Needed (If 'Yes', please detail action required and include location/station)
13	Has the operator properly installed outlet protection (such as riprap, turf mats, etc.) at all temporary and permanent discharge points?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
14	Are all outlet protection measures functioning properly in order to reduce discharge velocity, promote infiltration, and eliminate scour?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
15	Have all discharge points been inspected to ensure the prevention of scouring and channel erosion?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
16	Have sediment controls been installed along perimeter areas that will receive stormwater from earth disturbing activities?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
17	Is the operator maintaining sediment controls in accordance with the requirements in the <i>RI SESC Handbook</i> ?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
18	Have temporary sediment barriers been installed around permanent infiltration areas (such as bioretention areas, infiltration basins, etc.)?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
19	Have staging areas and equipment routing been implemented to avoid compaction where permanent infiltration areas will be located?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
20	Are surface outlet structures (such as skimmers, siphons, etc.) installed for each temporary sediment basin? [Exception: frozen conditions]	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
21	Have all temporary sediment basins or traps been inspected and maintained as required to ensure proper function?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
22	Does the project include the use of polymers, flocculants, or other chemicals to control erosion, sedimentation, or runoff from the site?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
23	Are all chemicals being managed in accordance with Appendix J of the <i>RI SESC Handbook</i> and current best management practices?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
24	Has the site operator taken steps to prohibit the following pollutant discharges on the site?			
a	Contaminated groundwater.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		

	Compliance Question		Assoc. Photo/ Figure #	Corrective Action Needed (If 'Yes', please detail action required and include location/station)
b	Wastewater from washout of concrete; unless properly contained, managed, and disposed of.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
c	Wastewater from washout and cleanout of stucco, paint, form release oils, curing compounds, and other construction products.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
d	Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
e	Soaps or solvents used in vehicle and equipment washing.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
f	Toxic or hazardous substances from a spill or other release.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
25	Is the operator using properly constructed entrances/exits to the site so sediment removal occurs prior to vehicles exiting?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
26	If needed, are additional controls (such as rumble strips, rattle plates, etc.) in place to remove sediment from tires prior to exiting?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
27	Is sediment track-out being removed by the end of the same workday in which it occurs (via sweeping, shoveling, or vacuuming)?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
28	Are all wastes generated at the site being managed and properly disposed of by the end of each workday?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
29	Are all chemicals and hazardous waste materials stored properly in covered areas and surrounded by containment control systems?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
30	Has the operator established highly visible locations for the storage of spill prevention and control equipment on the construction site?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
31	Are allowable non-stormwater discharges being managed properly with adequate controls?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
32	Is the site operator properly managing groundwater or stormwater that is removed from excavations, trenches, or similar points of accumulation?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
33	Are proper procedures and controls in place for the storage of materials that may discharge pollutants if	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		

	Compliance Question		Assoc. Photo/ Figure #	Corrective Action Needed (If 'Yes', please detail action required and include location/station)
	exposed to stormwater?			
	Are stockpiles located within the limits of disturbance?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
	Are stockpiles being protected from contact with stormwater using a temporary sediment barrier?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
	Where needed, has cover or appropriate temporary vegetative or structural stabilization been utilized for stockpiles?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
	Is the operator effectively managing the generation of dust through the use of water, chemicals, or minimization of exposed soil?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
	Are designated washout areas (such as wheel washing stations, washout for concrete, paint, stucco, etc.) clearly marked on the site?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
	Are vehicle fueling and maintenance areas properly located to prevent pollutants from impacting stormwater and sensitive receptors?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A		
	(Other)			

(add more as necessary)

PROJECT:

INSPECTION DATE:

General Field Comments:

PROJECT:

INSPECTION DATE:

Photos:

(Associated photos – each photo should be dated and have a unique identification # and written description indicating where it is located within the project area. If a close up photo is required, it should be preceded with a photo including both the detail area and some type of visible fixed reference point. Photos should be annotated with Station numbers and other identifying information where needed.)

Photo #: (insert Photo here)	Station:
	Description:

Photo #: (insert Photo here)	Station:
	Description:

Photo #: (insert Photo here)	Station:
	Description:

Photo #: (insert Photo here)	Station:
	Description:

Photo #: (insert Photo here)	Station:
	Description:

Photo #: (insert Photo here)	Station:
	Description:

(add more as necessary)

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ATTACHMENT G
SESC PLAN AMENDMENT LOG

ATTACHMENT

E

OPERATION AND
MAINTENANCE PLAN

VCP, LLC

STORMWATER OPERATION & MAINTENANCE PLAN

PROPOSED SOLAR DEVELOPMENT – KNIGHT
STREET

PLAT 275 LOTS 38 AND 52





STORMWATER OPERATION & MAINTENANCE PLAN

PROPOSED SOLAR DEVELOPMENT – KNIGHT STREET

PLAT 275 LOTS 38 AND 52

VCP, LLC

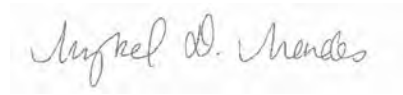
PROJECT NO.: 3652200299
DATE: NOVEMBER 30, 2022

WSP USA ENVIRONMENT & INFRASTRUCTURE INC.
100 APOLLO DRIVE, SUITE 302
CHELMSFORD, MA 01824

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SIGNATURES

PREPARED BY



Mykel Mendes
Project Engineer

APPROVED BY



Andrew Vardakis, PE
Project Manager

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APPENDICES

- Appendix A: Operation & Maintenance Figure
- Appendix B: Stormwater Facility Maintenance Agreement
- Appendix C: Operation, Maintenance, and Management Inspection Checklists

1.0 INTRODUCTION

On behalf of VCP, LLC (developer), WSP Environment & Infrastructure, Inc. (WSP) has prepared this Stormwater Operation & Maintenance Plan in support of the redevelopment of a proposed solar development project to be located on a 16.3±-acre parcel of land at Knight Street in Warwick, Rhode Island. The project area consists of Assessor's Plat (AP) 275 Lot 38 and 52.

The proposed 998.4 kilowatt solar development will occupy approximately 3.85± acres of the total 16.3± acre parcel assemblage. Solar panels will be installed on a 30-degree tilt racking system connected from the customer-owned electrical equipment (transformers and load centers) located within the fence to new utility poles and then to the interconnection point at an existing utility pole #17 on Knight Street. The proposed access road will be improved to conform to City requirements and will provide vehicular access for inspection and maintenance of the solar equipment. The project has also been designed to control stormwater quality and quantity for the development. Proposed water quality BMPs for treatment of runoff include a crushed stone access road (pervious pavement). Mitigation of peak runoff has been provided to ensure post-development rates will be less than pre-development discharge rates for the 1-, 2-, 10-, 25- and 100-year storm events. All components of the stormwater management system have been designed to comply with the requirements set forth in the latest edition of the "Rhode Island Stormwater Design and Installation Standards Manual (RISDISM)" and the Rhode Island Stormwater Management, Design, and Installation Rules (250-RICR-150-10-8). The location of the stormwater BMP is depicted on the Operations & Maintenance Figure provided in Appendix A.

The proposed stormwater BMP must be inspected regularly and maintained in accordance with the checklist provided in Appendix C and described herein to ensure that they continue to perform as designed. Inspections shall be performed by someone with knowledge and experience with stormwater systems; however, when the routine inspection reveals a question of structural or hydraulic integrity affecting public safety, inspections shall be performed by a registered professional engineer. The inspection process shall document observations made in the field and shall cover structural conditions, evidence of vandalism, condition of vegetation, occurrence of obstructions, unsafe conditions, and build-up of trash, sediments, and pollutants.

Routine maintenance activities shall be scheduled to be performed on a regular basis and generally do not depend on findings from inspections. These tasks shall include such things as vegetation maintenance (such as mowing), and trash/debris removal. These tasks shall be performed as needed, depending upon the season and type of actions required.

This project includes one stormwater BMP for which inspections must be performed and documented by Inspection Checklist(s). The BMP is listed in the table below and the appropriate Inspection Checklist(s) noted. Refer to the following section for more detailed descriptions of each type of BMP and the figure included in Appendix A for their locations.

2.0 Specific BMP Inspection Requirements

2.1 General Stormwater Inspection Requirements

General site-wide conditions shall be inspected simultaneous with stormwater inspections. Landscaped areas shall be checked for any eroded drainage paths and repaired, as necessary. Any loose debris on the site shall be removed and disposed of appropriately. If any significant sediment build up occurs on the roadways or drives, it shall be removed by sweeping or other methods. All debris and sediments shall be disposed of in accordance with applicable local, state and federal guidelines and regulations.

For all stormwater facilities, inspections are an integral part of system maintenance. During the six months immediately after construction, all stormwater facilities shall be inspected at least twice or more following precipitation events of at least 1.0 inch to ensure that the system is functioning properly. Thereafter, inspections shall be conducted on an annual basis and after storm events of greater than or equal to the 1-year, 24-hour Type III precipitation event, unless indicated otherwise in the following sections.

2.2 Short-term Requirements

Once construction has been completed, inspections and required maintenance shall be performed during the first growing season. These inspections shall be performed weekly during the first month after construction is completed and monthly for the remainder of the first growing season. The goal of these inspections is to ensure that no erosion of the partially stabilized soils is occurring. Any erosion that is observed shall be remedied quickly by repairing and reseeding as necessary.

2.3 Crushed Stone Access Road

Annually in the spring, the crushed stone shall be re-distributed and supplemented to achieve an even, compacted surface conforming to the original design grades. The crushed stone surface shall not be mounded higher than adjacent grades. Snowplow damage shall be inspected throughout the winter season and repaired as needed. Any vegetation growing within the roadway is to be removed immediately upon identification. Ruts and potholes shall be repaired as required. If standing water is observed more than 48 hours after a storm event, then the crushed stone surface shall be excavated, the subsoil shall be scarified to breakup any hard-packed sediment, and the roadway shall be restored to original design specifications. Trash and debris shall be removed from the crushed stone surface as needed and shall be disposed of in accordance with applicable local, state, and federal guidelines and regulations. The surface of the crushed stone access road shall not be used to store soil or other materials that could clog the permeable stone surface.

The Crushed Stone Access Road Operation, Maintenance, and Management Inspection Checklist shall be completed after each inspection and/or after maintenance is performed. This checklist can be found in Appendix C.

2.4 Long-term Maintenance of Non-stormwater Related Activities

Solid Waste Containment: The project will not be occupied regularly once completed, so solid waste containment is not necessary. Any solid waste generated during routine maintenance and inspection activities shall be immediately removed by the inspector and disposed of off-site in conformance with all applicable regulatory standards.

Deicing and Salt Storage: Salt use shall be sparing to the extent practicable and no de-icing is anticipated.

Snow Disposal: Because the Site is only inspected quarterly for routine maintenance and inspection, little or no snow plowing is anticipated.

Pavement Sealants: No pavement sealants shall be used on this property.

Lawn and Landscape Management: The Owner shall employ the standards for ground management specified in Appendix G (G.7) of the 2015 RISDISM to the extent practicable. This includes mowing to maintain grass height between 4" and 18". All sediment control structures located down gradient of soils stabilized by vegetative measure shall remain in place until vegetation is established. Established means a minimum of 85% of the area is vegetated with vigorous growth. The use of pesticides, fungicides and herbicides are prohibited. Fertilizer use on site shall be only a slow-release variety. All landscaping and landscaping maintenance shall be performed by a licensed subcontractor and all materials removed from the premises shall be in conformance with all applicable regulatory standards

APPENDIX

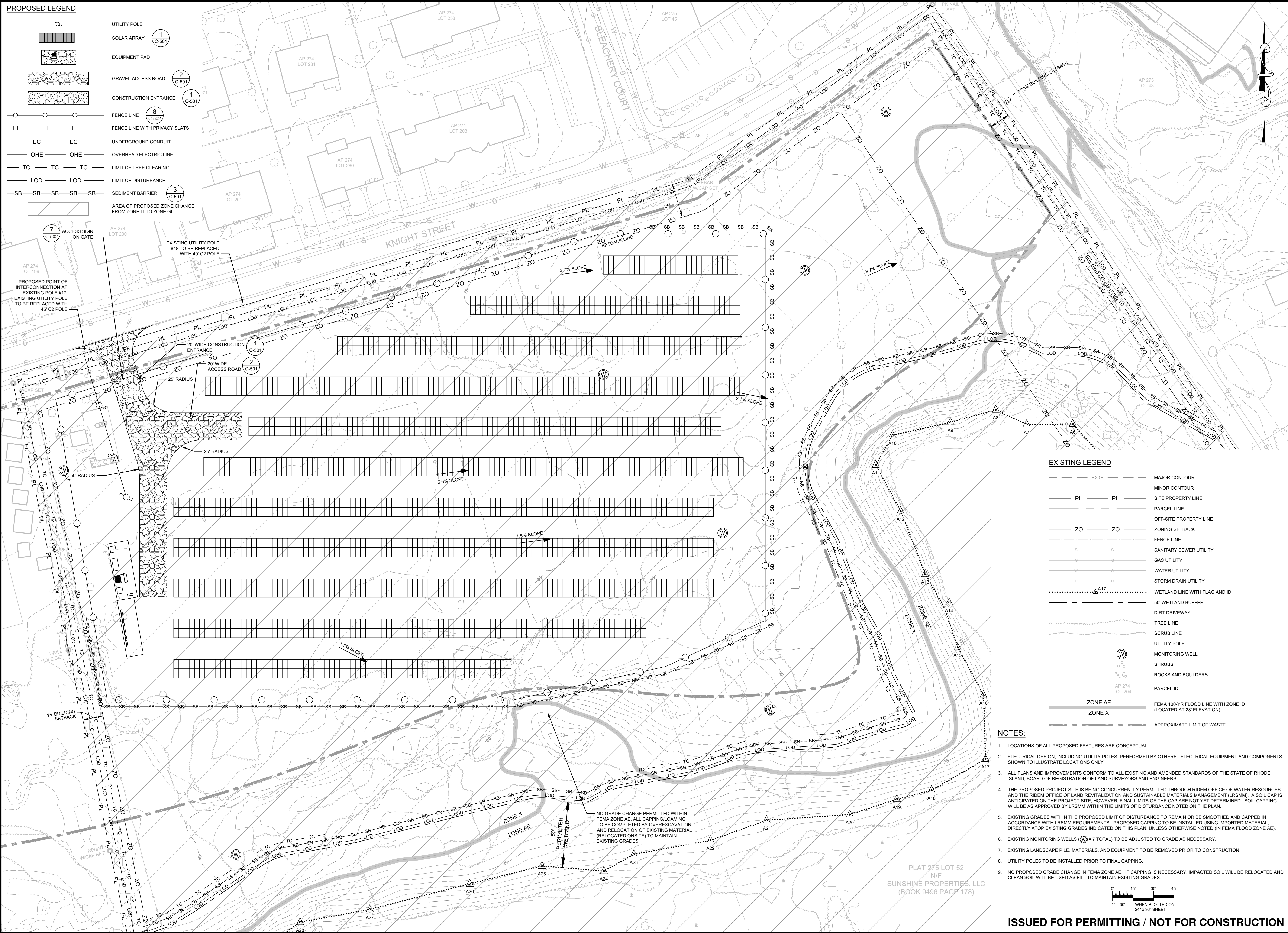
A

OPERATION &
MAINTENANCE
FIGURE

PROPOSED LEGEND

- UTILITY POLE
- SOLAR ARRAY (1 C-501)
- EQUIPMENT PAD
- GRAVEL ACCESS ROAD (2 C-501)
- CONSTRUCTION ENTRANCE (4 C-501)
- FENCE LINE (8 C-502)
- FENCE LINE WITH PRIVACY SLATS
- EC UNDERGROUND CONDUIT
- OHE OVERHEAD ELECTRIC LINE
- TC LIMIT OF TREE CLEARING
- LOD LIMIT OF DISTURBANCE
- SB SEDIMENT BARRIER (3 C-501)
- AREA OF PROPOSED ZONE CHANGE FROM ZONE LI TO ZONE GI

- ACCESS SIGN ON GATE (7 C-502)
- EXISTING UTILITY POLE #18 TO BE REPLACED WITH 40' C2 POLE
- PROPOSED POINT OF INTERCONNECTION AT EXISTING POLE #17, EXISTING UTILITY POLE TO BE REPLACED WITH 45' C2 POLE

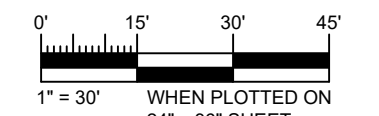


EXISTING LEGEND

- MAJOR CONTOUR
- MINOR CONTOUR
- SITE PROPERTY LINE
- PARCEL LINE
- OFF-SITE PROPERTY LINE
- ZONING SETBACK
- FENCE LINE
- SANITARY SEWER UTILITY
- GAS UTILITY
- WATER UTILITY
- STORM DRAIN UTILITY
- WETLAND LINE WITH FLAG AND ID
- 50' WETLAND BUFFER
- DIRT DRIVEWAY
- TREE LINE
- SCRUB LINE
- UTILITY POLE
- MONITORING WELL
- SHRUBS
- ROCKS AND BOULDERS
- PARCEL ID
- ZONE AE FEMA 100-YR FLOOD LINE WITH ZONE ID (LOCATED AT 28' ELEVATION)
- ZONE X
- APPROXIMATE LIMIT OF WASTE

NOTES:

1. LOCATIONS OF ALL PROPOSED FEATURES ARE CONCEPTUAL.
2. ELECTRICAL DESIGN, INCLUDING UTILITY POLES, PERFORMED BY OTHERS. ELECTRICAL EQUIPMENT AND COMPONENTS SHOWN TO ILLUSTRATE LOCATIONS ONLY.
3. ALL PLANS AND IMPROVEMENTS CONFORM TO ALL EXISTING AND AMENDED STANDARDS OF THE STATE OF RHODE ISLAND, BOARD OF REGISTRATION OF LAND SURVEYORS AND ENGINEERS.
4. THE PROPOSED PROJECT SITE IS BEING CONCURRENTLY PERMITTED THROUGH RIDEM OFFICE OF WATER RESOURCES AND THE RIDEM OFFICE OF LAND REVITALIZATION AND SUSTAINABLE MATERIALS MANAGEMENT (LRSM). A SOIL CAP IS ANTICIPATED ON THE PROJECT SITE, HOWEVER, FINAL LIMITS OF THE CAP ARE NOT YET DETERMINED. SOIL CAPPING WILL BE AS APPROVED BY LRSM WITHIN THE LIMITS OF DISTURBANCE NOTED ON THE PLAN.
5. EXISTING GRADES WITHIN THE PROPOSED LIMIT OF DISTURBANCE TO REMAIN OR BE SMOOTHED AND CAPPED IN ACCORDANCE WITH LRSM REQUIREMENTS. PROPOSED CAPPING TO BE INSTALLED USING IMPORTED MATERIAL, DIRECTLY ATOP EXISTING GRADES INDICATED ON THIS PLAN, UNLESS OTHERWISE NOTED (IN FEMA FLOOD ZONE AE).
6. EXISTING MONITORING WELLS (W) = 7 TOTAL) TO BE ADJUSTED TO GRADE AS NECESSARY.
7. EXISTING LANDSCAPE PILE, MATERIALS, AND EQUIPMENT TO BE REMOVED PRIOR TO CONSTRUCTION.
8. UTILITY POLES TO BE INSTALLED PRIOR TO FINAL CAPPING.
9. NO PROPOSED GRADE CHANGE IN FEMA ZONE AE. IF CAPPING IS NECESSARY, IMPACTED SOIL WILL BE RELOCATED AND CLEAN SOIL WILL BE USED AS FILL TO MAINTAIN EXISTING GRADES.



PLAT 275 LOT 52
N/F
SUNSHINE PROPERTIES, LLC
(BOOK 9496 PAGE 178)

WSP
WSP USA ENVIRONMENT AND INFRASTRUCTURE, INC.
100 APOLLO DRIVE, SUITE 302
CHELMSFORD, MA 01824
978-692-9090
WSP.COM

REVISION	DATE	ISSUE / REVISION DESCRIPTION	ISSUED
3	9/10/2021	RESPONSE TO RIBEM COMMENTS	GA
2	8/20/2021	RESPONSE TO RIBEM COMMENTS	GA
1	6/28/2021	ADDRESSED COMMENTS	GA
0	5/27/2021	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	GA

PROJECT: 998.40 KW DC GROUND-MOUNT SOLAR PV DEVELOPMENT
275 KNIGHT STREET
WARWICK, RHODE ISLAND

TITLE: PROPOSED SITE PLAN

CLIENT: VCP, LLC
150 TRUMBULL ST.
HARTFORD, CT 06103

SCALE:

VEROGY

DESIGNED BY: CR
DRAWN BY: BEG
CHECKED BY: GAA
SCALE: AS SHOWN

PROJECT NUMBER: 3652200299

DRAWING NUMBER: C-101

SHEET NUMBER: 3 OF 5

APPENDIX

B

STORMWATER
FACILITY
MAINTENANCE
AGREEMENT

Stormwater Facility Maintenance Agreement

THIS AGREEMENT, made and entered into this ___ day of _____, 20___, by and between Sunshine Properties LLC hereinafter called the "Landowner", and the Town of Portsmouth, hereinafter called the "Town".

WITNESSETH, that WHEREAS, the Landowner is the owner of certain real property described as Assessors Plat 275 Lot 38 and 52, as recorded by deed in the land records of City of Warwick, Deed Book 9496, Page 178 hereinafter called the "Property".

WHEREAS, the Landowner is proceeding to build on and develop the property; and

WHEREAS, the Site Plan/Subdivision Plan known as 998.4 kW Solar Development, hereinafter called the "Plan", which is expressly made a part hereof, as approved or to be approved by the Town, provides for detention of stormwater within the confines of the property; and

WHEREAS, the Town and the Landowner, its successors and assigns, agree that the health, safety, and welfare of the residents of the Town require that on-site stormwater management facilities be constructed and maintained on the Property; and

WHEREAS, the Town requires that on-site stormwater management facilities as shown on the Plan be constructed and adequately maintained by the Landowner, its successors and assigns.

NOW, THEREFORE, in consideration of the foregoing premises, the mutual covenants contained herein, and the following terms and conditions, the parties hereto agree as follows:

1. The on-site stormwater management facilities shall be constructed by the Landowner, its successors and assigns, in accordance with the plans and specifications identified in the Plan.
2. The Landowner, its successors and assigns, shall adequately maintain the stormwater management facilities in accordance with the required Operation and Maintenance Plan. This includes all pipes, channels or other conveyances built to convey stormwater to the facility, as well as all structures, improvements, and vegetation provided to control the quantity and quality of the stormwater. Adequate maintenance is herein defined as good working condition so that these facilities are performing their design functions. The Stormwater Best Management Practices Operation, Maintenance and Management Checklists are to be used to establish what good working condition is acceptable to the Town.

3. The Landowner, its successors and assigns, shall inspect the stormwater management facility as required in the Operation and Maintenance Plan. The purpose of the inspection is to assure safe and proper functioning of the facilities. The inspection shall cover the entire facilities, berms, outlet structures, basin areas, access roads, etc. Deficiencies shall be noted in an inspection report.
4. The Landowner, its successors and assigns, hereby grant permission to the Town, its authorized agents and employees, to enter upon the Property and to inspect the stormwater management facilities whenever the Town deems necessary upon 48-hours's notice by the Town. The purpose of inspection is to follow-up on reported deficiencies and/or to respond to citizen complaints. The Town shall provide the Landowner, its successors and assigns, copies of the inspection findings and a directive to commence with the repairs if necessary.
5. In the event the Landowner, its successors and assigns, fails to maintain the stormwater management facilities in good working condition acceptable to the Town, upon 72 hours' notice the Town may enter upon the Property and take whatever steps necessary to correct deficiencies identified in the inspection report and to charge the costs of such repairs to the Landowner, its successors and assigns. This provision shall not be construed to allow the Town to erect any structure of permanent nature on the land of the Landowner outside of the easement for the stormwater management facilities. It is expressly understood and agreed that the Town is under no obligation to routinely maintain or repair said facilities, and in no event shall this Agreement be construed to impose any such obligation on the Town.
6. The Landowner, its successors and assigns, will perform the work necessary to keep these facilities in good working order as appropriate. In the event a maintenance schedule for the stormwater management facilities (including sediment removal) is outlined on the approved plans, the schedule will be followed.
7. In the event the Town pursuant to this Agreement, performs work of any nature, or expends any funds in performance of said work for labor, use of equipment, supplies, materials, and the like, the Landowner, its successors and assigns, shall reimburse the Town upon demand, within thirty (30) days of receipt thereof for all actual costs incurred by the Town hereunder.
8. This Agreement imposes no liability of any kind whatsoever on the Town and the Landowner agrees to hold the Town harmless from any liability in the event the stormwater management facilities fail to operate properly.
9. This Agreement shall be recorded among the land records of the Town and shall constitute a covenant running with the land, and shall be binding on the Landowner, its administrators, executors, assigns, heirs and any other successors in interests.

WITNESS the following signatures and seals:

Company/Corporation/Partnership Name (Seal)

By: _____

(Type Name and Title)

The foregoing Agreement was acknowledged before me this ____ day of _____, 20____, by

NOTARY PUBLIC

My Commission Expires: _____

By: _____

(Type Name and Title)

The foregoing Agreement was acknowledged before me this ____ day of _____, 20____, by

NOTARY PUBLIC

My Commission Expires: _____

Approved as to Form:

[Town/City] Attorney Date

APPENDIX

C

OPERATION,
MAINTENANCE, AND
MANAGEMENT
INSPECTION
CHECKLISTS

**Crushed Stone Access Road
Operation, Maintenance, and Management Inspection Checklist**

Project:

Location:

Site Status:

Date:

Time:

Inspector:

MAINTENANCE ITEM	SATISFACTORY/ UNSATISFACTORY	COMMENTS
1. Debris Cleanout (Annually, As needed)		
No dumping of yard wastes into practice		
Litter (leaves, branches, etc.) have been removed		
2. Vegetation (Annually, As needed)		
Remove any vegetation from within roadway		
3. Sediment Deposition / Soil Compaction (Annual, After major storms)		
a. Sediments removed once a year or when sediments cause a change in the grade elevations		

MAINTENANCE ITEM	SATISFACTORY/ UNSATISFACTORY	COMMENTS
b. 1. Areas of obvious compaction are excavated, scarified, and reset with washed crushed stone 2. If standing water is observed more than 48 hours after a storm, crushed stone surface shall be excavated, the subsoil shall be scarified to breakup any hard-packed sediment, and the roadway shall be restored to original design specifications		
4. Road Surface (Annually)		
Repair any ruts and potholes within the roadway		
Regrade Crushed Washed Stone to original design specifications		
Repair any snow plow damage within the roadway		

Comments:

Actions to be Taken:

ATTACHMENT

F

DECOMMISSIONING
PLAN AND COST
ESTIMATE



Decommissioning and Restoration Plan
Ground Mount PV Array
Knight Street Solar

Date:

December 2023

Prepared By:

Verogy





Table of Contents

- 1. Overview**
- 2. Decommissioning & Restoration**
 - 2.1 Preparation & Mobilization**
 - 2.2 Photovoltaic Equipment Removal**
 - 2.3 Civil Restoration**
- 3. Estimated Costs**
- 4. Health and Safety Concerns**





Decommissioning and Restoration Plan

1. Overview

After the proposed Kight Street Solar Project has reached the end of its operational lifetime the current/future owners (“Owner”) of the proposed Photovoltaic (PV) facility will be responsible to decommission the project. The Project is designed for an operational life of at least 35 years. It is anticipated that advances in technology and efficiency over that timeframe will create an economic advantage in replacing the project.

Decommissioning of a PV facility is the removal of all system components associated with the generating system and restoring the site to as close to pre-construction conditions as possible. Decommissioning procedures are developed to ensure environmental protection, public safety, and health, and that the work being performed is in compliance with all applicable regulations.

The Project Owner will be responsible for:

- All decommissioning costs
- Obtaining all permits required for the decommissioning, removal and legal disposal of system components prior to the start of decommissioning activities
- The complete decommissioning of the facility, including the removal and disposal of all equipment and restoration of the site in accordance with applicable permits and in compliance with all applicable rules and regulations in effect governing material disposal

2. Decommissioning & Restoration Plan

2.1. Preparation & Mobilization

Prior to decommissioning the system, the Owner of the facility and the decommissioning contractors will begin the preparation and planning phase of the project. The decommissioning process shall be completed no later than 18 months following the discontinuation of operations of the facility. Prior to decommissioning activity taking place a site assessment will take place to evaluate site conditions and put a protection plan together to protect surrounding natural resources. Upon site mobilization and prior to the start of the removal of any system components, proper erosion and sediment controls will be installed. The access roads and fencing will remain in place for use by the decommissioning and site restoration workers until decommissioning activities are completed unless the site owner requests that they remain in place. Debris will be placed in dumpsters on-site until transportation to proper disposal facilities is arranged.





2.2. Photovoltaic Equipment Removal

- The system will be de-energized from the utility power grid. The infrastructure connecting the facility to the utility power grid will be removed unless the landowner determines that the electrical service line will be beneficial for future use of the site, in which case the line may remain after decommissioning.
- All wirings, cables, conduits, panelboards, inverters, transformers and associated equipment will be uninstalled and recycled as applicable.
- PV modules will be uninstalled and recycled as applicable.
- The steel racking system will be disassembled and recycled as applicable
- Concrete ballast foundations which supported the module racking will be removed and recycled/disposed of as applicable.
- The demolition debris and removed equipment may be cut or dismantled into smaller pieces that can be safely lifted or carried by the deconstruction equipment being used. Most of the glass and steel and aluminum will be processed for transportation and delivery to an off-site recycling center. Minimal non-recyclable materials are anticipated; these will be properly disposed of at a qualified disposal facility.

2.3 Civil Restoration

- Any resulting holes from the removal of the steel piles will be backfilled with locally imported soil to match existing site soil conditions.
- The concrete transformer and interconnection equipment pads will be broken up and removed.
- The on-site access roads servicing the Project and the security fencing around the Project will remain in place during decommissioning activities to support the removal of equipment. Once removal activities are completed, discussion with the landowners will occur to determine if the roads or security fencing will be beneficial for future use of site. If the access roads or security fencing is determined to be beneficial for future use of site, these facilities may remain in place.
- Access roads that will not be utilized to support future use of the site will be restored to preconstruction conditions. Aggregate base material of the roads will be removed, and the compacted base section will be filled with locally imported soil to match existing onsite soils. The areas will then be seeded to match existing onsite groundcover.
- If the security fencing is not to be used, it will be removed and transported to the nearest recycling facility.
- Once all Project equipment has been removed, additional activities will occur to return the property back to conditions similar to pre-construction. Reclamation will restore vegetative cover and hydrological function after the closure of the facility.
- As previously discussed, any excavated areas remaining after the removal of equipment pads, access road base materials, or fence posts will be backfilled with locally imported soil to match existing onsite soils.
- Once landform features and soils are restored, a seed mix will be applied to disturbed areas to match the existing onsite groundcover.





2.4 Landscaping and Berm

- The landscaping and berm will remain in place on site and not be removed as part of the decommissioning process.

3. Estimated Costs

The following costs for decommissioning are based on the New York State Energy Research & Development Authority 2023 Decommissioning Solar Panel Systems guide book¹ (“Guide Book”). The estimated costs provided in the Guide Book are based on a 2 MW AC ground-mounted system, those costs were factored down to the 0.75 MW AC the size of the Knight Street Project.

Tasks	Estimated Unit Cost Per 2MW	Project Cost at 0.75 MW
Remove Rack Wiring	\$2,459	\$925
Remove Panels	\$2,450	\$920
Dismantle Racks	\$12,350	\$4,635
Remove Electrical Equipment	\$1,850	\$700
Breakup and Remove Concrete Pads or Ballasts	\$1,500	\$570
Remove Racks	\$7,800	\$2,925
Remove Cable	\$6,500	\$2,440
Remove Power Poles	\$13,850	\$5,200
Remove Fence (if not requested to remain by property owner)	\$4,950	\$1,860
Seed Disturbed Ares	\$250	\$100
Truck to Recycling Center	\$2,250	\$850
Current Total		\$21,125.00
Total After 35 Years (2% annual inflation rate)		\$42,247.67

¹ NYSERDA 2023 Decommissioning Solar Panels Systems Guide Book - <https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Programs/NY-Sun/2023-Decommissioning-Solar-Panel-Systems.pdf>





4. Health and Safety Concerns

Site decommissioning will entail the use of heavy equipment, the handling of heavy and sharp objects and limited exposure to potentially live electrical components. A Health and Safety Plan will be created based on the individual characteristics of the site to minimize and eliminate all possible risks and hazards. The Health and Safety Plan will include a Job Hazard Analysis that will analyze each step of construction for hazards, along with any climate conditions or hazardous materials that may be seen or used throughout the duration of the job. The plan will outline steps to take if a hazard is identified and how to proceed with each hazard. Along with this, all workers will have training and personal protective equipment (PPE) in compliance with OSHA standards. A daily toolbox talk will be held where the foreman or supervisor will go over daily hazards and activities to be completed.



ATTACHMENT

G

STATE PERMITS



RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF WATER RESOURCES
235 Promenade Street
Providence, Rhode Island 02908

October 20, 2023

Sunshine Properties, LLC
John P. Morgan, Member
181 Knight Street
Warwick, RI 02886

Insignificant Alteration – Permit

Re: Application No. 21-0184 in reference to the location below:

Approximately 75 feet south of Knight Street (at 275 Knight Street), Utility Pole 17, approximately 350 southwest of its intersection with Bleachery Court, Assessor's Plat 275, Lots 38 & 52, Warwick, RI.

Dear Mr. Morgan:

Kindly be advised that the Department of Environmental Management's ("DEM") Freshwater Wetlands Program ("Program") has completed its review of your **Request for Preliminary Determination** application. This review included a site inspection of the above referenced property ("subject property") and an evaluation of the solar array with crushed stone access road, electrical equipment, fencing, interconnection, landscaping, grading activities and associated site alterations as illustrated and detailed on revised site plans submitted with your application. These revised site plans were received by the DEM on September 22, 2021, with revised Sheet 4 of 8 (Drawing No. C-101) received October 17, 2023, and Sheet 5 of 8 (Drawing C-102) received October 3, 2023.

Our observations of the subject property, review of the site plans and evaluation of the proposed project reveals that alterations of freshwater wetlands are proposed. However, pursuant to 250-RICR-150-15-1.9 of the Rules and Regulations Governing the Administration and Enforcement of the Fresh Water Wetlands Act, 250-RICR-150-15-1 (Rules), this project may be permitted as an **insignificant alteration** to freshwater wetlands under the following terms and conditions:

Terms and Conditions for Wetlands Application No. 21-0184; RIPDES No. RIR102216:

1. This letter is the DEM's permit for this project under the R.I. Fresh Water Wetlands Act, R.I. Gen. Laws § 2-1-18 et seq.
2. This determination also includes your final authorization to discharge storm water associated with construction activity under the **2020 RIDPES General Permit for Stormwater Discharge During Construction Activity ("CGP")**. For future references and inquiry, your permit authorization number is RIPDES No. **RIR102216**. This RIDPES CGP permit is not transferable to any person except after written notice to the Director, in the form of a Permit Transfer Form available on the RIDEM Stormwater Construction Permitting website.
3. This permit is specifically limited to the project, site alterations and limits of disturbance as detailed on the site plans submitted with your application and received by the DEM on September 22, 2021, with revised Sheet 4 of 8 (Drawing No. C-101) received October 17, 2023, and Sheet 5 of 8 (Drawing C-102) received October 3, 2023. A copy of the site plans stamped approved by the DEM is

Telephone 401.222.4700 | www.dem.ri.gov | Rhode Island Relay 711

- enclosed. Changes or revisions to the project that would alter freshwater wetlands are not authorized without a permit from the DEM.
4. Where the terms and conditions of the permit conflict with the approved site plans, these terms and conditions shall be deemed to supersede the site plans.
 5. You must notify this Program in writing of the anticipated start date, and of your contractor's contact information, by submitting the Notice of Start of Construction Form prior to commencement of any permitted site alterations or construction activity. You must also notify this Program in writing upon completion of the project, including submittal of the Notice of Termination Form. The Start of Construction Form and the Notice of Termination can be found on the webpage: dem.ri.gov/stormwaterconstruction
 6. A copy of the stamped approved site plans and a copy of this permit must be kept at the site at all times during site preparation, construction, and final stabilization. Copies of this permit and the stamped approved plans must be made available for review by any DEM or City representative upon request.
 7. Within ten (10) days of the receipt of this permit, you must record this permit in the land evidence records of the City of Warwick and supply this Program with written documentation obtained from the City showing this permit was recorded.
 8. The effective date of this permit is the date this letter was issued. This permit expires four (4) years from the date of this letter unless renewed pursuant to the Rules.
 9. Any material utilized in this project must be clean and free of matter that could pollute any freshwater wetland.
 10. Prior to commencement of site alterations, you shall erect or post a sign resistant to the weather and at least twelve (12) inches wide and eighteen (18) inches long, which boldly identifies the initials "DEM" and the application number of this permit. This sign must be maintained at the site in a conspicuous location until such time that the project is complete.
 11. Both the owner and the contractor retained to undertake the construction activity are required to comply with all terms and conditions of the CGP. This includes maintaining the Soil Erosion and Sediment Control (SESC) Plan, performing the required inspections and maintenance of the selected Best Management Practices (BMPs), and retaining inspection records. Further information on the requirements of the CGP is available at:
<http://www.dem.ri.gov/programs/benviron/water/permits/ripdes/pdfs/cgp092620.pdf>.
 12. Temporary erosion and sediment controls detailed or described on the approved site plans shall be properly installed at the site prior to or commensurate with site alterations. Such controls shall be properly maintained, replaced, supplemented, or modified as necessary throughout the life of this project to minimize soil erosion and to prevent sediment from being deposited in any wetlands not subject to disturbance under this permit.
 13. Upon permanent stabilization of all disturbed soils, temporary erosion and/or sediment controls must be removed.
 14. You are responsible for the proper installation, operation, maintenance, and stability of any mitigative features, stormwater treatment facilities, and systems of treatment and control that are installed or used in compliance with this permit to prevent harm to adjacent wetlands until

documentation is provided that this responsibility has been assigned to another entity. The long-term operation and maintenance plan shall be strictly followed. The long-term O & M Plan shall be that entitled "Stormwater Operation & Maintenance Plan: Proposed Solar Development Project – Plat 275, Lot 38 and 52, Knight Street – Warwick, RI – Project No. 3652200299" submitted initially in June 2021 and revised in September 2021 by Wood Environment and Infrastructure Solutions, PLC.

15. The owner must ensure that fertilizer is only utilized as necessary to establish initial vegetative growth of grass.
16. You are obligated to install, utilize and follow all best management practices detailed or described on the approved site plans in the construction of the project to minimize or prevent adverse impacts to any adjacent freshwater wetlands and the functions and values provided by such wetlands.
17. You must provide written certification from a registered land surveyor or registered professional engineer that the stormwater drainage system including any and all basins, piping systems, catch basins, culverts, swales and any other stormwater management control features have been constructed/installed in accordance with the site plans approved by this permit. This written certification must be submitted to this Program within twenty (20) days of its request or upon completion of the project.
18. This Program has made specific revisions to the approved site plans. These revisions are clearly marked in red on the approved plans. Specifically, the site plans have been renumbered sequentially 1 of 8 through 8 of 8 and the Drawing Index on the Covert Sheet revised accordingly.

Pursuant to the provisions in 250-RICR-150-15-1.7(A)(9) and 250-RICR-150-15-1.11(D), as applicable, any properly recorded and valid permit is automatically transferred to the new owner upon sale of the property.

Please be aware that the RIDEM's Rules and Regulations Governing the Establishment of Various Fees (250-RICR-30-00-1) require that RIPDES CGP permit holders to pay an Annual Fee of \$100.00. An invoice will be sent to the owner on record in May/June of each year if the construction was still active as of December 31st of the previous year. The owner will be responsible for the Annual Fee until the construction activity has been completed, the site has been properly stabilized, and a completed Notice of Termination (NOT) has been received by the RIPDES Program.

You are required to comply with the terms and conditions of this permit and to carry out this project in compliance with the Rules at all times. Failure to do so may result in an enforcement action by this Department.

In permitting the proposed alterations, the DEM assumes no responsibility for damages resulting from faulty design or construction.

Kindly be advised that this permit is not equivalent to a verification of the type or extent of freshwater wetlands on site. Should you wish to have the types and extent of freshwater wetlands verified, you may submit the appropriate application in accordance with 250-RICR-150-15-1.8(C).

This permit does not remove your obligation to obtain any local, state, or federal approvals or permits required by ordinance or law and does not relieve you from any duties owed to adjacent landowners with specific reference to any changes in drainage.

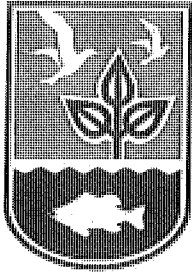
Please contact Rene Legault of this office (telephone: 401-222-4700, ext. 2777732) should you have any questions regarding this letter.

Sincerely,

Nancy L. Freeman
Nancy L. Freeman, Environmental Scientist III
Office of Water Resources
Freshwater Wetlands Program
NLF/RJL/rjl

Enclosure: Approved site plans

cc: Mark Dennen, DEM OLRSSM (File No. SR-35-1122)
Alfred T. DeCorte, City of Warwick Director & Building Official
Neal Personcus, DEM Stormwater Program
Andrew Vardakis, P.E., WSP USA, Inc.
Brian Fitzgerald, Director of Development, VCP, LLC Verogy
Christopher H. Dill, EIT, DEM Stormwater Program



RHODE ISLAND

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

OFFICE OF LAND REVITALIZATION AND SUSTAINABLE MATERIALS MANAGEMENT

235 Promenade Street, Room 380

Providence, Rhode Island 02908

August 3, 2023

REMEDIAL DECISION LETTER

SR-33-0472

Mykel Mendes, Senior Consultant, Environmental Engineer
WSP

166 Valley Street, Building 6
Providence, RI 02909

RE: Knight Street Landfill, 180 Knight St., Warwick, RI, Plat 275 Lots 38 and 52

Dear Mr. Mendes:

The Office of Land Revitalization and Sustainable Materials Management (LRSMM), as reflected in 250-RICR-140-30-1, Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases (the Remediation Regulations) and 250-RICR-140-05-2, Solid Waste Regulations No. 2 Solid Waste Landfills (the Solid Waste Regulations) has established the Landfill Closure Program. The purpose of the Landfill Closure Program (LCP) is to integrate the investigation and remediation/closure requirements in the Remediation Regulations and Solid Waste Regulations. A Remedial Decision Letter (RDL) is a formal, written communication from the Department that approves a site investigation, identifies the preferred remedial alternative and authorizes the development of a Remedial Action Work Plan (RAWP) in order to achieve the objectives of the environmental clean-up.

In the matter of the above-referenced property (the Site), the Department's Office of LRSMM is in receipt of the following documentation submitted on behalf of VCP, LLC (Knight Street Landfill):

1. Site Investigation Work Plan dated September 2007, received October 2, 2007, and prepared by EA Engineering, Science and Technology, Inc.;
2. Site Investigation with SIR Checklist dated February 2008, received February 11, 2008, and prepared by EA Engineering, Science and Technology, Inc.;
3. Revised Site Investigation Report with revised preferred remedial alternative dated March 2008, received March 25, 2008, and prepared by EA Engineering, Science and Technology, Inc.;
4. Site Investigation Report- 2022 Update Former Pontiac Mills Property/Knight St. Landfill VCP, LLC

Pontiac Ave- Knight Street Landfill

Collectively, these documents define “Existing contamination” at the Site and fulfill the requirements of a Site Investigation Report (SIR) as described in Section 1.8.8 of the Remediation Regulations. In addition, according to our records, public notice was conducted to all abutting property owners, tenants, easement holders and the municipality regarding the substantive findings of the completed investigation in accordance with Sections 1.8.7(A)(2) and 1.8.9 of the Remediation Regulations. The opportunity for public review and comment on the technical feasibility of the proposed remedial alternatives commenced on July 6, 2023 and the period closed on July 20, 2023. No comments were received on the proposed remedy.

The preferred remedial alternative, as stated in the SIR, consists of the following conceptual measures:

- Installation of engineered barrier cap over areas of the site that do not currently contain two (2) feet of clean soil cover over solid waste as well as over areas that exceed GB leachability criteria for soils.
- Installing effective gas system at the landfill to mitigate landfill gas issues as needed.
- Some soil samples exceed Industrial/Commercial Direct Exposure Criteria for lead (up to 1740 mg/kg), arsenic (up to 25.1 mg/kg) and PCB (1 sample at 10.71 mg/kg). All areas of exceedances will be covered with clean soil as described above. For those areas with exceedance of GB leachability criteria or exceedances of the Direct Exposure Criteria at less than 2 feet depth, and engineered cap consisting of an impermeable geomembrane overlain by two (2) feet of certified clean fill will be placed. This cap will extend a minimum of 15 feet beyond the location of any exceedances of GB standards.
- An Environmental Monitoring Plan will be submitted to the Department that includes the following items:
 1. Landfill gas monitoring by permanent gas monitoring wells to be installed close to knight street shall be done annually. In the event of offsite migration above the Department standard of 25% LEL is detected, methane mitigation measures shall be implemented. Also, any enclosed structures on the property must take methane detection and/or mitigation measures into account.
 2. Groundwater monitoring on a quarterly basis as required by RIDEM solid waste regulations. After 8 quarters of sampling, they may petition to reduce monitoring to semi-annual.
- An Environmental Land Use Restriction (ELUR), approved by RIDEM, shall be recorded on the deed for the entire property. The ELUR shall require the performance of annual inspections to document the status of the ELUR and the condition of the engineered controls. The ELUR shall also provide protections to ensure the integrity of the cap and that buildings cannot be constructed at the site without RIDEM written authorization. The ELUR shall be recorded for the entire property in the Land Evidence Records for the City of Warwick, and a recorded copy forwarded back to the department within fifteen (15) days of recording.

- Submission of a Remedial Action Work Plan (RAWP).
- Submission of an Environmental Monitoring Plan addressing post closure environmental monitoring for groundwater and soil gas for a 30-yr period after landfill closure.
- Submission of a Closure Report documenting all the work performed in the Remedial Action including cap material compliance sampling results and as-built drawings.

The Department hereby approves the SIR, with the above identified preferred remedial alternative, and requires a RAWP be submitted for review and approval, and implemented, to achieve the objectives of the environmental clean-up, in accordance with the following conditions:

1. In accordance with Sections 1.9 and 1.10 of the Remediation Regulations, a RAWP, Environmental Land Use Restriction (ELUR), and Soil Management Plan (SMP) shall be submitted for Department review and approval within sixty (60) days from the date of this letter. The RAWP shall describe all of the technical details, engineer design elements, and schedules associated with the implementation of the proposed remedy. All of the subsections outlined in Section 1.10 of the Remediation Regulations must be included in order to facilitate the review and approval of the RAWP. If an item is not applicable to this Site, simply state that it is not applicable and provide an explanation in the RAWP.
2. Pursuant to Section 1.11.2 of the Remediation Regulations, an application fee for Remedial Action Approvals in the amount of one thousand (\$1,000.00) dollars shall be made payable to the State of Rhode Island General Treasurer and remitted to the Office of Management Services with the attached Remedial Action Approval Application Fee Form. Receipt of this Remedial Action Approval Application Fee is required prior to the Department's RAWP review.
3. Once the Department reviews the RAWP for consistency with Sections 1.9 and 1.10 of the Remediation Regulations, any written comments generated and forwarded as a result of the review(s) shall be incorporated forthwith into a RAWP Addendum, to be submitted for final approval.
4. Upon finalization of the RAWP, the Department will issue a Remedial Approval Letter (RAL), signifying Department approval. All remedial measures required by the Department shall be implemented, in accordance with the approved schedule, to ensure all applicable exposure pathways at the site are appropriately addressed.
5. Also, 2 rounds of PFAS sampling, approved by the Department, will be required as per the above listed regulations during the monitoring phase.
6. As the site represents approximately half of a landfill property that exists on both sides of a property boundary, the Department may require additional action based on conditions at the adjacent landfill to ensure that activities on one side of the property boundary do not negatively impact the landfill on the other side of said boundary.

Please be advised that the Department reserves the right to require additional actions under the aforementioned Remediation Regulations at the Property should any of the following occur:

- Conditions at the Site previously unknown to the Department are discovered;

- Information previously unknown to the Department becomes available;
- Policy and/or regulatory requirements change; and/or
- Failure by VCP, LLC or any future holder of any interest in the Property to adhere to the terms and conditions of the Department approved RAWP, schedule, RAL, ELUR and/or SMP for the Property.

If you have any questions regarding this letter or would like the opportunity to meet with Department personnel, please contact me by telephone at (401) 222-2797, ext. 7177, or by E-mail at walid.ali@dem.ri.gov.

Sincerely,



Mark M. Dennen, CPG
Supervising Environmental Scientist
Office of Land Revitalization and Sustainable Materials Management

Cc: Walid Ali, Principal Environmental Scientist – RIDEM / OLRSM
Ashley Blauvelt, Supervising Environmental Engineer – RIDEM / OLRSM

Attachment: Remedial Action Approval Application Fee Form



RHODE ISLAND

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

OFFICE OF LAND REVITALIZATION AND SUSTAINABLE MATERIALS MANAGEMENT

235 Promenade Street, Room 380

Providence, Rhode Island 02908

REMEDIAL ACTION APPROVAL APPLICATION FEE FORM

Rule 1.11.2 of the Department's Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases, requires an application fee for Remedial Action Approvals in the amount of one thousand (\$1,000) dollars. Please submit this form and check, made payable to the State of Rhode Island General Treasurer, directly to:

**R.I. Department of Environmental Management
Office of Management Services - Rm 340
235 Promenade Street
Providence, RI 02908**

Please complete this page and attach it to the check or money order. This information must be provided to coordinate your fee with the application submitted.

Site Name: _____

Address: _____

Town/City: _____

File Number: SR-33-0472

Contact Person: _____

Phone No: _____

RIDEM Project Manager: Kasie McKenzie

FOR RIDEM OFFICE USE ONLY:

Fee Amount Received: _____

Date Received: _____

Check#: _____

Receipt Account:

10.074.3765103.03.461043

cc:74:3481 Leg.17-18-841



STATE OF RHODE ISLAND

HISTORICAL PRESERVATION & HERITAGE COMMISSION

Old State House 150 Benefit Street Providence, RI 02903

Telephone 401-222-2678
TTY 401-222-3700

Fax 401-222-2968
www.preservation.ri.gov

March 10, 2023

Via email: peter.garland@wsp.com

Peter Garland
Civil Engineer
WSP USA
100 Apollo Drive, Suite 302
Chelmsford, MA 01824

Re: RIHPHC Project No. 17234
Proposed Solar Facility
275 Knight Street
Warwick, RI

Dear Mr. Garland:

The Rhode Island Historical Preservation and Heritage Commission (RIHPHC) staff has reviewed the information that you provided for the above-referenced project. Verogy, Inc. is proposing to install a 988.4-kilowatt ground-mounted solar facility on two parcels at 275 Knight Street (plat 275, lots 38 & 52) in Warwick, Rhode Island.

The project site is approximately 400 feet east of the Pontiac Mills complex, which is individually listed in the National Register of Historic Places. Verogy, Inc. anticipates applying for permits from the RI Department of Environmental Management for construction of the solar facility. The property is currently improved with temporary structures and was operated as a hardscaping business. The new facility will require the removal of vegetation and the installation of a seven-foot-high fence for screening. Based on our review of available information, it is the RIHPHC's conclusion that the project will have no adverse effect on historic properties.

These comments are provided in accordance with the Rhode Island Historic Preservation Act and Rhode Island General Laws. If you have any questions, please contact RIHPHC Project Review Coordinator Elizabeth Totten at 401-222-2671 or elizabeth.totten@preservation.ri.gov.

Sincerely,

Jeffrey Emidy
Executive Director
Interim State Historic Preservation Officer

ATTACHMENT

H

PRE-DEVELOPMENT
NOISE STUDY



October 31, 2023

Bradley Parsons
Director of Design and Permitting
Verogy Solar Services
124 LaSalle Road
West Hartford, CT 06107
Email: bp Parsons@verogy.com

Subject: Environmental & Community Noise Assessment
Knight Street Solar / VCP, LLC – 275 Knight Street, Warwick, RI
Verogy Solar Services – West Hartford, CT

Dear Mr. Parsons,

WSP USA Environment & Infrastructure, Inc. (“WSP”) is pleased to submit the following environmental and community noise assessment for the Knight Street Solar site to Verogy Solar Services (“Verogy”) for the proposed solar photovoltaic (“PV”) energy generating facility to be located at 275 Knight Street, Warwick, RI (herein the “Facility” and/or “Site”).

This environmental noise assessment report is provided to summarize our findings to assure that the proposed Knight Street Solar / VCP, LLC facility (“Knight Street Solar”), as designed and considered, will be in compliance with the requirements of the City of Warwick Planning Department and the City of Warwick Code of Ordinances, Noise Regulation (i.e., [§40-13](#)). The sound pressure levels at the nearby sensitive residential receptors have been estimated using ISO 9613-2 calculations implemented in both spreadsheet format and SoundPLAN computer modeling software. It is the intention that, after construction of the Facility is completed, a certified sound level measurement survey will be conducted to confirm the conclusions of this study.

The results of this preliminary study demonstrate that the facility, as designed and considered, will comply with the City of Warwick noise requirements.

BACKGROUND

Knight Street Solar, a Verogy subsidiary, proposes to construct, operate, and maintain a 998 kilowatt (“kW”) solar photovoltaic electric generating facility located at 275 Knight Street, Warwick, RI.

As requested by the City of Warwick Planning Department, Verogy is hereby submitting an independent, pre-developed noise study for which a baseline sound level value is established indicating community background noise in perimeter areas adjacent to neighbors.¹ Additional post-startup noise testing will be conducted after the Facility is constructed to confirm the results of this study and assure that the Facility does not cause a noise nuisance condition.

Verogy has agreed to employ noise mitigation (i.e., attenuation) measures should the systems associated with the Facility be deemed responsible for an increase in offsite sound levels of three (3) decibels (“dB”) or more. It is noted that the, the City of Warwick Noise Ordinance restricts property line noise from increasing the ambient noise level² by 10 dBA or more, which is far less restrictive than that 3 dB limit specified by the City Planning Board.

¹ See Attachment G for copy of the Daniel Geagan’s (City of Warwick, Planning Dept.) email dated April 25, 2023. The City of Warwick originally requested that the noise study be conducted “over several weeks” using a long-term, unattended monitoring strategy. As indicated in the Daniel Geagan email, a prior approved approach was to use a more practical industry accepted measurement technique for establishing background community sound levels (i.e., short-term, attended).

² Background ambient noise in the areas adjacent to the Facility are established using an approach specified in §40-13.

WSP was contracted by Verogy for professional consulting services related to acoustical assessment of the proposed photovoltaic solar energy system (i.e., solar array). The goals of this assessment were to better understand the sound environment (i.e., background community sound levels) in the area, quantify the sound levels associated with the Facility, evaluate the predicted sound levels at the property lines surrounding the Site because of the daytime operation of the solar array, and potentially identify opportunities for sound attenuation, if deemed necessary.

Throughout this report there are numerous methods used to quantify and describe community sound levels. All of them use a logarithmic-scaled unit of measure known as the ‘decibel’ (i.e., dB). The ‘decibel’ is an essential scale for understanding perception of sound levels. Attachment A of this report provides a broad technical summary of the various sound terminology and statistical analysis methods used throughout this report.

APPLICABLE NOISE REGULATIONS

The City of Warwick Code of Ordinances §40-13 prohibits the emission of excessive noise beyond the boundaries of one’s property such that the noise impacting residential properties exceeds the following:

Table 1 – City of Warwick Noise Ordinance – Maximum Permissible Noise Levels

Time of Day	Sound Level Limit
8:00 AM – 10:00 PM, Daytime	60 dBA
10:00 PM – 8:00 AM, Nighttime	50 dBA

Additionally, the City of Warwick prohibits any noise which exceeds the *ambient noise* level by ten (10) dBA or more, when measured at the nearest property line, and which is physically annoying to persons or which is harsh, prolonged, unnatural or unusual in its time, place and use so as to cause physical discomfort, or is injurious to the health, safety and welfare of the citizens of the city.

For the purposes of this ordinance, *ambient noise* is defined as all-encompassing noise associated with a given environment, being a composite of sounds from many sources, near and far. Ambient noise level is the average over 15 minutes excluding random or intermittent noises and the alleged offensive noise at the location and time of day at which a comparison with an alleged offensive noise is to be made.

The City of Warwick Planning Department, Zoning Board of Review requires that Verogy submit an independent, pre-development noise study for which a baseline shall be established indicating general background noise in perimeter areas adjacent to neighbors. Additionally, a post-startup noise study shall be executed to ensure no increase in noise occurs from the Facility. The Zoning Board of Review specifies that noise mitigation must be employed for solar energy systems responsible for an increased background sound levels by 3 dBA or more. This limitation is assumed to apply at the residential property lines of the Facility.

On April 25, 2023, Verogy (i.e., Brad Parsons) informed the Zoning Board of Review (i.e., Daniel Geagan) that standard acoustical industry practice does not require collection of background sound level measurements over a period of *several weeks*. The standard practice in environmental sound level measurement is to record community sound pressure levels at multiple locations at rapid intervals (i.e., between 125 milliseconds and 1-second sampling interval). The sound level measurements are collected consecutively during a 20- to 30-minute sample period (i.e., observation time interval) which is conducted during a time period that is reasonably representative of “typical” community noise conditions (i.e., minimal wind, no precipitation, no snow-cover, no unusual events), and during the time of day at which a nuisance is most likely to occur at nearby sensitive receptors (i.e., daytime or nighttime). In the case of solar energy systems, because the systems do not operate at night, measurement shall be collected during the daytime.

All sound level measurements were conducted in general accordance with American National Standards Institute (“ANSI”) S12.8-1994, Outdoor Measurement of Sound Pressure Level and ANSI S12.9-1992, Qualities and Procedures for Description and Measurement of Environmental Sound.

EXISTING ACOUSTIC ENVIRONMENT

FACILITY LOCATION

The Knight Street Solar facility is to be located on a 16.4-acre parcel of land bounded by the Pawtuxet River to the south and interstate I-95 immediately across the river to the southeast, the Pontiac / Union Mills multi-purpose commercial / residential development to the west with a 4.5-acre vacant lot located between the properties, duplex-style residential properties to the north across Knight Street, and light industrial properties to the north and northeast of the Site.

The property is located on a historic landfill and is currently occupied by a sand, gravel and landscaping materials supply company, Earth Products, Inc.

The Site is located along Knight Street, which are single lane asphalt-paved road. The Site is approximately 0.25 miles (365 m) away from I-95 (east-southeast), and approximately 0.75 miles (1,200 m) away from I-295 (west-southwest) interstate highways. Another major source of community sound in the area is the Rhode Island T.F. Green Airport (“KPVD”), which is located 1.5 – 2.0 miles to the west of the Site, although the main runway approach corridors do not overlap the property.

A locus map for the Site is shown in Figure 1 (see Attachment B).

SOUND LEVEL MONITORING

On Thursday, October 12 and Friday, October 13, 2023, WSP personnel performed daytime sound level monitoring in the vicinity of three (3) property line locations at the Facility. The daytime attended measurements were collected between 10:20 AM and 2:00 PM during what is considered a typical weekday operational period – this is, mostly sunny midday conditions during which the solar array would be expected to operate at near full capacity.

Solar PV facilities produce electricity during the daytime hours, when the sun’s rays are collected by the panels. After sunset, the Facility will not receive solar radiation nor generate any electricity. During the nighttime inverters and transformer will not produce any noise.

The sections below summarize the methodologies employed by WSP personnel during the sound level measurement session, describe the measurement locations, and present the results of the community sound level monitoring.

MONITORING LOCATIONS

The daytime sound level measurements were collected at three (3) locations indicated in Figure 2 (see Attachment B).

- PL-1: This non-residential property line location is near the western side of the Site. The location is approximately 45 ft (13.7 m) to the west of the proposed location of the Facility’s DC-AC power inverters, and approximately 60 ft (18.3 m) to the southwest of the transformer. The location abuts the vacant lot along at the eastern end of the Pontiac / Union Mills property at 334 Knight Street.
- PL-2: This residential property line location is near the northwest corner of the Site near the Knight Street access driveway. The location is approximately 200 ft (61 m) to the north of the proposed location of the Facility’s DC-AC power inverters, and approximately 160 ft (49 m) to the north of the proposed transformer. The location abuts Knight Street and is directly across the street from the two-family residential property at 241-243 Knight Street.
- PL-3: This residential property line location is along the north side of the Site. The location is approximately 350 ft (106 m) to the northeast of the proposed location of the Facility’s DC-AC power inverters, and approximately 320 ft (98 m) to the northeast of the proposed transformer. The location abuts Knight Street and is directly across the street from the two-family residential property at 215-217 Knight Street.

The monitoring locations were selected to capture various sound level micro-environments that occur along the border of the Facility property.

MONITORING METHODOLOGY

The community sound level measurements were collected at the locations indicated in Figure 2 (see Attachment B) during two (2) sessions on Thursday, October 12, 2023 (12:20 PM – 2:00 PM) and on Friday, October 13, 2023 (10:20 AM – 11:55 AM). At the time of the monitoring surveys the weather conditions were as follows:

- Session #1 (10/12/23): The temperature was between 65°F to 67°F and the relative humidity varied between approximately 57% and 61%. There was a relatively consistent light breeze [3 – 5 miles per hour (“mph”)] throughout the monitoring period with occasional gusts (7 – 10 mph). The wind was from the south to southeast direction. No precipitation was reported, and the sky was mostly clear during all measurements.
- Session #2 (10/13/23): The temperature was between 55°F to 57°F and the relative humidity varied between approximately 65% and 70%. There was a relatively consistent breeze [5 – 7 miles per hour (“mph”)] throughout the monitoring period with occasional gusts (10 – 12 mph). The wind was from the north to northwest direction. No precipitation was reported, and the sky was mostly clear during all measurements.

The change in wind direction from the south-southeast during the first monitoring session to the north-northwest during the second monitoring session was the most obvious difference between the two noise surveys and caused a noticeable difference in the ambient background sound levels. During the first monitoring session (i.e., with the wind out of the south-southeast) the most obvious source of consistent community noise was observed to be caused by vehicle traffic traveling on I-95. During the second monitoring session (i.e., with the wind out of the north-northwest) the traffic from I-95 was not regularly audible at the monitoring locations. This is a well documented phenomenon; Attachment A of this report provides a broad technical summary of the upwind / downwind effect on sound propagation observed during these sound level monitoring events.

At each of the three (3) monitoring locations a series of six (6) short-term (i.e., 5-minute) sound level measurements periods were recorded during each of the two (2) monitoring sessions (i.e., total measurement time at each location was 60-minutes). Field notes and observations for each monitoring location are attached to this report (see Attachment C). These observations included traffic counts for vehicles driving on Knight Street during the monitoring sessions.

All sound level measurements were conducted in general accordance with American National Standards Institute (“ANSI”) S12.8-1994, Outdoor Measurement of Sound Pressure Level. Each measurement was 30 minutes in duration, and the L_{eq} , L_{90} , L_{50} , and L_{10} for each period was calculated from the measurement data.

All sound level measurements were collected with a calibrated Casella CEL-633C real-time octave band analyzer, which was equipped with precision condenser microphone having an operating range of 19 dB to 140 dB, and an overall frequency range of 12.5 Hz to 20 kHz. The sound level meter used meets or exceeds all requirements set forth by the ANSI for Type 1 quality and accuracy. Prior to and following all measurement sessions, the sound analyzer was calibrated with an ANSI Type 1 calibrator, which had accuracy traceable to the National Institute of Standards and Technology (“NIST”). All instrumentation was laboratory calibrated per ANSI recommendations within the last twelve (12) months. Copy of the equipment certificate of calibrations are attached (see Attachment D).

For all measurement sessions the microphone was fitted with an environmental windscreen to minimize the effects of air movement, and tripod mounted at a height of 1.3 meters above grade. All measurements were made away from the influence of vertical reflecting surfaces in compliance with ANSI S12.9-1992, Qualities and Procedures for Description and Measurement of Environmental Sound. All data were downloaded to a computer following the measurement session for post-processing and analysis.

MONITORING RESULTS

The following table provides the broadband sound level monitoring results for all locations. These results are useful in comparing difference sound micro-environments that occur along the property line.

Table 2 – Daytime Existing Sound Monitoring Results

Location ID	Date	Start	End	Cumulative Sound Pressure Level (dBA)			
				L _{eq}	L ₁₀	L ₅₀	L ₉₀
PL-1	10/12/23	12:20 PM	12:50 PM	54.1	55.5	53.1	51.7
	10/13/23	10:21 AM	10:51 AM	55.2	56.7	51.7	48.9
PL-2	10/12/23	12:54 PM	1:24 PM	66.4	69.9	58.0	55.4
	10/13/23	10:53 AM	11:53 AM	64.4	66.5	53.4	49.0
PL-3	10/12/23	1:30 PM	2:00 PM	64.7	67.5	57.6	55.3
	10/13/23	11:25 AM	11:55 AM	65.1	68.5	55.2	50.3

The L₉₀ monitoring results are summarized in Figure 2 (see Attachment B), and the detailed monitoring results data summaries are provided in Attachment C. The time-series plots shown in Attachment C provide an overall summary of how the recorded sound levels varied throughout the monitoring periods on 5-minute and 1-second timescales.

Since the operative metric of the existing community sound levels to which the noise from the photovoltaic solar array operations must be compared is the L₉₀, the remainder of this analysis focuses on the L₉₀ metric recorded during the monitoring sessions. The L₉₀ metric is utilized because L₉₀ sound levels are normally minimally affected by seasonal changes and variations in local conditions (e.g., roadway and airplane traffic, etc.). In other words, it is reasonable to assume that if the daytime sound levels were re-recorded the L₉₀ sound level measurements would likely be indistinguishable from each other. This assumes that the follow-up study is conducted during ‘typical’ periods (i.e., relatively normal weather conditions and not during an extremely windy, extremely hot, or snowy weather conditions). Attachment A of this report provides a technical summary of the L₉₀ statistical metric.

CALCULATED FUTURE SOUND LEVELS

This section describes the sound impact analysis methodologies and modeling results associated with WSP’s review of the proposed Knight Street Solar facility.

FACILITY OPERATIONS

The primary significant continuous source of Facility noise is emitted by the six (6) DC-AC power inverters. These units convert the 12-volt direct current (“DC”) power produced by the photovoltaic panels to the high-voltage alternating current (“AC”) power used by the electrical transmission grid. When operating, the DC-AC inverters emit an electrical humming sound and have built in cooling fans which also emits some noise.

The secondary source of Facility noise is the one (1) 750 kVA transformer, which is used to step-up the power output from the inverters to a voltage required by the location distribution network.

Other intermittent and relatively minor sources of facility sound (e.g., low-speed motors used to adjust solar panel angle) are not considered to be capable of generating enough sound to produce a nuisance noise condition at the property line.

DC-AC INVERTER SOUND POWER

The Knight Street Solar facility proposes to utilize six (6) CPS SCH100/125KTL-DO/US-600 high performance inverters installed near the western side of the Site. The site plan design calls for the inverter bank to be located approximately 40 ft (12.2 m) from the western property line, as shown in the figures in Attachment B.

The CPS product data sheet is provided in Attachment E and specifies that the CPS inverter produces audible noise level less than 65 dBA (ea.) at 1 meter and 25 °C. Additional field sound level testing was performed on a CPS inverter by Brooks Acoustics Corporation (“BAC”) on May 14, 2022. WSP reviewed the

field-testing data provided in the BAC acoustical engineering study dated April 26, 2023, and determined it to be collected appropriately and in good agreement with the manufacturer’s data sheet.

The following table summarizes WSP’s review of the CPS inverter sound level data, and the computation of sound power level (“Lw”) for input into the sound propagation models.

Table 3 – Source Specific Sound Measurement Conversion to Sound Power Level

Source Sound Parameter	Octave Band Center Frequency (Hz) Sound Level (dB)								Broadband Sound Level	
	63	125	250	500	1K	2K	4K	8K	(dB)	(dBA)
BAC Measured Source Sound Pressure Level (Lp) @ 1 ft. ^[1]	69.3	68.7	64.0	65.1	66.4	61.5	52.1	44.1	74.4	69.2
WSP Calculated Source Sound Power Level (Lw) ^[2]	72.2	71.6	66.9	68.0	69.3	64.4	55.0	47.0	77.3	72.2
WSP Calculated Source Sound Pressure Level (Lp) @ 1 m ^[3]	64.2	63.6	58.9	60.0	61.3	56.4	47.0	39.0	69.3	64.2

- ^[1] The CPS inverter near-field sound test was conducted at the East Windsor Solar One facility by Brooks Acoustics Corp. (BAC) on May 14, 2022. The octave band sound pressure level values (measured at 1 ft.) are provided in BAC’s East Windsor Solar Two - Acoustical Design Study dated April 26, 2023.
- ^[2] The CPS inverter sound power level (for use in sound modeling) was computed by WSP using standard procedures specified in ISO 3740, Acoustics – Determination of Sound Power Levels of Noise Sources.
- ^[3] The CPS inverter sound pressure level at 1 m was calculated by WSP using the sound power value (calculated above) and using the procedures specified in ISO 9613-2, Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation. The calculated sound pressure level at 1 meter (i.e., 64.2 dBA) demonstrates good agreement with the sound pressure level specified by CPS in the manufacturer’s data sheet (i.e., < 65 dBA @ 1 m) (see Attachment E).

Utilizing the source-specific monitoring data, WSP calculated the sound power level (“Lw”) for the bank of six (6) DC-AC inverters, as follows:

Table 4 – Source Specific Sound Power Levels – Inverters

Source Sound Parameter	Octave Band Center Frequency (Hz) Sound Level (dB)								Broadband Sound Level	
	63	125	250	500	1K	2K	4K	8K	(dB)	(dBA)
Single-Unit CPS Inverter Lw	72.2	71.6	66.9	68.0	69.3	64.4	55.0	47.0	77.3	72.2
6-Unit, Bank CPS Inverter, Lw	80.0	79.4	74.7	75.8	77.1	72.2	62.8	54.8	85.1	79.9

See Attachment A for a summary of the methodology used to calculate the combined sound power level for each DC-AC inverter bank. The detailed sound power computation results are provided in Attachment F.

TRANSFORMER SOUND POWER

The Knight Street Solar facility proposes to utilize one (1) Maddox 750 kVA liquid-filled transformer. The transformer will be located on a pad adjacent to the inverters and approximately 40 ft (12.2 m) from the western property line, as shown in the figures in Attachment B.

The Maddox product data sheet is provided in Attachment E and specifies that the transformer complies with National Electrical Manufacturers Association (“NEMA”) TR1 sound rating of 58 dBA. The sound power levels resulting from the operation of the transformer were estimated using data from NEMA TR1 (2000) and

transformer surface area data. The NEMA standard provides maximum sound level values for transformers, and manufacturers routinely meet this specification. Hence, the results based on NEMA may slightly overestimate the noise impact since the actual transformer is expected to be quieter.

The octave band sound power level of the transformer was calculated using Equation 112-18 in “Handbook of Noise and Vibration Control” (excerpt provided in Appendix F):

$$L_w = \text{NEMA Rating} + 10 \log A + C + 10$$

Where, NEMA Rating = A-weighted sound level of the transformer

A = total surface area of the sidewall of the transformer in m²

C = octave band correction (as specified in Table 20)

WSP utilized methodologies detailed by NEMA to calculate the sound power level (“L_w”) for the transformer, as follows:

Table 5 – Source Specific Sound Power Levels – Transformer

Source Sound Parameter	Octave Band Center Frequency (Hz) Sound Level (dB)								Broadband Sound Level	
	63	125	250	500	1K	2K	4K	8K	(dB)	(dBA)
750 kV Transformer, L _w	74.1	76.1	71.1	71.1	65.1	60.1	55.1	48.1	79.8	71.3

See Attachment A for a summary of the methodology used to calculate the combined sound power level for the transformer. The detailed sound power computation results are provided in Attachment F.

SOUND LEVEL MODELING ANALYSIS

The proposed Knight Street Solar facility’s sound impacts at the property line locations were modeled using both a simplified spreadsheet model (i.e., “WSP”) and the more refined SoundPLAN (i.e., “SPLAN”) computer software modeling program. Both of the sound modeling calculations use sound propagation algorithms and attenuation methodologies that are based on ANSI S12.62 and ISO 9613-2, Acoustics - Attenuation of Sound During Propagation Outdoors - Part 2: General Method of Calculation, and other industry accepted standards.

All sound propagation losses, such as geometric spreading, air absorption, ground absorption, and barrier shielding are calculated automatically in accordance with these recognized standards. Reflection from adjacent structures and terrain effects was accounted for in the SoundPLAN modeling; however, these effects are not included in the simplified WSP spreadsheet model.

The following additional considerations were included in the models:

- The WSP models did not include sound propagation losses caused by vegetation (i.e., foliage).
- The WSP models included higher ground reflectivity effects (G = 0.5) along the propagation path corresponding to more compacted ground surface with reflective solar panels than currently exists onsite.

These considerations cause the propagation models to predict higher sound levels (i.e., more conservative results) than would otherwise be expected.

Discrete modeling receptors were chosen at the residential and non-residential property line locations corresponding to where the ambient noise monitoring was conducted in order that direct comparison to existing noise levels could be assessed. The future maximum sound levels were calculated at the three (3) property line locations based on simultaneous operation of all six (6) DC-AC inverters and the one (1) transformer at maximum load.

The following table presents the modeled sound level impact results for both the WSP spreadsheet model and the SoundPLAN software model.

Table 6 – Future Facility Sound Level Impact Results

Location ID	Minimum Background Sound Level (L ₉₀) (dBA)	Maximum Predicted Sound Level from Facility (dBA)		Total Predicted Sound Level (dBA)		Predicted Sound Level Increase (dBA)	
		WSP	SPLAN	WSP	SPLAN	WSP	SPLAN
PL-1 ^[1]	48.9	47.6	47.4	51.3	51.2	+2.4	+2.3
PL-2	49.0	34.2	35.7	49.1	49.2	+0.1	+0.2
PL-3	50.3	28.9	30.9	50.3	50.3	+0.0	+0.0

^[1] PL-1 is a non-residential property line location directly to the west of the inverter bank and represents the worst-case sound level impact from the proposed Facility.

A noise contour map for the entire property, which also depicts the SoundPLAN results for the residential receptors evaluated, is presented in Figure 3 (see Attachment B).

A review of the data in the above table reveals that the sound generated by the Facility will be **well below** the City of Warwick daytime noise standard at all residential locations (i.e., 60 dBA). Slight increases in environmental and community sound levels will occur over the minimum daytime L₉₀ levels, but the total property line sound level, even when added to ambient noise, will remain at or below the 3 dBA increase specified by the City of Warwick Planning Department. The magnitude of the increases in community sound level caused by the Facility are deemed to be **barely perceptible** (i.e., less than 3 dBA increase).

TONAL ANALYSIS

A discrete tone is a sound that consists primarily of a single pitch such that it is clearly audible against the normal broadband background sounds, even when the tone is at a lower level. Tones are generally more annoying than broadband noise.

The City of Warwick does not specify any discrete tone (or a pure tone) limitation.

Also, it is generally not possible to model the potential for discrete tones since this would require the use of propagation algorithms applied to 1/3 octave band data, which are not available. The Facility design will therefore include a specification to all equipment vendors that discrete tone noise must be controlled.

The source specific measurement data for the CPS DC-AC inverter (i.e., field sound level testing was performed on a CPS inverter by BAC on May 14, 2022) showed no prominent discrete tone present. Therefore, it is highly unlikely that such a tone will develop via constructive and/or destructive interference as the equipment sound waves propagate from the source to the property line(s).

A review of the modeling data in the above table reveals that the sound generated by the Facility, even if it were to produce a prominent discrete tone, will remain **well below** the City of Warwick daytime noise standard at all residential locations.

CONCLUSION

An environmental and community noise modeling analysis of the proposed Knight Street Solar project was conducted in order to determine if operational sound levels from the proposed Facility would comply with the City of Warwick Planning Department and the City of Warwick noise standards. Ambient background sound levels were also measured and compared to proposed Facility sound levels.

The modeling study utilized vendor obtained data and field measurement data for the major noise generating equipment sources (i.e., CPS DC-AC inverters and Maddox transformer), which were incorporated into the WSP and SoundPLAN computer propagation models. The modeling results reveal that the sound level from the proposed Facility will be in compliance with the City of Warwick noise standards at all residential property lines. Increases in existing background (i.e., L₉₀) sound levels are expected to be minimal.

The sound levels from the Knight Street Solar facility are expected to be in full compliance with City of Warwick Code of Ordinances §40-13 at all residences surrounding the Site. Furthermore, the sound levels from the

Facility are **not** expected to increase offsite background sound levels by 3 dBA or more, as required by the City of Warwick Planning Department.

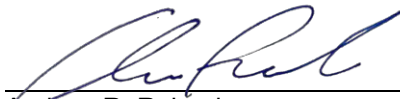
The conclusions and calculations provided are based on the background sound level measurements collected on October 12 & 13, 2023 by WSP and on source-specific measurements collect on May 14, 2022 by BAC. The observations in this report were valid on the date and time of the investigation. Reported noise levels contained herein are a factor of operational conditions and environmental conditions present at the time of the assessment and may represent “normal” facility noise levels. Measurements and calculations in this report should be considered accurate to within one (1) decibel.

This report is intended to be used in its entirety for the purposes of Verogy Solar Services to assist in making decisions with respect to the development of the proposed solar photovoltaic project located at 275 Knight Street, Warwick, RI. Any use of this report, or portions thereof, out of context or any application of this report for purposes other than those explicitly expressed above is considered inappropriate and is done at the sole risk of the user.

If you have any questions, or require additional information, please contact me (860-966-4391, andy.roland@wsp.com), or Andrew Vardakis, P.E. (781-552-9899, andrew.vardakis@wsp.com), at your earliest convenience.

Sincerely,

WSP



Andrew R. Roland
Senior Project Engineer



Andrew P. Vardakis, P.E.
Vice President, Civil Engineering

- Attachments:
- A. Environmental Acoustics Technical Background
 - B. Environmental & Community Noise Assessment Figures
 - C. Sound Level Monitoring Field Notes and Results
 - D. Monitoring Equipment Certificates of Calibration
 - E. Manufacturer’s Technical Data Sheet
 - F. Environmental Noise Modeling Calculations
 - G. Planning Department Email Re: Verogy – Noise Study, 4/25/2023

cc: Paul G. Richard (WSP)

Attachment A

Environmental Acoustics Technical Background

Decibel Scale

All sounds originate from a source. The sound energy produced by a source creates variations in air pressure which travel in all directions, much like how a wave ripples across water. The “loudness” or intensity of a sound depends on the sound pressure level, defined as the ratio of two pressures: the measured sound pressure from the source divided by a reference pressure (i.e., the minimum threshold pressure of human hearing). This measured ratio is expressed using the decibel (“dB”) scale, which is a logarithmic scale designed to accommodate the wide range of sound intensities the human ear can respond to – that is, approximately 20 micropascals (“μPa”) up to 100 kilopascals (“kPa”). On the decibel scale, the threshold of human hearing is equal to 0 dB, while levels above 140 dB can cause immediate hearing damage.

The following formula is used to convert a sound pressure value measured in pascals into a decibel value:

$$L_p [dB] = 20 \cdot \log_{10}(P_{rms} / P_0)$$

where: L_p = sound pressure level in decibels (dB)

P_{rms} = root mean square of measured sound pressure waveform in pascals (Pa)

P_0 = 0.00002 Pa, reference sound pressure in pascals (Pa)

The table below provides some examples of common sources of sound and their sound pressure levels. All sound levels in this assessment are provided in A-weighted decibels, abbreviated “dBA.” The A-weighted sound level reflects how the human ear responds to sound, by deemphasizing sounds that occur in frequencies (i.e., pitch) at which the human ear is least sensitive to sound and emphasizing sounds that occur in frequencies at which the human ear is most sensitive. In the context of environmental and community sound, noise is defined as “unwanted sound.”

Comparison of Sound Levels and Sensation of Loudness

Sound Pressure Level (dBA)	Example Sound Source	Perceived Loudness
140	Gun Shot at 3 ft.	Physical Pain
130	Jet Aircraft at 200 ft.	
120	Rock Band (near stage)	Deafening
110	Motorcycle at 3 ft.	
100	Lawn Mower at 3 ft.	Very Loud
90	Noisy Factory Floor	
80	Heavy Truck at 50 ft.	Loud
70	Busy Restaurant	
60	Normal Conversation	Normal
50	Quiet Office	Quiet
40	Living Room	
30	Quiet Library	Faint
20	Empty Auditorium	
10	Soundproof Room	Barely Audible
0	-	Threshold of Hearing

One property of the logarithmic nature of the decibel scale is that the combined sound levels of multiple sound sources is not simply the sum of the contributing sound decibel levels. For example, if the sound of one source measured to have a sound level of 70 dBA is added to another source of 70 dBA, the total is only 73 dBA, not a doubling to 140 dBA. Another mathematical property of the decibel scale is that if one source of sound is at least 10 dB higher than another source, then the total sound is simply the sound level of the louder source. For example, if a sound source at 80 dBA is added to a source at 65 dBA, then the total sound level is 80 dBA.

The following formula is used to combine decibel sound level values:

$$L [dB] = 10 \cdot \log_{10}(10^{L_1/10} + 10^{L_2/10})$$

where: L = combined sound level of source 1 and source 2 in decibels (dB)

L_1 = sound level of sound source 1 in decibels (dB)

L_2 = sound level of sound source 2 in decibels (dB)

In terms of human perception of sound, a ± 3 dB difference is considered a barely perceptible change for broadband sounds (i.e., sounds that include all frequencies). Similarly, a difference of ± 10 dB is perceived as a halving or doubling of apparent sound loudness and the response that goes with it.

The tables below provide a summary comparison of sound pressure levels and loudness sensations.

Subjective Perception of Changes in Sound level

Change in Sound Level	Perceived Change in Loudness (Absolute Difference in Sound Energy)
± 3 dB	Barely Noticeable Change (2x [or 1/2] energy)
± 5 dB	Easily Noticeable Change (4x [or 1/4] energy)
± 10 dB	Double (or Half) as Loud (10x [or 1/10] energy)
± 20 dB	Very "Dramatic" Change (100x [or 1/100] energy)

Frequency / A-Weighting

Sound is transmitted by pressure variations in air – that is, the compression / release of gas pressure in air. Frequency of pressure waves is expressed in Hertz ("Hz"), which is defined as the number of complete wave cycles per second. Low frequency sound has fewer waves per second (longer wavelength) than high frequency sound (shorter wavelength) and is often described in musical terms as 'pitch' or 'tone'. The frequency range of audible sound that the human ear responds to is 20 to 20,000 Hz. This range is difficult to use to express individual sounds since most sounds created within the environment are composed of multiple frequencies being emitted simultaneously (i.e., broadband). Broadband sound is therefore divided into frequency "bands" called octaves which are identified by their center frequency to make using frequency measurements easier. Octave bands are necessary to evaluate environmental noise because the human ear responds differently to each octave band.

Environmental sound is commonly expressed in terms of an A-weighted sound decibel level ("dBA"). The A-weighting is a standard frequency filter used to make measured sound levels more nearly approximate the frequency response of the human ear, which is centered at a frequency of 1,000 Hz. The table below shows the approximate adjustments made within each octave band frequency to contour un-weighted octave band sound pressure levels in decibels ("dB" or "dBZ") to A-weighted sound pressure levels ("dBA").

A-Weighed Octave Band Adjustments

Octave (Hz)	32	64	125	250	500	1K	2K	4K	8K	16K
A-Adj. Value (dB)	-39.4	-26.2	-16.1	-8.6	-3.6	0.0	+1.2	+1.0	-1.1	-6.6

As shown above, the A-weighting sound levels emphasize the middle frequency sounds (i.e., 1 kHz – 4 kHz), and de-emphasize low- and high-frequency sounds. A 'broadband' sound includes sound pressures at all octave bands expressed as a single representative value.

The A-weighted broadband value is calculated by taking the logarithmic summation of all octave band sound pressure level according to the following formula:

$$L_p [dBA] = 10 \cdot \log_{10}(\sum 10^{(L_x + Adj_x)/10})$$

where: L_p = broadband sound pressure level in A-weighted decibels (dBA)

L_x = sound pressure level at octave band (x) in un-weighted decibels (dB)

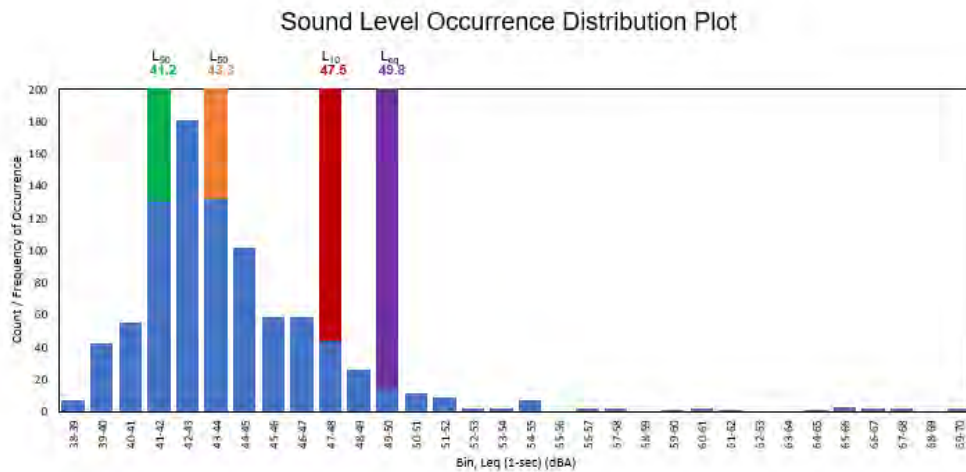
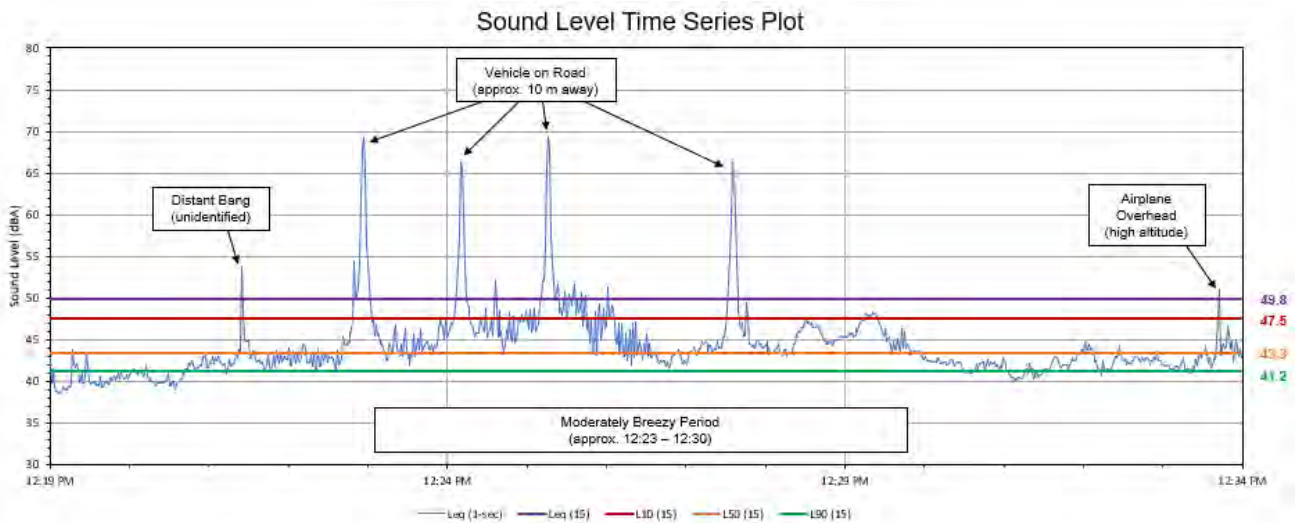
Adj_x = octave band (x) adjustment to A-weighting (\pm dB) (see table above)

Temporal Sound Metrics

Environmental sound levels vary from moment to moment – that is, some sounds are sharp and impulsive lasting a very short time, while others rise and fall over much longer periods of time. These are termed “temporal” sound level variations, and there are various measures (i.e., metrics) which are designed to account for various levels of temporal variation in sound. The most commonly used in this analysis are the 90% exceedance level (i.e., L_{90}), and the equivalent sound level (i.e., L_{eq}).

- L_{90} sound metric is a statistical value that calculates the steady-state sound pressure level that is exceeded during 90% of the measurement period. In other words, the L_{90} represents the “quietest” 10% of a sound measurement period and is normally considered the background sound level. The L_{90} calculation effectively eliminates nearly all temporal variation in recorded noise and is used to set baseline and continuous background sound levels. The L_{90} can be considered the “residual” sound level, which is the ambient sound leftover when nearly all obvious intermittent noise sources are eliminated from the measurement. This is known as an exceedance value, or the percent of time (n) during a measurement period a sound level value is exceeded (L_n). Conversely, the L_{10} sound level metric is the statistical value that calculates the “loudest” 10% of the measurement period (i.e., the sound pressure level that is exceeded for only 10% of the measurement period).
- L_{50} is the median sound level – that is, the sound level value that is exceeded by 50% (i.e., half) of the data sample. The L_{50} is not skewed by a small proportion of extremely high or low sound level values, and therefore provides a good representation of the most typical sound level recorded during the sample period.
- L_{eq} , or equivalent sound level, is the steady-state sound level over a period that has the same acoustic energy as the fluctuating sound that occurred during the same period of time. As an example, if two (2) sounds were measured, and one (1) sound had twice (2X) the sound energy but lasted for half as long, the two (2) sounds would be characterized as having the same equivalent sound level (since the energy released is equivalent). The L_{eq} is directly related to the effects of sound on peoples’ perceived intrusiveness or level of annoyance since it expresses the equivalent magnitude of the sound as a function of occurrence frequency and time. The L_{eq} is commonly referred to as the average sound pressure level, although this is not necessarily an accurate description. In certain situations, the L_{eq} sound level should be considered overly conservative as the value is more significantly affected by short-duration loud noises. This is caused by the logarithmic nature of the decibel scale and that it is a time-integrated energy average (as opposed to a simple arithmetic average). For example, a 76 dB sound level equates to ‘quadruple’ (i.e., four times) the sound energy produced by a 70 dB source, therefore the L_{eq} value is mostly determined by loud sounds if there are fluctuations during a measurement period.

The L_{eq} and L_{90} (L_{50} and L_{10}) values are both automatically calculated with a sound level meter in accordance with the methods define in American National Standards Institute (“ANSI”) S1.4-1983. The figure below provides a visual description of how these sound level metrics are used to summarize fluctuating sound data during an example 15-minute measurement period. The figure also demonstrates how the ‘skewness’ of the data frequency distribution will generate a L_{eq} value which exceeds the L_{10} metric due to several loud, short-duration events.



Sound Power versus Sound Pressure

Sound power (“L_w”) and sound pressure (“L_p”) are two distinct and commonly confused descriptors of sound because both values are typically expressed in the decibel scale. Sound power is the acoustical energy emitted by the sound source and is an absolute value. It is not affected by the environment and is independent of distance to the source. On the other hand, sound pressure levels vary substantially with distance from the source and also are diminished by other environmental factors (e.g., obstacles, barriers, air absorption, wind, etc.). Sound pressure is what human ears experience (or hear), and what sound level meters measure.

The total acoustical power emitted by a sound source is given in terms of the sound power level (L_w). The sound power level of a source is an intrinsic property of the unit for a give set of operating conditions irrespective of the orientation of the source. Sound power is a theoretical value that is not directly measured. It is a characteristic of the sound source and is an estimate of the total sound power emitting in all directions by the source. The value of sound power level is determined by the following equation:

$$L_w \text{ (dB)} = 10 \cdot \log_{10}(W / W_0)$$

where: L_w = sound power of source in decibels (dB)

W = acoustic power radiated by the source in watts (W)

W₀ = 10⁻¹² W, reference power in watts (W)

The sound pressure level (L_p) is a measure of the magnitude of the acoustical pressure wave at a specific receptor location. The magnitude of the sound pressure level is a result of how the sound power is distributed and influenced by the environment between the sound source and the receiver location. Environmental influences may include distance between the source and the receiver, atmospheric attenuation of the path of propagation, reflections from surfaces, as well as sound transmission and refraction through and around

fluid/solid structures. In many instances these effects are frequency dependent necessitating an analysis that can account for the change in spectral distribution of the sound power during the propagation from the source to the receiver.

Sound Level Reduction Over Distance

The calculation to estimate environmental sound pressure value at a given location from a source value at a given sound power level is detailed in ISO 9613-2: Acoustics – Attenuation of Sound During Propagation Outdoors. This is the commonly accepted procedure for ‘modeling’ predicted sound level impact at a receptor location due to the introduction of a sound source. As mentioned above, this calculation is influenced by numerous factors – for example, geometric divergence (i.e., wave-spreading due to distance between source and receiver), atmospheric absorption, ground and surface reflection and absorption, and screening and refraction due to obstacles between source and receiver. The following section provides an explanation of the most basic of these ‘factors’ – that is, geometric divergence or sound level reduction over distance.

When traveling from a source to a receptor in an outdoor environment, sound energy levels decrease with increasing distance from source to receptor. This is due to geometric divergence (or wave-spreading), and the decrease in sound level from any source normally follows the “inverse-square law”. The inverse-square law generally applies to energy as it is radiated outward in three-dimensions (i.e., spherically). As the emitted energy gets farther from the source it is spread out over an area that increases in proportion to the square of the distance from the source (i.e., r^2). The attenuation value due to spherical spreading in the free field is equal to:

$$A_{div} \text{ (dB)} = 10 \cdot \log_{10}(4 \cdot \pi \cdot r^2) = 20 \cdot \log_{10}(r) + 11$$

where: A_{div} = attenuation due to geometric divergence in decibels (dB)

r = distance from the source to the receiver in meters (m)

In general, at distances greater than 50 feet from a point source, every doubling of the distance between the source and the receiver produces a 6 dB reduction in sound level at the receptor. However, for heavy roadway traffic, which can be approximated as a line source, sound levels typically decrease by approximately 3 dB every time the distance between the road and the receptor is doubled due to the cylindrical spreading of the waves. In either case the actual reduction in sound levels over the distance is dependent on the characteristics of the source itself (e.g., frequency, directionality, etc.) and the conditions over which the sound travels (e.g., barriers, topography, groundcover, etc.).

Atmospheric Effects

Wind and temperature variations can cause bending of sound waves and can influence changes in sound levels at large distances and help explain the variation that occurs in outdoor sound propagation and measurements.

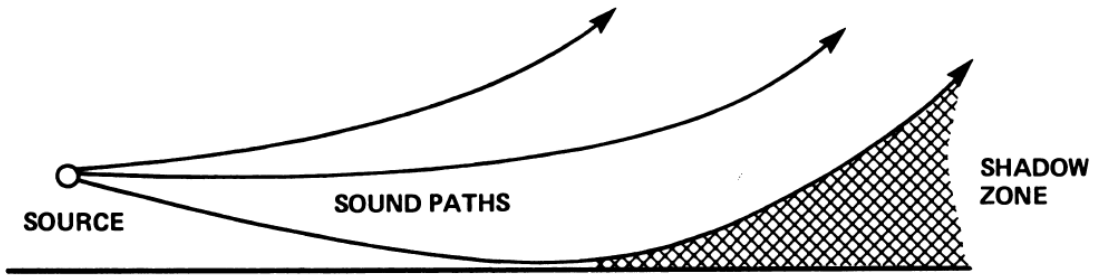
A steady, smooth flow of wind, equal at all altitudes, would have no noticeable effect on sound transmission. In practice, however, wind speeds are generally higher above the ground than at the ground level, and the resulting wind speed gradients tend to “bend” sound waves over large distances. Sound traveling with the wind is bent down to earth, while sound traveling against the wind is bent upwards toward the sky.

The figure below shows illustrates the influence wind can have on sound propagation:

WIND DIRECTION
→



WIND DIRECTION
←



Attachment B

Environmental & Community Noise Assessment Figures



Proposed
Knight Street Solar

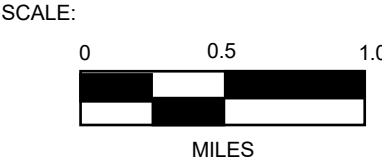


WSP USA ENVIRONMENT & INFRASTRUCTURE, INC.
100 APOLLO DRIVE, SUITE 302
CHELMSFORD, MA 01824

CLIENT:
VEROGY SOLAR SERVICES
124 LASALLE ROAD
WEST HARTFORD, CT 06107

PROJECT:
KNIGHT STREET SOLAR
275 KNIGHT STREET
WARWICK, RI 02886

PROJECT NO:	3652230417
REVISION:	00
DRAWN BY:	ARR
CHECKED BY:	PGR
DATE:	10/24/2023



NOTES:

FIGURE TITLE:
SITE LOCUS MAP

FIGURE NUMBER:
1





ID:	PL-2
L ₉₀ (1):	55.4 dBA
L ₉₀ (2):	49.0 dBA

ID:	PL-3
L ₉₀ (1):	55.3 dBA
L ₉₀ (2):	50.3 dBA

ID:	PL-1
L ₉₀ (1):	51.7 dBA
L ₉₀ (2):	48.9 dBA



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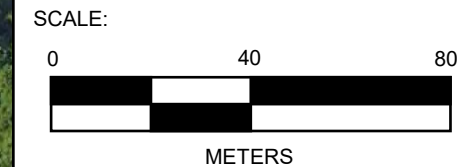
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REVISION: 00

DRAWN BY: ARR

CHECKED BY: PGR

DATE: 10/24/2023



NOTES:
 L₉₀ = RESIDUAL (I.E., 90% EXCEEDANCE) SOUND LEVEL
 dBA = A-WEIGHTED DECIBELS

EXISTING AMBIENT DAYTIME SOUND LEVEL MONITORING CONDUCTED BY ANDY ROLAND (WSP) DURING TWO (2) SESSIONS:
 • THURS. OCT. 12, 2023 (12:20 – 14:00)
 • FRI. OCT. 13, 2023 (10:20 – 11:55)

SOUND LEVELS MEASURED AT EACH LOCATION FOR TWO (2) 30-MINUTE PERIODS USING CASELLA CEL-633C TYPE 1 OCTAVE BAND ANALYZER (SN: 4210504)

FIGURE TITLE:
 SOUND LEVEL MONITORING LOCATIONS & DAYTIME RESULTS SUMMARY

FIGURE NUMBER:
 2



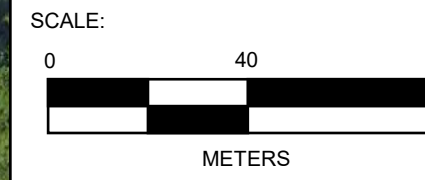


WSP USA ENVIRONMENT & INFRASTRUCTURE, INC.
 100 APOLLO DRIVE, SUITE 302
 CHELMSFORD, MA 01824

CLIENT:
VEROGY SOLAR SERVICES
 124 LASALLE ROAD
 WEST HARTFORD, CT 06107

PROJECT:
KNIGHT STREET SOLAR
 275 KNIGHT STREET
 WARWICK, RI 02886

PROJECT NO:	3652230417
REVISION:	00
DRAWN BY:	ARR
CHECKED BY:	PGR
DATE:	10/24/2023



CONTOUR LEVELS (dBA):

35	
40	
45	
50	◀ Nighttime Limit
55	
60	◀ Daytime Limit
65	

NOTES:

SPL = SOUND PRESSURE LEVEL
 dBA = A-WEIGHTED DECIBELS

City of Warwick Ordinance, §40-13 Noise. Prohibits noise impacting residential property use which equals or exceeds:

- 60 dBA (8:00 AM – 10:00 PM)
- 50 dBA (10:00 PM – 8:00 AM)

FIGURE TITLE:
 SOUNDPLAN MODELING RESULTS SUMMARY

FIGURE NUMBER:
 3

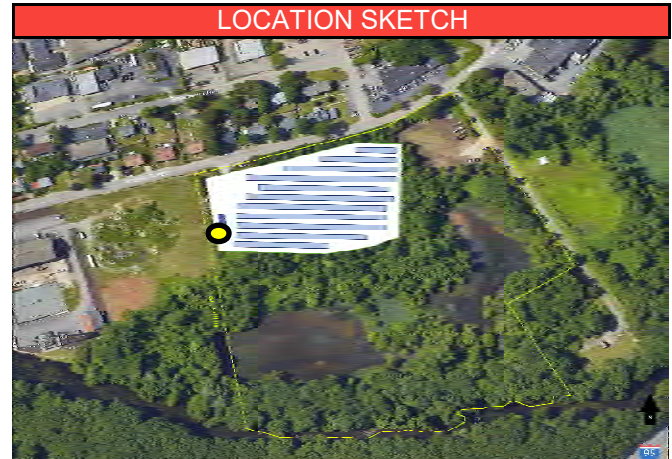
Attachment C

Sound Level Monitoring Field Notes and Results

WSP USA E&I, Inc.
Environmental Noise Monitoring Field Notes

Project Name:	Verogy - Warwick
Performed By:	A. Roland

LOCATION INFORMATION	
Location ID:	PL-1
Description:	Daytime, Session 1
Date:	Thu. Oct 12, 2023
Start Time:	12:20:00 PM
End Time:	12:50:00 PM



WEATHER CONDITIONS	
Temperature:	65 °F
Wind Speed:	3 - 5 mph
Direction:	S
Humidity:	65%
Sky Type:	Mostly clear
Precipitation:	n/a

GENERAL SOUND SOURCES (order by most prominent)

1)	Distant vehicle traffic on I-95 (consistent)
2)	Natural sounds (e.g., crickets, birds, etc.)
3)	Rustling leaves from light breeze (consistent), with occasional gusts (7-10 mph)
4)	Vehicles passing on Knight Street (~2-3 vehicles per minute)
5)	

MONITORING NOTES / EVENTS

Event Description:	Number of Instances, Start Time, End Time:
Loud engine on I-95*	12:22, 12:23, 12:34, 12:34, 12:38
Vehicle onsite**	12:24, 12:37, 12:47, 12:48, 12:49, 12:50
Speaking w/ owner***	12:42-12:45

TRAFFIC COUNT (nearest roadway)

	12:20 PM	12:21 PM	12:22 PM	12:23 PM	12:24 PM	12:25 PM	12:26 PM	12:27 PM	12:28 PM	12:29 PM
Knight St.	5	0	1	2	3	1	4	2	3	1
	12:30 PM	12:31 PM	12:32 PM	12:33 PM	12:34 PM	12:35 PM	12:36 PM	12:37 PM	12:38 PM	12:39 PM
	2	3	3	2	5	4	1	1	1	2
	12:40 PM	12:41 PM	12:42 PM	12:43 PM	12:44 PM	12:45 PM	12:46 PM	12:47 PM	12:48 PM	12:49 PM
	2	2	0	3	1	3	5	2	1	3

OTHER COMMENTS

* Several "loud engines" on I-95 may have been actually been airplanes taking off from T.F. Green. Difficult to distinguish between the two sources with the prevailing wind direction from the south.
 ** Onsite vehicles included trucks, bobcat, and front end loader
 *** Owner of Earth Products, Inc. approached monitor to talk. He and A. Roland stood ~20 ft. from monitor and briefly discussed project and site history.

Environmental Noise Monitoring Data Sheet

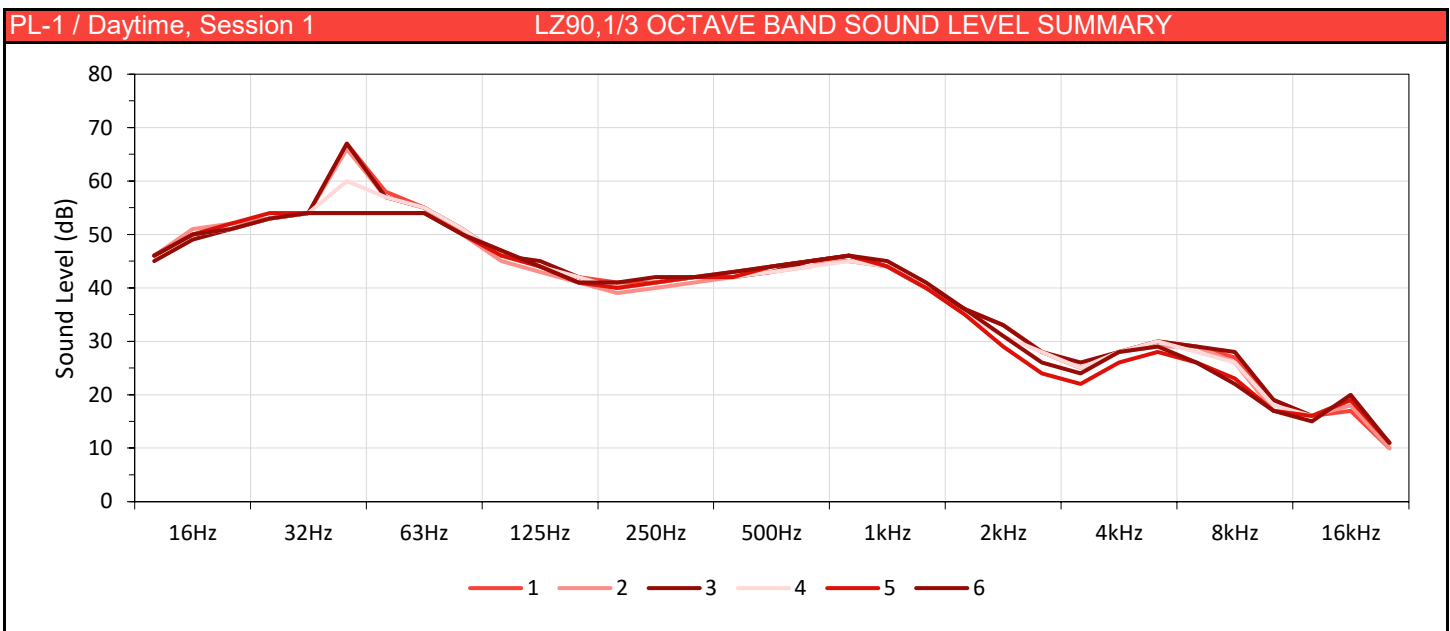
Project Name:	Verogy - Warwick
Project No:	3652230417

MEASUREMENT INFORMATION	
Location ID:	PL-1
Description:	Daytime, Session 1
Date:	Thu. Oct 12, 2023
Start Time:	12:20:00 PM
End Time:	12:50:00 PM

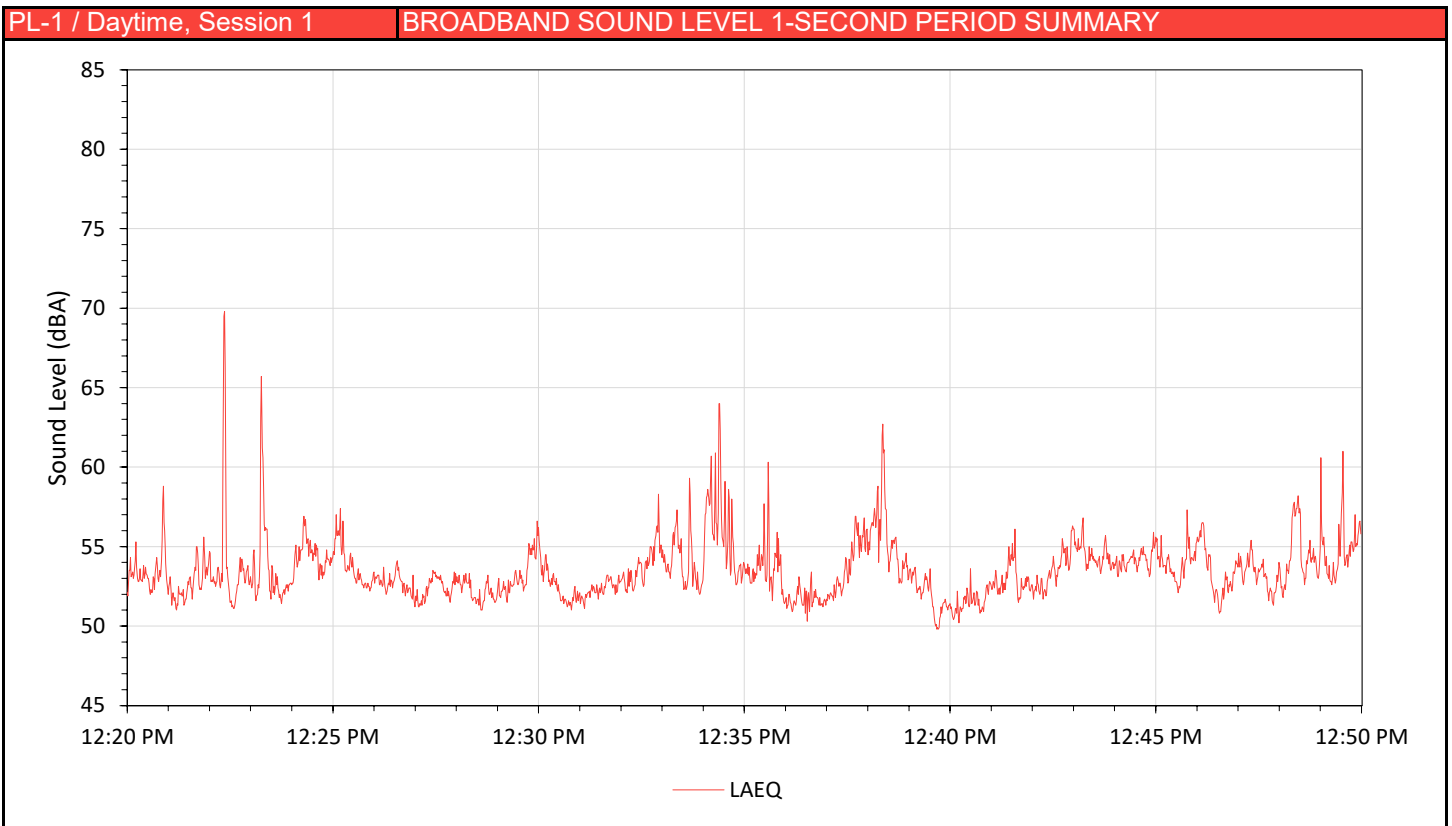
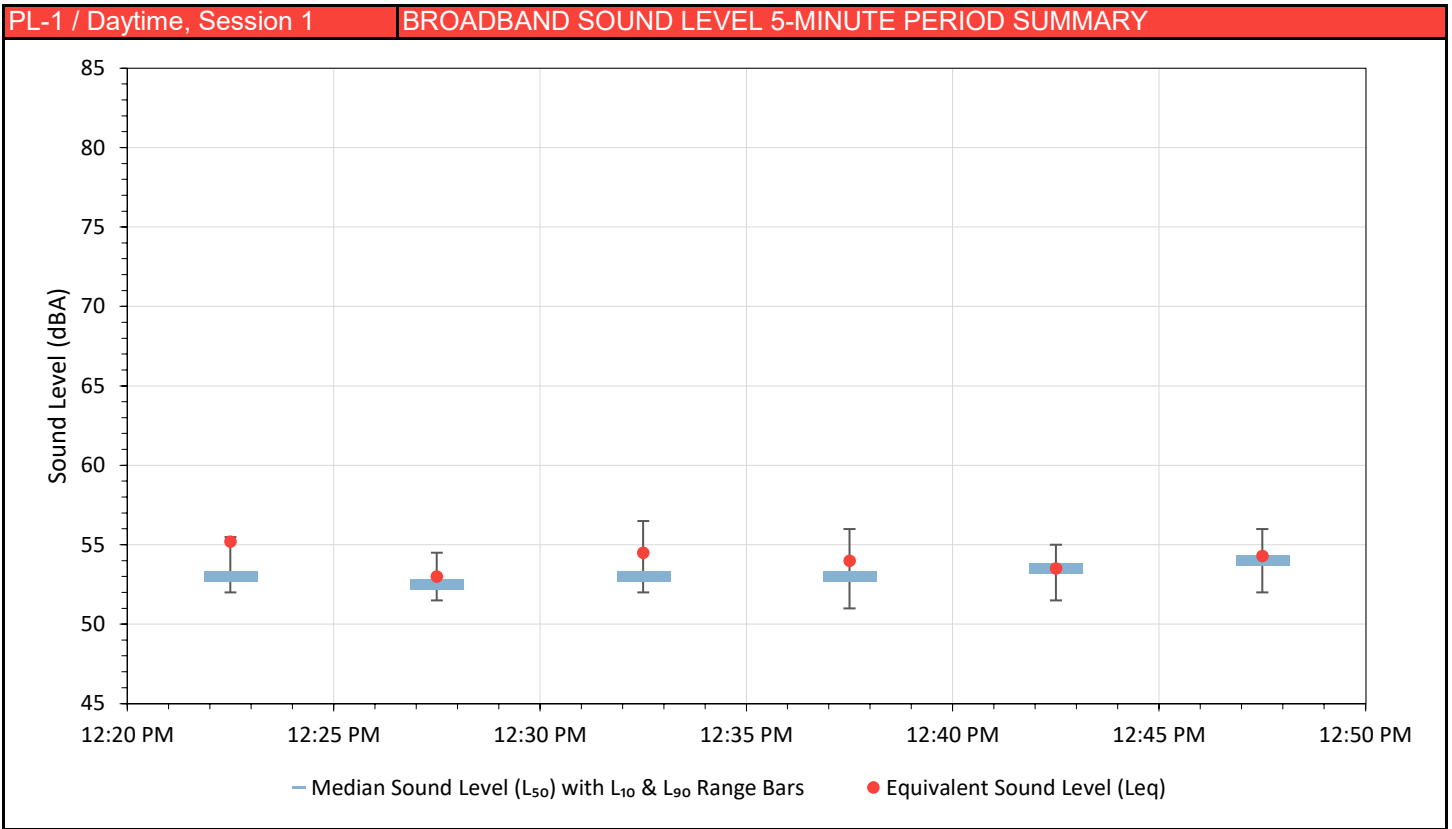


SUMMARY INFORMATION	
Duration:	00:30:00
Response:	Random
Overload:	FALSE
Cal. (Before):	12:18:54 PM
Cal. (After):	12:50:59 PM
Cal. Drift:	-0.1

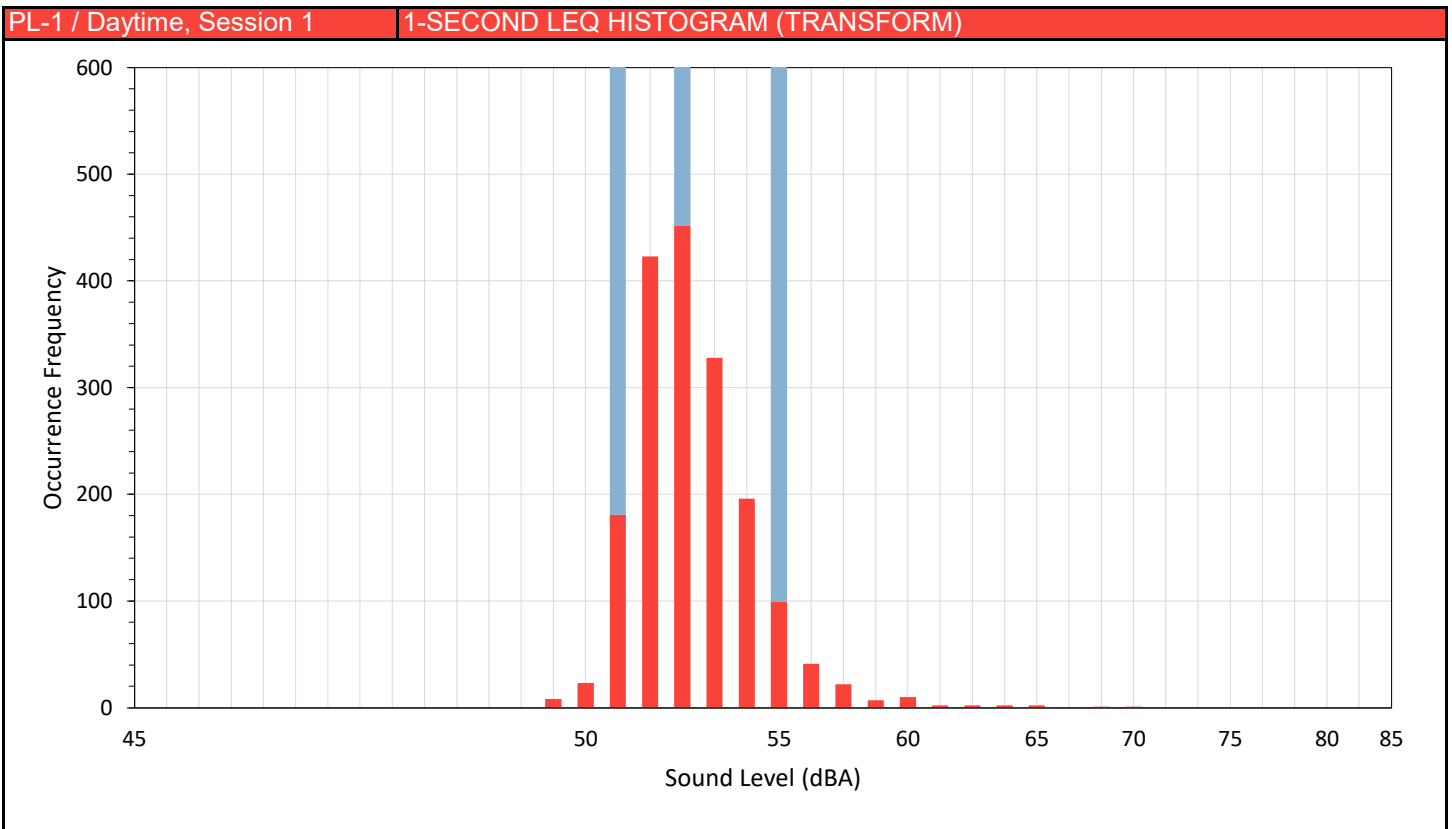
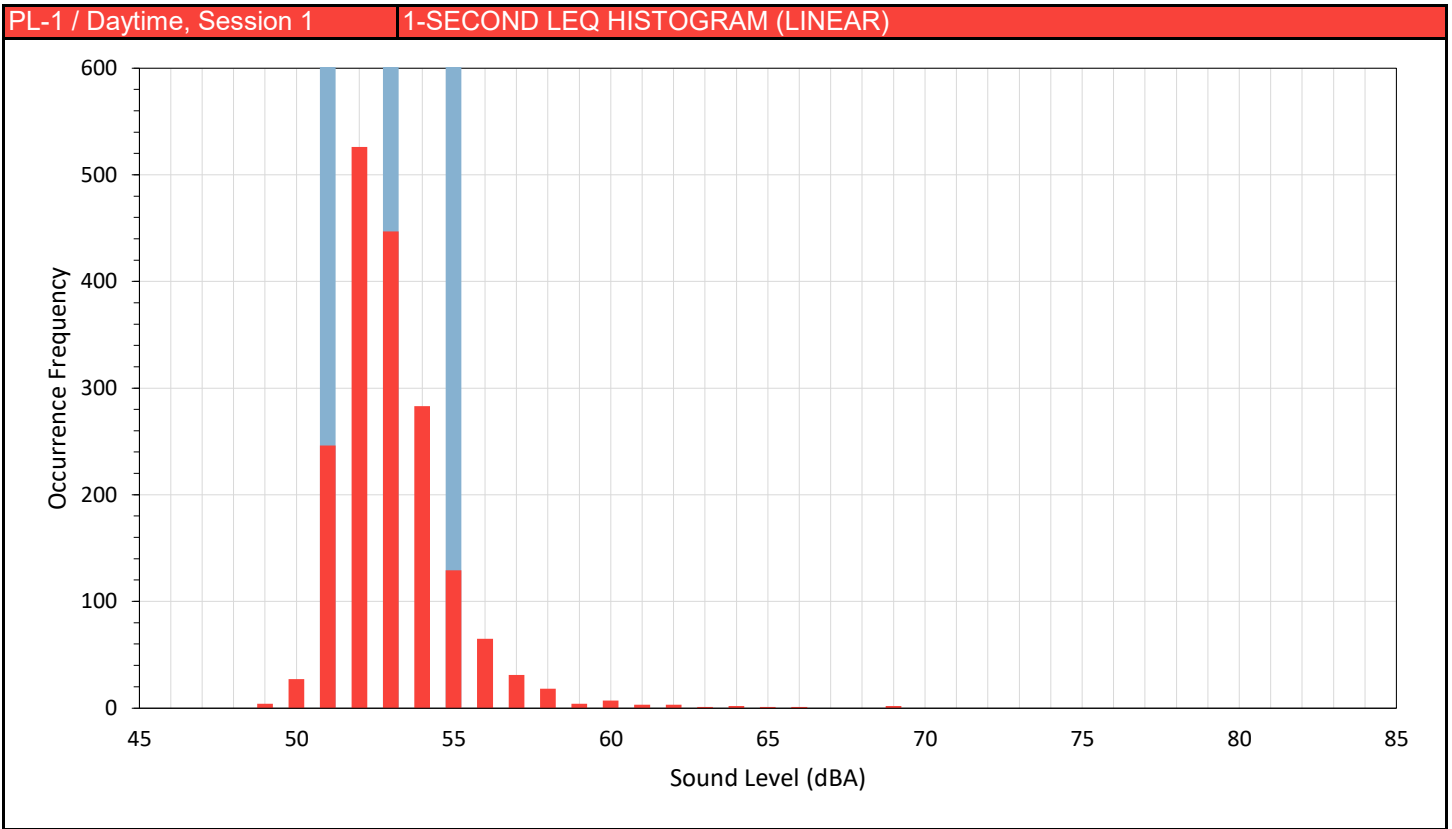
RESULTS SUMMARY					
		Cumulative Results			
		L_{eq}	L_{10}	L_{50}	L_{90}
Octave Band SPL (dB)	32 Hz:	68.2	69.7	66.9	63.3
	63 Hz:	64.7	67.4	62.6	59.2
	125 Hz:	55.4	57.8	52.4	49.1
	250 Hz:	51.8	54.1	48.7	45.8
	500 Hz:	52.3	54.1	50.7	48.4
	1 kHz:	50.9	51.9	50.3	48.7
	2 kHz:	39.7	41.1	39.1	37.6
	4 kHz:	35.8	37.7	34.5	32.4
	8 kHz:	32.2	33.3	31.6	30.1
Broadband (dBA):		54.1	55.5	53.1	51.7



Environmental Noise Monitoring Summary Charts



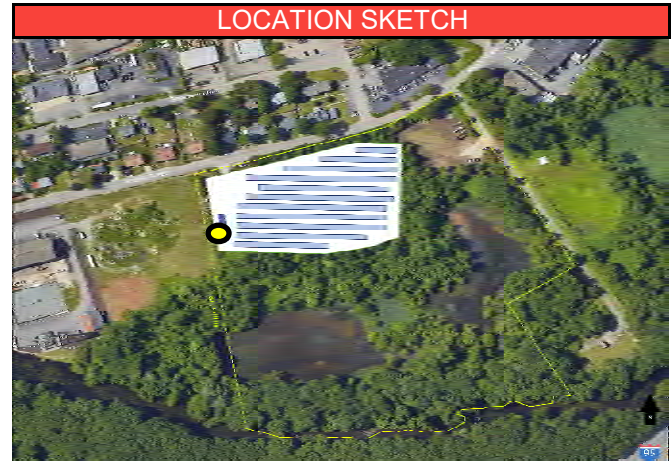
Environmental Noise Monitoring Distribution Charts



WSP USA E&I, Inc.
Environmental Noise Monitoring Field Notes

Project Name:	Verogy - Warwick
Performed By:	A. Roland

LOCATION INFORMATION	
Location ID:	PL-1
Description:	Daytime, Session 2
Date:	Fri. Oct 13, 2023
Start Time:	10:21:00 AM
End Time:	10:50:59 AM



WEATHER CONDITIONS	
Temperature:	55 °F
Wind Speed:	5 - 7 mph
Direction:	N
Humidity:	70%
Sky Type:	Clear
Precipitation:	n/a

GENERAL SOUND SOURCES (order by most prominent)

1)	Natural sounds (e.g., crickets, birds, etc.)
2)	Rustling leaves from breeze (consistent), with occasional gusts (10-12 mph)
3)	Vehicles passing on Knight Street (~2-3 vehicles per minute)
4)	Distant vehicle traffic on I-95 (barely audible due to prevailing wind direction)
5)	

MONITORING NOTES / EVENTS

Event Description:	Number of Instances, Start Time, End Time:
Vehicle onsite*	10:21-10:24, 10:24, 10:25
Truck enter/exit site	10:21, 10:24, 10:26, 10:28, 10:43
Backup alarm onsite	10:25, 10:26, 10:28, 10:29, 10:31
Dog barking (distant)	10:27
Leaf blower (distant)	10:32~10:33, 10:38~10:39
Airplane (high altitude)	10:35

TRAFFIC COUNT (nearest roadway)

	10:21 AM	10:22 AM	10:23 AM	10:24 AM	10:25 AM	10:26 AM	10:27 AM	10:28 AM	10:29 AM	10:30 AM
Knight St.	2	1	1	4	3	2	0	3	2	2
	10:31 AM	10:32 AM	10:33 AM	10:34 AM	10:35 AM	10:36 AM	10:37 AM	10:38 AM	10:39 AM	10:40 AM
	2	3	5	2	0	3	6	2	2	1
	10:41 AM	10:42 AM	10:43 AM	10:44 AM	10:45 AM	10:46 AM	10:47 AM	10:48 AM	10:49 AM	10:50 AM
	3	3	5	2	1	2	1	2	2	2

OTHER COMMENTS

Traffic noise from I-95 reduced dramatically due to shift in the wind direction to the north.
 * Onsite vehicles included trucks and front end loader

Environmental Noise Monitoring Data Sheet

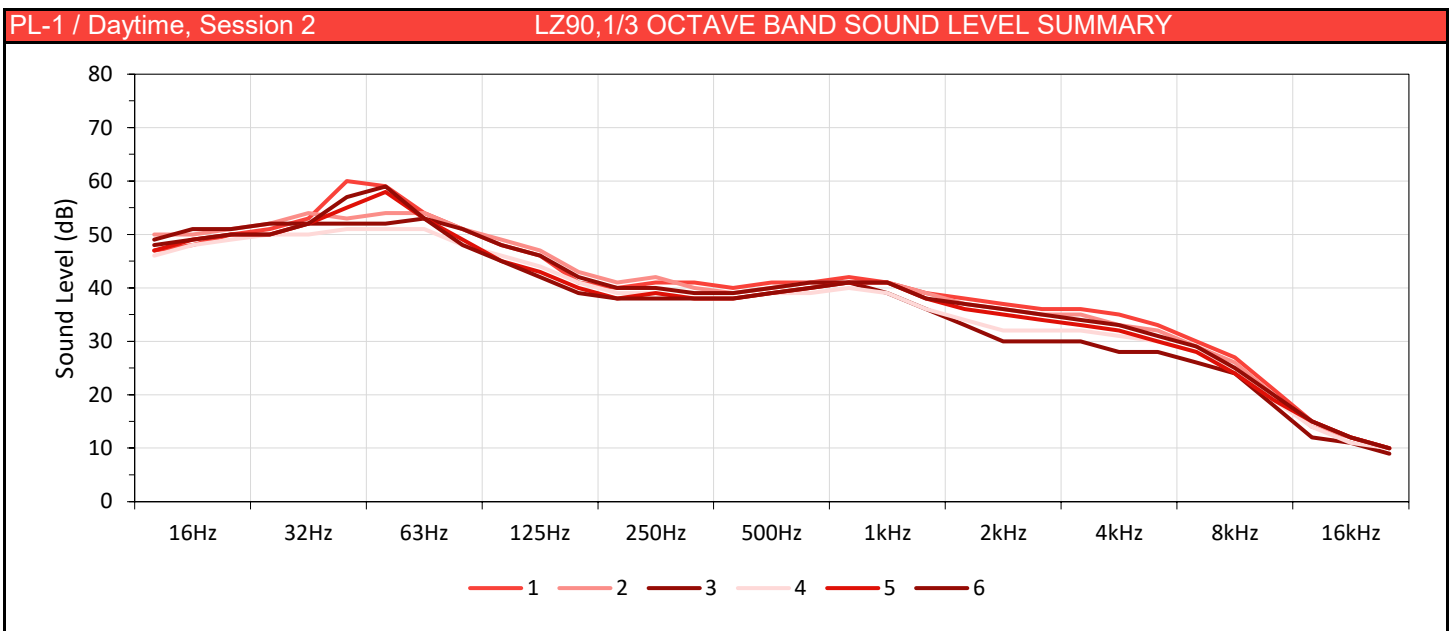
Project Name:	Verogy - Warwick
Project No:	3652230417

MEASUREMENT INFORMATION	
Location ID:	PL-1
Description:	Daytime, Session 2
Date:	Fri. Oct 13, 2023
Start Time:	10:21:00 AM
End Time:	10:50:59 AM

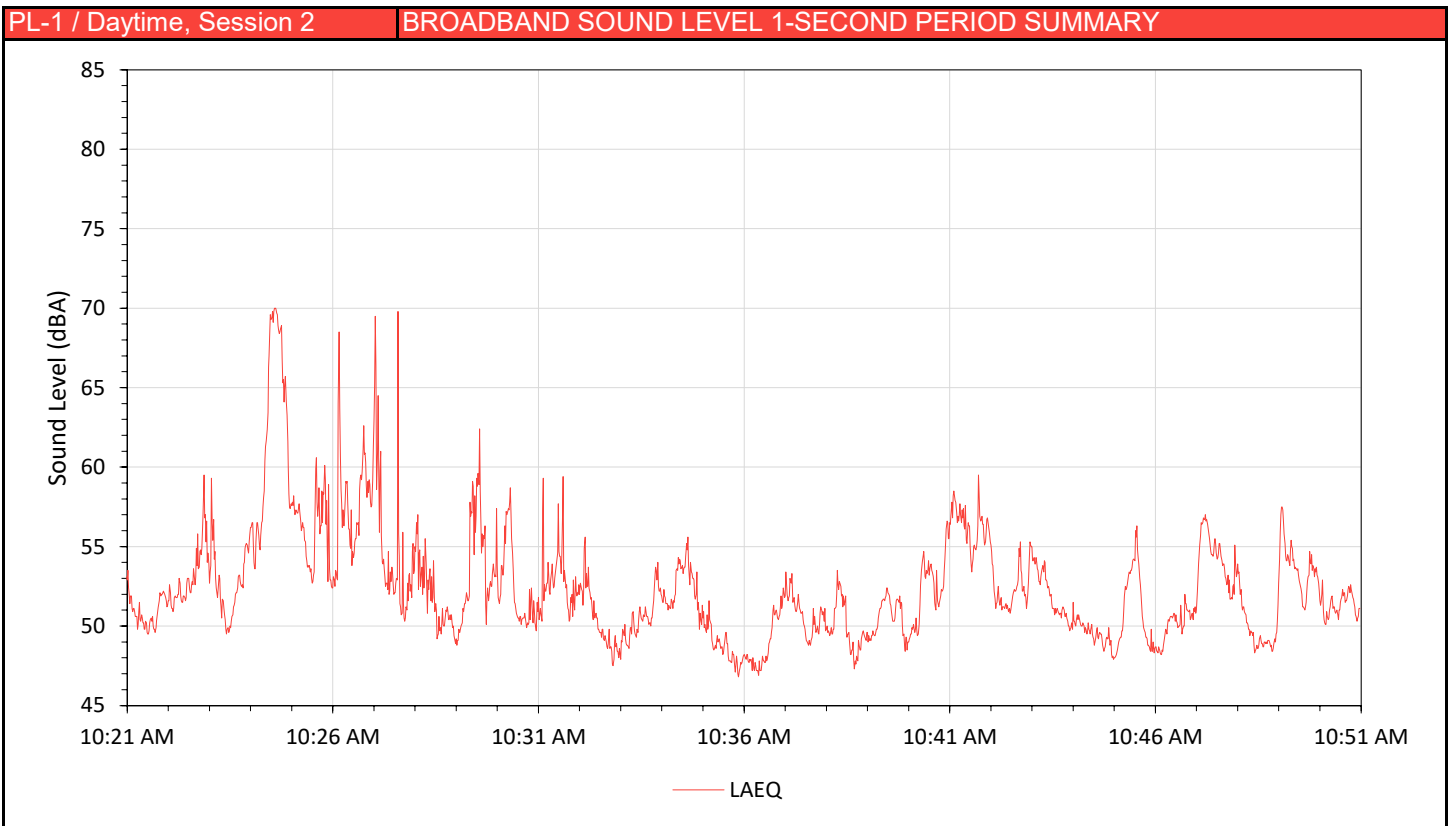
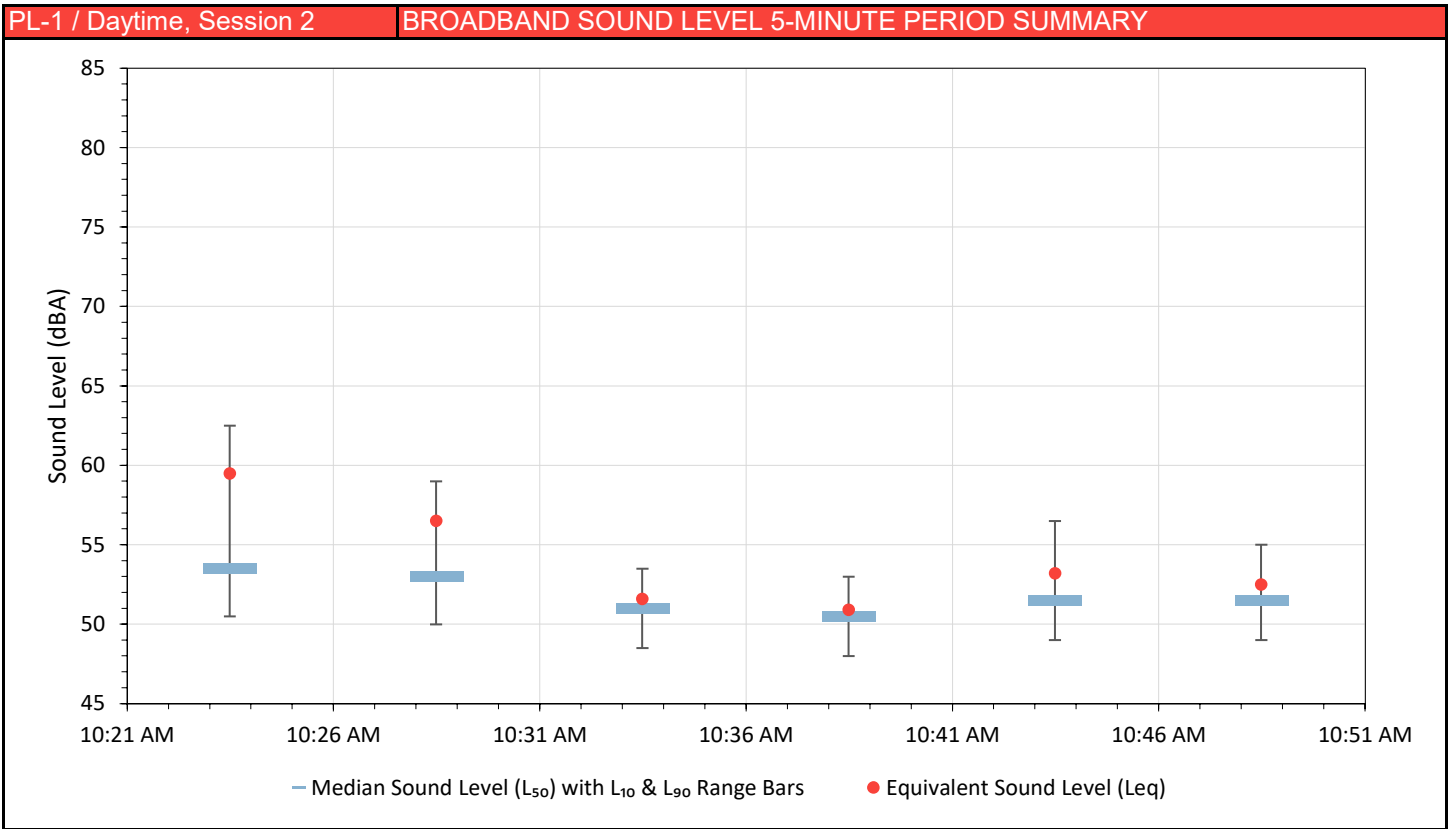


SUMMARY INFORMATION	
Duration:	00:29:59
Response:	Random
Overload:	FALSE
Cal. (Before):	10:17:37 AM
Cal. (After):	10:51:29 AM
Cal. Drift:	0.5

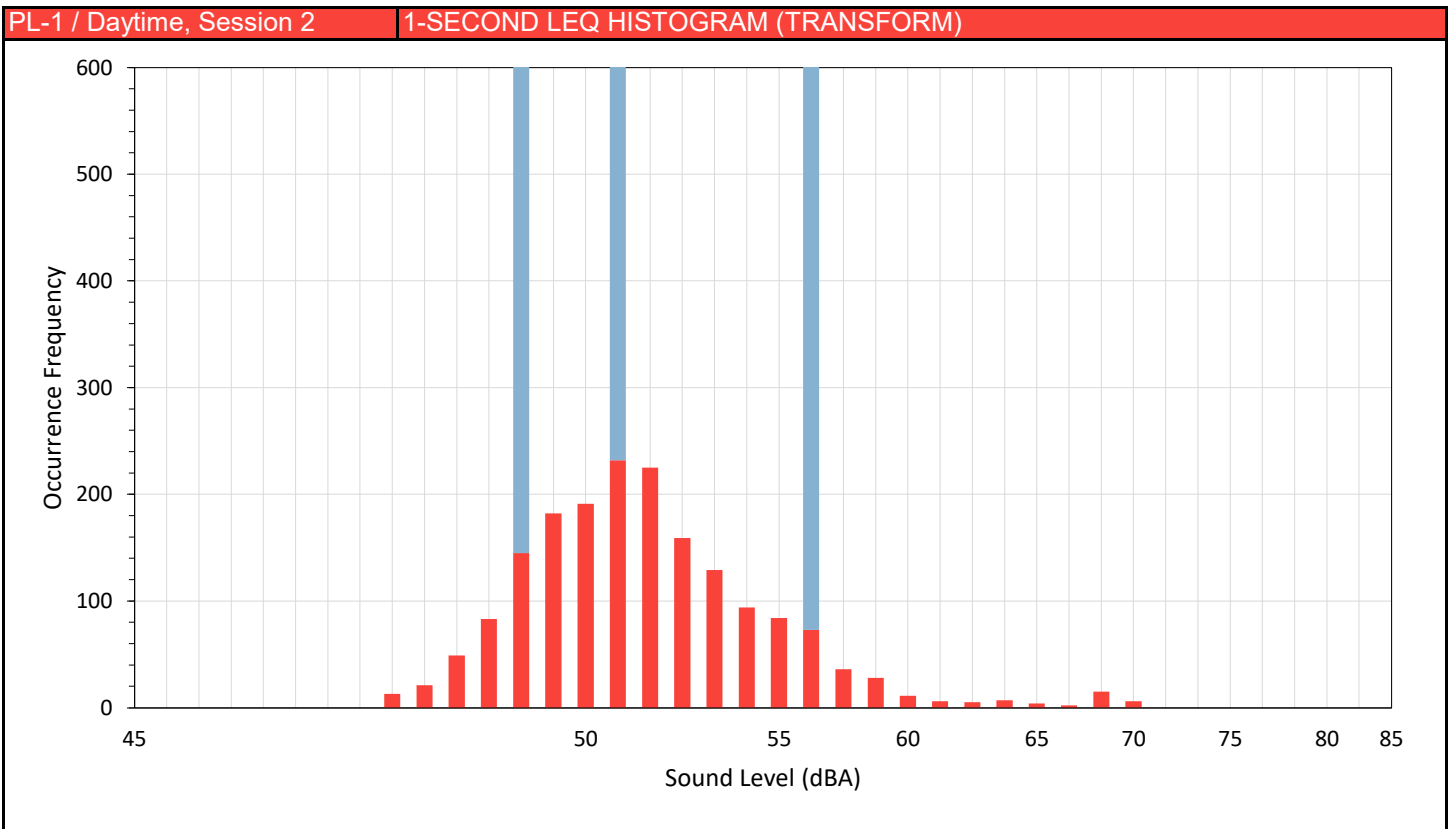
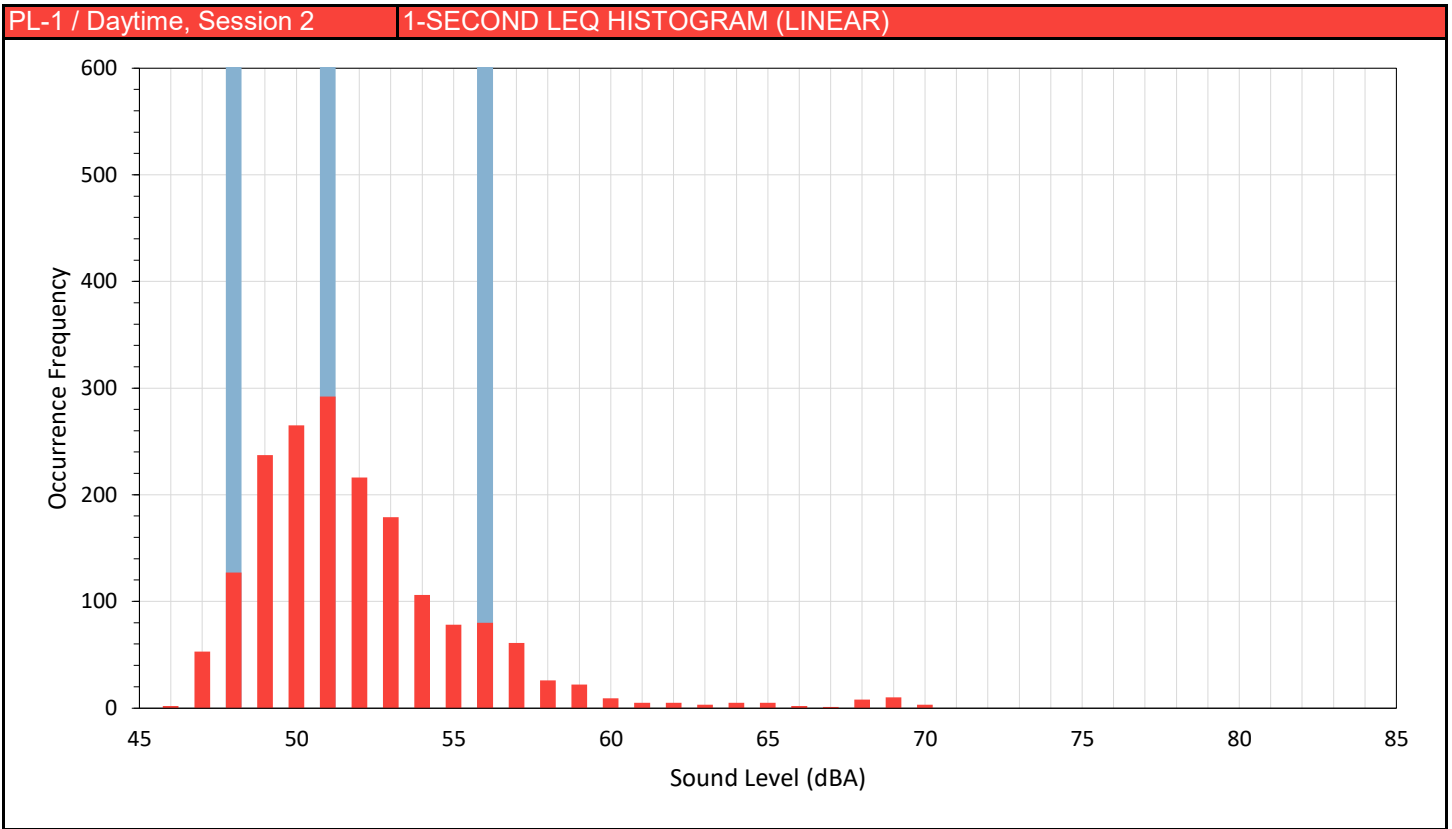
RESULTS SUMMARY					
		Cumulative Results			
		L_{eq}	L_{10}	L_{50}	L_{90}
Octave Band SPL (dB)	32 Hz:	67.3	69.9	63.0	57.9
	63 Hz:	66.8	67.9	62.5	58.4
	125 Hz:	56.4	57.8	52.8	49.6
	250 Hz:	52.2	52.8	47.0	44.2
	500 Hz:	49.4	51.6	46.6	44.4
	1 kHz:	49.8	51.1	46.6	44.7
	2 kHz:	48.6	49.4	44.0	39.5
	4 kHz:	46.2	47.9	42.1	36.9
	8 kHz:	38.1	40.6	34.9	30.4
Broadband (dBA):		55.2	56.7	51.7	48.9



Environmental Noise Monitoring Summary Charts



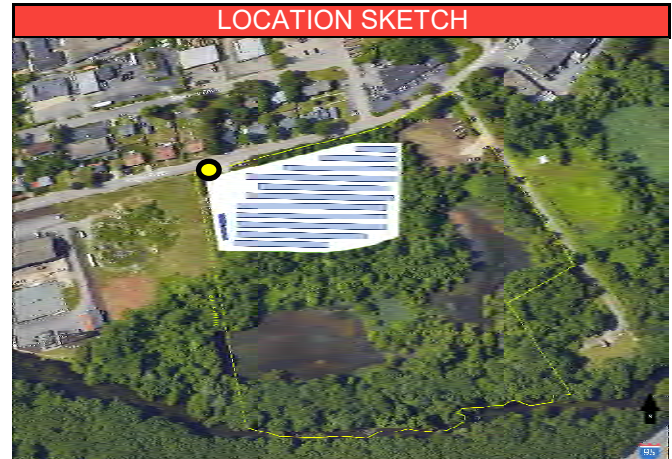
Environmental Noise Monitoring Distribution Charts



WSP USA E&I, Inc.
Environmental Noise Monitoring Field Notes

Project Name:	Verogy - Warwick
Performed By:	A. Roland

LOCATION INFORMATION	
Location ID:	PL-2
Description:	Daytime, Session 1
Date:	Thu. Oct 12, 2023
Start Time:	12:54:00 PM
End Time:	1:24:00 PM



WEATHER CONDITIONS	
Temperature:	67 °F
Wind Speed:	3 - 5 mph
Direction:	S
Humidity:	61%
Sky Type:	Partly cloudy
Precipitation:	n/a

GENERAL SOUND SOURCES (order by most prominent)	
1)	Distant vehicle traffic on I-95 (consistent)
2)	Vehicles passing on Knight Street (~3-4 vehicles per minute)
3)	Natural sounds (e.g., crickets, birds, etc.)
4)	Rustling leaves from light breeze (consistent), with occasional gusts (7-10 mph)
5)	

MONITORING NOTES / EVENTS	
Event Description:	Number of Instances, Start Time, End Time:
Vehicle onsite*	12:54-1:03
Truck enter/exit site	12:56, 12:59, 1:02
Police siren (distant)	12:57, 1:01
Survey crew (~40 ft.)**	1:12-1:24
Airplane	1:20

TRAFFIC COUNT (nearest roadway)										
Knight St.	12:54 PM	12:55 PM	12:56 PM	12:57 PM	12:58 PM	12:59 PM	1:00 PM	1:01 PM	1:02 PM	1:03 PM
	5	5	5	7	1	2	6	2	3	4
	1:04 PM	1:05 PM	1:06 PM	1:07 PM	1:08 PM	1:09 PM	1:10 PM	1:11 PM	1:12 PM	1:13 PM
	6	4	3	1	1	0	4	5	3	2
	1:14 PM	1:15 PM	1:16 PM	1:17 PM	1:18 PM	1:19 PM	1:20 PM	1:21 PM	1:22 PM	1:23 PM
	2	5	3	3	2	2	3	3	0	4

OTHER COMMENTS	
* Onsite vehicles included trucks and bobcat	
** Survey crew working (quietly) near corner of property line	

Environmental Noise Monitoring Data Sheet

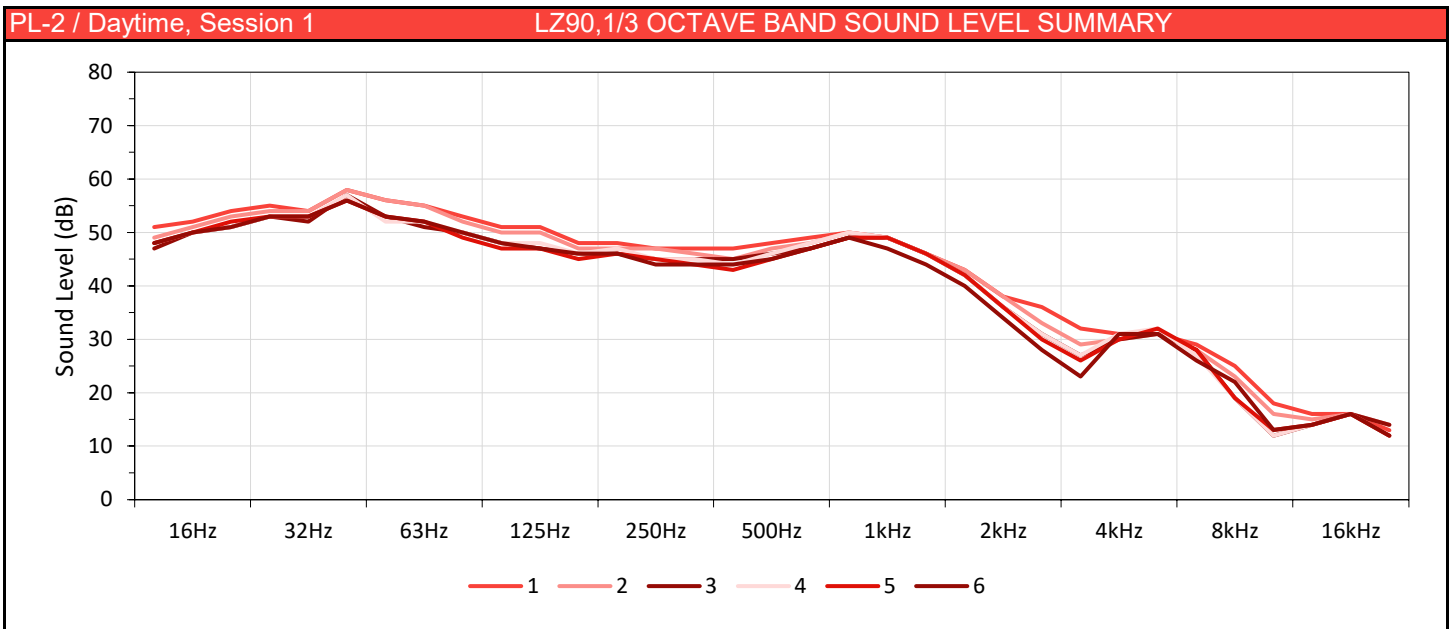
Project Name:	Verogy - Warwick
Project No:	3652230417

MEASUREMENT INFORMATION	
Location ID:	PL-2
Description:	Daytime, Session 1
Date:	Thu. Oct 12, 2023
Start Time:	12:54:00 PM
End Time:	1:24:00 PM

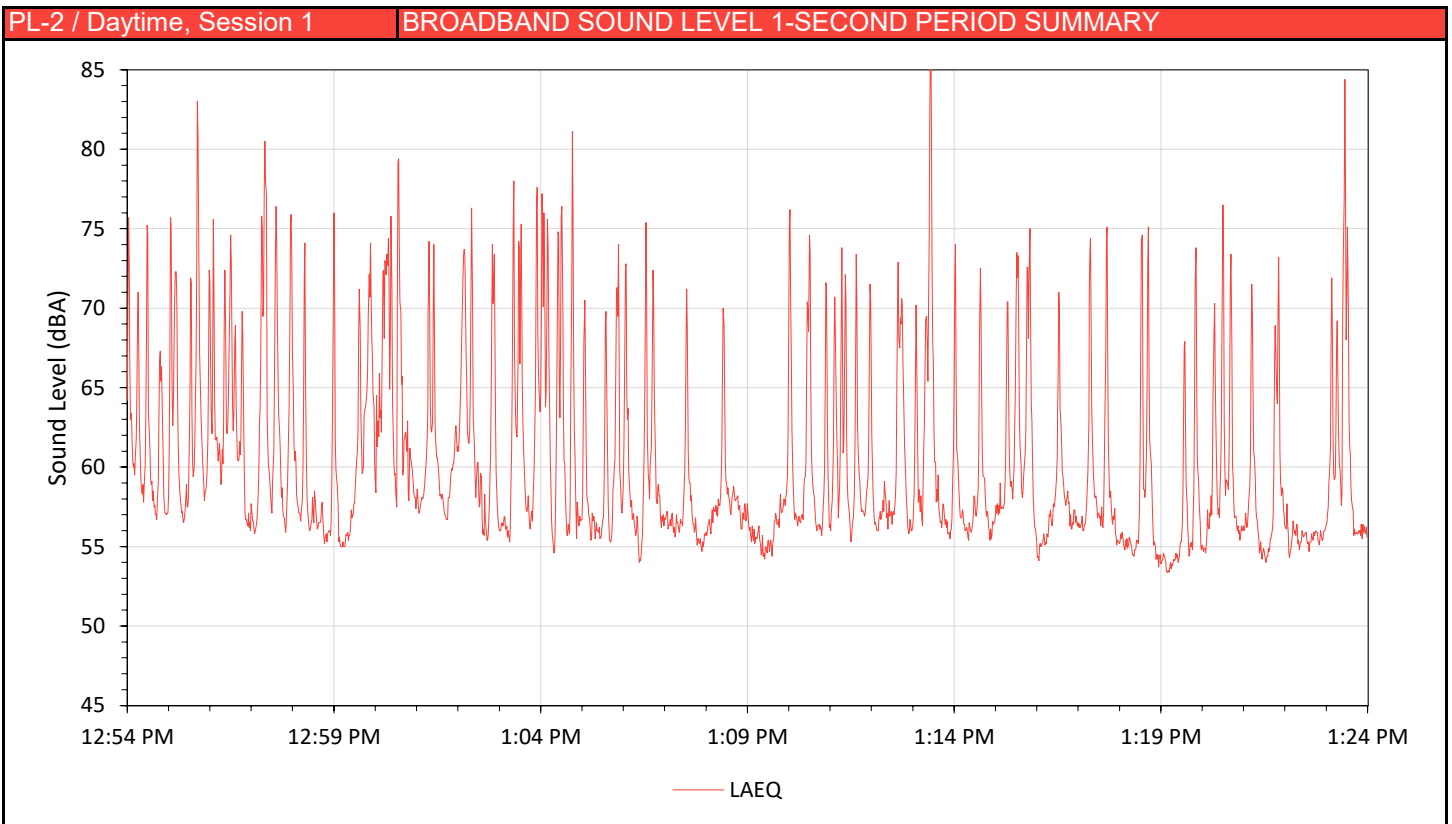
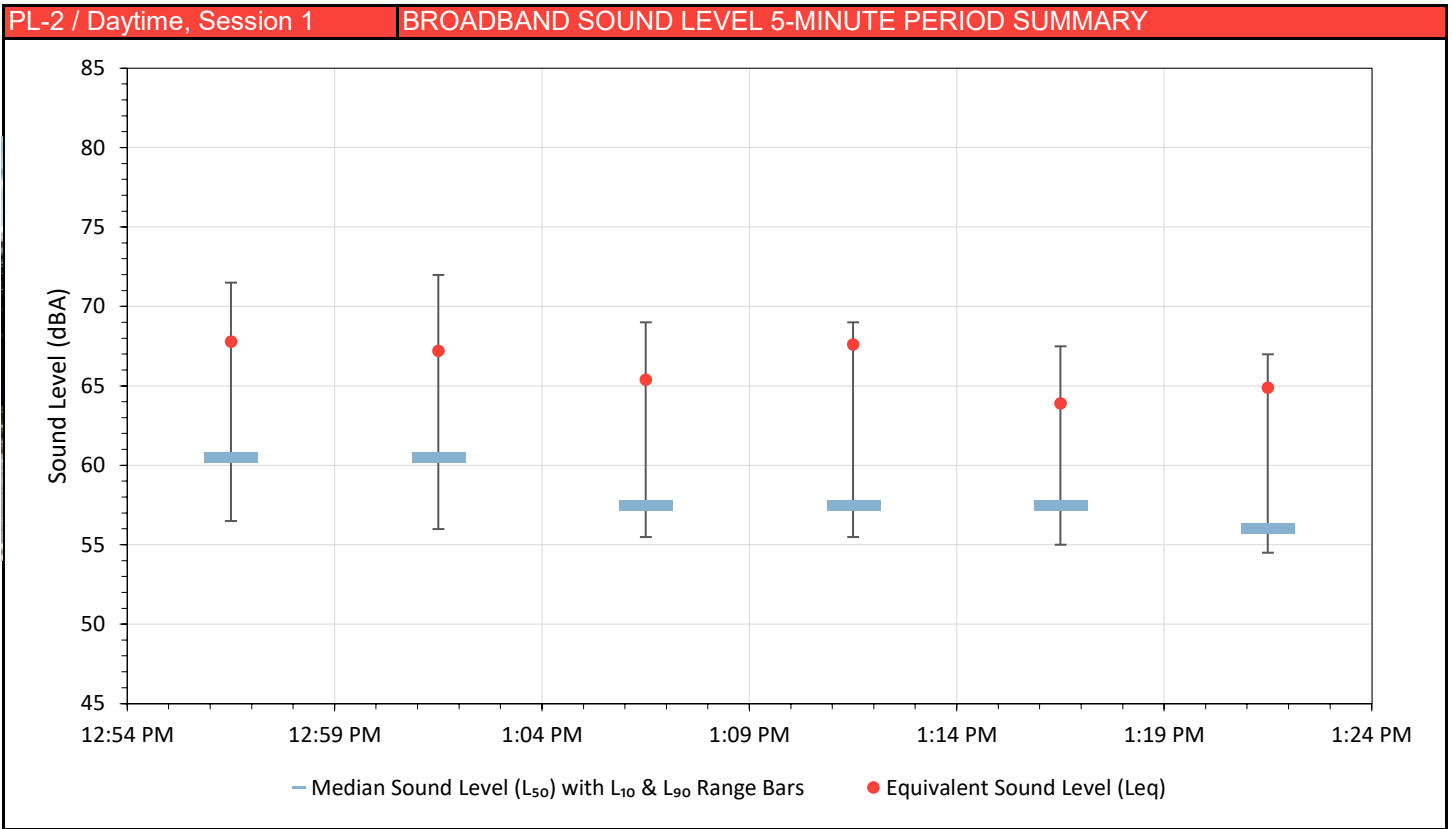


SUMMARY INFORMATION	
Duration:	00:30:00
Response:	Random
Overload:	FALSE
Cal. (Before):	12:50:59 PM
Cal. (After):	1:24:28 PM
Cal. Drift:	-0.1

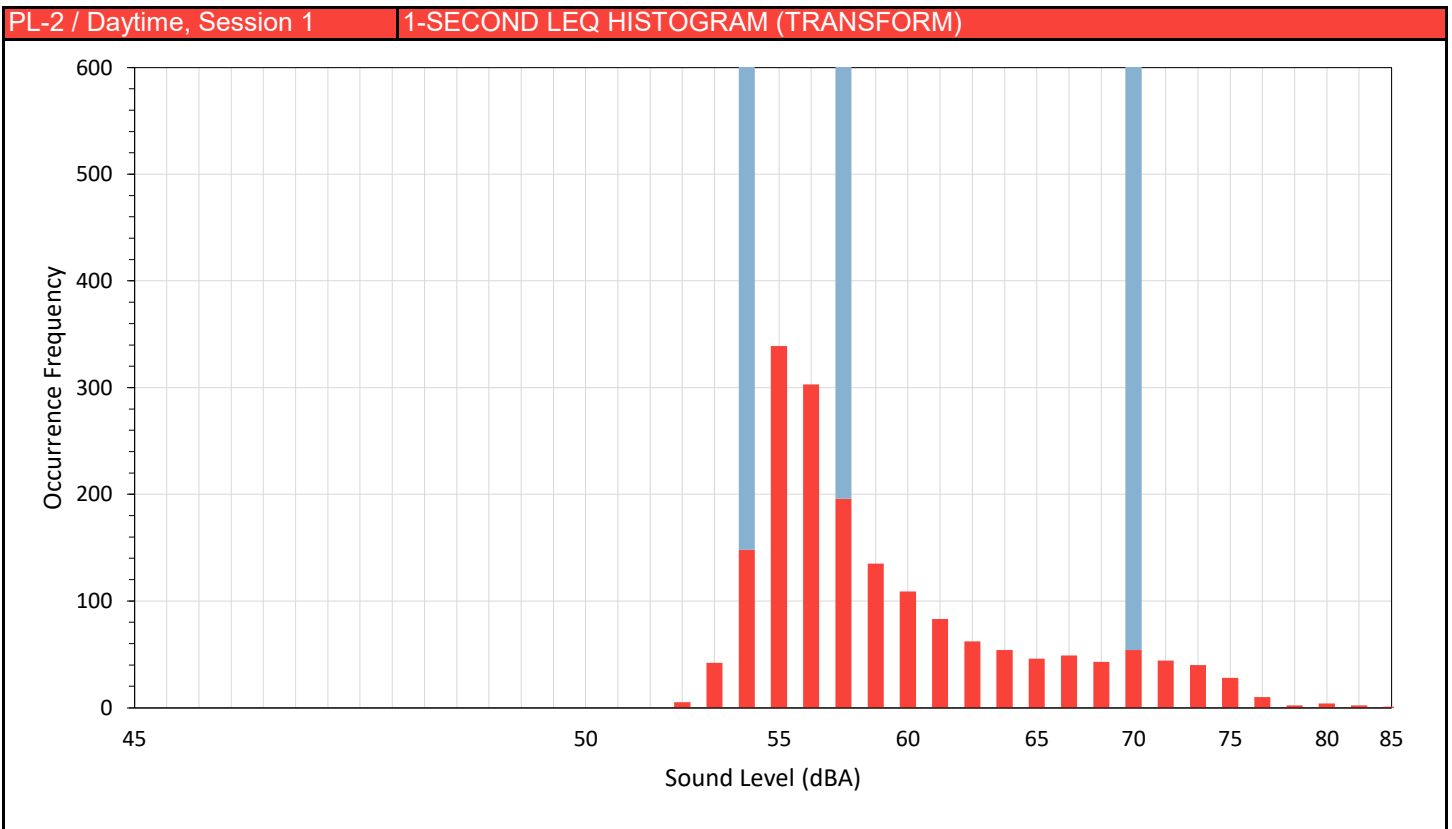
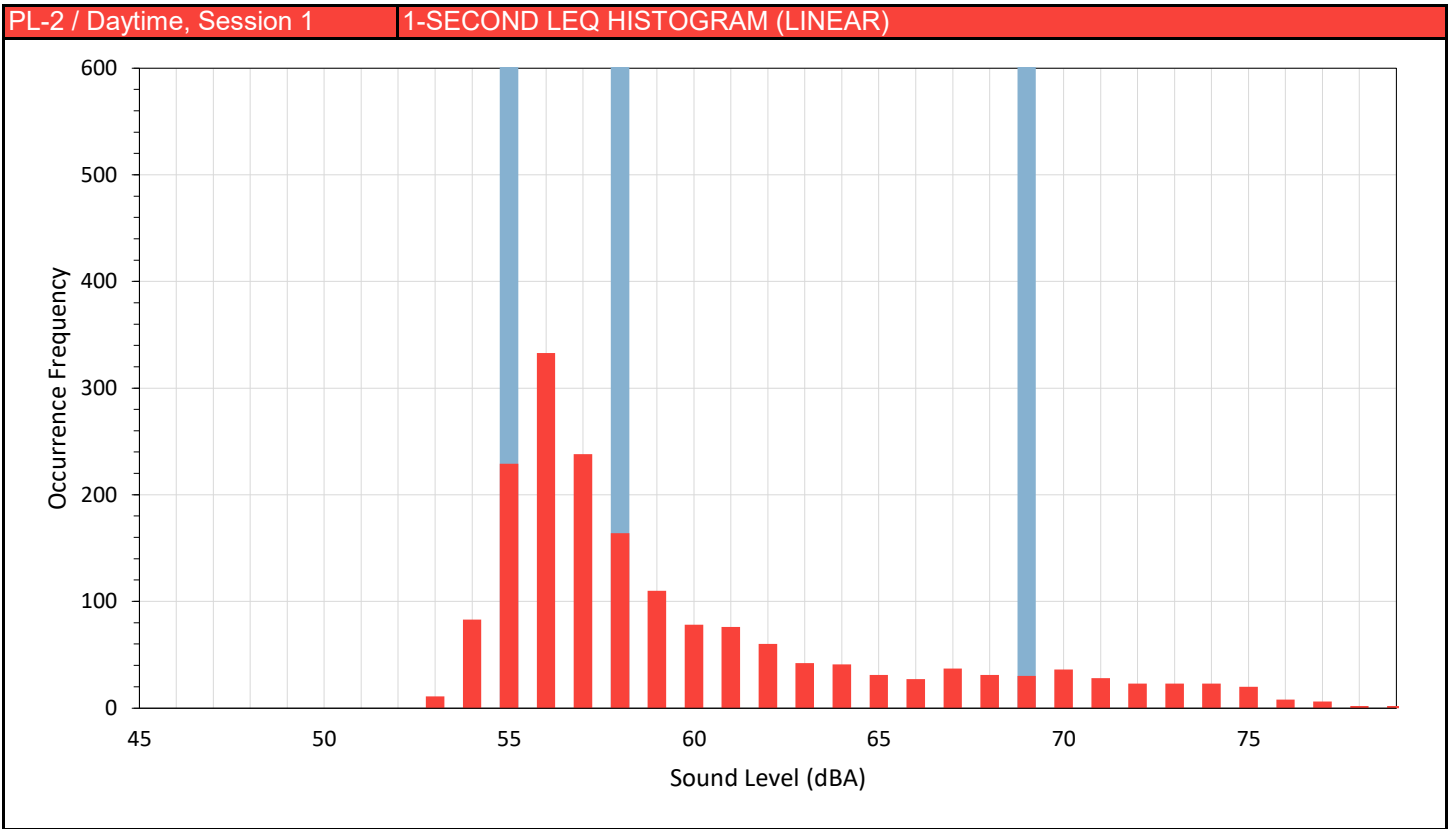
RESULTS SUMMARY					
		Cumulative Results			
		L_{eq}	L_{10}	L_{50}	L_{90}
Octave Band SPL (dB)	32 Hz:	66.1	67.7	63.3	59.7
	63 Hz:	68.2	67.4	61.6	57.4
	125 Hz:	63.5	63.6	56.4	52.7
	250 Hz:	61.4	62.8	54.0	50.6
	500 Hz:	61.3	62.7	54.2	51.1
	1 kHz:	63.4	66.6	55.7	53.0
	2 kHz:	58.3	61.1	47.1	43.4
	4 kHz:	53.1	51.6	38.9	35.0
	8 kHz:	50.0	43.1	31.4	28.8
Broadband (dBA):		66.4	69.9	58.0	55.4



Environmental Noise Monitoring Summary Charts



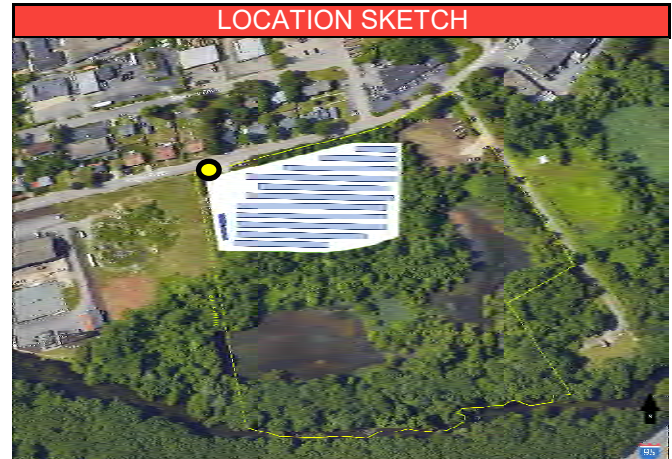
Environmental Noise Monitoring Distribution Charts



WSP USA E&I, Inc.
Environmental Noise Monitoring Field Notes

Project Name:	Verogy - Warwick
Performed By:	A. Roland

LOCATION INFORMATION	
Location ID:	PL-2
Description:	Daytime, Session 2
Date:	Fri. Oct 13, 2023
Start Time:	10:53:00 AM
End Time:	11:22:59 AM



WEATHER CONDITIONS	
Temperature:	56 °F
Wind Speed:	5 - 7 mph
Direction:	N / NW
Humidity:	67%
Sky Type:	Clear
Precipitation:	n/a

GENERAL SOUND SOURCES (order by most prominent)

1)	Natural sounds (e.g., crickets, birds, etc.)
2)	Rustling leaves from breeze (consistent), with occasional gusts (10-12 mph)
3)	Vehicles passing on Knight Street (~2 vehicles per minute)
4)	Distant vehicle traffic on I-95 (barely audible due to prevailing wind direction)
5)	

MONITORING NOTES / EVENTS

Event Description:	Number of Instances, Start Time, End Time:
Leaf blower (distant)	10:53~11:05
Airplane (high altitude)	10:53, 11:06, 11:19, 11:22
Truck enter/exit site	10:57, 11:08, 11:11, 11:16
Moderate wind gust	11:01-11:02, 11:08

TRAFFIC COUNT (nearest roadway)

Knight St.	10:53 AM	10:54 AM	10:55 AM	10:56 AM	10:57 AM	10:58 AM	10:59 AM	11:00 AM	11:01 AM	11:02 AM
		2	4	1	2	3	4	5	1	2
Knight St.	11:03 AM	11:04 AM	11:05 AM	11:06 AM	11:07 AM	11:08 AM	11:09 AM	11:10 AM	11:11 AM	11:12 AM
		1	2	3	1	0	2	1	1	3
Knight St.	11:13 AM	11:14 AM	11:15 AM	11:16 AM	11:17 AM	11:18 AM	11:19 AM	11:20 AM	11:21 AM	11:22 AM
		2	0	1	2	3	0	3	2	4

OTHER COMMENTS

Traffic noise from I-95 reduced dramatically due to shift in the wind direction to the north.

Environmental Noise Monitoring Data Sheet

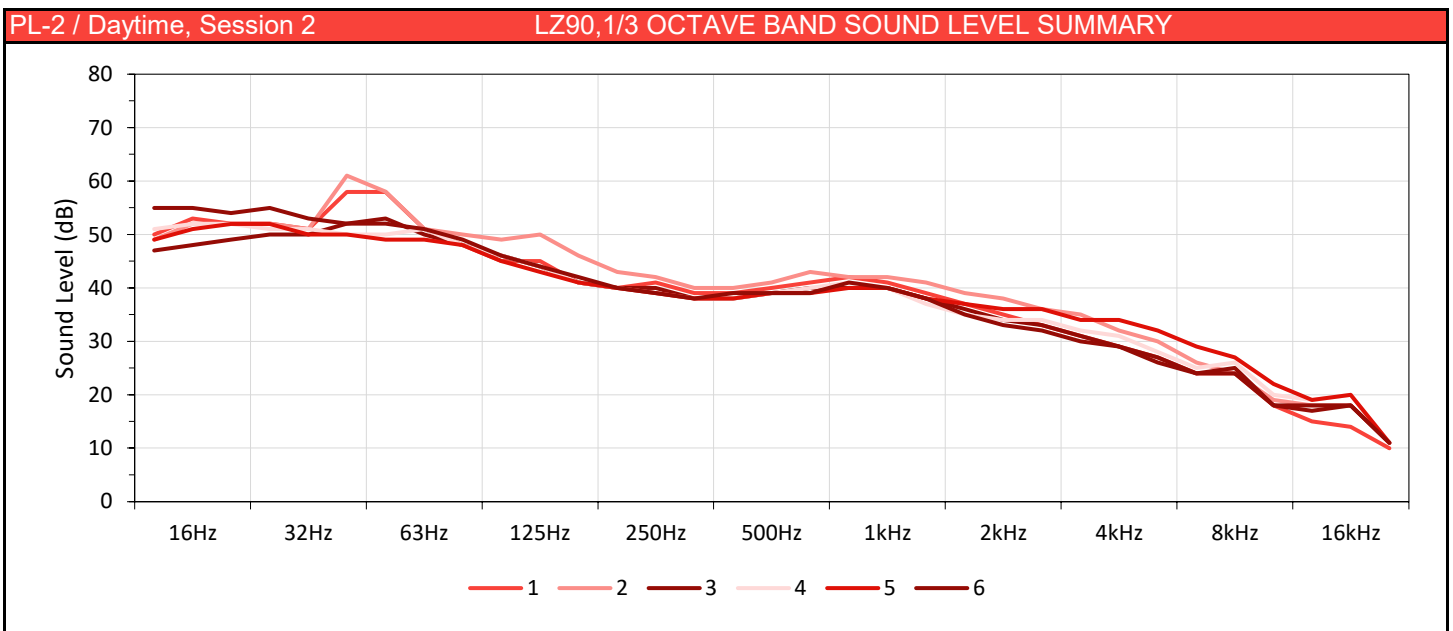
Project Name:	Verogy - Warwick
Project No:	3652230417

MEASUREMENT INFORMATION	
Location ID:	PL-2
Description:	Daytime, Session 2
Date:	Fri. Oct 13, 2023
Start Time:	10:53:00 AM
End Time:	11:22:59 AM

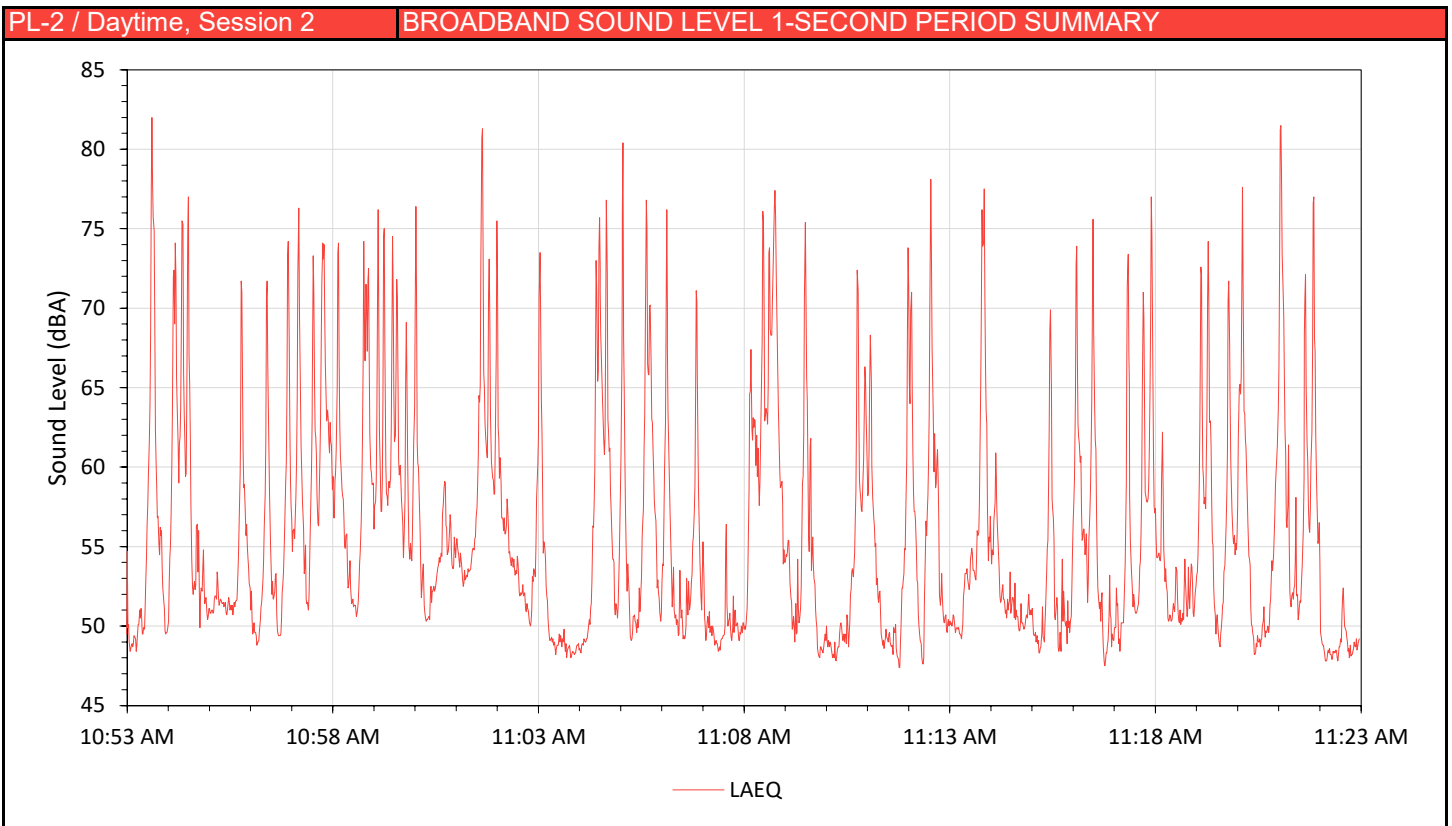
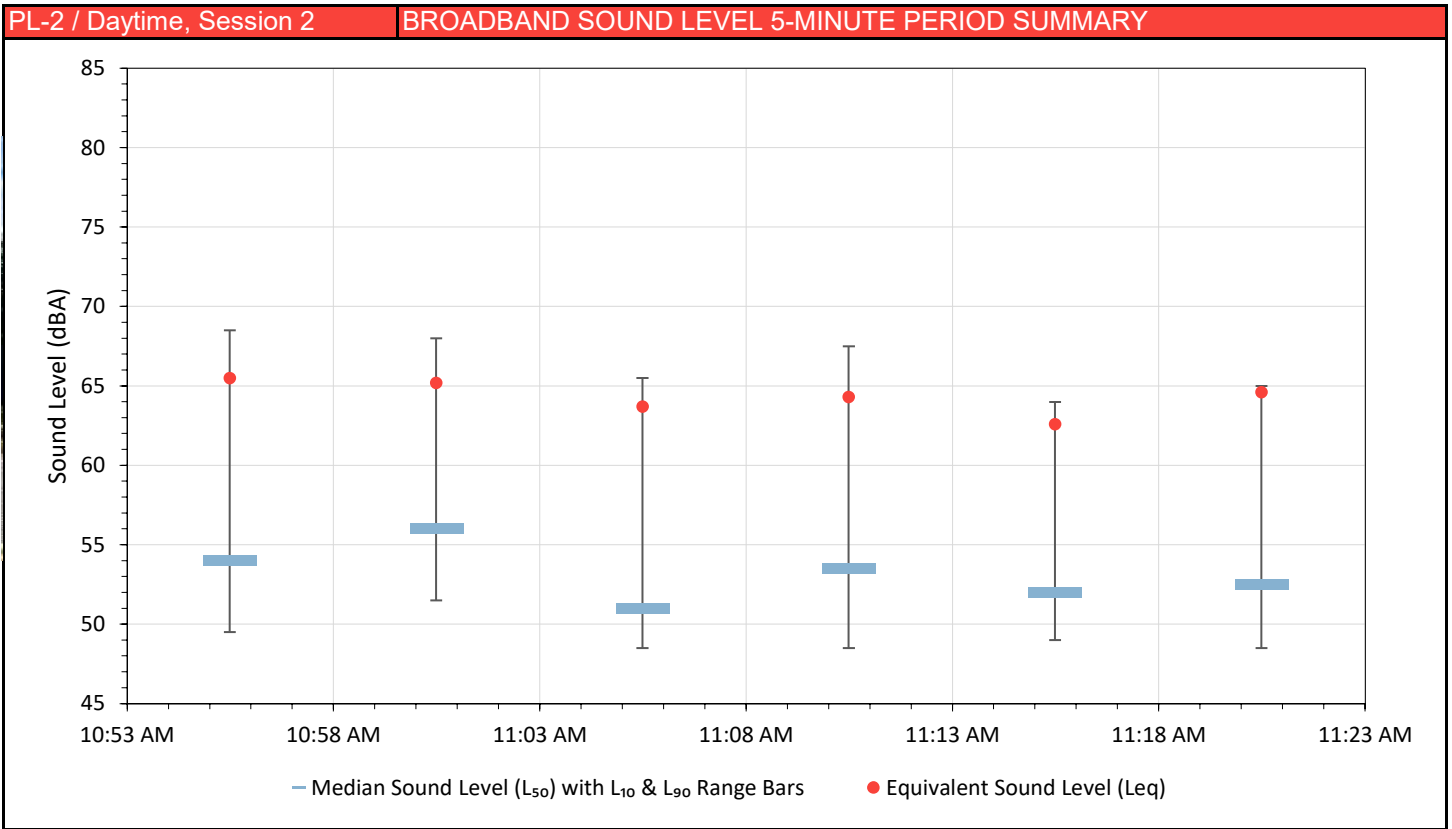


SUMMARY INFORMATION	
Duration:	00:29:59
Response:	Random
Overload:	FALSE
Cal. (Before):	10:51:29 AM
Cal. (After):	11:23:29 AM
Cal. Drift:	0.1

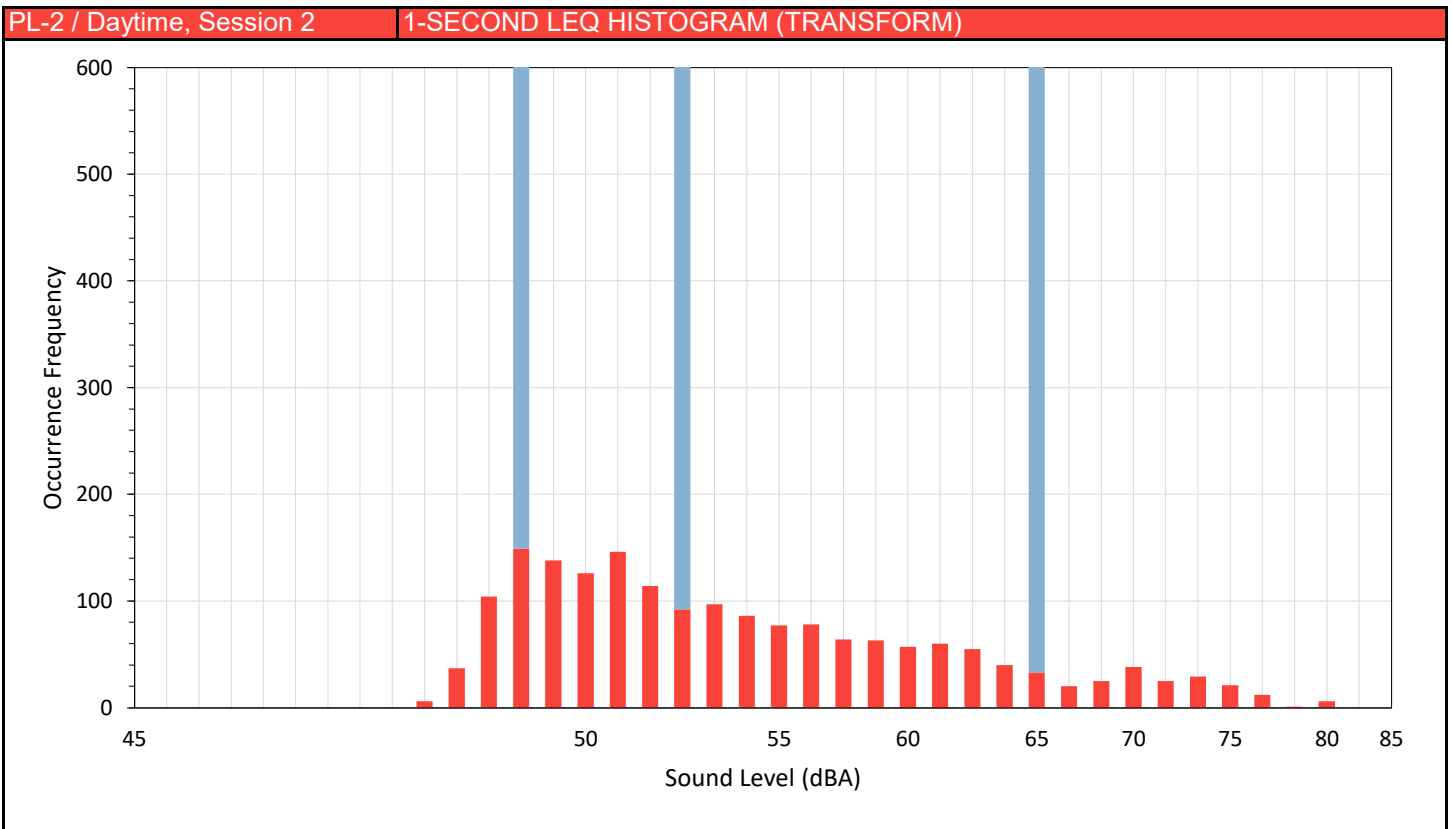
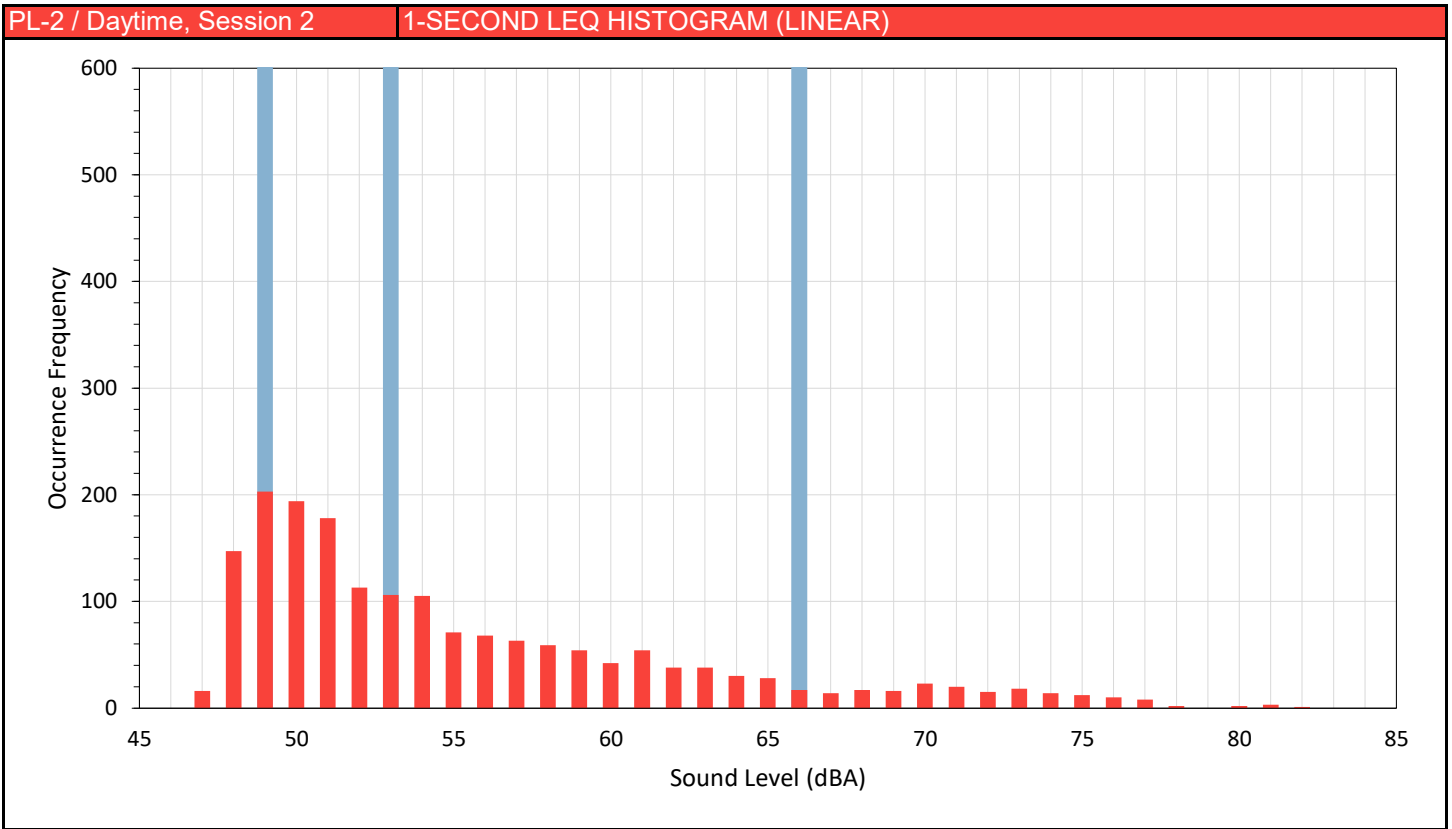
RESULTS SUMMARY					
		Cumulative Results			
		L_{eq}	L_{10}	L_{50}	L_{90}
Octave Band SPL (dB)	32 Hz:	74.0	74.1	64.1	57.7
	63 Hz:	68.7	69.3	61.0	56.3
	125 Hz:	62.2	62.4	53.1	49.5
	250 Hz:	58.8	59.6	48.0	44.5
	500 Hz:	59.3	59.9	47.6	44.3
	1 kHz:	61.5	63.2	48.6	44.9
	2 kHz:	56.8	58.8	44.7	40.1
	4 kHz:	49.2	50.0	41.0	35.5
	8 kHz:	41.7	43.5	35.0	28.7
Broadband (dBA):		64.4	66.5	53.4	49.0



Environmental Noise Monitoring Summary Charts



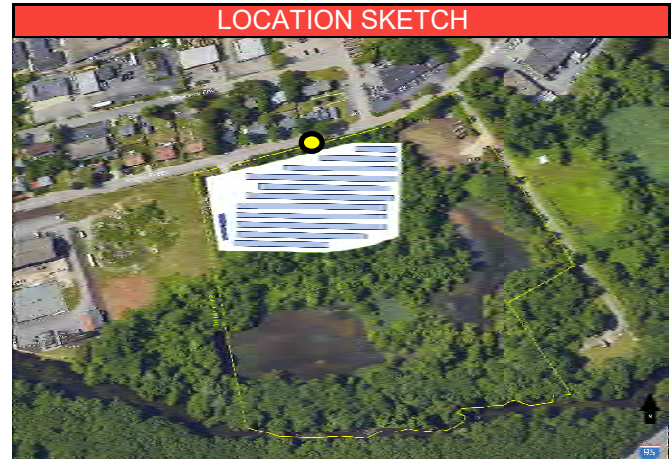
Environmental Noise Monitoring Distribution Charts



WSP USA E&I, Inc.
Environmental Noise Monitoring Field Notes

Project Name:	Verogy - Warwick
Performed By:	A. Roland

LOCATION INFORMATION	
Location ID:	PL-3
Description:	Daytime, Session 1
Date:	Thu. Oct 12, 2023
Start Time:	1:30:00 PM
End Time:	2:00:00 PM



WEATHER CONDITIONS	
Temperature:	67 °F
Wind Speed:	3 - 5 mph
Direction:	SE
Humidity:	57%
Sky Type:	Mostly clear
Precipitation:	n/a

GENERAL SOUND SOURCES (order by most prominent)

1)	Distant vehicle traffic on I-95 (consistent)
2)	Vehicles passing on Knight Street (~3 vehicles per minute)
3)	Natural sounds (e.g., crickets, birds, etc.)
4)	Rustling leaves from light breeze (consistent), with occasional gusts (7-10 mph)
5)	

MONITORING NOTES / EVENTS

Event Description:	Number of Instances, Start Time, End Time:
Survey crew (~40 ft.)*	1:30-1:33
Vehicle onsite**	1:33-1:34, 1:39
Electric saw ***	1:39~1:42, 1:46~1:56
Loud engine on I-95****	1:47, 1:57

TRAFFIC COUNT (nearest roadway)

Knight St.	1:30 PM	1:31 PM	1:32 PM	1:33 PM	1:34 PM	1:35 PM	1:36 PM	1:37 PM	1:38 PM	1:39 PM
		3	4	6	3	0	2	2	3	5
Knight St.	1:40 PM	1:41 PM	1:42 PM	1:43 PM	1:44 PM	1:45 PM	1:46 PM	1:47 PM	1:48 PM	1:49 PM
		2	0	3	4	4	4	4	3	4
Knight St.	1:50 PM	1:51 PM	1:52 PM	1:53 PM	1:54 PM	1:55 PM	1:56 PM	1:57 PM	1:58 PM	1:59 PM
		1	2	4	2	2	4	4	4	3

OTHER COMMENTS

* Survey crew working (quietly) near property line
 ** Onsite vehicles included trucks, bobcat, and front end loader
 *** Saw sound (periodic) from north of the location (i.e., Bleachery Ct.)
 **** Loud engine @ 1:57 may have been actually been airplane taking off from T.F. Green. Difficult to distinguish between the two sources with the prevailing wind direction from the southeast.

Environmental Noise Monitoring Data Sheet

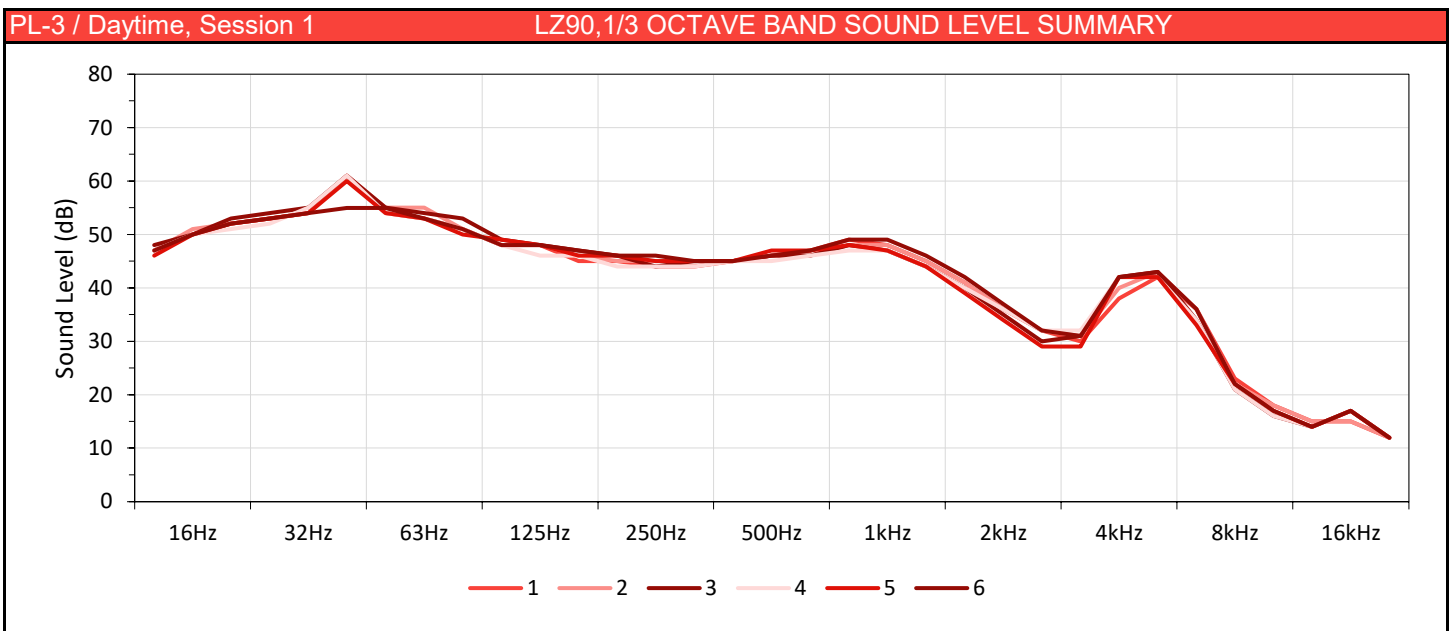
Project Name:	Verogy - Warwick
Project No:	3652230417

MEASUREMENT INFORMATION	
Location ID:	PL-3
Description:	Daytime, Session 1
Date:	Thu. Oct 12, 2023
Start Time:	1:30:00 PM
End Time:	2:00:00 PM

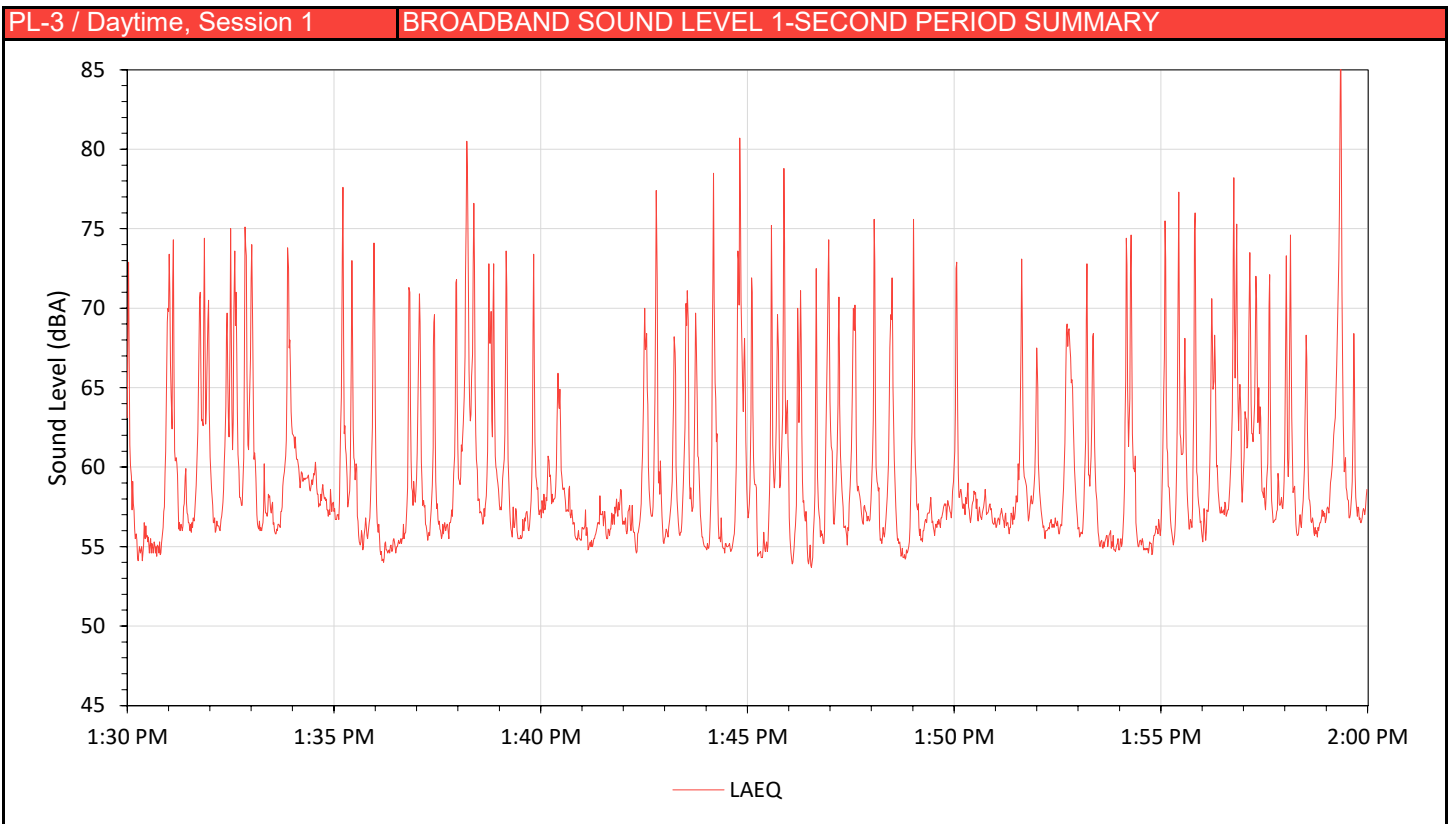
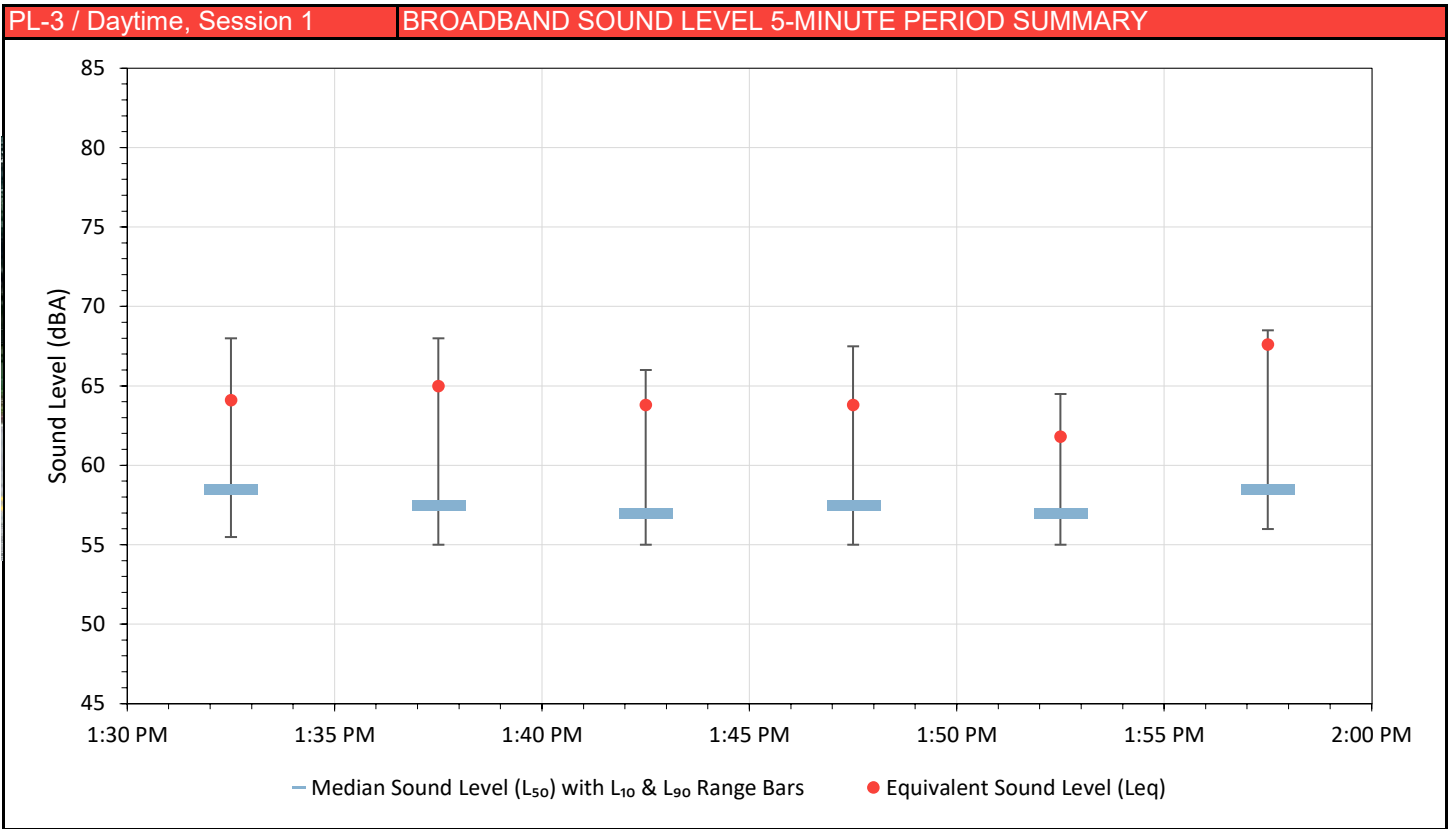


SUMMARY INFORMATION	
Duration:	00:30:00
Response:	Random
Overload:	FALSE
Cal. (Before):	1:24:28 PM
Cal. (After):	2:00:32 PM
Cal. Drift:	0.2

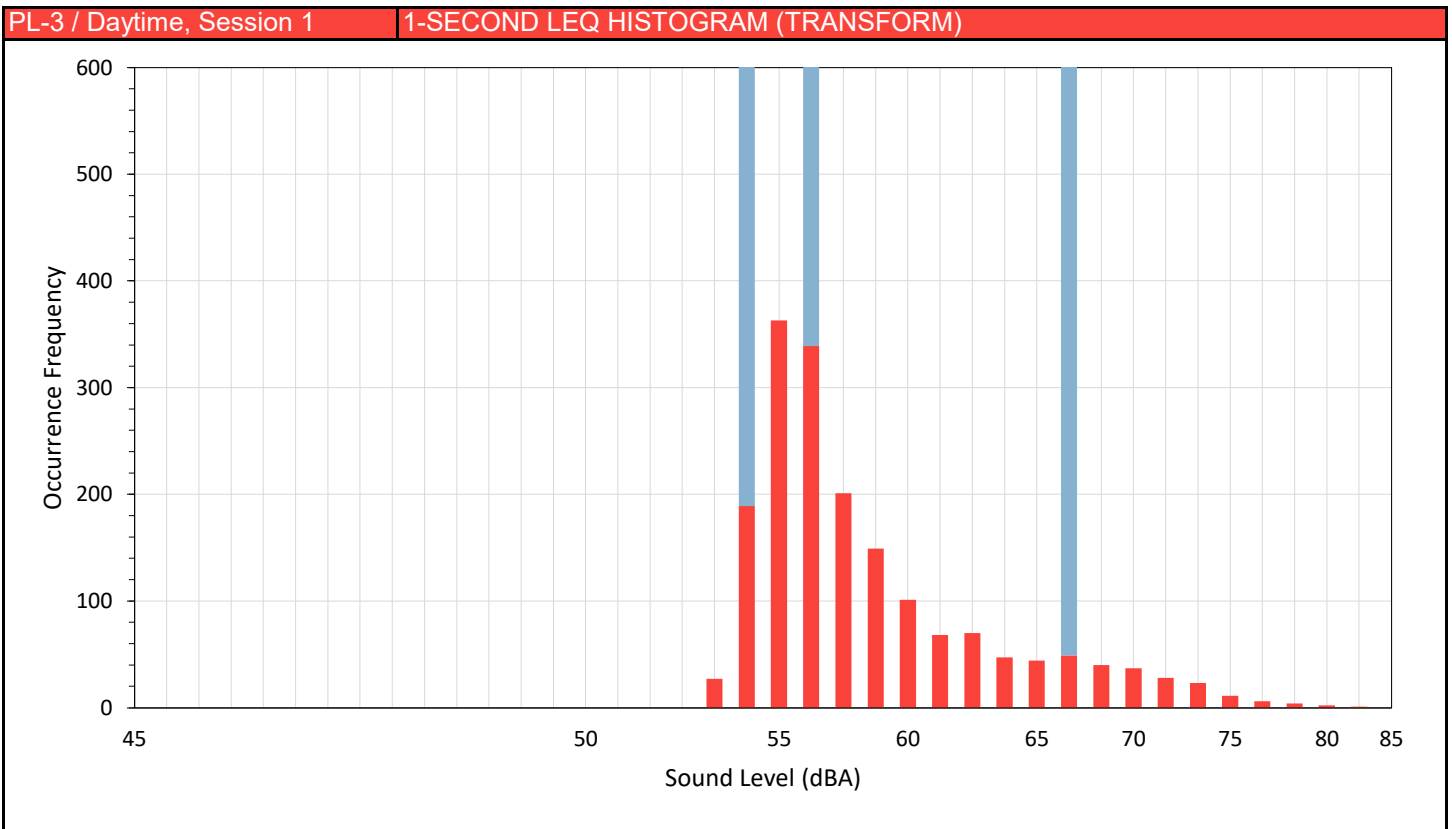
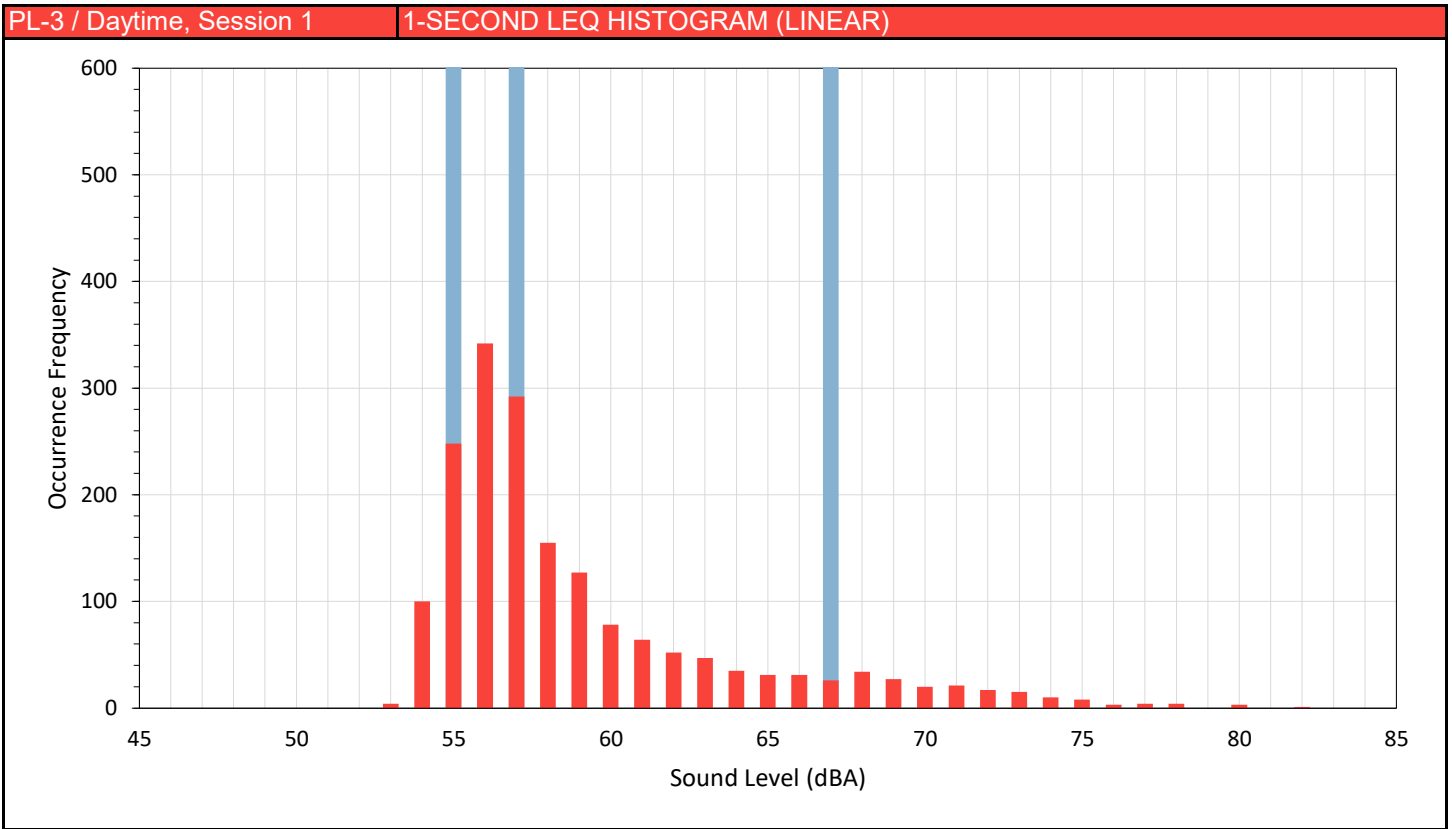
RESULTS SUMMARY					
		Cumulative Results			
		L_{eq}	L_{10}	L_{50}	L_{90}
Octave Band SPL (dB)	32 Hz:	66.8	69.1	65.2	61.7
	63 Hz:	71.6	69.0	62.2	58.1
	125 Hz:	62.3	61.9	55.8	52.3
	250 Hz:	61.2	60.5	53.0	49.7
	500 Hz:	59.8	60.6	53.5	50.7
	1 kHz:	61.6	63.8	54.4	51.9
	2 kHz:	56.8	59.7	46.7	42.1
	4 kHz:	51.0	51.4	46.6	45.1
8 kHz:	42.5	42.2	36.6	35.1	
Broadband (dBA):		64.7	67.5	57.6	55.3



Environmental Noise Monitoring Summary Charts



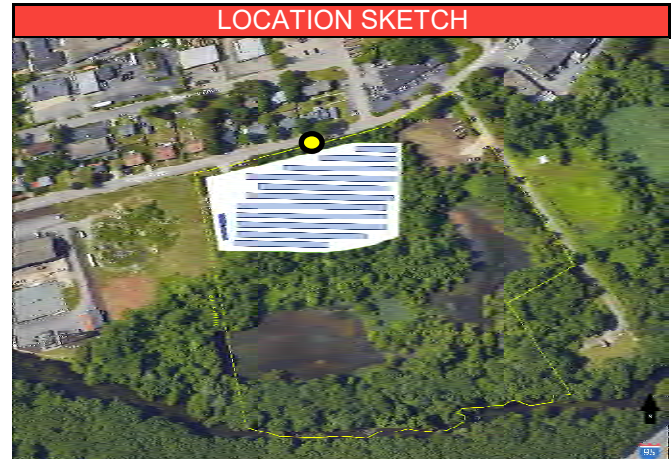
Environmental Noise Monitoring Distribution Charts



WSP USA E&I, Inc.
Environmental Noise Monitoring Field Notes

Project Name:	Verogy - Warwick
Performed By:	A. Roland

LOCATION INFORMATION	
Location ID:	PL-3
Description:	Daytime, Session 2
Date:	Fri. Oct 13, 2023
Start Time:	11:25:04 AM
End Time:	11:55:04 AM



WEATHER CONDITIONS	
Temperature:	57 °F
Wind Speed:	5 - 7 mph
Direction:	NW
Humidity:	65%
Sky Type:	Clear
Precipitation:	n/a

GENERAL SOUND SOURCES (order by most prominent)

1)	Natural sounds (e.g., crickets, birds, etc.)
2)	Rustling leaves from breeze (consistent), with occasional gusts (10-12 mph)
3)	Vehicles passing on Knight Street (~3 vehicles per minute)
4)	Distant vehicle traffic on I-95 (barely audible due to prevailing wind direction)
5)	Activities from industrial park to the north (Bleachery Ct.)

MONITORING NOTES / EVENTS

Event Description:	Number of Instances, Start Time, End Time:
Airplane (taking off)	11:25
Airplane (prop.)	11:26, 11:34, 11:35-11:36, 11:37-11:38, 11:45-11:46, 11:48
Police siren (distant)	11:30
Airplane (high altitude)	11:33, 11:45, 11:47
Vehicle onsite*	11:50

TRAFFIC COUNT (nearest roadway)

Knight St.	11:25 AM	11:26 AM	11:27 AM	11:28 AM	11:29 AM	11:30 AM	11:31 AM	11:32 AM	11:33 AM	11:34 AM
		1	3	2	1	2	2	3	4	0
Knight St.	11:35 AM	11:36 AM	11:37 AM	11:38 AM	11:39 AM	11:40 AM	11:41 AM	11:42 AM	11:43 AM	11:44 AM
		5	3	0	2	4	5	1	2	2
Knight St.	11:45 AM	11:46 AM	11:47 AM	11:48 AM	11:49 AM	11:50 AM	11:51 AM	11:52 AM	11:53 AM	11:54 AM
		5	2	5	3	2	3	9	3	3

OTHER COMMENTS

Traffic noise from I-95 reduced dramatically due to shift in the wind direction to the north.
 * Onsite vehicles included bobcat and front end loader

Environmental Noise Monitoring Data Sheet

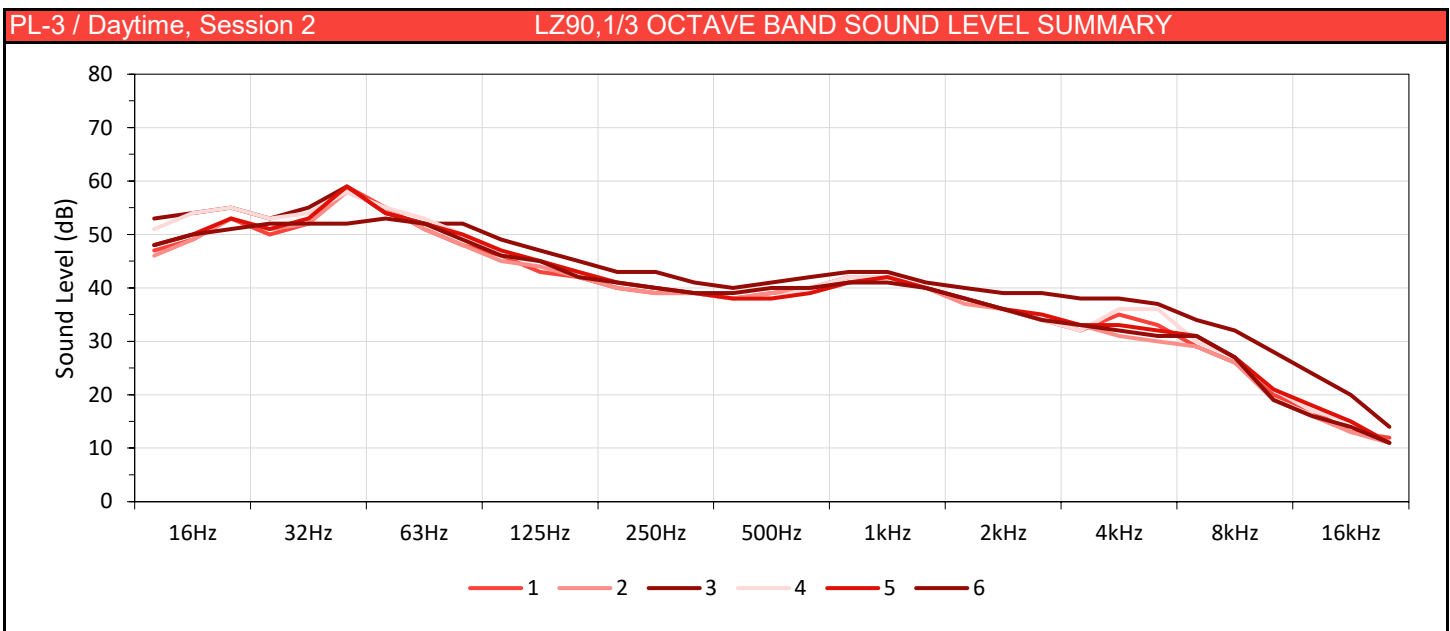
Project Name:	Verogy - Warwick
Project No:	3652230417

MEASUREMENT INFORMATION	
Location ID:	PL-3
Description:	Daytime, Session 2
Date:	Fri. Oct 13, 2023
Start Time:	11:25:04 AM
End Time:	11:55:04 AM

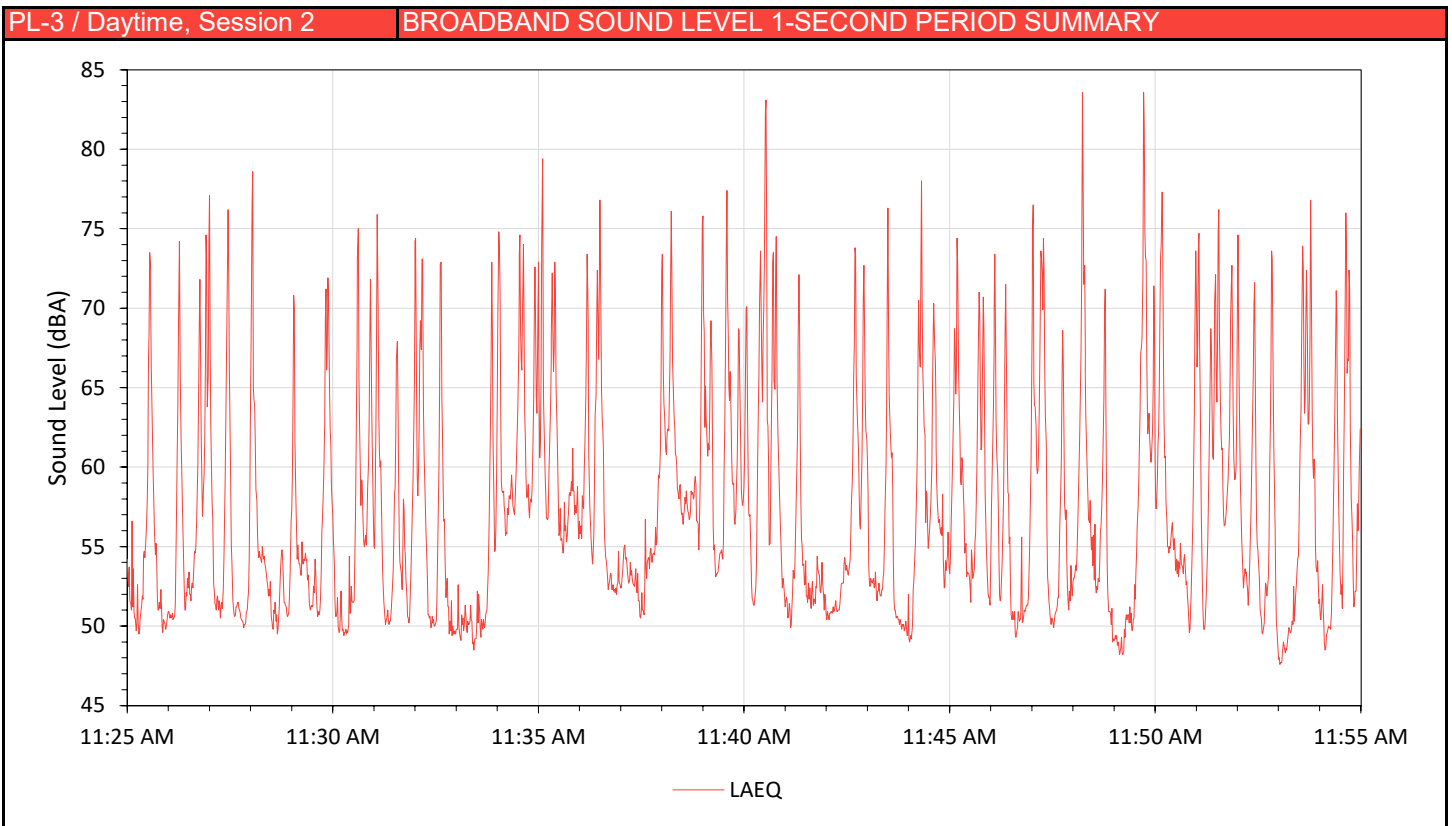
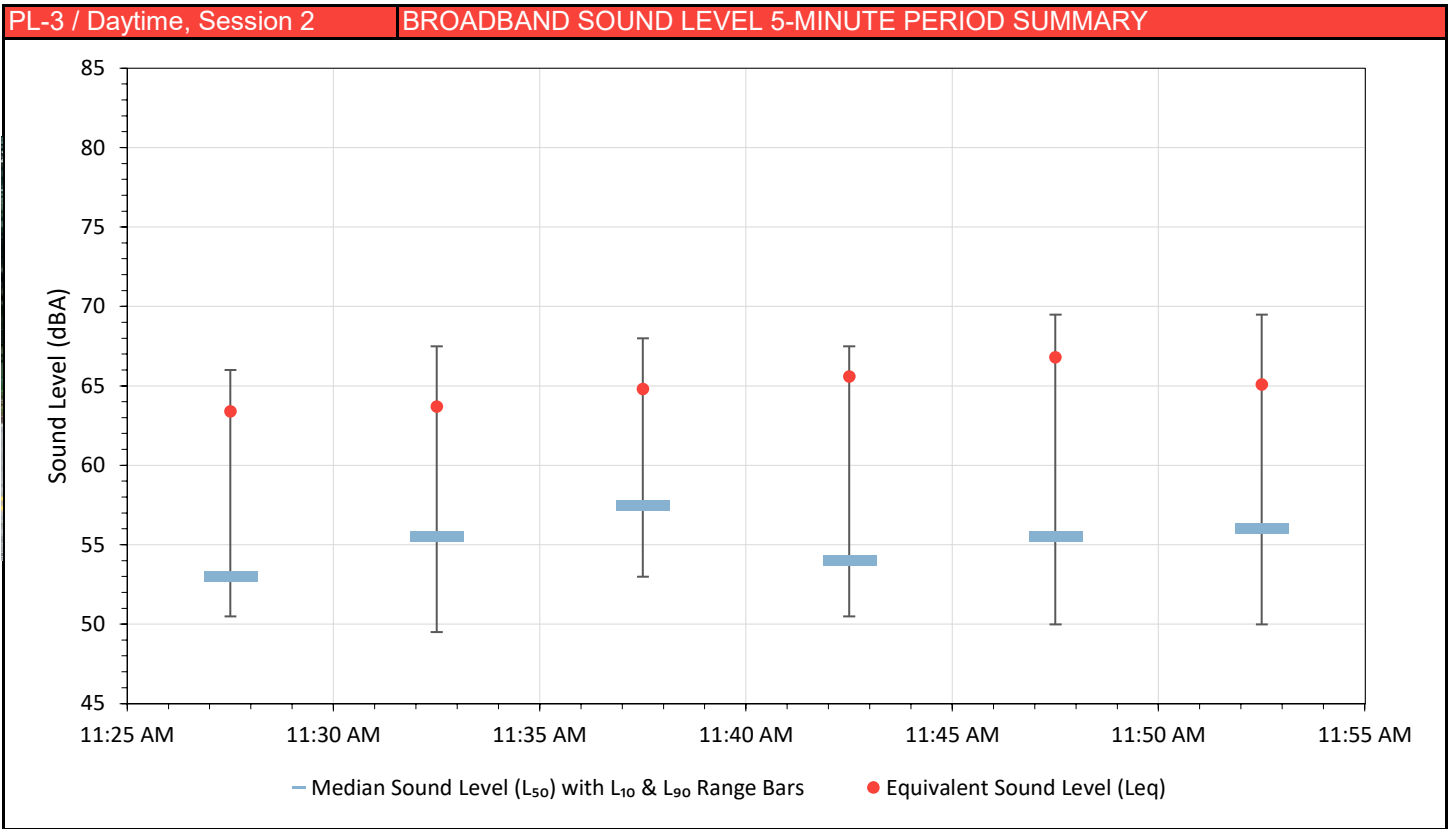


SUMMARY INFORMATION	
Duration:	00:30:00
Response:	Random
Overload:	FALSE
Cal. (Before):	11:23:29 AM
Cal. (After):	11:55:27 AM
Cal. Drift:	-0.2

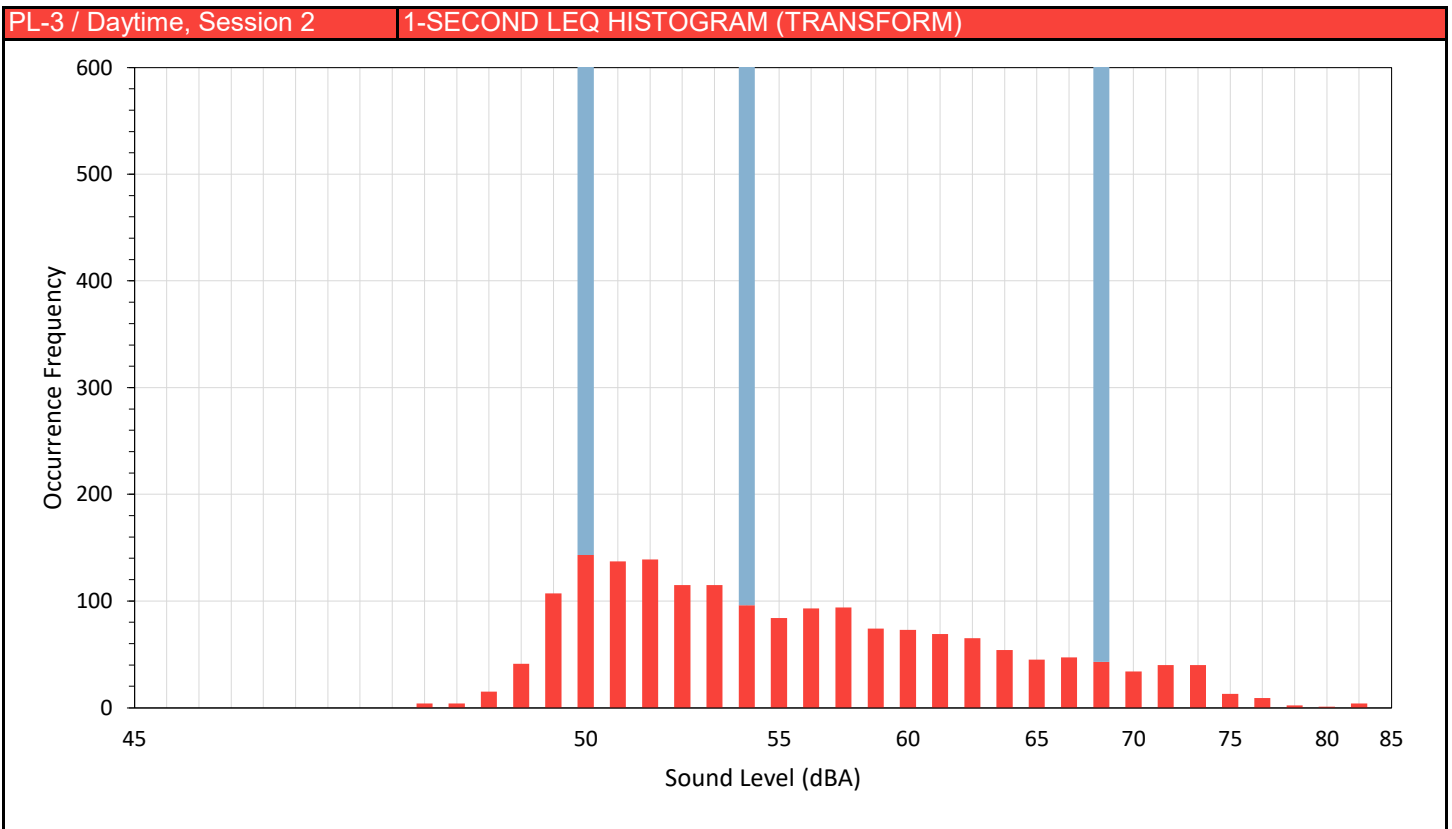
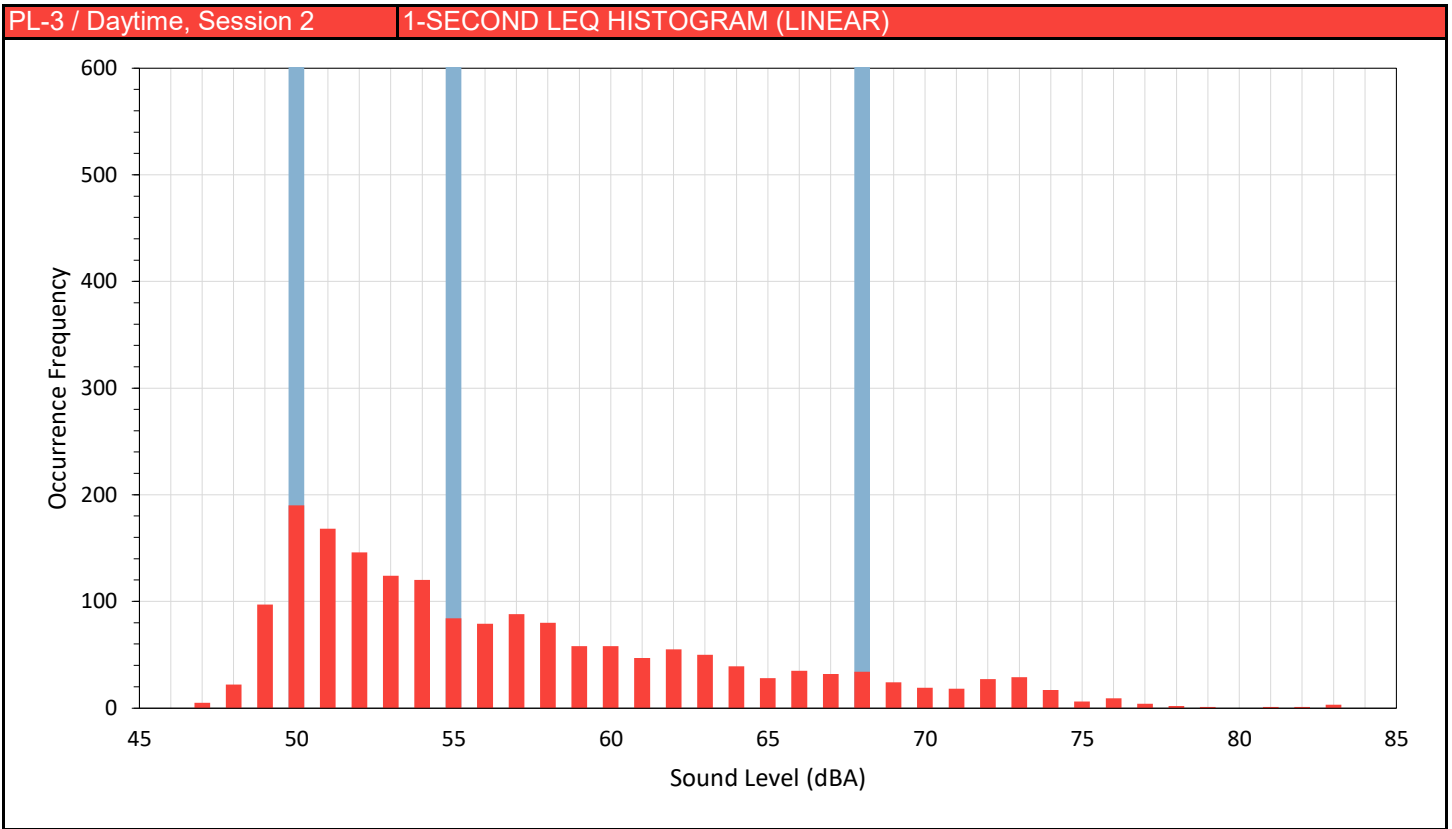
RESULTS SUMMARY					
		Cumulative Results			
		L_{eq}	L_{10}	L_{50}	L_{90}
Octave Band SPL (dB)	32 Hz:	68.8	70.5	63.9	59.8
	63 Hz:	66.8	68.3	60.9	57.2
	125 Hz:	65.2	63.2	54.4	49.8
	250 Hz:	63.6	61.3	50.6	45.0
	500 Hz:	59.0	60.9	48.7	44.1
	1 kHz:	61.9	65.2	50.7	46.1
	2 kHz:	57.7	60.9	47.2	41.5
	4 kHz:	49.8	51.9	43.2	38.5
	8 kHz:	43.2	45.3	37.2	32.7
Broadband (dBA):		65.1	68.5	55.2	50.3



Environmental Noise Monitoring Summary Charts



Environmental Noise Monitoring Distribution Charts



Attachment D

Monitoring Equipment Certificates of Calibration

Certificate of Conformity and Calibration

Instrument Model:-	CEL-633C		
Serial Number	4210504		
Firmware revision	V006-05		
Microphone Type:-	CEL-261	Preamplifier Type:-	CEL-495
Serial Number	5084	Serial Number	005056
Instrument Class/Type:-	1		



Applicable standards:-

IEC 61672: 2013 / EN 60651 (Electroacoustics - Sound Level Meters)
IEC 60651 1979 (Sound Level Meters), ANSI S1.4: 1983 (Specifications For Sound Level Meters)

Note:- The test sequences performed in this report are in accordance with the current Sound level meter Standard - IEC61672. The combination of tests performed are considered to confirm the products electro-acoustic performance to all applicable standards including superceded Sound Level Meter Standards - IEC60651 and IEC60804.

Test Conditions:-	23.1 °C	Test Engineer:-	Chue Moua
	44 %RH	Date of Issue:-	September 22, 2023
	986.8 mBar		

Declaration of conformity:-

This test certificate confirms that the instrument specified above has been successfully tested to comply with the manufacturer's published specifications. Tests are performed using equipment traceable to national standards in accordance with Casella's ISO 9001:2015 quality procedures. This product is certified as being compliant to the requirements of the CE Directive.

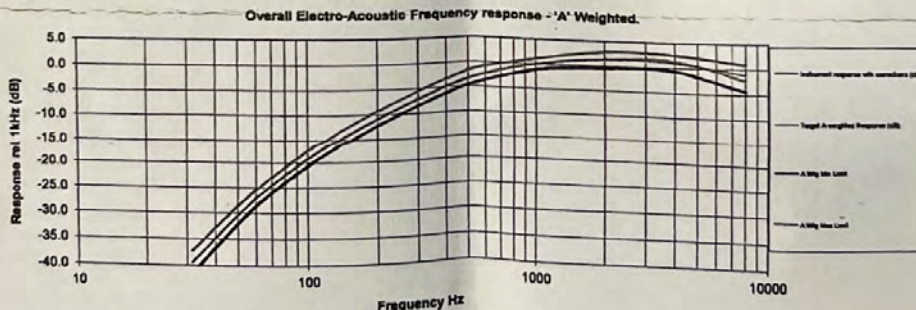
Test Summary:-

Self Generated Noise Test	All Tests Pass
Electrical Signal Test Of Frequency Weightings	All Tests Pass
Frequency & Time Weightings At 1 kHz	All Tests Pass
Level Linearity On The Reference Level Range	All Tests Pass
Toneburst Response Test	All Tests Pass
C-peak Sound Levels	All Tests Pass
Overload Indication	All Tests Pass
Acoustic Tests	All Tests Pass

Combined Electro-Acoustic Frequency Response - A Weighted

Combined Electro-Acoustic Frequency Response - A Weighted (IEC 61672-3:2006)

The following A-Weighted frequency response graph shows this instruments overall frequency response based upon the application of multi-frequency pressure field calibrations. The microphones Pressure to Free field correction coefficients are applied to pressure response. Reference level taken at 1kHz.



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Tel: +91 124 4465171
E-mail:rajeshjoshi@casellasolutions.com

FA05190

CASELLA

Certificate of Conformity and Calibration

Customer: 5145086
Instrument: CEL-120/1
Serial Number: 4914399
Job Number: 300539965
Date of Issue: 22-Sep-2023
Engineer: Chue Moua

Traceable Equipment: Reference Calibrator E011384
DVM type Fluke 45 E011386

Test Conditions:

Ambient Temperature 23.4 °C
Ambient Humidity 45.5 %RH
Ambient Pressure 987 mBar

Results:

	Level 1	Level 2	Frequency
Initial Reading	114.09 dB	94.04 dB	1.0001 kHz
Final Reading	114.01 dB	93.98 dB	1.0001 kHz

Uncertainty:

Level ± 0.15 dB
Frequency ± 0.5 Hz

This test certificate confirms that the instrument specified above has been successfully tested to comply with the manufacturer's published specifications.

Tests are performed using equipment traceable to national standards in accordance with Casella's ISO 9001:2015 quality procedures.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k=2$, providing a level of confidence of approximately 95%.

This certificate may not be reproduced other than in full, except with prior written approval of the issuing laboratory.

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Attachment E

Manufacturer's Technical Data Sheets

100/125 kW, 1500 Vdc String Inverters for North America



CPS SCH100/125KTL-DO/US-600

The 100 and 125 kW high power CPS three-phase string inverters are designed for ground mount applications. The units are high performance, advanced and reliable inverters designed specifically for the North American environment and grid. High efficiency at 99.1% peak and 98.5% CEC, wide operating voltages, broad temperature ranges and a NEMA Type 4X enclosure enable this inverter platform to operate at high performance across many applications. The CPS 100/125 kW products ship with the Standard or Centralized Wire-box, each fully integrated and separable with AC and DC disconnect switches. The Standard Wire-box includes touch-safe fusing for up to 20 strings. The CPS FlexOM Gateway enables communication, controls and remote product upgrades.

Key Features

- NFPA 70 and NEC compliant
- Touch-safe DC Fuse holders add convenience and safety
- CPS FlexOM Gateway enables remote firmware upgrades
- Integrated AC and DC disconnect switches
- 1 MPPT with 20 fused inputs for maximum flexibility
- Copper- and Aluminum-compatible AC connections
- NEMA Type 4X outdoor rated enclosure
- Advanced Smart-Grid features (CA Rule 21 certified)
- kVA headroom yields 100 kW @ 0.9 PF and 125 kW @ 0.95 PF
- Generous 1.87 (100 kW) and 1.5 (125 kW) DC/AC inverter load ratios
- Separable wire-box design for fast service
- Standard 5-year warranty with extensions to 20 years



100/125KTL Standard Wire-box



100/125KTL Centralized Wire-box



Model Name	CPS SCH100KTL-DO/US-600	CPS SCH125KTL-DO/US-600
DC Input		
Max. PV power	187.5 kW	
Max. DC input voltage	1500 V	
Operating DC input voltage range	860-1450 Vdc	
Start-up DC input voltage / power	900 V / 250 W	
Number of MPP trackers	1	
MPPT voltage range ¹	870-1300 Vdc	
Max. PV input current (Isc x 1.25)	275 A	
Number of DC inputs	Standard Wire-box: 20 PV source circuits, pos. and neg. fused Centralized Wire-box: 1 input circuit, 1-2 terminations per pole, non-fused	
DC disconnection type	Load-rated DC switch	
DC surge protection	Type II MOV (with indicator/remote signaling)	
AC Output		
Rated AC output power	100 kW	125 kW
Max. AC output power ²	100 kVA (111 kVA @ PF>0.9)	125 kVA (132 kVA @ PF>0.95)
Rated output voltage	600 Vac	
Output voltage range ³	528-660 Vac	
Grid connection type ⁴	3Φ / PE / N (neutral optional)	
Max. AC output current @ 600 Vac	96.2 / 106.8 A	120.3 / 127.0 A
Rated output frequency	60 Hz	
Output frequency range ³	57-63 Hz	
Power factor	>0.99 (±0.8 adjustable)	>0.99 (±0.8 adjustable)
Current THD	<3%	
Max. fault current contribution (1-cycle RMS)	41.47 A	
Max. OCPD rating	200 A	
AC disconnection type	Load-rated AC switch	
AC surge protection	Type II MOV (with indicator/remote signaling)	
System		
Topology	Transformerless	
Max. efficiency	99.1%	
CEC efficiency	98.5%	
Stand-by / night consumption	<4 W	
Environment		
Enclosure protection degree	NEMA Type 4X	
Cooling method	Variable speed cooling fans	
Operating temperature range	-22°F to +140°F / -30°C to +60°C (derating from +108°F / +42°C)	
Non-operating temperature range ⁵	-40°F to +158°F / -40°C to +70°C maximum	
Operating humidity	0-100%	
Operating altitude	8202 ft / 2500 m (no derating)	
Audible noise	<65 dBA @ 1 m and 25°C	
Display and Communication		
User interface and display	LED indicators, WiFi + APP	
Inverter monitoring	Modbus RS485	
Site-level monitoring	CPS FlexOM Gateway (1 per 32 inverters)	
Modbus data mapping	SunSpec / CPS	
Remote diagnostics / firmware upgrade functions	Standard / (with FlexOM Gateway)	
Mechanical		
Dimensions (W x H x D)	Standard Wire-box: 45.28 x 24.25 x 9.84 in (1150 x 616 x 250 mm) Centralized Wire-box: 39.37 x 24.25 x 9.84 in (1000 x 616 x 250 mm)	
Weight	Inverter: 121 lbs (55 kg) Standard Wire-box: 55 lbs (25 kg) Centralized Wire-box: 33 lbs (15 kg)	
Mounting / installation angle	15 - 90 degrees from horizontal (vertical or angled)	
AC termination	M10 stud type terminal [3Φ] (wire range: 1/0 AWG - 500 kcmil CU/AL; lugs not supplied) Screw clamp terminal block [N] (#12 - 1/0 AWG CU/AL)	
DC termination	Standard Wire-box: Screw clamp fuse holder (wire range: #12 - #6 AWG CU) Centralized Wire-box: Busbar, M10 bolts (wire range: #1AWG - 500kcmil CU/AL [1 termination per pole], #1 AWG - 300 kcmil CU/AL [2 terminations per pole]; lugs not supplied)	
Fused string inputs	20 A fuses provided (fuse values up to 30 A acceptable)	
Safety		
Certifications and standards	UL 1741-SA/SB Ed. 3, CSA-C22.2 NO.107.1-01, IEEE 1547-2018, FCC PART15	
Selectable grid standard	IEEE 1547a-2014, IEEE 1547-2018 ⁶ , CA Rule 21, ISO-NE	
Smart-grid features	Volt-RideThru, Freq-RideThru, Ramp-Rate, Specified-PF, Volt-VAR, Freq-Watt, Volt-Watt	
Warranty		
Standard ⁷	5 years	
Extended terms	10, 15 and 20 years	

1) See user manual for further information regarding MPPT voltage range when operating at non-unity PF.

2) "Max AC apparent power" rating valid within MPPT voltage range and temperature range of -30°C to +40°C (-22°F to +104°F) for 100 kW PF≥0.9, and 125 kW PF≥0.95.

3) The "output voltage range" and "output frequency range" may differ according to the specific grid standard.

4) Wye neutral-grounded; delta may not be corner-grounded.

5) See user manual for further requirements regarding non-operating conditions.

6) Firmware version 12.0 or later required.

7) 5-year warranty effective for units purchased after October 1, 2019.

Audible Sound Levels in Liquid-Filled Transformers



All transformers have a slight hum (or buzz) when operating, but certain regulations are in place to ensure they are built to operate as quietly as practically possible.

Below are the latest **NEMA TR-1** Average decibel ratings as of 2020.

Self-Cooled, Two Winding kVA Rating	Average Decibels (dB)
45-500	56
501-700	57
701-1000	58
1001-1500	60
1501-2000	61

2001-2500	62
2501-3000	63
3001-4000	64
4001-5000	65
5001-6000	66
6001-7500	67
7501-10000	68

Maddox Industrial Transformer liquid-filled **padmount** and **substation transformers** are built to the latest NEMA, IEEE, ANSI standards, and Department of Energy regulations.

Call us if you have any questions: 1-866-485-7802

Attachment F

Environmental Noise Modeling Calculations



WSP USA E&I, Inc. - Environmental Noise Modeling Calculations
Knight Street Solar - 275 Knight St., Warwick, RI
Verogy Solar Services - West Hartford, CT

Source Specific Sound Pressure Level Measurements at Reference Location										
Source Equipment	Octave Band Center Frequency (Hz) Sound Level (dB)								Broadband Z-Weighted	Broadband A-Weighted
	63	125	250	500	1000	2000	4000	8000		
CPS 100/125 kW Inverter	69.3	68.7	64.0	65.1	66.4	61.5	52.1	44.1	74.4 dB	69.2 dBA
Notes:										
The CPS Inverter near-field sound test was conducted at the East Windsor Solar One facility by Brooks Acoustics Corp. (BAC) on May 14, 2022.										
Octave band sound pressure level un-weighted decibel values (measured at 1 ft.) are provided in BAC, East Windsor Solar Two - Acoustical Design Study dated April 26, 2023										

Converting Source Specific Sound Pressure Level (L _p) to Sound Power Level (L _w)										
Measurement Configuration			* as reported by Brooks Acoustics Corp.							
Source Height (h _s)	1.50 m	4.92 ft								
Measurement Height (h _r)	1.25 m	4.10 ft								
Horizontal Offset (d _h)	0.30 m	1.00 ft								
Measurement Distance (d _p)	0.39 m	1.29 ft								
Boundary Condition Factor (Q)	1 -		* near-field data most appropriately modeled w/ Q = 1							
Temperature (T)	25.0 °C									
Pressure (P)	101.3 kPa									
Relative Humidity (RH)	50.0 %									
Water Vapor Content (H)	15,957 ppmv									
Ground at Source (G _s)	0.00 -									
Ground at Receiver (G _r)	0.00 -									
Ground in Middle (G _m)	0.00 -									
Parameters	Octave Band Center Frequency (Hz) Sound Level (dB)								Broadband Z-Weighted	Broadband A-Weighted
	63	125	250	500	1000	2000	4000	8000		
Sound Pressure Level (L _p)	69.3	68.7	64.0	65.1	66.4	61.5	52.1	44.1	74.4 dB	69.2 dBA
Geometric Divergence (A _{div})	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9		
Atmospheric Absorption (A _{atm})	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Atmospheric Absorption Coefficient (α)	0.01	0.04	0.13	0.32	0.57	1.02	2.55	8.50		
Ground Absorption (A _{gr})	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Source Region Parameters (a', b', c', d')		1.5	1.5	1.5	1.5					
Source Region Ground Attenuation (A _s)	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5		
Receptor Region Parameters (a', b', c', d')		1.5	1.5	1.5	1.5					
Receptor Region Ground Attenuation (A _r)	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5		
Middle Region Ground Attenuation (A _m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
A-Weighting Adjustment (ADJ _A)	26.2	16.1	8.6	3.6	0.0	-1.2	-1.0	1.1		
Sound Power Level (L_w)	72.2	71.6	66.9	68.0	69.3	64.4	55.0	47.0	77.3 dB	72.2 dBA
Notes:										
Each CPS inverter unit is expected to produce sound power level (L _w) 72.2 dBA when operating at full-load										



WSP USA E&I, Inc. - Environmental Noise Modeling Calculations
Knight Street Solar - 275 Knight St., Warwick, RI
Verogy Solar Services - West Hartford, CT

Comparing Calculated Sound Power Level (L_w) with Vendor Supplied Sound Pressure Level (L_p)										
Projection Configuration			* as reported in Chint Power Systems (CPS) Technical Data Sheet							
Source Height (h_s)	1.50 m	4.92 ft								
Measurement Height (h_r)	1.50 m	4.92 ft								
Horizontal Offset (d_h)	1.00 m	3.28 ft								
Measurement Distance (d_p)	1.00 m	3.28 ft								
Boundary Condition Factor (Q)	1 -		* near-field data most appropriately modeled w/ Q = 1							
Temperature (T)	25.0 °C									
Pressure (P)	101.3 kPa									
Relative Humidity (RH)	70.0 %									
Water Vapor Content (H)	22,484 ppmv									
Ground at Source (G_s)	0.00 -									
Ground at Receiver (G_r)	0.00 -									
Ground in Middle (G_m)	0.00 -									
Parameters	Octave Band Center Frequency (Hz)								Broadband Z-Weighted	Broadband A-Weighted
	63	125	250	500	1000	2000	4000	8000		
Sound Power Level (L_w)	72.2	71.6	66.9	68.0	69.3	64.4	55.0	47.0	77.3 dB	72.2 dBA
Geometric Divergence (A_{div})	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0		
Atmospheric Absorption (A_{atm})	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1		
Atmospheric Absorption Coefficient (α)	0.01	0.03	0.10	0.30	0.62	1.05	2.18	6.50		
Ground Absorption (A_{gr})	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0		
Source Region Parameters (a', b', c', d')		1.5	1.6	1.6	1.5					
Source Region Ground Attenuation (A_s)	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5		
Receptor Region Parameters (a', b', c', d')		1.5	1.6	1.6	1.5					
Receptor Region Ground Attenuation (A_r)	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5		
Middle Region Ground Attenuation (A_m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
A-Weighting Adjustment (ADJ_A)	26.2	16.1	8.6	3.6	0.0	-1.2	-1.0	1.1		
Sound Pressure Level (L_p)	64.2	63.6	58.9	60.0	61.3	56.4	47.0	39.0	69.3 dB	64.2 dBA
Notes:										
CPS Technical Data Sheet specifies unit noise <65 dBA @ 1 m, which is shown to be consistent with sound level values measured by Brooks Acoustics Corp.										



WSP USA E&I, Inc. - Environmental Noise Modeling Calculations
Knight Street Solar - 275 Knight St., Warwick, RI
Verogy Solar Services - West Hartford, CT

Converting Transformer Specific NEMA Sound Level (L _p) to Sound Power Level (L _w)												
Source Equipment			* NEMA TR1 rating provided by manufacturer (i.e., Maddox) * dimensions per Maddox standard specs									
NEMA Sound Level Rating (L _p)		58.0 dBA										
Transformer Height (H _t)	1.98 m	6.50 ft										
Transformer Width (W _t)	1.52 m	5.00 ft										
Transformer Length (L _t)	1.70 m	5.58 ft										
Surface Area (SA _t)	12.79 m ²	137.58 ft ²										
Source Equipment			Octave Band Center Frequency (Hz) Sound Level (dB)						Broadband Z-Weighted	Broadband A-Weighted		
			63	125	250	500	1000	2000	4000	8000		
NEMA Transformer Octave Band Corrections			-5.0	-3.0	-8.0	-8.0	-14.0	-19.0	-24.0	-31.0		
Sound Power Level (L_w)			74.1	76.1	71.1	71.1	65.1	60.1	55.1	48.1	79.8 dB	71.3 dBA
Notes:												
Maddox certifies that the 750 kVA liquid-filled transformer complies with NEMA TR1 sound levels, or 58 dBA. L _w = NEMA rating + 10 log (SA) + C + 10, where SA = surface area and C = octave band corrections (C1 for outdoor location, per Table 20, Handbook of Noise and Vibration Control)												

Propagation Model Source Sound Power Levels												
Source Equipment			Octave Band Center Frequency (Hz) Sound Level (dB)						Broadband Z-Weighted	Broadband A-Weighted		
			63	125	250	500	1000	2000	4000	8000		
CPS Inverter Bank (6 units)			80.0	79.4	74.7	75.8	77.1	72.2	62.8	54.8	85.1 dB	79.9 dBA
Maddox Transformer (1 unit)			74.1	76.1	71.1	71.1	65.1	60.1	55.1	48.1	79.8 dB	71.3 dBA
Notes:												
Combined unit sound power level = L _{w total} = 10 · log (n · 10 ^{L_w/10}), where n = number of units (i.e., 6)												



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Knight Street Solar - 275 Knight St., Warwick, RI
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Sound Propagation Modeling										
Projection Configuration			<i>Modeling Location: Western property line (non-residential, nearest PL)</i>							
Source Height (h_s)	1.50 m	4.92 ft	* Model inverter bank and transformer impact result at PL-1 - Inverter Bank = 45 ft (13.7 m); Transformer = 60 ft (18.3 m) * model as free radiating source (i.e., no directivity)							
Measurement Height (h_r)	1.50 m	4.92 ft								
Horizontal Offset (d_h)	18.29 m	60.00 ft								
Measurement Distance (d_p)	18.29 m	60.00 ft								
Boundary Condition Factor (Q)	1 -									
Temperature (T)	25.0 °C									
Pressure (P)	101.3 kPa									
Relative Humidity (RH)	70.0 %									
Water Vapor Content (H)	22,484 ppmv									
Ground at Source (G_s)	0.50 -									
Ground at Receiver (G_r)	0.50 -									
Ground in Middle (G_m)	0.50 -									
Parameters	Octave Band Center Frequency (Hz)								Broadband Z-Weighted	Broadband A-Weighted
		63	125	250	500	1000	2000	4000		
Sound Power Level (L_w)	74.1	76.1	71.1	71.1	65.1	60.1	55.1	48.1	79.8 dB	71.3 dBA
Geometric Divergence (A_{div})	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2		
Atmospheric Absorption (A_{atm})	0.0	0.0	0.0	0.1	0.1	0.2	0.4	1.2		
Atmospheric Absorption Coefficient (α)	0.01	0.03	0.10	0.30	0.62	1.05	2.18	6.50		
Ground Absorption (A_{gr})	-3.0	-1.3	0.7	0.0	-1.3	-1.5	-1.5	-1.5		
Source Region Parameters (a', b', c', d')		1.7	3.7	3.0	1.7					
	Source Region Ground Attenuation (A_s)	-1.5	-0.6	0.3	0.0	-0.6	-0.8	-0.8	-0.8	
	Receptor Region Parameters (a', b', c', d')		1.7	3.7	3.0	1.7				
	Receptor Region Ground Attenuation (A_r)	-1.5	-0.6	0.3	0.0	-0.6	-0.8	-0.8	-0.8	
	Middle Region Ground Attenuation (A_m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
A-Weighting Adjustment (ADJ_A)	26.2	16.1	8.6	3.6	0.0	-1.2	-1.0	1.1		
Sound Pressure Level (L_p)	40.8	41.1	34.2	34.8	30.0	25.1	19.9	12.1	45.1 dB	35.5 dBA
Propagation Model Sound Impact Results (copy and paste after each model iteration)										
Source Equipment	Octave Band Center Frequency (Hz) Sound Level (dB)								Broadband Z-Weighted	Broadband A-Weighted
		63	125	250	500	1000	2000	4000		
Inverter Bank Contribution	49.2	47.0	40.8	42.3	44.6	39.8	30.3	21.7	53.1 dB	47.3 dBA
Transformer Contribution	40.8	41.1	34.2	34.8	30.0	25.1	19.9	12.1	45.1 dB	35.5 dBA
Sound Level Impact Result	49.8	48.0	41.6	43.0	44.8	40.0	30.6	22.1	53.7 dB	47.6 dBA
Notes:										
The combined sound level impact caused by (6) CPS inverters and (1) Maddox transformer operating simultaneously upon the sound environment at the PL-1 nearest (non-residential) property line located to the west of the invert bank source is approximately 47-48 dBA										



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Knight Street Solar - 275 Knight St., Warwick, RI
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Sound Propagation Modeling										
Projection Configuration			<i>Modeling Location: Northwestern property line (nearest residential PL)</i>							
Source Height (h_s)	1.50 m	4.92 ft	* Model inverter bank and transformer impact result at PL-2 - Inverter Bank = 200 ft (61 m); Transformer = 160 ft (48.8 m) * model as free radiating source (i.e., no directivity)							
Measurement Height (h_r)	1.50 m	4.92 ft								
Horizontal Offset (d_h)	48.78 m	160.00 ft								
Measurement Distance (d_p)	48.78 m	160.00 ft								
Boundary Condition Factor (Q)	1 -									
Temperature (T)	25.0 °C									
Pressure (P)	101.3 kPa									
Relative Humidity (RH)	70.0 %									
Water Vapor Content (H)	22,484 ppmv									
Ground at Source (G_s)	0.50 -									
Ground at Receiver (G_r)	0.50 -									
Ground in Middle (G_m)	0.50 -									
Parameters	Octave Band Center Frequency (Hz)								Broadband Z-Weighted	Broadband A-Weighted
		63	125	250	500	1000	2000	4000		
Sound Power Level (L_w)	74.1	76.1	71.1	71.1	65.1	60.1	55.1	48.1	79.8 dB	71.3 dBA
Geometric Divergence (A_{div})	44.8	44.8	44.8	44.8	44.8	44.8	44.8	44.8		
Atmospheric Absorption (A_{atm})	0.0	0.0	0.1	0.1	0.3	0.5	1.1	3.2		
Atmospheric Absorption Coefficient (α)	0.01	0.03	0.10	0.30	0.62	1.05	2.18	6.50		
Ground Absorption (A_{gr})	-3.0	-1.0	2.9	1.6	-1.1	-1.5	-1.5	-1.5		
Source Region Parameters (a', b', c', d')	Source Region Ground Attenuation (A_s)		2.0	5.9	4.6	1.9				
	Receptor Region Parameters (a', b', c', d')		2.0	5.9	4.6	1.9				
	Receptor Region Ground Attenuation (A_r)		-1.5	-0.5	1.4	0.8	-0.5	-0.8	-0.8	
	Middle Region Ground Attenuation (A_m)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	A-Weighting Adjustment (ADJ_A)		26.2	16.1	8.6	3.6	0.0	-1.2	-1.0	1.1
Sound Pressure Level (L_p)	32.3	32.3	23.4	24.6	21.1	16.3	10.7	1.6	36.1 dB	26.0 dBA
Propagation Model Sound Impact Results (copy and paste after each model iteration)										
Source Equipment	Octave Band Center Frequency (Hz) Sound Level (dB)								Broadband Z-Weighted	Broadband A-Weighted
		63	125	250	500	1000	2000	4000		
Inverter Bank Contribution	36.3	33.6	24.5	26.9	31.1	26.4	16.3	5.7	39.6 dB	33.5 dBA
Transformer Contribution	32.3	32.3	23.4	24.6	21.1	16.3	10.7	1.6	36.1 dB	26.0 dBA
Sound Level Impact Result	37.8	36.0	27.0	28.9	31.5	26.8	17.3	7.1	41.2 dB	34.2 dBA
Notes:										
The combined sound level impact caused by (6) CPS inverters and (1) Maddox transformer operating simultaneously upon the sound environment at the PL-2 nearest (residential) property line located to the north of the invert bank source is approximately 34-35 dBA										



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Sound Propagation Modeling										
Projection Configuration			<i>Modeling Location: North property line (alternate residential PL)</i>							
Source Height (h_s)	1.50 m	4.92 ft	* Model inverter bank and transformer impact result at PL-3 - Inverter Bank = 350 ft (106 m); Transformer = 320 ft (98 m) * model as free radiating source (i.e., no directivity)							
Measurement Height (h_r)	1.50 m	4.92 ft								
Horizontal Offset (d_h)	97.56 m	320.00 ft								
Measurement Distance (d_p)	97.56 m	320.00 ft								
Boundary Condition Factor (Q)	1 -									
Temperature (T)	25.0 °C									
Pressure (P)	101.3 kPa									
Relative Humidity (RH)	70.0 %									
Water Vapor Content (H)	22,484 ppmv									
Ground at Source (G_s)	0.50 -									
Ground at Receiver (G_r)	0.50 -									
Ground in Middle (G_m)	0.50 -									
Parameters	Octave Band Center Frequency (Hz)								Broadband Z-Weighted	Broadband A-Weighted
		63	125	250	500	1000	2000	4000		
Sound Power Level (L_w)	74.1	76.1	71.1	71.1	65.1	60.1	55.1	48.1	79.8 dB	71.3 dBA
Geometric Divergence (A_{div})	50.8	50.8	50.8	50.8	50.8	50.8	50.8	50.8		
Atmospheric Absorption (A_{atm})	0.0	0.0	0.1	0.3	0.6	1.0	2.1	6.3		
Atmospheric Absorption Coefficient (α)	0.01	0.03	0.10	0.30	0.62	1.05	2.18	6.50		
Ground Absorption (A_{gr})	-3.2	-0.9	4.4	2.7	-1.1	-1.6	-1.6	-1.6		
Source Region Parameters (a', b', c', d')		2.2	7.5	5.8	2.1					
	Source Region Ground Attenuation (A_s)	-1.5	-0.4	2.3	1.4	-0.5	-0.8	-0.8	-0.8	
	Receptor Region Parameters (a', b', c', d')		2.2	7.5	5.8	2.1				
	Receptor Region Ground Attenuation (A_r)	-1.5	-0.4	2.3	1.4	-0.5	-0.8	-0.8	-0.8	
	Middle Region Ground Attenuation (A_m)	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	
A-Weighting Adjustment (ADJ_A)	26.2	16.1	8.6	3.6	0.0	-1.2	-1.0	1.1		
Sound Pressure Level (L_p)	26.5	26.2	15.8	17.3	14.7	9.9	3.8	-7.4	30.0 dB	19.3 dBA
Propagation Model Sound Impact Results (copy and paste after each model iteration)										
Source Equipment	Octave Band Center Frequency (Hz) Sound Level (dB)								Broadband Z-Weighted	Broadband A-Weighted
		63	125	250	500	1000	2000	4000		
Inverter Bank Contribution	31.9	28.8	18.6	21.3	26.0	21.3	10.6	-1.9	34.8 dB	28.3 dBA
Transformer Contribution	26.5	26.2	15.8	17.3	14.7	9.9	3.8	-7.4	30.0 dB	19.3 dBA
Sound Level Impact Result	33.0	30.7	20.4	22.7	26.3	21.6	11.5	-0.9	36.1 dB	28.9 dBA
Notes:										
The combined sound level impact caused by (6) CPS inverters and (1) Maddox transformer operating simultaneously upon the sound environment at the PL-3 alternate (residential) property line located to the northeast of the invert bank source is approximately 28-29 dBA										

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Verogy Solar Services - West Hartford, CT

Additional Model Notes

Horizontal Offset (d_h), is the distance from the center of the source to the measurement point transposed onto the x/y-plane.

Boundary Condition Factor (Q), accounts for the reflective planes or boundaries around the source of the noise. These planes act as reflectors focusing the sound into a certain direction.

For general modeling, Q has the following values:

Q = 1 -- Point source freely radiating in all directions (e.g. chimney)

Q = 2 -- Point source with a single reflective plane (e.g. source on ground)

Q = 4 -- Point source with two reflective planes (e.g. floor & wall)

Q = 8 -- Point source with three reflective planes (e.g. floor corner)

Ground Effect Factor (G), introduced to represent ground reflectivity (0 = hard, 1 = soft) along the propagation path (i.e. source region, receptor region & middle region). For general modeling, G has the following values:

G = 0 -- Pavement or Water

G = 0.1 -- Packed Ground

G = 0.6 - 0.8 -- Lawn or Field of Grass

G = 0.7 - 0.9 -- Forest (w/ leaves) or Plowed Field

G = 1.0 -- Fresh Snow

Geometric Divergence (A_{div}) = $10 \cdot \log[(4 \pi r^2) / Q]$

Atmospheric Absorption (A_{atm}) = $\alpha \cdot d_p / 100$

Table 18 Frequency Adjustments (in dB) for DRPR Electric Motors

Octave Frequency Band (Hz)	Value Subtracted from Overall (dB)
31	9
63	9
125	7
250	7
500	6
1000	9
2000	12
4000	18
8000	27
A-weighted	4

DRPR Motors The normalized unweighted sound pressure levels for DRPR motors follow approximately the following relationships

$$L_p = 12 + 17 \log \text{kW} + 15 \log \text{rpm} \quad (16)$$

for power ratings under 37 kW, and

$$L_p = 23 + 10 \log \text{kW} + 15 \log \text{rpm} \quad (17)$$

for power ratings above 37 kW. For motors above 300 kW, the calculated noise value for a 300-kW motor should be used. The octave band adjustments for DRPR motors are given in Table 18.

2.9 Steam Turbines¹

Steam turbines are sometimes used as primary or backup drivers for chillers, pumps, and air compressors. The noise levels of steam turbines are found generally to increase with increasing power rating, but it has not been possible to attribute any specific noise characteristics with speed or turbine blade passage frequency. Suggested normalized sound pressure

levels for steam turbines, with a power range of 370 to 11,000 kW, are given in Table 19.

2.10 Transformers¹

Transformer manufacturers commonly provide an average A-weighted sound pressure level for their products. Typically, this is an average of the sound pressure levels, on a reference sound producing surface space at a distance of 0.3 m from the outline of the transformer. On the basis of field studies of many transformer installations, the sound power level in octave bands has been related to the average A-weighted sound pressure level and the area of the four side walls of the unit. This relationship is expressed by

$$L_W = \text{average } L_{pA} + 10 \log A + C + 10 \quad (18)$$

where *A* is the total surface of the four side walls of the transformer in the square metres and *C* is an octave band correction that has different values for different uses, as shown in Table 20. If the exact dimensions of the transformer are not known, an approximation will suffice. If in doubt, the area should be estimated on the high side. An error of 25% in area will produce a change of 1 dB in the sound power level. The most nearly applicable *C* value from Table 20 should be used. The *C*₁ value assumes normal radiation of sound. The *C*₂ value should be used in regular-shaped confined spaces where standing waves will likely occur, which typically may produce 6 dB higher sound pressure levels at the transformer harmonic frequencies of 120, 240, 360, 480, and 600 Hz (for 60-Hz line frequency; or other sound frequencies for other line frequencies). The *C*₃ value is an approximation of the noise of a transformer that has grown noisier (by about 10 dB) during its lifetime. This happens occasionally when the laminations or tie bolts become loose, and the transformer begins to buzz or rattle. In a highly critical location, it would be wise to use this value. Field measurements have shown that transformers may actually have A-weighted sound pressure levels that range from a few decibels (2 or 3 dB) above to as much as 5 or 6 dB below the quoted

Table 19 Normalized Sound Pressure Levels for Steam Turbines

Octave Frequency Band (Hz)	Sound Pressure Level (dB)		
	Steam Turbine Power [hp (kW)]		
	500–1500 (373–1119)	1501–5000 (1120–3730)	5001–15,000 (3731–11,190)
31	86	88	90
63	91	93	95
125	91	93	95
250	88	90	92
500	85	87	89
1000	85	88	91
2000	87	91	95
4000	84	88	92
8000	76	81	86
Overall	97	99	102
A-weighted	92	95	99

Table 20 Octave Band Corrections for Transformers

Octave Frequency Band (Hz)	Octave Band Corrections (dB)		
	C_1^a	C_2^b	C_3^c
31	-11	-11	-11
63	-5	-2	-2
125	-3	+3	+3
250	-8	-2	+2
500	-8	-2	+2
1000	-14	-11	-4
2000	-19	-19	-9
4000	-24	-24	-14
8000	-31	-31	-21

^a Use C_1 for outdoor location or for indoor location in a large mechanical room (over 140 m³) containing many other pieces of mechanical equipment that serve as obstacles to diffuse sound and breakup standing waves.

^b Use C_2 for indoor locations in transformer vaults or small rooms (under 140 m³) with parallel walls and relatively few other large-size obstacles that can diffuse sound and breakup standing waves.

^c Use C_3 for any location where a serious noise problem would result if the transformer should become noisy following its installation and initial period of use

A-weighted sound pressure level. Quieted transformers that contain various forms of noise control treatments can be purchased at as much as 15 to 20 dB below normal A-weighted ratings.

3 PROPAGATION OF AIRBORNE NOISE FROM MECHANICAL EQUIPMENT ROOMS

The analysis of the impact of mechanical equipment, on surrounding spaces is relatively straightforward.⁵ Once the sound pressure level within the mechanical equipment room has been established, the degree of transmission to adjacent spaces can be determined with knowledge of the transmission loss properties of the walls, floor, and ceiling of the mechanical room and the acoustical properties of the adjacent room.

3.1 Transmission Loss of Mechanical Room Partitions

Transmission loss data for different partitions can be found in many publications. As a general rule this information is derived from laboratory measurements (e.g., ASTM E90-04).⁶ However, due to measurement limitation, transmission loss data below 100 Hz is rarely reported. Large mechanical equipment will often produce significant acoustic energy below 100 Hz. Therefore, there is a need to obtain transmission loss performance below 100 Hz, or alternatively, estimate the low-frequency performance. Quite often a single-number rating, such as the sound transmission class (STC) is provided. However, most of these single-number classifications are heavily weighted toward the 500- to 2000-Hz frequency range. While this range is suitable for the evaluation of isolation for speech, some music, and most transportation noise sources,

NOISE AND VIBRATION CONTROL IN BUILDINGS

it is not suitable for the evaluation of mechanical equipment noise sources. An alternative rating called the mechanical transmission class (MTC) may be used for rating partition transmission loss for mechanical equipment. The determination of the MTC is similar to the STC in that it uses the same reference curve and measured one-third octave band transmission loss data. The determination of the MTC rating differs from the determination of the STC rating in that:

1. No deficiencies are allowed in the 125- and 160-Hz one-third octave bands.
2. Moreover, if there are any surpluses above the STC contour in the 125- and 160-Hz one-third octave bands, the rating is increased by one-third of the sum of the surpluses.

Studies have indicated that, when the A-weighted sound pressure level within the mechanical equipment room is less than the sum of the MTC rating of the partition and the room criterion (RC) rating of the background sound within the adjacent room, the intrusive noise should be acceptable. MTC ratings are useful as a cursory evaluation technique. Final selection of partition types should be based on a more complete analysis (e.g., octave or one-third octave band analysis).

3.2 Openings in Walls

An opening, such as a door, window, or louvered vent, in an exterior wall of a noisy room will allow noise to escape from that room and perhaps be disturbing to neighbors. The sound power of the sound that passes through the opening can be estimated from

$$L_W = L_p + 10 \log A \quad (19)$$

where L_p is the sound pressure level in the room at the location of the opening and A is the area, in square metres, of the opening. For normal openings (windows or vents) without ducted connections to the noise source, it may be assumed that the sound radiates freely in all directions in front of the opening.

4 VIBRATION ISOLATION OF MECHANICAL EQUIPMENT¹

If mechanical equipment is not provided with proper vibration isolation, acoustic energy will be transmitted into the supporting structure resulting in unwanted vibration and structure-borne sound. The isolator types and isolation guidelines presented in this chapter are based on experience with successful installation of mechanical equipment in commercial buildings.

4.1 Isolator Types and Transmissibility

A transmissibility curve is often used to indicate the general behavior of a vibration-isolated system. Transmissibility is roughly defined as the ratio of the force transmitted through the isolated system to the supporting structure to the driving force exerted by the piece of vibrating equipment. Strict interpretation

Attachment G

Planning Department Email Re: Verogy – Noise Study, 4/25/2023

From: [Geagan Daniel T](#)
To: [Brad Parsons](#)
Cc: [Kravitz Thomas J](#); sresnick@resnickandcaffrey.com; [Robyn Foster](#); [James Cerkanowicz](#)
Subject: RE: [EXT] - RE: Verogy - Noise study
Date: Tuesday, April 25, 2023 11:17:12 AM
Attachments: [image001.png](#)

Brad-

We certainly defer to standard industry practice when measuring ambient background noise.

Please have WSP give a brief explanation of the methodology and how it relates to the City noise Ordinance when submitting the report. As long as the background noise level is obtained within industry standards, we will be in agreement as to the testing.

Thank you,

Dan



Daniel T Geagan
Deputy Director Planning
Planning Department
City of Warwick
(401) 921-9685
<https://www.warwickri.gov>
daniel.t.geagan@warwickri.gov

From: Brad Parsons [mailto:bparsons@verogy.com]
Sent: Tuesday, April 25, 2023 10:41 AM
To: Geagan Daniel T <daniel.t.geagan@warwickri.gov>
Cc: [Kravitz Thomas J](mailto:kravitz.thomas.j@warwickri.gov) <kravitz.thomas.j@warwickri.gov>; sresnick@resnickandcaffrey.com; [Robyn Foster](mailto:Robyn.Foster@resnickandcaffrey.com) <Robyn.Foster@resnickandcaffrey.com>; [James Cerkanowicz](mailto:James.Cerkanowicz@verogy.com) <James.Cerkanowicz@verogy.com>
Subject: [EXT] - RE: Verogy - Noise study

Dan,

I talked to my noise consultant about this and he mentioned that just leaving the equipment out on site for a week is not the standard practice to measure noise. The following is from our consultant WSP, and we would be happy to get on a call to discuss with you further. At the end of the day we just wanted to make sure that we are getting this right so we only have to do this once.

- The standard practice in environmental sound measurement is to record sound levels at rapid intervals (i.e., between 125 milliseconds (fast) to 1-second (slow) sampling interval). The sound level measurements are collected consecutively during a 20- to 30-minute sample period (i.e., observation time interval) which is collected during a time period that is reasonably representative of “typical” noise conditions (i.e., minimal wind (< 12 mph), no

precipitation, no snow-cover, no unusual events), and during the time-of-day at which a nuisance is most likely to occur at nearby sensitive receptors (i.e., daytime or nighttime). In the case of solar, because the systems don't operate at night, it would be the daytime.

In talking with WSP this is in line with Section 2 of the City Noise Ordinance to define the ambient noise.

Again we would be happy to get on a call to discuss.

Bradley J. Parsons, PE, PMP
Director of Design and Permitting
M: 203.814.6866

From: Geagan Daniel T <daniel.t.geagan@warwickri.gov>
Sent: Monday, April 24, 2023 9:26 AM
To: Brad Parsons <bparsons@verogy.com>
Cc: 'Joseph Shekarchi' <joe@shekarchilaw.com>; Kravitz Thomas J <thomas.j.kravitz@warwickri.gov>
Subject: Verogy - Noise study

Hi Brad-

I spoke with Tom and with Building – they suggested that a week's worth of data would be a better representation of the ambient background noise. Is it possible to leave the equipment out to capture the average over a week (including capturing measurements on a weekend)?

Thanks,

Dan



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