VPC, LLC

NARRATIVE REPORT

PROPOSED SOLAR DEVELOPMENT

KNIGHT STREET

PLAT 275 LOTS 38 AND 52
KNIGHT STREET
WARWICK, RI

NARRATIVE REPORT

PROPOSED SOLAR DEVELOPMENT – KNIGHT STREET

PLAT 275 LOTS 38 AND 52 KNIGHT STREET WARWICK, RI

VPC, LLC

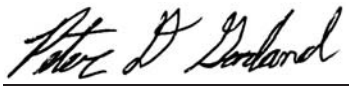
PROJECT NO.: 3652-200299
DATE: JANUARY 19, 2023

WSP
100 APOLLO DRIVE, SUITE 302
CHELMSFORD, MA 01824

T: +1 978-692-9090
F: +1 833-774-2707
wsp.com

SIGNATURES

PREPARED BY



Peter Garland
Project Engineer

APPROVED BY

Andrew Vardakis, PE
Associate Engineer / Project Manager

WSP USA Environment & Infrastructure Inc. prepared this report solely for the use of the intended recipient, RIDOT Environmental Division – Office of Stormwater, in accordance with the professional services agreement. The intended recipient is solely responsible for the disclosure of any information contained in this report. The content and opinions contained in the present report are based on the observations and/or information available to WSP USA Environment & Infrastructure Inc. at the time of preparation. If a third party makes use of, relies on, or makes decisions in accordance with this report, said third party is solely responsible for such use, reliance, or decisions. WSP USA Environment & Infrastructure Inc. does not accept responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken by said third party based on this report. This limitations statement is considered an integral part of this report.

TABLE OF CONTENTS

FIGURES

TABLES

APPENDICES

1.0 INTRODUCTION

On behalf of Warwick Solar Two, LLC, LLC ("Verogy"), WSP USA Environment & Infrastructure, Inc. (WSP) has prepared this Project Narrative Report in support of a proposed 998.4± kilowatt (kW) Direct Current (DC) solar development project to be located on Knight Street in Warwick, Rhode Island. The entire development parcel assemblage is zoned LI-Limited Industrial and is comprised of Assessor's Plat (AP) 275, Lot 38 and 52, totaling 16.3± acres, as designated by the City of Warwick Tax Assessor's office (See **Appendix A** for the Site Plan).

Figure 1: Site Location

The subject parcels are located more than 1,500 feet south of the municipal boundary between the Cities of Cranston and Warwick. The proposed solar development project (the "Site" or the "Project") will be sited 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. 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.

2.0 EXISTING CONDITIONS

2.1 Existing and Surrounding Land Uses

The Site is currently vacant land that was formerly an undeveloped portion of the Pontiac Enterprises, Ltd. 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. See **Appendix B** for the Site Location and Half Mile Vicinity Maps.

2.2 Zoning

The City of Warwick allows the use of a "Contaminated Site solar energy system, ground mounted" with a Special Use Permit in Zones LI (Light Industrial) and GI (General Industrial) zoning districts. The entirety of the project site is zoned "LI", Limited Industrial with a portion of the site, Lot 38, located within the City's historic district.

2.3 Topography

Based on available record survey data, the elevation within the parcel boundary slopes gradually from 37 to 31 feet from northwest to southeast. The project will be situated on a relatively flat area of the site where elevations range from 36 to 37 (<1% slope). The site survey shows areas of steep elevations; however, these are material stockpiles used for the landscaping company which are assumed to be removed prior to development. The development of a solar field will occur following site remediation, which will require earthwork during implementation of an engineered cap, installation of a vapor barrier and active soil gas mitigation system, and installation of groundwater monitoring wells.

2.4 Parking and Access

There is one proposed driveway extending from the existing curb cut on Knight Street onto the western portion of the Site; therefore, no new curb cut is required. The proposed road will include a turnaround to allow access for maintenance and emergency services vehicles.

2.5 Utilities

Utilities are present along Knight Street, including electric (overhead lines), water, gas, and sewer. Verogy has applied for and received interconnection approval from Rhode Island Energy (formally National Grid). The proposed project is not a subdevelopment; therefore, no public water or sewer service is required.

2.6 Wetlands

A letter titled, "Freshwater Wetland Delineations" was provided by Natural Resource Services, Inc. (NRS) for the Project. A copy of NRS's letter and supporting documents are provided in **Appendix C**. 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

2.7 Impairments/TMDLs within Watershed

The (federal) Clean Water Act (CWA) Section 303(d) requires states to identify and list those waterbodies that are not expected to meet state water quality standards after the implementation of technology-based controls and, as such, require the development of Total Maximum Daily Loads (TMDLs). States must include on the lists the specific cause(s) of the impairment (if known). The State's 303(d) list of impaired waters, developed by the RIDEM, fulfills

this CWA requirement. On-site wetlands are tributary to the Pawtuxet River. 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 (ID Number: RI0006017R-03) 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; therefore, all new development or redevelopment projects discharging stormwater into the Pawtuxet River must include stormwater quality best management practices (BMPs) to address the impairments.

2.8 Onsite Soils and Groundwater

The Natural Resources Conservation Services (NRCS) Web Soil Survey mapping identified the soils within the proposed development area as follows:

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

See **Appendix D** for NRCS Web Soil Survey Map – Hydrologic Soil Group.

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.

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 (**Appendix E**). 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. Groundwater at the Site is classified as GB by RIDEM, indicating that groundwater is presumed unsuitable for public consumption.

2.9 Natural Heritage Area

Based on a review of RIDEM's Environmental Resource Map, there are no Natural Heritage Areas in the vicinity of the Site.

2.10 Flood Zone - 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 portion of the Site. The proposed development is located within Zone X and only limited clearing is occurring within Zone AE; therefore, there are no anticipated flood zone issues. See **Appendix F** for FEMA Flood Maps.

2.11 Historic Contamination and Proposed Remediation

The Site is formerly an undeveloped portion of the Pontiac Enterprises, Ltd. (Pontiac) property, but has since been separated through subdivision. The mill structures associated with Pontiac's operations are located west of the Site and were occupied by textile manufacturers from the late 1800s to 1996. Operations included bleaching, dyeing, and printing cotton fabrics. Subsequently, the Pontiac property has been occupied by 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. EA Engineering Science and Technology, Inc. prepared a Site Investigation report for the Property titled "Site Investigation Report Former Pontiac Mills Property Plat 275, Lots 38 and 52 Warwick, Rhode Island, Final, March 2008"

WSP and VCP, LLC, are working with RIDEM to remediate 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.

On October 17, 2022, RIDEM provided a letter to the City of Warwick Director of Planning stating that certain actions must occur as part of a landfill closure to satisfy the regulations before the reuse of the property can occur. Once RIDEM is satisfied with the investigation and remediation efforts, using the Site as a solar development is a reuse that RIDEM encourages. See Appendix G for a copy of the RIDEM letter.

3.0 PROPOSED DEVELOPMENT SCHEME

The proposed solar development will occupy approximately 3.9± acres of the total 16.3± acre parcel assemblage. The Project will be constructed in one phase. A gated chain link fence will surround the array to prevent unauthorized access, and an access road from Knight Street will be constructed along the western portion of the array with crushed stone to provide reliable access to maintenance and emergency services vehicles. One concrete equipment pad will be installed within the fence perimeter to support electrical equipment. An overhead utility line will be installed to connect the project to the existing grid. See **Appendix A** for the Site Plan. The project will be constructed in one phase; therefore, no phasing is proposed. WSP and VCP, LLC, will be working with the City of Warwick and the historic district to address any visablity concers associated with the project along Knight Street. The proposed visual mitigation measures will be included in the Site Plans for the Preliminary Plan Stage.

The proposed project is not a subdevelopment, therefore, will not house any people or school children.

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 preferred remedial alternative is further described in the previous section (Section 2.11).

Wetland resources and their associated protective buffers roughly surround the proposed development area. Based on direction from Natural Resource Services, Inc., proposed improvements will be sited away from wetlands to the maximum extent practicable.

The City of Warwick allows the use of a "Contaminated Site solar energy system, ground mounted" with a Special Use Permit in Zones LI (Light Industrial) and GI (General Industrial) zoning districts. The entirety of the project site is zoned "LI", Limited Industrial with a portion of the site, Lot 38, located within the City's historic district.
Stormwater Management

3.1 Stormwater Management

Apart from crushed stone access roads which is a pervious surface, the entire site will be loamed and seeded and maintained as meadow grass for the life of the project. Under this design, the solar panels do not function as impervious surfaces and all stormwater runoff flowing off the racks will flow over grass downgradient. The design ensures post-development peak runoff rates are less than or equal to pre- development conditions. Drainage plans and calculations, and soil erosion and sediment control plan have been submitted to RIDEM in September 2021 and will be included in the Preliminary Plan Stage. The project will be designed and permitted in accordance with the Rhode Island Department of Environmental Management (RIDEM) rules and regulation, the Rhode Island Stormwater Design and Installation Standards Manual (RISDISM), and the City of Warwick regulations.

3.2 Zoning: Administrative Procedures for Solar Energy Systems on Contaminated Sites - Comments

This Applications, Drawings, and supporting documentation were prepared in accordance with the City of Warwick Zoning Ordinance: Section III, Appendix A, Section 500 (Amendment for Solar Energy Systems on Contaminated Sites). Information required in the Ordinance is listed in the narrative below (followed by WSP's comments in **bold**).

> Purpose and Applicability. The purpose of this section is to regulate the installation of solar energy systems by providing standards for the placement, design, construction, operation monitoring modification and removal of such systems. These standards are intended to ensure that solar energy systems are compatible with the surrounding area, provide for public safety, and minimize impacts on scenic, natural, and historic resources. The Provision of this section shall apply, as specified herein, to construction, operation, and/or repair of solar energy system installation in the City.

Large scale solar energy systems (which refers to systems that are not either (1) and Accessory solar system or (2) a contaminated site solar system as defined by this ordinance) shall be prohibited throughout the City of Warwick.

Review procedures. Contaminated sites (i.e. brownfield sites) subject to solar energy systems shall require Planning Board review in accordance with Major Land Development review provisions.

Any system located in a historic overlay district in view of a public ROW as determined by the Building Official, must obtain a Certificate of Appropriateness in accordance with Section 311.

A Certificate of Approprateness will be provided as part of the Preliminary Plan Submission.

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.

(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 will be provided as part of the Preliminary Plan Submission. WSP has engaged a RI-licensed landscape architect to provide a landscape buffer.

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.

	Req	**Existing/Provided**
Minimum lot area (square feet)	6,000	**732,160**
Maximum density, dwelling units per acre	N/A	**N/A**
Minimum frontage (feet) (1), (4)	60	**737**
Minimum lot width (feet) (1), (4)	60	**737**
Minimum front and corner side yard (feet)	25	**35 to solar panels, fence is in setback**
Maximum front yard (feet)	—	**N/A**
Minimum side yard (feet)	15 (3)	**43' to equipment, 72' to solar panels**
Minimum rear yard (feet) (6)	20 (3)	**>500**
Maximum structure height (feet)	45	**10**
Minimum landscaped open space (5)	10%	**TBD at Preliminary Plan**

(B) The maximum height of a ground-mounted solar energy system shall be 10 feet.

The proposed solar array consisting of the racking system and solar modules will not exceed 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 solar PV modules will have anti-reflective coating to prevent solar glare.

(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.

The applicant is currently working to complete a noise study; this will be provided as part of the Preliminary Plan Submission.

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

The applicant will comply with this requirement by confirmig eith the Fire Marshal. The proposed design is similar to the other projects in the City.

(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.

The applicant is currently working to complete a public safety preparedness and response plan; this will be provided as part of the Preliminary Plan Submission.

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

WSP and VCP, LLC, are working with RIDEM to remediate 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.

On October 17, 2022, RIDEM provided a letter to the City of Warwick Director of Planning stating that certain actions must occur as part of a landfill closure to satisfy the regulations before the reuse of the property can occur. Once RIDEM is satisfied with the investigation and remediation efforts, using the Site as a solar development is a reuse that RIDEM encourages. See Appendix G for a copy of the RIDEM letter.

(I) Unless required by ELUR, no substantial clearing or grading of the proposed project site shall have occurred five (5) 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 within five (5) years of the submission this application. See aerial photographs of the site below from 2022 and 2016.

2022 Aerial Photograph

2016 Aerial Photograph

(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.

The Project is not proposing any clearcutting, but will require vegetation removal along the the southern limits of the solar array for shading purposes. The Project intention is to leave all of the existing vegetation along Knight Street. The existing vegetation along Knight Street will be supplemented with landscaping plantings along the north and west.

(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.\

A chain link fence is currently the preferred method proposed along with the vegetative screening along Knight Street. The solar panels will be facing south away from abutting properties to the north and existing vegetation will remain on Site south of the solar array to screen the project from the south.

(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).

This standard will be met, see Seeding and Revegetation Plan, Note 12 on drawing C-501.

(3) Buffer plantings shall be maintained for the life of the project by the owner, applicant, and or operator of the facility.

This standard will be met.

(4) A 1 to 1 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 3 inch caliper at breast height.

This standard will be met. Trees will be removed, but whether they are 20" diameter or greater will need to be verified in the field. It is not anticipated based on previous site visits that any trees are equal to or greater than 20 inches in diameter.

(5) Soil erosion and sediment control systems shall be maintained at all times in accordance with RIDEM wetlands permit(s), and local regulations.

This standard will be met, see Drawing C-501.

(6) Clearing, cutting, girdling, and any other form of disturbance to an old growth tree or old growth forest is prohibited.

This standard will be met. No disturbance of old growth trees or forest is proposed.

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

This standard will be met. The site is a landfill; therefore no blasting or ledge removal will occur.

(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).

This standard will be met.

(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.

The Utility company requires 3 poles for the project, that will contain the Primary Meter, Fused Cutouts, and Disconnect Switch. All other equipment will be pad mounted. Connection from the disconnect switch to the pad mounted equipment will be via conduit on grade as to limit exaction on the landfill. All connections from the solar array to the equipment pad will be via cable tray on grade.

(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.

This standard will be met.

(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.

This will be provided as part of the Final Plan Submission.

(N) Perimeter fencing shall be raised a minimum of 8 inches for wildlife passage and be comprised of black coated chain link fence.

This standard will be met.

(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 twenty-four (24) hour emergency contact number.

This standard will be met.

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

This standard will be met. There will not be any lighting installed for this 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.

The applicant is currently working to complete a decommissioning plan and cost estimate; that will be provided as part of the Preliminary Plan Submission.

The applicant requests that surety funds be provided to the City of Warwick upon approval of the Final Plan Application but prior to the issuance of the building permit.

(1) Funds deposited shall be equal in amount to removal of the system, as verified by the City's peer review engineer, inclusive of 2% annual inflation over life of the system with funds deposited into an interest bearing escrow account under City control.

This standard will be met.

(2) The calculation of the decommissioning reserve shall be predicated upon the assumption that 100% 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 5 years.

This standard will be met.

(3) A separate surety of an amount equal to the cost of repairing 100% 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.

The applicant requests that the cost of repairing the pollinator mix be included as a line item in the decommissioning estimate and provide as a part of the total surety rather than as a separate surety.

(4) Within one week after permanent shutdown, the owner, applicant, and or operator shall notify the Building Official and remove the system within 6 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.

This standard will be met.

(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.

This standard will be met.

(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 per day for each violation. Each day of existence of a violation shall be deemed a separate offense.

This standard will be met.

(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.

This standard will be met.

APPENDIX

A MASTER PLAN CHECKLIST AND SITE PLAN

KNIGHT STREET SOLAR

998.40 KW DC GROUND-MOUNT SOLAR PV DEVELOPMENT
275 KNIGHT STREET
WARWICK, RHODE ISLAND
LAST ISSUED ON JANUARY 19, 2023
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	CONSTRUCTION, EROSION, AND SEDIMENTATION CONTROL DETAILS AND NOTES	C-501
5	CONSTRUCTION, EROSION, AND SEDIMENTATION CONTROL DETAILS	C-502
-	BOUNDARY & TOPOGRAPHIC SURVEY, PLAT 275 LOTS 38 & 52, KNIGHT STREET, WARWICK, RHODE ISLAND	N/A

PROPERTY OWNER

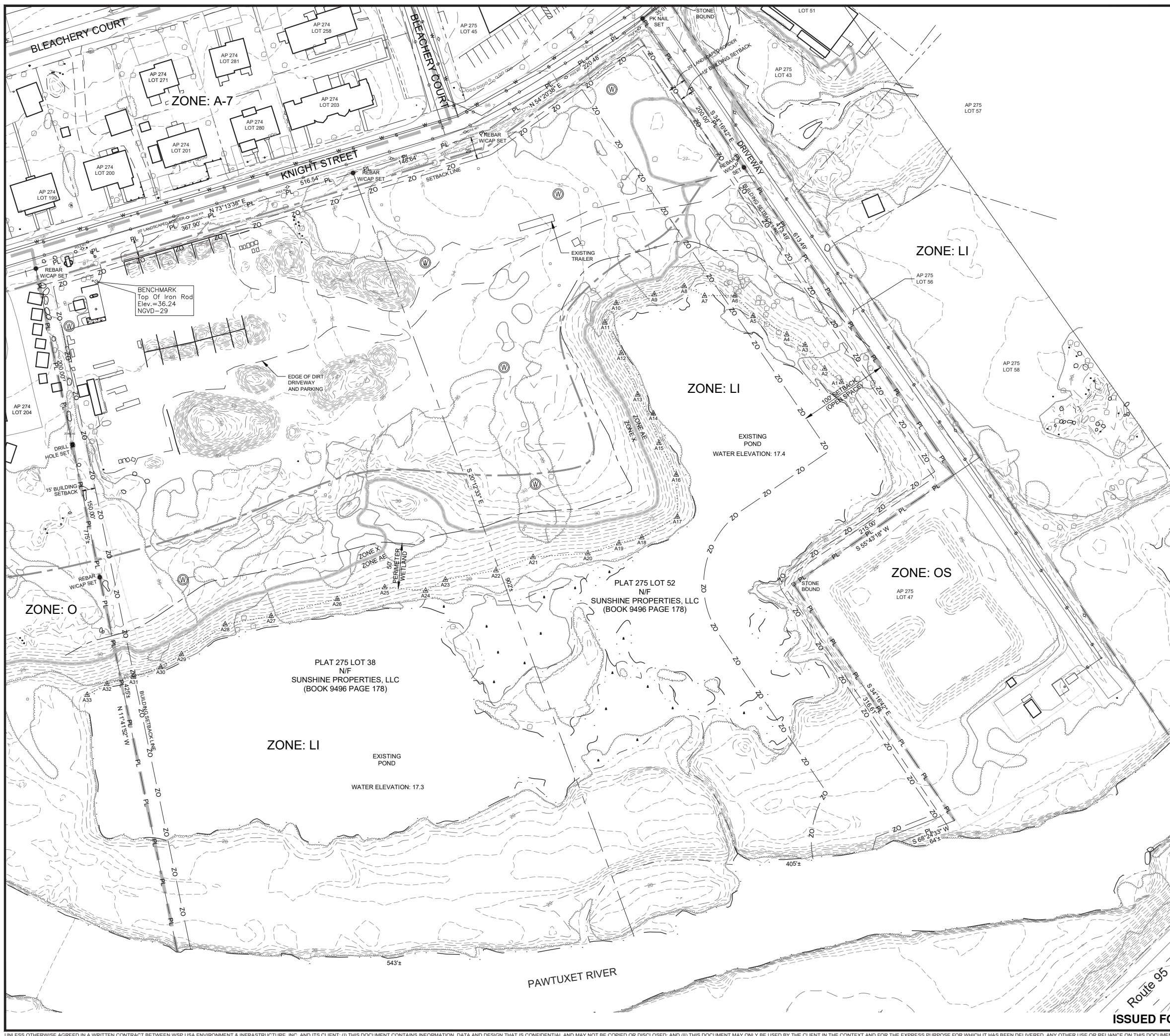
SUNSHINE PROPERTIES, LLC
181 KNIGHT ST.
WARWICK, RHODE ISLAND 02886

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



GENERAL NOTES:

1. 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.
2. HORIZONTAL DATUM IS BASED ON RHODE ISLAND STATE GRID COORDINATE SYSTEM NAD83 (2011) AND THE VERTICAL DATUM IS REFERENCED TO NAVD 29.
3. 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.
4. 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.
5. 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).
6. 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.
7. 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.
8. LANDSCAPE MATERIAL STOCKPILES WILL BE REMOVED WHEN CURRENT TENANT VACATES THE SITE.

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
- AP 274 LOT 204 — PARCEL ID
- ZONE AE / ZONE X — FEMA 100-YR FLOOD LINE WITH ZONE ID (LOCATED AT 28' ELEVATION)
- APPROXIMATE LIMIT OF WASTE
- ZONE: LI / ZONE: OS — WARWICK ZONING BOUNDARY WITH ID

1" = 50' WHEN PLOTTED ON 24" x 36" SHEET

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	APPROVED
4	1/19/2023	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	PDG	APV
3	9/10/2021	RESPONSE TO RIDEM COMMENTS	CR	GA
2	8/20/2021	RESPONSE TO RIDEM COMMENTS	CR	GA
1	6/28/2021	ADDRESSED COMMENTS	CR	GA
0	5/27/2021	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	CR	GA

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

TITLE: EXISTING CONDITIONS PLAN

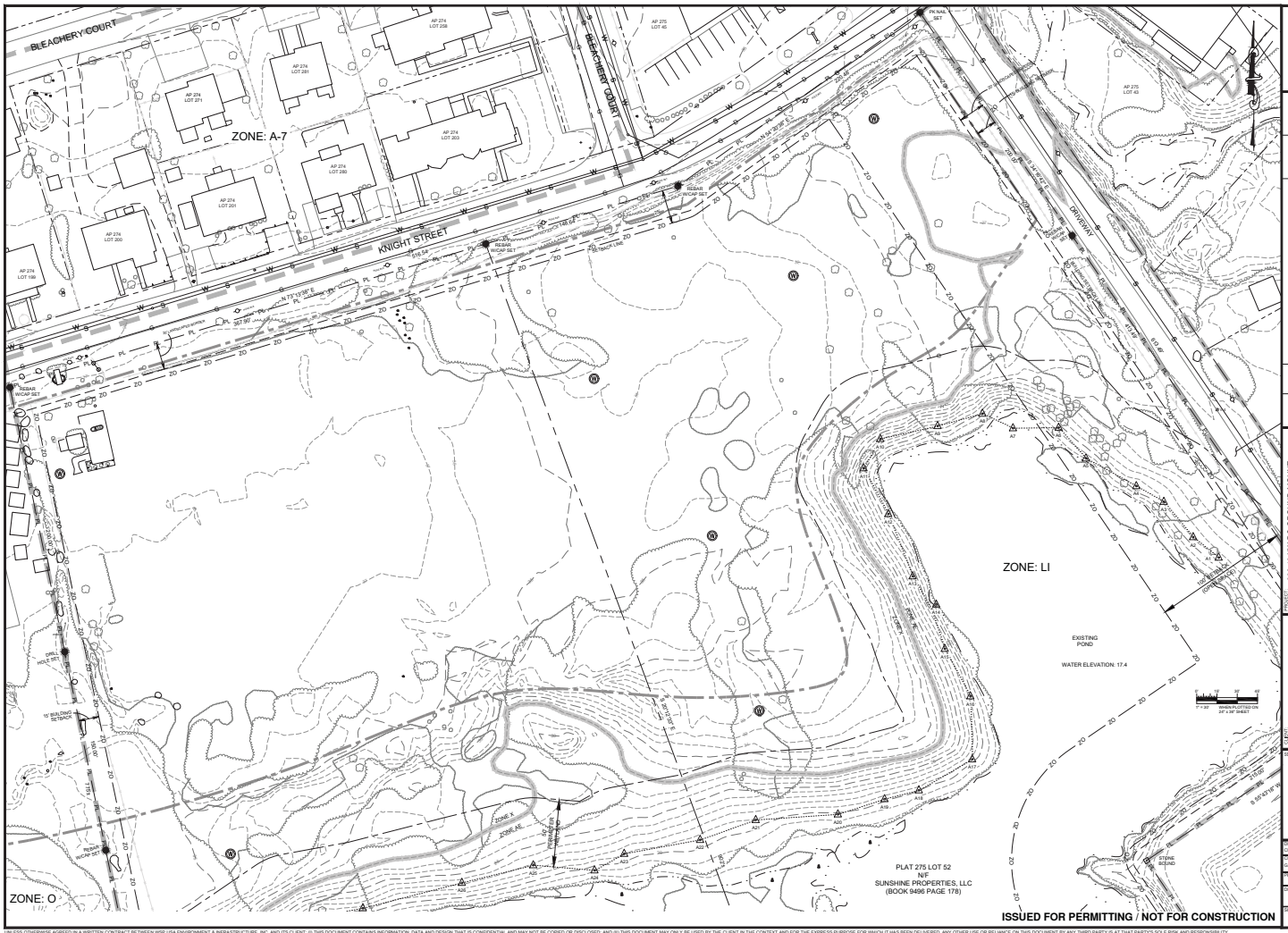
CLIENT: VCP, LLC, 150 TRUMBULL ST., HARTFORD, CT 06103 — VEROGY

SEAL: ANDREW P. VARDAKIS, STATE OF RHODE ISLAND, No. 12219, REGISTERED PROFESSIONAL ENGINEER (CIVIL), 01/19/2023

DESIGNED BY: CR	DRAWN BY: BEG
CHECKED BY: GAA	SCALE: AS SHOWN
PROJECT NUMBER: 3652200299	
DRAWING NUMBER: V-101	
SHEET NUMBER: 1 OF 5	

ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION

U:\- CAD Projects\Verogy\Knight Street\7.0 CAD\7.1 Design - Permitting\Sheets\1 - 3652200299 - V-101.dwg - Layout1 - Jan. 19, 2023 8:39am - peter.garland



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

NO.	DATE	REVISION	BY	APP.
0	3/27/2023	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	PSG	GA
1	4/28/2023	ADDRESSED COMMENTS	CR	GA
2	5/19/2023	RESPONSE TO PEER COMMENTS	CR	GA
3	6/16/2023	ADDRESSED COMMENTS	CR	GA
4	12/8/2023	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	CR	GA
5	1/19/2024	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	CR	GA

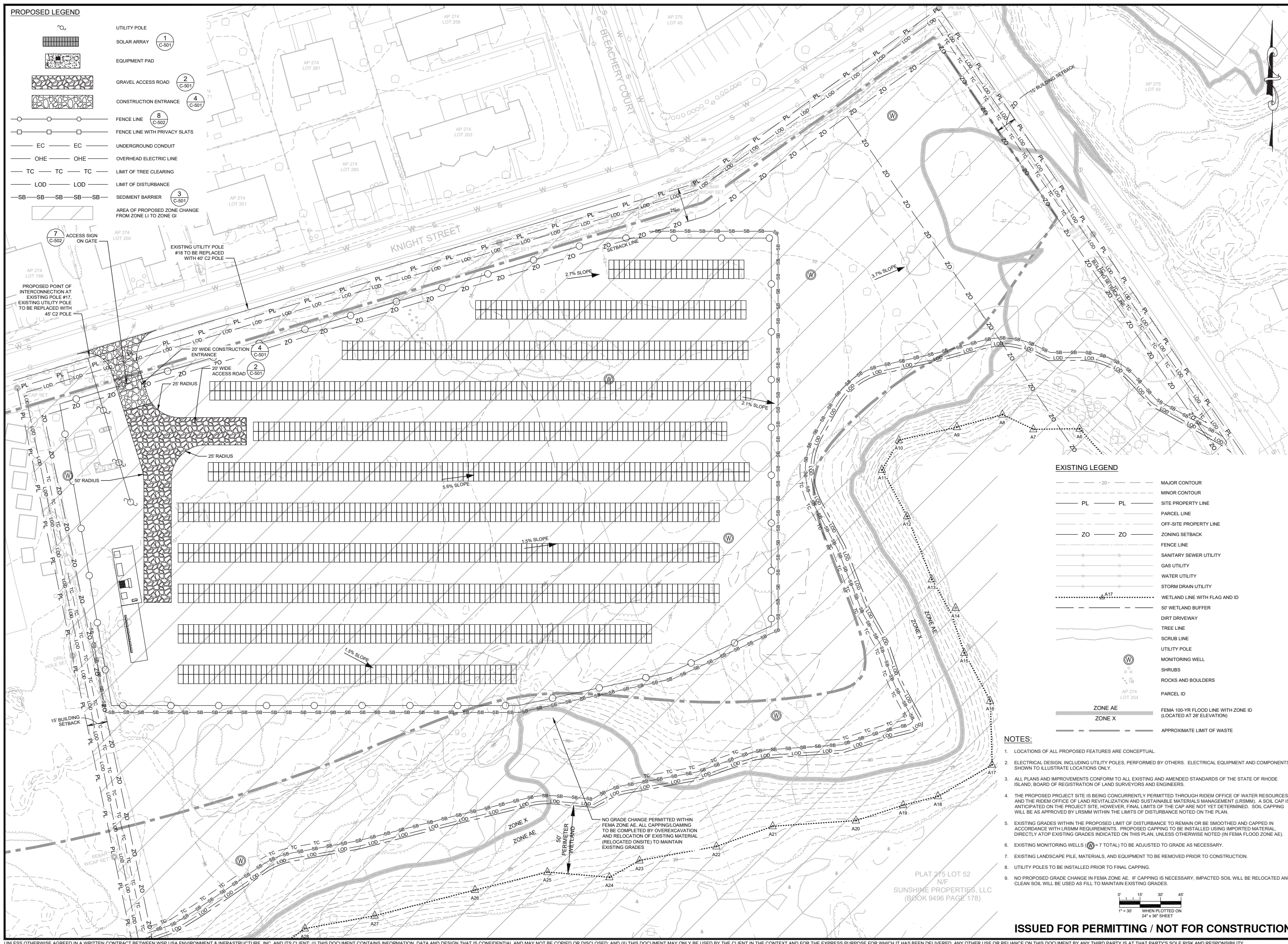
PROJECT: 998.40 KW DC GROUND-MOUNT SOLAR PV DEVELOPMENT
WASHINGTON COUNTY
WASHROCK, RHODE ISLAND

TITLE: POST-TENANT EXISTING CONDITIONS PLAN

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

SEAL: ANDREW P. VARDAKIS — No. 12219 — REGISTERED PROFESSIONAL ENGINEER (CIVIL) — 01/19/2024

DESIGNED BY: CR	DRAWN BY: MEG
CHECKED BY: GAA	SCALE: AS SHOWN
PROJECT NUMBER:	34522/00206
DRAWING NUMBER:	V-102
SHEET NUMBER:	2 OF 5



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 (LRSMM). 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 LRSMM 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 LRSMM 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.

0' 15' 30' 45'
1" = 30' WHEN PLOTTED ON 24" x 36" SHEET

ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION

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	APPROVED
4	1/19/2023	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	PDG	APV
3	9/10/2021	RESPONSE TO RIDEM COMMENTS	CR	GA
2	8/20/2021	RESPONSE TO RIDEM COMMENTS	CR	GA
1	6/28/2021	ADDRESSED COMMENTS	CR	GA
0	5/27/2021	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	CR	GA

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

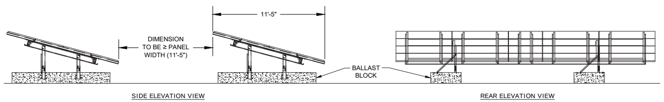
TITLE:
PROPOSED SITE PLAN

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

SEAL:
ANDREW P. VARDAKIS
STATE OF RHODE ISLAND
No. 12219
REGISTERED PROFESSIONAL ENGINEER (CIVIL)
01/19/2023

DESIGNED BY: CR	DRAWN BY: BEG
CHECKED BY: GAA	SCALE: AS SHOWN
PROJECT NUMBER: 3652200299	
DRAWING NUMBER: C-101	
SHEET NUMBER: 3 OF 5	

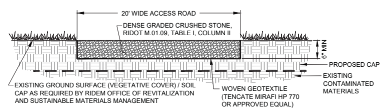
U:\- CAD Projects\Verogy\Knight Street\7.0 CAD\7.1 Design - Permitting\Sheets\3 - 3652200299 - C-101.dwg - Layout1 - Jan. 19, 2023 8:42am - peter.garland



NOTES:

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

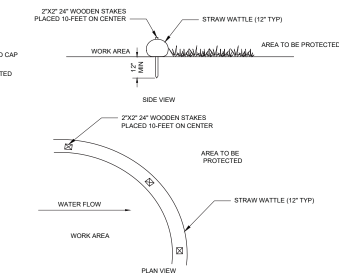
SOLAR PV ARRAY (1)
NOT TO SCALE



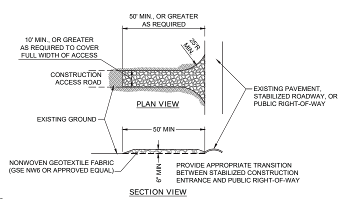
NOTES:

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

ACCESS ROAD (2)
NOT TO SCALE



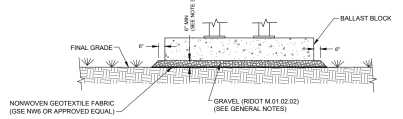
SEDIMENT BARRIER (STRAW WATTLE) (3)
NOT TO SCALE



NOTES:

1. STONE TO BE 1"-3" STONE, RECLAIMED STONE, OR RECYCLED CONCRETE EQUIVALENT.
2. LENGTH - AS REQUIRED, BUT NOT LESS THAN 50 FT.
3. THICKNESS - NOT LESS THAN SIX (6) INCHES.
4. WIDTH - TEN (10) FT. MIN, BUT NOT LESS THAN THE FULL TRAVELED WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS.
5. FILTER CLOTH - SHALL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING OF STONE.
6. SURFACE WATER - ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ENTRANCE SHALL BE PIPED ACROSS OR BENEATH THE ENTRANCE.
7. 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.
8. 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.
9. PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED AFTER EACH RAIN.

STABILIZED CONSTRUCTION ENTRANCE (4)
NOT TO SCALE



NOTES:

1. MINIMUM 6" GRAVEL TO BE PLACED 6" BEYOND ALL SIDES OF THE BLOCK.
2. 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.
3. ACTUAL BALLAST BLOCK DIMENSIONS MAY CHANGE; TOTAL BALLAST BLOCK AREA SHALL NOT EXCEED 6,000 SQFT.

BALLAST INSTALLATION (5)
NOT TO SCALE

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 ABUTTING LANDS:

1. 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.
2. 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.
3. 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.
4. 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.
5. 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.
6. 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.
7. 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.
8. 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:

1. CONSTRUCTION ACTIVITIES SHALL BE SCHEDULED TO MINIMIZE THE AREA OF DISTURBED SOIL THAT IS EXPOSED AT ONE TIME.
2. DUST CONTROL SHALL BE USED ON CONSTRUCTION ROUTES AND OTHER DISTURBED AREAS SUBJECT TO SURFACE DUST MOVEMENT AND DUST BLOWING.
3. MAINTAIN DUST CONTROL MEASURES PROPERLY THROUGH DRY WEATHER PERIODS UNTIL ALL DISTURBED AREAS HAVE BEEN PERMANENTLY STABILIZED.
4. 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.
5. VEGETATIVE COVER - FOR DISTURBED AREAS NOT SUBJECT TO TRAFFIC, VEGETATION PROVIDES THE MOST PRACTICAL METHOD OF DUST CONTROL.
6. 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.
7. SPRAY-ON ADHESIVE - LATEX EMULSIONS OR RESIN IN WATER CAN BE SPRAYED ONTO MINERAL SOIL TO PREVENT PARTICLES FROM BLOWING AWAY.
8. 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.
9. 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.
10. STONE - USED TO STABILIZE CONSTRUCTION ROADS; CAN ALSO BE EFFECTIVE FOR DUST CONTROL.
11. 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.

MONITORING PROGRAM:

1. 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.
2. 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.
3. AFTER THE CONSTRUCTION INSPECTOR HAS DETERMINED THAT THE PROJECT AREA HAS BEEN PERMANENTLY STABILIZED (70% COVER HAS BEEN ACHIVED 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.

1. 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.
2. 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.
3. 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.
4. SEEDING METHODS MAY BE DRILL SEEDINGS, BROADCASTS AND ROLLED, CULTIPACKED, OR TRACKED WITH A SMALL TRACK PIECE OF CONSTRUCTION EQUIPMENT, OR HYDRO-SEEDING, WITH SUBSEQUENT TRACKING.
5. WATERING MAY BE REQUIRED DURING DRY PERIODS CONSULT SEED MANUFACTURER'S INSTRUCTIONS.
6. STEEP SLOPES (3:1 AND STEEPER) SHALL BE STABILIZED BY INSTALLING EROSION CONTROL BLANKET (ERONET C125 BY NORTH AMERICAN GREEN, OR APPROVED EQUAL).
7. INSPECT SEEDED AREAS FOR FAILURE AND MAKE NECESSARY REPAIRS AND RESEED IMMEDIATELY. CONDUCT A FOLLOW-UP SURVEY AFTER ONE YEAR AND RESEED WHERE NECESSARY.
8. 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.
9. SEEDED AREAS SHOULD BE FERTILIZED DURING THE SECOND GROWING SEASON.
10. LIME AND FERTILIZE THEREAFTER AT PERIODIC INTERVALS, AS NEEDED. HERBICIDES SHALL NOT BE USED.
11. 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.
12. THE USE OF FUNGICIDES, PESTICIDES, HERBICIDES, INSECTICIDES, CHEMICALS, OR SOLVENTS SHALL BE PROHIBITED.

ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION

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	APPROVED
4	1/19/2023	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	PDG	APV
3	9/10/2021	RESPONSE TO RIDEM COMMENTS	CR	GA
2	8/20/2021	RESPONSE TO RIDEM COMMENTS	CR	GA
1	6/28/2021	ADDRESSED COMMENTS	CR	GA
0	5/27/2021	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	CR	GA

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

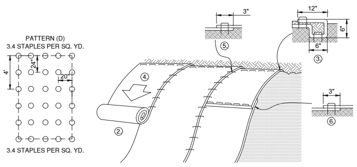
TITLE: CONSTRUCTION, EROSION, AND SEDIMENTATION CONTROL DETAILS AND NOTES

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

SEAL: ANDREW P. VARDAKIS
STATE OF RHODE ISLAND
No. 12219
HOPE
REGISTERED PROFESSIONAL ENGINEER (CIVIL)
01/19/2023

DESIGNED BY: CR	DRAWN BY: BEG
CHECKED BY: GAA	SCALE: AS SHOWN
PROJECT NUMBER: 3652200299	
DRAWING NUMBER: C-501	
SHEET NUMBER: 4 OF 5	

U:\- CAD Projects\Verogy\Knight Street\7.0 CAD\7.1 Design - Permitting\Sheets\4 - 3652200299 - C-501.dwg - Layout1 - Jan. 19, 2023 8:42am - peter.garland



STAPLE PATTERN GUIDE
6.67' WIDE ROLLS

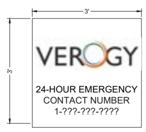
SLOPE INSTALLATION
(SEE STEPS BELOW)

NOTE:

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.

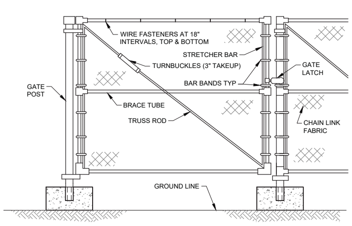
EROSION CONTROL BLANKET INSTALLATION (6)
NOT TO SCALE



NOTE:

CONTACT NUMBER TO BE FINALIZED PRIOR TO CONSTRUCTION.

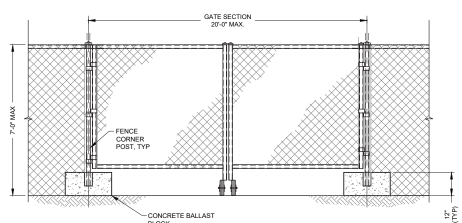
ACCESS SIGN DETAIL (7)
NOT TO SCALE



NOTES:

1. BALLAST AND FINAL FENCE DESIGN TO BE FINALIZED PRIOR TO CONSTRUCTION.

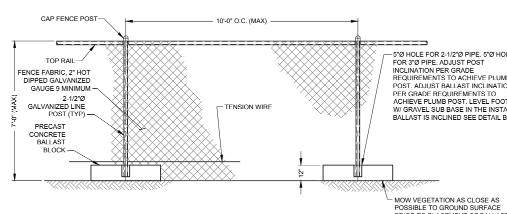
PEDESTRIAN CHAIN LINK FENCE GATE
NOT TO SCALE



NON-FROST SUSCEPTIBLE MATERIAL

FENCE GATE DETAIL
NOT TO SCALE

NOTE:
THE FENCE BALLAST DESIGN DOES NOT IMPLY COMPLIANCE WITH THE NEC OR OTHER APPLICABLE CODES OR REGULATIONS.



FENCE ELEVATION
NOT TO SCALE

BALLASTED FENCE DETAIL (8)
NOT TO SCALE

ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION

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	APPROVED
4	1/19/2023	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	PDG	APV
3	9/10/2021	RESPONSE TO RIDEM COMMENTS	CR	GA
2	8/20/2021	RESPONSE TO RIDEM COMMENTS	CR	GA
1	6/28/2021	ADDRESSED COMMENTS	CR	GA
0	5/27/2021	ISSUED FOR PERMITTING / NOT FOR CONSTRUCTION	CR	GA

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

TITLE:
CONSTRUCTION, EROSION, AND SEDIMENTATION CONTROL DETAILS 1

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

SEAL:
ANDREW P. VARDAKIS
STATE OF RHODE ISLAND
No. 12219
HOPE
REGISTERED PROFESSIONAL ENGINEER (CIVIL)
01/19/2023

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

PROJECT NUMBER: 3652200299

DRAWING NUMBER: **C-502**

SHEET NUMBER: **5 OF 5**

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:

1.) 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.

2.) 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.

3.) 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.

4.) 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.

5.) The gas line location depicted hereon was compiled from information provided by National Grid.

6.) The wetlands depicted hereon were field survey located July 30, 2008 by Cherenzia & Associates, Ltd.

7.) 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.

8.) 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 28)

"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

NATHAN D. LAUDER
No. 1842
PROFESSIONAL LAND SURVEYOR

PLAN REVISIONS			
DATE	DESCRIPTION	DWN BY	CHK BY

STREET INDEX
KNIGHT STREET

Civil Engineers
Land Surveyors
Land Use Planners
Environmental Consultants
CHERENZIA
& ASSOCIATES, LTD.
Raymond F. Cherenzia, P.E., L.S.

BOUNDARY & TOPOGRAPHIC SURVEY
PREPARED FOR
KNIGHT STREET GROUP, LLC
PLAT 275 LOTS 38 & 52
KNIGHT STREET
WARWICK, RHODE ISLAND

SCALE: 1"=60' DRAWN BY: TWS
MARCH 27, 2009 CHECK BY: NDL

60 0 60 120 180 Feet

SHEET: 1 OF 1 JOB NO.: 208064

APPENDIX C
CITY OF WARWICK, RHODE ISLAND
INSTRUCTIONS AND CHECKLIST FOR MAJOR SUBDIVISIONS AND MAJOR LAND DEVELOPMENT PROJECTS

These **Instructions** and **Checklist** apply to **Major Subdivisions**, as defined in Section 2.3.3, and **Major Land Development Projects.**

There are four (4) stages of review - Preapplication, Master Plan, Preliminary Plan and Final Plan. See Article 5 for purposes, meetings and other requirements. The Checklist below is intended to guide the Applicant through each stage by noting submission requirements.

1. Preapplication

Application Form for Submission of Major Subdivision and Major Land Development Plans and submit to the Administrative Officer with the following:

One (1) copy of a proposed subdivision or land development plan, which shall at least be a copy of the appropriate sheet(s) of the City of Warwick Assessors Plat. The Applicant need only depict an illustrative site plan, sufficient for general discussion and concept review. Required submissions are noted with a • in the Checklist under Column 1.

2. Master Plan

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

Five (5) copies of a narrative report (8 1/2 x 11 sheets, stapled or bound) providing a general description of the existing physical environment and existing use(s) of the property along with a general description of the uses and type of development proposed by the Applicant. Required submissions are noted with a • in the Checklist under Column 2. In addition, the report shall include items noted below:

X A. An aerial photograph or a copy of an existing aerial photograph of the proposed subdivision or land development parcel and surrounding area may be required by the Administrative Officer.

X B. A copy of the soils map of the subdivision or land development parcel(s) and surrounding area, and a general analysis of soil types and suitability for the development proposed.

X C. Site Plan suitable for public presentation.

N/A D. An estimate of the approximate number of people, including school-aged children to be housed in the proposed or land development.

N/A E. Proposed phasing, if any.

X 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.

TBD 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.

TBD 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.

X 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.

N/A 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 archaeologic 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) 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 filling 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)~~ 10 blue print 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 •
X	1	•	•	•	•	Application Form with name and address of Applicant and/or property owner
X	2		•	•	•	Date of plan preparation, with revision date(s) (if any).
X	3		•	•	•	Graphic scale and true north arrow.
X	4	•	•	•	•	Plat and lot number(s) of the parcel being subdivided.
X	5	•	•	•	•	Zoning district(s) of the parcel being subdivided. If more than one district, zoning boundary lines must be shown.
X	6		•	•	•	Deed Book and Page References must be shown.
X	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.
X	9		•			Location and dimensions of existing property lines within or adjacent to the subdivision or land development parcel.
X	10			•	•	Existing property lines shall show interior angles and distances.
X	11		•	•	•	Location and dimensions of existing easements and rights-of-way, including, buildings, water courses, railroads, utilities, and other similar features.
X	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 •
X 13	•	•	•	•	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.
14		•	•		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.
X 15		•	•	•	Location of wooded areas, if any, and notation of existing groundcover.
X 16	•				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.
X 17		•			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.
18			•	•	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.
X 19			•	•	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 20			•	•	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.
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).
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.
25			•	•	Base flood elevation data.
26			•		Soil erosion and sediment control plan.
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.
30			•		Proposed street plan, profiles and cross-sections drawn at a scale of not less than 1" = 40'.
31			•	•	Monuments - See Appendix D, Section D.5.a
32			•	•	Proposed street names.

X

N/A

N/A

X-FEMA Map

N/A

N/A

	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.
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).
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.
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: 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

APPENDIX

B

AERIAL MAP, HALF MILE VICINITY MAP, 200-FOOT ABUTTER MAP AND LIST

AERIAL MAP

Ground -Mount Solar Development
Knight Street Solar
Parcel ID 275-0038 and 275-0052
Master Plan

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

Legend

Site Property Line

Notes & Sources

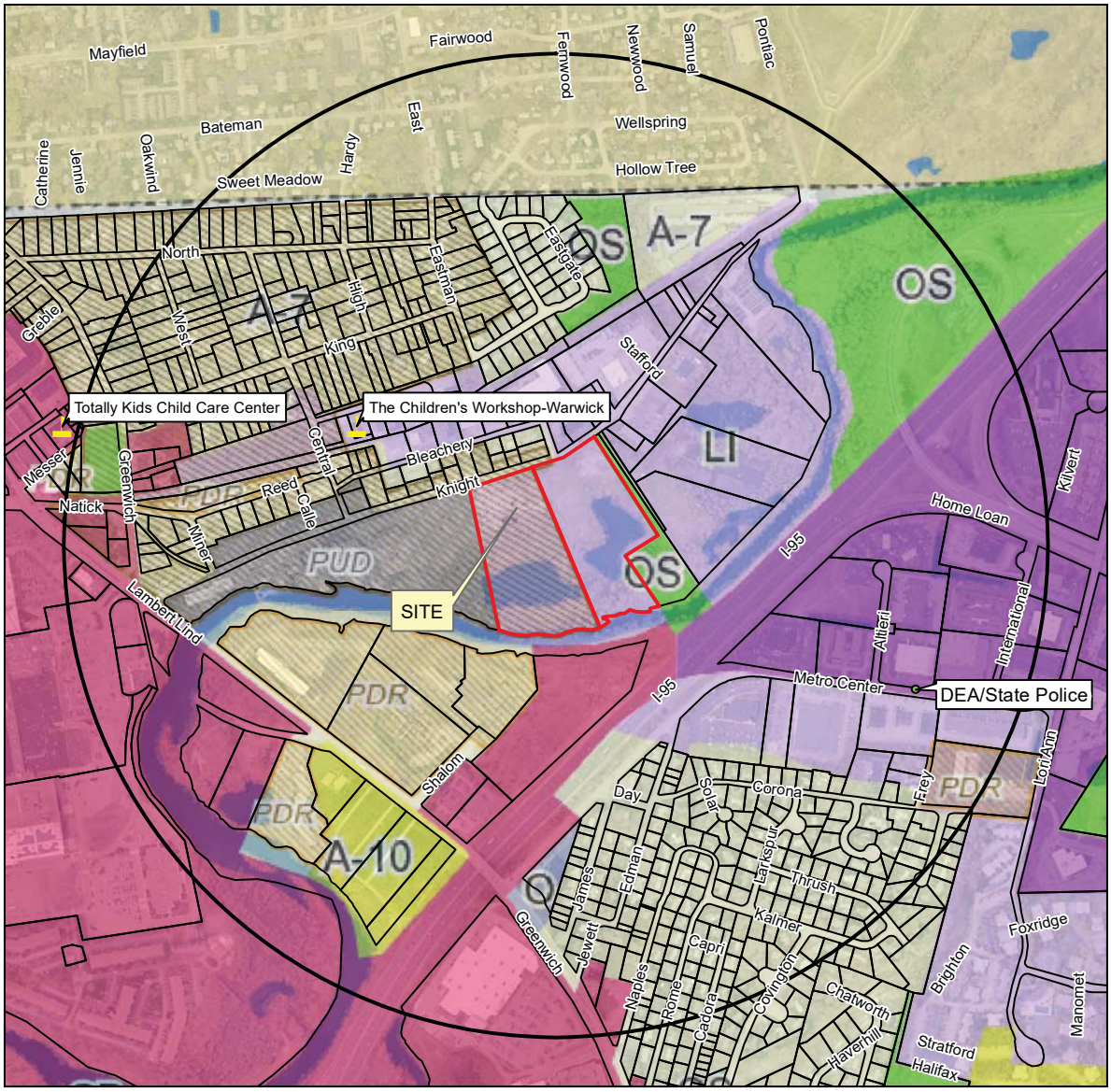
0 0.1 Miles

N

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

FIGURE 1

H:\Verogy\Warwick_RI\Task1\MXD\Fig1_AerialMap.mxd May 03, 2021 DWN: ilana.ton CHKD: CMR



VICINITY MAP

Ground -Mount Solar Development
Knight Street Solar
Parcel ID 275-0038 and 275-0052
Master Plan

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

Legend

- Schools
- State Facilities
- Site Property Line
- Half Mile Buffer
- Parcel Lines
- (H) Historic
- (IE) Institutional - Educational
- (IH) Institutional - Health Care
- (PDR) Planned District Residential
- (PUD) Planned Unit Development
- (PUD/Office/Historic)
- (R) Restrictions
- (SFC) Single Family Cluster
- (V) Village
- (A-7) Residence A-7 District
- (A-10) Residence A-10 District
- (A-15) Residence A-15 District
- (A-40) Residence A-40 District
- (G) Gateway
- (GB) General Business District
- (GI) General Industrial District
- (IM) Warwick Station Intermodal District
- (LI) Light Industrial District
- (O) Office District
- (OS) Open Space District
- (V) Village District
- (WB) Waterfront Business District

Notes & Sources

Notes: Schools and State Facilities datalayers obtained from RIGIS. Unofficial Zoning datalayer is approximated. Fires Stations are not visible within the current extent.

0 0.1 Miles

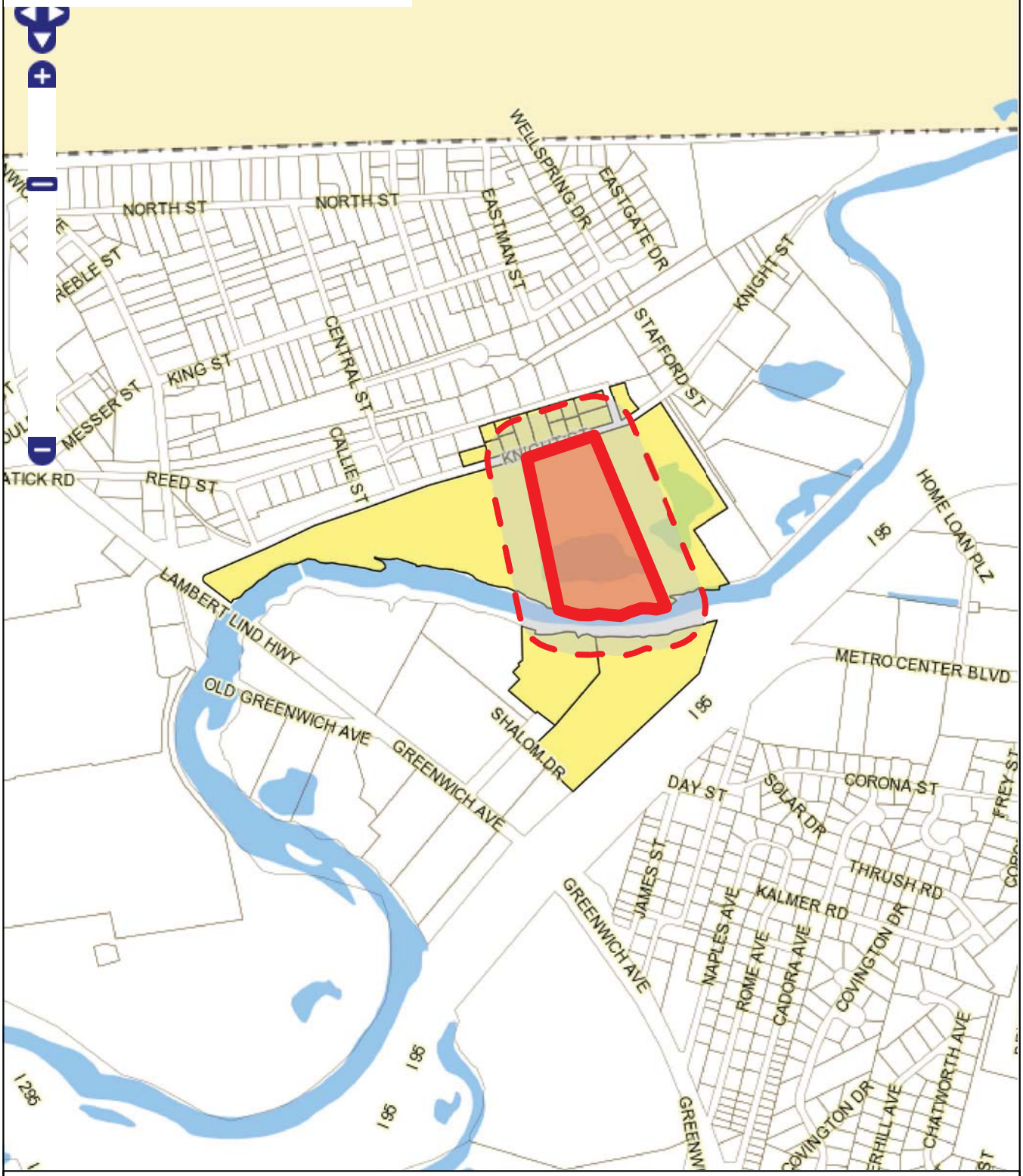
N

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

FIGURE 1

H:\Verogy\Warwick_RI\Task1\MXD\Fig1_VicinityMap.mxd May 10, 2021 DWN: ilana.ton CHKD: CMR

200-foot Abutters Lot 38



City of Warwick, Rhode Island

Selected Parcel: KNIGHT ST ID: 275-0038

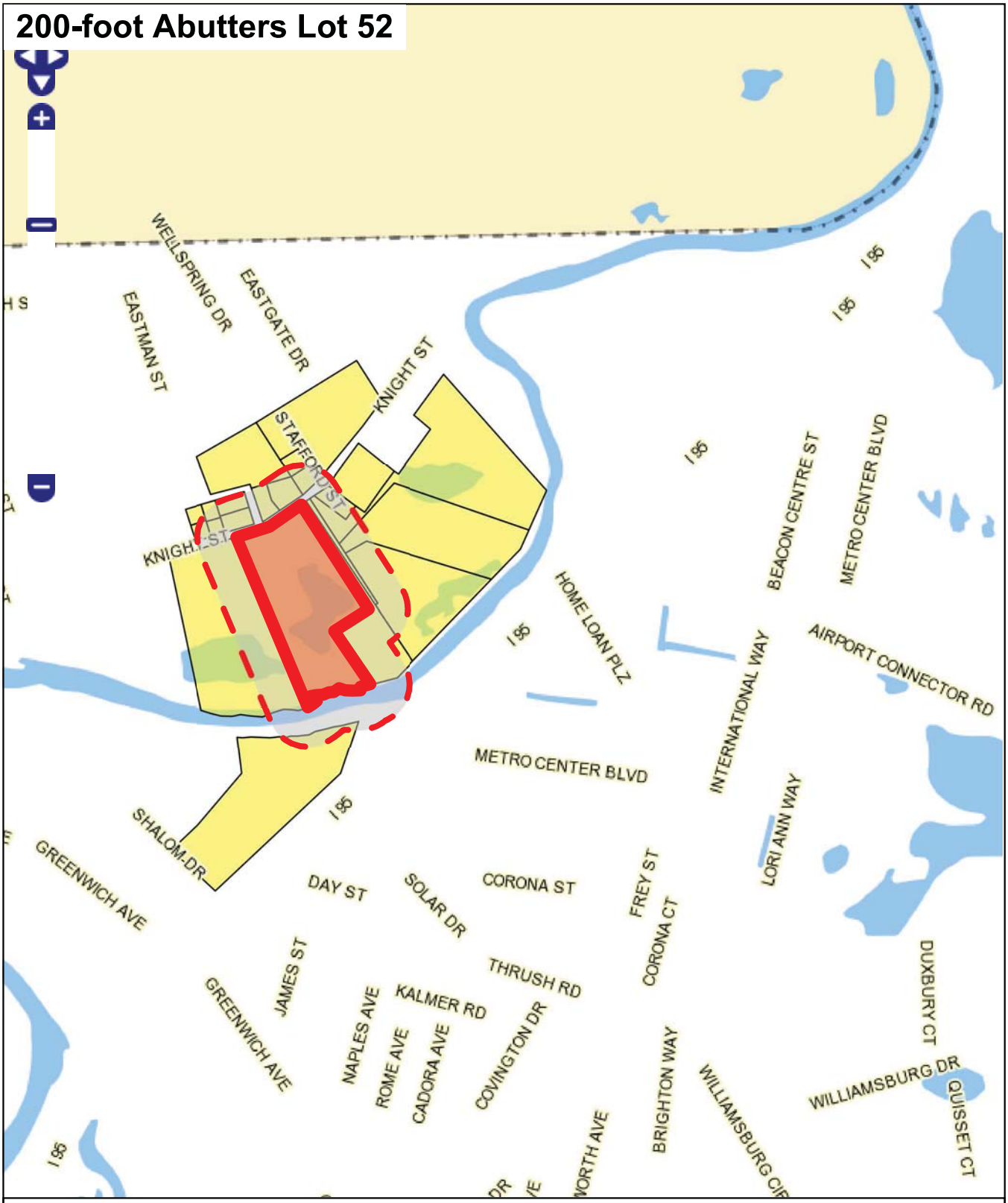
Printed on 10/25/2021

200 m
1000 ft

N

MainStreetMaps
MainStreetGIS, LLC
www.mainstreetgis.com

200-foot Abutters Lot 52



City of Warwick, Rhode Island

Selected Parcel: KNIGHT ST ID: 275-0052

Printed on 10/25/2021

200 m
1000 ft

N

MainStreetMaps
MainStreetGIS, LLC
www.mainstreetgis.com

Parcel ID: 271-019 I -0000
JEWISH HOME FOR THE AGED OF RI
99 HILLSIDE AVE
WARWICK RI 02886

Parcel ID: 271-0192-0000
SHALOM HOUSING INC
1 SHALOM DR
WARWICK RI 02886

Parcel ID: 274-0196-0000
SOUZA, BRIAN M
269 KNIGHT ST
WARWICK RI 02886

Parcel ID: 274-0197-0000
LEMAY, LORINE D & LARRY T/E
159 WELLSPRING DR
WARWICK RI 02886

Parcel ID: 274-0199-0000
MURPHY, ROBERT & LOMAS, NANCY
TR'S
SHAW, LAURINDA IRREVOC TRUST
241 KNIGHT ST
WARWICK RI 02886

Parcel ID: 274-0200-0000
OGARA, ROBERT W JR
233 KNIGHT ST
WARWICK RI 02886

Parcel ID: 274-0201-0000
TRAVER, RONALD J JR
225 KNIGHT ST
WARWICK RI 02886

Parcel ID: 274-0203-0000
FOOKS, WILLIAM B
43 MAGNOLIA LN
COVENTRY RI 02816

Parcel ID: 274-0204-MAIN

Parcel ID: 274-0204-000J
BT HOTEL WARWICK LLC
C/O JOHN BAILEY
DALLAS TX 75254

Parcel ID: 274-0258-0000
FOOKS, WILLIAM B
43 MAGNOLIA LN
COVENTRY RI 02816

Parcel ID: 274-0271-0000
READ, ALEXANDER
129DOVER LN
RICHMOND RI 02812

Parcel ID: 274-0272-0000
TSAI, XIE XI
TSAI, BETTY J
118 SUMMIT AVENUE
WAKEFIELD RI 02879

Parcel ID: 274-0276-0000
MORAN, BARBARA A
249 KNIGHT ST
WARWICK RI 02886

Parcel ID: 274-0277-0000
HOPKINS, JAMES A
HOPKINS, LORI A
249 KNIGHT ST
WARWICK RI 02886

Parcel ID: 274-0280-0000
RIVERA, ANTHONY
215-217 KNIGHT STREET
WARWICK RI 02886

Parcel ID: 274-0281-0000
ALLEN THOMAS V TRUSTEE
400 NARRAGANSETT PKWY SC-2
WARWICK RI 02888

Parcel ID: 275-0038-0000
SUNSHINE PROPERTIES LLC
181 KNIGHT ST
WARWICK RI 02886

Parcel ID: 275-0045-0000
KNIGHT ST HOLDING LLC
181 KNIGHT ST
WARWICK RI 02888

Parcel ID: 275-0052-0000
SUNSHINE PROPERTIES LLC
181 KNIGHT ST
WARWICK RI 02886

Parcel ID: 275-0010-0000
JCK LLC
159 KNIGHT ST
WARWICK RI 02886

Parcel ID: 275-0004-0000
RUSCO REAL ESTATE CO
25 BLEACHERY CT
WARWICK RI 02886

Parcel ID: 275-0009-0000
PETRO HOLDINGS INC
BOX 283
TIVERTON RI 02878

Parcel ID: 275-0048-0000
WEST BAY RESIDENTIAL SERVICES INC
158 KNIGHT ST
WARWICK RJ 02886

Parcel ID: 275-0046-0000
KNIGHT ST HOLDINGS LLC
181 KNIGHT ST
WARWICK RI 02888

Parcel ID: 275-0043-0000
BLOUNT COMMUNICATIONS INC
19 LUTHER AVE
WARWICK RI 02886

Parcel ID: 275-0056-0000
CITY OF WARWICK
3275 POST RD
WARWICK RI 02886

Parcel ID: 275-0051-0000
DEL'S LEMONADE & REFRESHMENTS INC
1260 **OAKLAWN AVE**
CRANSTON RI 02905

Parcel ID: 275-0047-0000
CITY OF WARWICK
3275 POST RD
WARWICK RI 02886

Parcel ID: 275-0057-0000
BLOUNT COMMUNICATIONS INC
19 LUTHER AVE
WARWICK RI 02886

Parcel ID: 275-0058-0000
BLOUNT COMMUNICATIONS INC
19 LUTHER AVE
WARWICK RI 02886

Parcel ID: 275-0112-0000
PETRO HOLDINGS INC
PO BOX283
TIVERTON RI 02878

APPENDIX

C LETTER OF FINDINGS - WETLANDS

Natural Resource Services, Inc.

February 12, 2021

Gregory Avenia, PE
Wood Environmental & Infrastructure Solutions
275 Promenade Street, Suite 100
Providence, RI 02908

RE: Freshwater Wetland Delineations
A.P. 275, Lots 38 & 52; Knight Street
Warwick, Rhode Island

Dear Mr. Avenia:

Natural Resource Services, Inc. (NRS) has completed the freshwater wetland delineation within the above referenced properties. This fieldwork was performed by staff biologist Hannah Chace on February 4th 2021. The wetland delineation was established in accordance with the standards outlined in Appendix 2 of the Rules and Regulations Governing the Administration and Enforcement of the Freshwater Wetlands Act (250 RICR 150-15-1). These land-use regulations are administered by the RI Department of Environmental Management (DEM), Office of Water Resources (OWR). It is important to note that in accordance with Section 1.8 (C)(4) of these regulations, all delineations performed by wetland consultants are not considered to be accurate for state regulatory purposes until the work is reviewed and approved by the DEM, OWR.

As part of our work, a hand-held GPS unit was used to locate the established wetland flagging. While this location work should not be construed as a professional survey, the data obtained is valuable for preliminary planning purposes. An aerial photograph is attached to this letter. The GPS data has been added as an overlay on the photo to provide a visual representation of the established wetland delineation.

The town tax assessor's database has the combined area of the subject lots listed as approximately 16.29 acres. The property has a road frontage access point on the southern side of Knight Street. A review of historic aerial photos reveals that the property has undergone a great deal of disturbance in the last 90 plus years. The property was clear cut within the interior of the property between at least 1939 and 1972. The wetlands on the property as they exist today appear to have been constructed between 1972 and 1981. These wetlands were previously verified by the DEM, OWR in 2010 (DEM File No. 10-0104).

NRS has field delineated a swamp contiguous to a pond within the southern portion of the property. The flag series labeled A1-A33 depicts the northernmost boundaries of the swamp. The freshwater wetland regulations define a swamp as a wetland which is greater than three (3) acres in total size and dominated by woody trees and shrubs. The shaded green area on the

P.O. Box 311 Harrisville, RI 02830 401-568-7390 FAX 401-568-7490

enclosed graphic represents the swamp. The regulations require the addition of a 50-foot perimeter wetland to the delineated limit of any swamp. The 50-foot perimeter wetland is identified by the yellow dashed line.

The Pawtuxet River which borders the southern edge of the property is depicted as a blue-lined perennial stream on the most recent US Geological Survey Topographic Maps for Warwick. The freshwater wetland regulations define any "blue-lined" perennial watercourse as a river. The portion of the river within the site appears to have an average width greater than 10 feet, thus a 200-foot riverbank wetland is required.

The freshwater wetland regulations consider the perimeter and riverbank wetlands as part of an integrated ecological system where no component is less worthy of regulatory protection than the wetland as a whole. As such, any proposed land disturbing activities within either the 50-foot perimeter or 200-foot riverbank wetland requires a permit from the DEM, OWR.

It is important to note that a new state freshwater wetlands law was enacted in July of 2015. This law made changes to the jurisdictional limits currently utilized in the regulations. The Department of Environmental Management (DEM) is writing new regulations pursuant to this statute which will require buffer zones for all freshwater wetlands. While a comprehensive timeline has not been established for the enactment of these rules, it is anticipated that they will be in effect at some point in 2021. If you submit an application for development prior to the promulgation of these rules, your project would then be grandfathered under the current wetland regulations and not subject to any new standards.

Please do not hesitate to contact me if you have any questions regarding the information presented in this letter of findings.

Very truly yours,

Scott P. Rabideau, PWS
Principal

Enclosures


1972


1981


2020

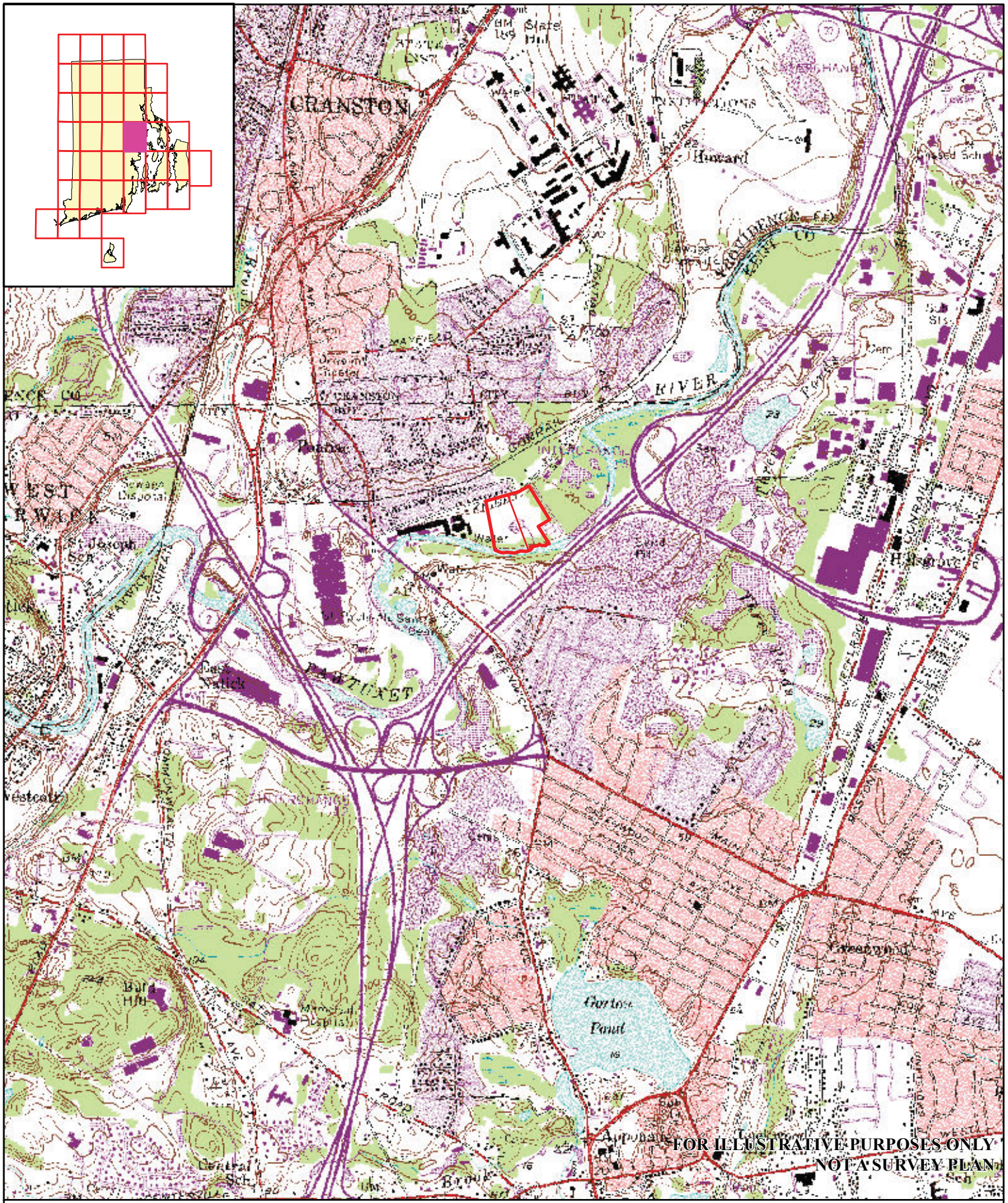
Site Sketch Depicting
Approximate Wetland Delineation
Knight St
A.P. 275, Lots 38 & 52
Warwick, RI

Performed by:
Hannah Chace - Staff Biologist - 2/4/2021
Located using a handheld Trimble GeoXH

N
W E
S

April 2020 aerial
RI DEM Mapping

Natural Resource Services, Inc.
PO Box 311
180 Tinkham Lane
Harrisville, RI 02830
p: (401) 568-7390
f: (401) 568-7490



USGS Topographic Map
Knight St
A.P. 275, Lots 38 & 52

Warwick, RI

East Greenwich Quad Map

Approximate Site Location

USGS Topographic Series

Contour Interval 10 Feet

National Geodetic Vertical Datum of 1929

Feet

0 1,000 2,000 4,000

N W E S

RIGIS

Natural Resource Services, Inc.
PO Box 311
180 Tinkham Lane
Harrisville, RI 02830
p: (401) 568-7390
f: (401) 568-7490

Wetland Edge Delineation Data Form (WETLAND)

Applicant: Wetland No.

Project: A.P 275, Lots 38 & 52; Knight Street Flag No. Sequence: A1-A33

City/Town: Warwick Date: 2/4/2021

Vegetation: List the three dominant species in each vegetative strata along with their NWI status:

Tree	Indicator Status	Herbs	Indicator Status
1.		1. Phragmites australis	FACW
2.		2.	
3.		3.	

Saplings/Shrubs	Woody Vines
1.	1.
2.	2.
3.	3.

List other vegetative species noted which may have affected determination of the wetland edge: _____.

Soil: SCS Soil Survey Mapping Unit: W
On Hydric Soils List? (Y/N) Y

Soil Profile (Note wetland flag no. nearest soil test pit): A25

Horizon	Depth	Matrix Color	Mottling Description	Depth to Saturation	Depth to Free Water
HTM	0-12"	10YR 3/3		Surface	3"

Other hydrological indicators (e.g. water marks, drainage patterns, root rhizospheres, etc.; see Appendix 4(A)(4) of the Rules):

Landscape position: Toeslope
Altered/atypical situation? (describe) Disturbed Site

Comments:

Wetland Edge Delineation Data Form (UPLAND)

Applicant:

Wetland No.

Project: A.P 275, Lots 38 & 52; Knight Street

Flag No. Sequence: A1-A33

City/Town: Warwick

Date: 2/4/2021

Vegetation: List the three dominant species in each vegetative strata along with their NWI status:

Tree	Indicator Status
1.	
2.	
3.	

Herbs	Indicator Status
1. Polygonum cuspidatum	FACU
2.	
3.	

Saplings/Shrubs	
1. Amelanchier canadensis	FAC
2.	
3.	

Woody Vines	
1. Celastrus orbiculatus	UPL
2.	
3.	

List other vegetative species noted which may have affected determination of the wetland edge: _____.

Soil: SCS Soil Survey Mapping Unit: UD

On Hydric Soils List? (Y/N) N

Soil Profile (Note wetland flag no. nearest soil test pit): A25

Horizon	Depth	Matrix Color	Mottling Description	Depth to Saturation	Depth to Free Water
HTM	0-10"	10YR 4/4			

Other indicators exhibiting an absence of wetland hydrology (e.g. absence of water marks, lack of redoximorphic features, lack of oxidized rhizospheres, etc.):

Landscape position: Backslope

Altered/atypical situation? (describe) Disturbed Site

Comments:

APPENDIX

D 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

January 22, 2021

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

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

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

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

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.

N

Meters
0 35 70 140 210

Feet
0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

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

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

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

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

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: 9lxk
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.

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Glossary

Many of the terms relating to landforms, geology, and geomorphology are defined in more detail in the following National Soil Survey Handbook link: “National Soil Survey Handbook.”

ABC soil

A soil having an A, a B, and a C horizon.

Ablation till

Loose, relatively permeable earthy material deposited during the downwasting of nearly static glacial ice, either contained within or accumulated on the surface of the glacier.

AC soil

A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil

The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil

Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil

A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvial cone

A semiconical type of alluvial fan having very steep slopes. It is higher, narrower, and steeper than a fan and is composed of coarser and thicker layers of material deposited by a combination of alluvial episodes and (to a much lesser degree) landslides (debris flow). The coarsest materials tend to be concentrated at the apex of the cone.

Alluvial fan

A low, outspread mass of loose materials and/or rock material, commonly with gentle slopes. It is shaped like an open fan or a segment of a cone. The material was deposited by a stream at the place where it issues from a narrow mountain valley or upland valley or where a tributary stream is near or at its junction with the main stream. The fan is steepest near its apex, which points upstream, and slopes gently and convexly outward (downstream) with a gradual decrease in gradient.

Alluvium

Unconsolidated material, such as gravel, sand, silt, clay, and various mixtures of these, deposited on land by running water.

Alpha,alpha-dipyridyl

A compound that when dissolved in ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction implies reducing conditions and the likely presence of redoximorphic features.

Animal unit month (AUM)

The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Aquic conditions

Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Argillic horizon

A subsoil horizon characterized by an accumulation of illuvial clay.

Arroyo

The flat-floored channel of an ephemeral stream, commonly with very steep to vertical banks cut in unconsolidated material. It is usually dry but can be transformed into a temporary watercourse or short-lived torrent after heavy rain within the watershed.

Aspect

The direction toward which a slope faces. Also called slope aspect.

Association, soil

A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity)

The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low: 0 to 3
Low: 3 to 6
Moderate: 6 to 9
High: 9 to 12
Very high: More than 12

Backslope

The position that forms the steepest and generally linear, middle portion of a hillslope. In profile, backslopes are commonly bounded by a convex shoulder above and a concave footslope below.

Backswamp

A flood-plain landform. Extensive, marshy or swampy, depressed areas of flood plains between natural levees and valley sides or terraces.

Badland

A landscape that is intricately dissected and characterized by a very fine drainage network with high drainage densities and short, steep slopes and narrow interfluves. Badlands develop on surfaces that have little or no vegetative cover overlying unconsolidated or poorly cemented materials (clays, silts, or sandstones) with, in some cases, soluble minerals, such as gypsum or halite.

Bajada

A broad, gently inclined alluvial piedmont slope extending from the base of a mountain range out into a basin and formed by the lateral coalescence of a series of alluvial fans. Typically, it has a broadly undulating transverse profile, parallel to the mountain front, resulting from the convexities of component fans. The term is generally restricted to constructional slopes of intermontane basins.

Basal area

The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.

Base saturation

The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Base slope (geomorphology)

A geomorphic component of hills consisting of the concave to linear (perpendicular to the contour) slope that, regardless of the lateral shape, forms an apron or wedge at the bottom of a hillside dominated by colluvium and slope-wash sediments (for example, slope alluvium).

Bedding plane

A planar or nearly planar bedding surface that visibly separates each successive layer of stratified sediment or rock (of the same or different lithology)

from the preceding or following layer; a plane of deposition. It commonly marks a change in the circumstances of deposition and may show a parting, a color difference, a change in particle size, or various combinations of these. The term is commonly applied to any bedding surface, even one that is conspicuously bent or deformed by folding.

Bedding system

A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bedrock

The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-controlled topography

A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bench terrace

A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum

Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout (map symbol)

A saucer-, cup-, or trough-shaped depression formed by wind erosion on a preexisting dune or other sand deposit, especially in an area of shifting sand or loose soil or where protective vegetation is disturbed or destroyed. The adjoining accumulation of sand derived from the depression, where recognizable, is commonly included. Blowouts are commonly small.

Borrow pit (map symbol)

An open excavation from which soil and underlying material have been removed, usually for construction purposes.

Bottom land

An informal term loosely applied to various portions of a flood plain.

Boulders

Rock fragments larger than 2 feet (60 centimeters) in diameter.

Breaks

A landscape or tract of steep, rough or broken land dissected by ravines and gullies and marking a sudden change in topography.

Breast height

An average height of 4.5 feet above the ground surface; the point on a tree where diameter measurements are ordinarily taken.

Brush management

Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Butte

An isolated, generally flat-topped hill or mountain with relatively steep slopes and talus or precipitous cliffs and characterized by summit width that is less than the height of bounding escarpments; commonly topped by a caprock of resistant material and representing an erosion remnant carved from flat-lying rocks.

Cable yarding

A method of moving felled trees to a nearby central area for transport to a processing facility. Most cable yarding systems involve use of a drum, a pole, and wire cables in an arrangement similar to that of a rod and reel used for fishing. To reduce friction and soil disturbance, felled trees generally are reeled in while one end is lifted or the entire log is suspended.

Calcareous soil

A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche

A general term for a prominent zone of secondary carbonate accumulation in surficial materials in warm, subhumid to arid areas. Caliche is formed by both geologic and pedologic processes. Finely crystalline calcium carbonate forms a nearly continuous surface-coating and void-filling medium in geologic (parent) materials. Cementation ranges from weak in nonindurated forms to very strong in indurated forms. Other minerals (e.g., carbonates, silicate, and sulfate) may occur as accessory cements. Most petrocalcic horizons and some calcic horizons are caliche.

California bearing ratio (CBR)

The load-supporting capacity of a soil as compared to that of standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Canopy

The leafy crown of trees or shrubs. (See Crown.)

Canyon

A long, deep, narrow valley with high, precipitous walls in an area of high local relief.

Capillary water

Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena

A sequence, or “chain,” of soils on a landscape that formed in similar kinds of parent material and under similar climatic conditions but that have different characteristics as a result of differences in relief and drainage.

Cation

An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity

The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Catsteps

See Terracettes.

Cement rock

Shaly limestone used in the manufacture of cement.

Channery soil material

Soil material that has, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a channer.

Chemical treatment

Control of unwanted vegetation through the use of chemicals.

Chiseling

Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Cirque

A steep-walled, semicircular or crescent-shaped, half-bowl-like recess or hollow, commonly situated at the head of a glaciated mountain valley or high on the side of a mountain. It was produced by the erosive activity of a mountain glacier. It commonly contains a small round lake (tarn).

Clay

As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay depletions

See Redoximorphic features.

Clay film

A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Clay spot (map symbol)

A spot where the surface texture is silty clay or clay in areas where the surface layer of the soils in the surrounding map unit is sandy loam, loam, silt loam, or coarser.

Claypan

A dense, compact subsoil layer that contains much more clay than the overlying materials, from which it is separated by a sharply defined boundary. The layer restricts the downward movement of water through the soil. A claypan is commonly hard when dry and plastic and sticky when wet.

Climax plant community

The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse textured soil

Sand or loamy sand.

Cobble (or cobblestone)

A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material

Material that has 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

COLE (coefficient of linear extensibility)

See Linear extensibility.

Colluvium

Unconsolidated, unsorted earth material being transported or deposited on side slopes and/or at the base of slopes by mass movement (e.g., direct gravitational action) and by local, unconcentrated runoff.

Complex slope

Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil

A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Concretions

See Redoximorphic features.

Conglomerate

A coarse grained, clastic sedimentary rock composed of rounded or subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer textured material. Conglomerate is the consolidated equivalent of gravel.

Conservation cropping system

Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage

A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil

Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the “Soil Survey Manual.”

Contour stripcropping

Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section

The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat)

A type of limnic layer composed predominantly of fecal material derived from aquatic animals.

Corrosion (geomorphology)

A process of erosion whereby rocks and soil are removed or worn away by natural chemical processes, especially by the solvent action of running water, but also by other reactions, such as hydrolysis, hydration, carbonation, and oxidation.

Corrosion (soil survey interpretations)

Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop

A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Crop residue management

Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cropping system

Growing crops according to a planned system of rotation and management practices.

Cross-slope farming

Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown

The upper part of a tree or shrub, including the living branches and their foliage.

Cryoturbate

A mass of soil or other unconsolidated earthy material moved or disturbed by frost action. It is typically coarser than the underlying material.

Cuesta

An asymmetric ridge capped by resistant rock layers of slight or moderate dip (commonly less than 15 percent slopes); a type of homocline produced by differential erosion of interbedded resistant and weak rocks. A cuesta has a long, gentle slope on one side (dip slope) that roughly parallels the inclined beds; on the other side, it has a relatively short and steep or clifflike slope (scarp) that cuts through the tilted rocks.

Culmination of the mean annual increment (CMAI)

The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Cutbanks cave

The walls of excavations tend to cave in or slough.

Decreasers

The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing

Postponing grazing or resting grazing land for a prescribed period.

Delta

A body of alluvium having a surface that is fan shaped and nearly flat; deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, generally a sea or lake.

Dense layer

A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depression, closed (map symbol)

A shallow, saucer-shaped area that is slightly lower on the landscape than the surrounding area and that does not have a natural outlet for surface drainage.

Depth, soil

Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Desert pavement

A natural, residual concentration or layer of wind-polished, closely packed gravel, boulders, and other rock fragments mantling a desert surface. It forms where wind action and sheetwash have removed all smaller particles or where rock fragments have migrated upward through sediments to the surface. It typically protects the finer grained underlying material from further erosion.

Diatomaceous earth

A geologic deposit of fine, grayish siliceous material composed chiefly or entirely of the remains of diatoms.

Dip slope

A slope of the land surface, roughly determined by and approximately conforming to the dip of the underlying bedrock.

Diversion (or diversion terrace)

A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divided-slope farming

A form of field stripcropping in which crops are grown in a systematic arrangement of two strips, or bands, across the slope to reduce the hazard of water erosion. One strip is in a close-growing crop that provides protection from erosion, and the other strip is in a crop that provides less protection from erosion. This practice is used where slopes are not long enough to permit a full stripcropping pattern to be used.

Drainage class (natural)

Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained*. These classes are defined in the “Soil Survey Manual.”

Drainage, surface

Runoff, or surface flow of water, from an area.

Drainageway

A general term for a course or channel along which water moves in draining an area. A term restricted to relatively small, linear depressions that at some time move concentrated water and either do not have a defined channel or have only a small defined channel.

Draw

A small stream valley that generally is shallower and more open than a ravine or gulch and that has a broader bottom. The present stream channel may appear inadequate to have cut the drainageway that it occupies.

Drift

A general term applied to all mineral material (clay, silt, sand, gravel, and boulders) transported by a glacier and deposited directly by or from the ice or transported by running water emanating from a glacier. Drift includes unstratified material (till) that forms moraines and stratified deposits that form outwash plains, eskers, kames, varves, and glaciofluvial sediments. The term is generally applied to Pleistocene glacial deposits in areas that no longer contain glaciers.

Drumlin

A low, smooth, elongated oval hill, mound, or ridge of compact till that has a core of bedrock or drift. It commonly has a blunt nose facing the direction from which the ice approached and a gentler slope tapering in the other direction. The longer axis is parallel to the general direction of glacier flow. Drumlins are products of streamline (laminar) flow of glaciers, which molded the subglacial floor through a combination of erosion and deposition.

Duff

A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Dune

A low mound, ridge, bank, or hill of loose, windblown granular material (generally sand), either barren and capable of movement from place to place or covered and stabilized with vegetation but retaining its characteristic shape.

Earthy fill

See Mine spoil.

Ecological site

An area where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. An ecological site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other ecological sites in kind and/or proportion of species or in total production.

Eluviation

The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation

A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Eolian deposit

Sand-, silt-, or clay-sized clastic material transported and deposited primarily by wind, commonly in the form of a dune or a sheet of sand or loess.

Ephemeral stream

A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Episaturation

A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

Erosion

The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (accelerated)

Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Erosion (geologic)

Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion pavement

A surficial lag concentration or layer of gravel and other rock fragments that remains on the soil surface after sheet or rill erosion or wind has removed the finer soil particles and that tends to protect the underlying soil from further erosion.

Erosion surface

A land surface shaped by the action of erosion, especially by running water.

Escarpment

A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Most commonly applied to cliffs produced by differential erosion. Synonym: scarp.

Escarpment, bedrock (map symbol)

A relatively continuous and steep slope or cliff, produced by erosion or faulting, that breaks the general continuity of more gently sloping land surfaces. Exposed material is hard or soft bedrock.

Escarpment, nonbedrock (map symbol)

A relatively continuous and steep slope or cliff, generally produced by erosion but in some places produced by faulting, that breaks the continuity of more gently sloping land surfaces. Exposed earthy material is nonsoil or very shallow soil.

Esker

A long, narrow, sinuous, steep-sided ridge of stratified sand and gravel deposited as the bed of a stream flowing in an ice tunnel within or below the ice (subglacial) or between ice walls on top of the ice of a wasting glacier and left

behind as high ground when the ice melted. Eskers range in length from less than a kilometer to more than 160 kilometers and in height from 3 to 30 meters.

Extrusive rock

Igneous rock derived from deep-seated molten matter (magma) deposited and cooled on the earth's surface.

Fallow

Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fan remnant

A general term for landforms that are the remaining parts of older fan landforms, such as alluvial fans, that have been either dissected or partially buried.

Fertility, soil

The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat)

The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity

The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity*.

Fill slope

A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.

Fine textured soil

Sandy clay, silty clay, or clay.

Firebreak

An area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of firefighters and equipment. Designated roads also serve as firebreaks.

First bottom

An obsolete, informal term loosely applied to the lowest flood-plain steps that are subject to regular flooding.

Flaggy soil material

Material that has, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone

A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain

The nearly level plain that borders a stream and is subject to flooding unless protected artificially.

Flood-plain landforms

A variety of constructional and erosional features produced by stream channel migration and flooding. Examples include backswamps, flood-plain splays, meanders, meander belts, meander scrolls, oxbow lakes, and natural levees.

Flood-plain splay

A fan-shaped deposit or other outspread deposit formed where an overloaded stream breaks through a levee (natural or artificial) and deposits its material (commonly coarse grained) on the flood plain.

Flood-plain step

An essentially flat, terrace-like alluvial surface within a valley that is frequently covered by floodwater from the present stream; any approximately horizontal surface still actively modified by fluvial scour and/or deposition. May occur individually or as a series of steps.

Fluvial

Of or pertaining to rivers or streams; produced by stream or river action.

Foothills

A region of steeply sloping hills that fringes a mountain range or high-plateau escarpment. The hills have relief of as much as 1,000 feet (300 meters).

Footslope

The concave surface at the base of a hillslope. A footslope is a transition zone between upslope sites of erosion and transport (shoulders and backslopes) and downslope sites of deposition (toeslopes).

Forb

Any herbaceous plant not a grass or a sedge.

Forest cover

All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type

A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Fragipan

A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Genesis, soil

The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai

Commonly, a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of clayey soils that shrink and swell considerably with changes in moisture content.

Glaciofluvial deposits

Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur in the form of outwash plains, valley trains, deltas, kames, eskers, and kame terraces.

Glaciolacustrine deposits

Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are bedded or laminated.

Gleyed soil

Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Graded stripcropping

Growing crops in strips that grade toward a protected waterway.

Grassed waterway

A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel

Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravel pit (map symbol)

An open excavation from which soil and underlying material have been removed and used, without crushing, as a source of sand or gravel.

Gravelly soil material

Material that has 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Gravelly spot (map symbol)

A spot where the surface layer has more than 35 percent, by volume, rock fragments that are mostly less than 3 inches in diameter in an area that has less than 15 percent rock fragments.

Green manure crop (agronomy)

A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water

Water filling all the unblocked pores of the material below the water table.

Gully (map symbol)

A small, steep-sided channel caused by erosion and cut in unconsolidated materials by concentrated but intermittent flow of water. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage whereas a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hard bedrock

Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hard to reclaim

Reclamation is difficult after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Hardpan

A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Head slope (geomorphology)

A geomorphic component of hills consisting of a laterally concave area of a hillside, especially at the head of a drainageway. The overland waterflow is converging.

Hemic soil material (mucky peat)

Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

High-residue crops

Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill

A generic term for an elevated area of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline. Slopes are generally more than 15 percent. The distinction between a hill and a mountain is arbitrary and may depend on local usage.

Hillslope

A generic term for the steeper part of a hill between its summit and the drainage line, valley flat, or depression floor at the base of a hill.

Horizon, soil

A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the “Soil Survey Manual.” The major horizons of mineral soil are as follows:

O horizon: An organic layer of fresh and decaying plant residue.

L horizon: A layer of organic and mineral limnic materials, including coprogenous earth (sedimentary peat), diatomaceous earth, and marl.

A horizon: The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon: The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon: The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon: The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon: Soft, consolidated bedrock beneath the soil.

R layer: Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

M layer: A root-limiting subsoil layer consisting of nearly continuous, horizontally oriented, human-manufactured materials.

W layer: A layer of water within or beneath the soil.

Humus

The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups

Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties include depth to a seasonal high water table, the infiltration rate, and depth to a layer that significantly restricts the downward movement of water. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Igneous rock

Rock that was formed by cooling and solidification of magma and that has not been changed appreciably by weathering since its formation. Major varieties include plutonic and volcanic rock (e.g., andesite, basalt, and granite).

Illuviation

The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil

A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers

Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration

The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity

The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate

The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate

The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Very low: Less than 0.2
Low: 0.2 to 0.4
Moderately low: 0.4 to 0.75
Moderate: 0.75 to 1.25
Moderately high: 1.25 to 1.75
High: 1.75 to 2.5
Very high: More than 2.5

Interfluve

A landform composed of the relatively undissected upland or ridge between two adjacent valleys containing streams flowing in the same general direction. An elevated area between two drainageways that sheds water to those drainageways.

Interfluve (geomorphology)

A geomorphic component of hills consisting of the uppermost, comparatively level or gently sloping area of a hill; shoulders of backwearing hillslopes can narrow the upland or can merge, resulting in a strongly convex shape.

Intermittent stream

A stream, or reach of a stream, that does not flow year-round but that is commonly dry for 3 or more months out of 12 and whose channel is generally below the local water table. It flows only during wet periods or when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders

On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Iron depletions

See Redoximorphic features.

Irrigation

Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin: Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border: Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding: Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation: Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle): Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow: Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler: Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation: Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding: Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame

A low mound, knob, hummock, or short irregular ridge composed of stratified sand and gravel deposited by a subglacial stream as a fan or delta at the margin of a melting glacier; by a supraglacial stream in a low place or hole on the surface of the glacier; or as a ponded deposit on the surface or at the margin of stagnant ice.

Karst (topography)

A kind of topography that formed in limestone, gypsum, or other soluble rocks by dissolution and that is characterized by closed depressions, sinkholes, caves, and underground drainage.

Knoll

A small, low, rounded hill rising above adjacent landforms.

Ksat

See Saturated hydraulic conductivity.

Lacustrine deposit

Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lake plain

A nearly level surface marking the floor of an extinct lake filled by well sorted, generally fine textured, stratified deposits, commonly containing varves.

Lake terrace

A narrow shelf, partly cut and partly built, produced along a lakeshore in front of a scarp line of low cliffs and later exposed when the water level falls.

Landfill (map symbol)

An area of accumulated waste products of human habitation, either above or below natural ground level.

Landslide

A general, encompassing term for most types of mass movement landforms and processes involving the downslope transport and outward deposition of soil and rock materials caused by gravitational forces; the movement may or may not involve saturated materials. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones

Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Lava flow (map symbol)

A solidified, commonly lobate body of rock formed through lateral, surface outpouring of molten lava from a vent or fissure.

Leaching

The removal of soluble material from soil or other material by percolating water.

Levee (map symbol)

An embankment that confines or controls water, especially one built along the banks of a river to prevent overflow onto lowlands.

Linear extensibility

Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at $^{1}/_{3}$- or $^{1}/_{10}$-bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the resulting value is COLE, coefficient of linear extensibility.

Liquid limit

The moisture content at which the soil passes from a plastic to a liquid state.

Loam

Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess

Material transported and deposited by wind and consisting dominantly of silt-sized particles.

Low strength

The soil is not strong enough to support loads.

Low-residue crops

Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Marl

An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal proportions; formed primarily under freshwater lacustrine conditions but also formed in more saline environments.

Marsh or swamp (map symbol)

A water-saturated, very poorly drained area that is intermittently or permanently covered by water. Sedges, cattails, and rushes are the dominant vegetation in marshes, and trees or shrubs are the dominant vegetation in swamps. Not used in map units where the named soils are poorly drained or very poorly drained.

Mass movement

A generic term for the dislodgment and downslope transport of soil and rock material as a unit under direct gravitational stress.

Masses

See Redoximorphic features.

Meander belt

The zone within which migration of a meandering channel occurs; the flood-plain area included between two imaginary lines drawn tangential to the outer bends of active channel loops.

Meander scar

A crescent-shaped, concave or linear mark on the face of a bluff or valley wall, produced by the lateral erosion of a meandering stream that impinged upon and undercut the bluff.

Meander scroll

One of a series of long, parallel, close-fitting, crescent-shaped ridges and troughs formed along the inner bank of a stream meander as the channel migrated laterally down-valley and toward the outer bank.

Mechanical treatment

Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil

Very fine sandy loam, loam, silt loam, or silt.

Mesa

A broad, nearly flat topped and commonly isolated landmass bounded by steep slopes or precipitous cliffs and capped by layers of resistant, nearly horizontal rocky material. The summit width is characteristically greater than the height of the bounding escarpments.

Metamorphic rock

Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement at depth in the earth’s crust. Nearly all such rocks are crystalline.

Mine or quarry (map symbol)

An open excavation from which soil and underlying material have been removed and in which bedrock is exposed. Also denotes surface openings to underground mines.

Mine spoil

An accumulation of displaced earthy material, rock, or other waste material removed during mining or excavation. Also called earthy fill.

Mineral soil

Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage

Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area

A kind of map unit that has little or no natural soil and supports little or no vegetation.

Miscellaneous water (map symbol)

Small, constructed bodies of water that are used for industrial, sanitary, or mining applications and that contain water most of the year.

Moderately coarse textured soil

Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil

Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon

A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Moraine

In terms of glacial geology, a mound, ridge, or other topographically distinct accumulation of unsorted, unstratified drift, predominantly till, deposited primarily by the direct action of glacial ice in a variety of landforms. Also, a general term for a landform composed mainly of till (except for kame moraines, which are composed mainly of stratified outwash) that has been deposited by a glacier. Some types of moraines are disintegration, end, ground, kame, lateral, recessional, and terminal.

Morphology, soil

The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil

Irregular spots of different colors that vary in number and size. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Mountain

A generic term for an elevated area of the land surface, rising more than 1,000 feet (300 meters) above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides. A mountain can

occur as a single, isolated mass or in a group forming a chain or range. Mountains are formed primarily by tectonic activity and/or volcanic action but can also be formed by differential erosion.

Muck

Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Mucky peat

See Hemic soil material.

Mudstone

A blocky or massive, fine grained sedimentary rock in which the proportions of clay and silt are approximately equal. Also, a general term for such material as clay, silt, claystone, siltstone, shale, and argillite and that should be used only when the amounts of clay and silt are not known or cannot be precisely identified.

Munsell notation

A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Natric horizon

A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.

Neutral soil

A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nodules

See Redoximorphic features.

Nose slope (geomorphology)

A geomorphic component of hills consisting of the projecting end (laterally convex area) of a hillside. The overland waterflow is predominantly divergent. Nose slopes consist dominantly of colluvium and slope-wash sediments (for example, slope alluvium).

Nutrient, plant

Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter

Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low: Less than 0.5 percent
Low: 0.5 to 1.0 percent
Moderately low: 1.0 to 2.0 percent
Moderate: 2.0 to 4.0 percent
High: 4.0 to 8.0 percent
Very high: More than 8.0 percent

Outwash

Stratified and sorted sediments (chiefly sand and gravel) removed or “washed out” from a glacier by meltwater streams and deposited in front of or beyond the end moraine or the margin of a glacier. The coarser material is deposited nearer to the ice.

Outwash plain

An extensive lowland area of coarse textured glaciofluvial material. An outwash plain is commonly smooth; where pitted, it generally is low in relief.

Paleoterrace

An erosional remnant of a terrace that retains the surface form and alluvial deposits of its origin but was not emplaced by, and commonly does not grade to, a present-day stream or drainage network.

Pan

A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material

The unconsolidated organic and mineral material in which soil forms.

Peat

Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped

An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedisediment

A layer of sediment, eroded from the shoulder and backslope of an erosional slope, that lies on and is being (or was) transported across a gently sloping erosional surface at the foot of a receding hill or mountain slope.

Pedon

The smallest volume that can be called “a soil.” A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation

The movement of water through the soil.

Perennial water (map symbol)

Small, natural or constructed lakes, ponds, or pits that contain water most of the year.

Permafrost

Ground, soil, or rock that remains at or below 0 degrees C for at least 2 years. It is defined on the basis of temperature and is not necessarily frozen.

pH value

A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Phase, soil

A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

Piping

Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitting

Pits caused by melting around ice. They form on the soil after plant cover is removed.

Plastic limit

The moisture content at which a soil changes from semisolid to plastic.

Plasticity index

The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plateau (geomorphology)

A comparatively flat area of great extent and elevation; specifically, an extensive land region that is considerably elevated (more than 100 meters) above the adjacent lower lying terrain, is commonly limited on at least one side by an abrupt descent, and has a flat or nearly level surface. A comparatively large part of a plateau surface is near summit level.

Playa

The generally dry and nearly level lake plain that occupies the lowest parts of closed depressions, such as those on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation and runoff. Playa deposits are fine grained and may or may not have a high water table and saline conditions.

Plinthite

The sesquioxide-rich, humus-poor, highly weathered mixture of clay with quartz and other diluents. It commonly appears as red mottles, usually in platy, polygonal, or reticulate patterns. Plinthite changes irreversibly to an ironstone hardpan or to irregular aggregates on repeated wetting and drying, especially if it is exposed also to heat from the sun. In a moist soil, plinthite can be cut with a spade. It is a form of laterite.

Plowpan

A compacted layer formed in the soil directly below the plowed layer.

Ponding

Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded

Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Pore linings

See Redoximorphic features.

Potential native plant community

See Climax plant community.

Potential rooting depth (effective rooting depth)

Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning

Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

Productivity, soil

The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil

A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use

Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and

promotes the accumulation of litter and mulch necessary to conserve soil and water.

Rangeland

Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reaction, soil

A measure of acidity or alkalinity of a soil, expressed as pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid: Less than 3.5
Extremely acid: 3.5 to 4.4
Very strongly acid: 4.5 to 5.0
Strongly acid: 5.1 to 5.5
Moderately acid: 5.6 to 6.0
Slightly acid: 6.1 to 6.5
Neutral: 6.6 to 7.3
Slightly alkaline: 7.4 to 7.8
Moderately alkaline: 7.9 to 8.4
Strongly alkaline: 8.5 to 9.0
Very strongly alkaline: 9.1 and higher

Red beds

Sedimentary strata that are mainly red and are made up largely of sandstone and shale.

Redoximorphic concentrations

See Redoximorphic features.

Redoximorphic depletions

See Redoximorphic features.

Redoximorphic features

Redoximorphic features are associated with wetness and result from alternating periods of reduction and oxidation of iron and manganese compounds in the soil. Reduction occurs during saturation with water, and oxidation occurs when the soil is not saturated. Characteristic color patterns are created by these processes. The reduced iron and manganese ions may be removed from a soil if vertical or lateral fluxes of water occur, in which case there is no iron or manganese precipitation in that soil. Wherever the iron and manganese are oxidized and precipitated, they form either soft masses or hard concretions or nodules. Movement of iron and manganese as a result of redoximorphic processes in a soil may result in redoximorphic features that are defined as follows:

1. Redoximorphic concentrations.—These are zones of apparent accumulation of iron-manganese oxides, including:
   A. Nodules and concretions, which are cemented bodies that can be removed from the soil intact. Concretions are distinguished from nodules on the basis of internal organization. A concretion typically has concentric layers that are visible to the naked eye. Nodules do not have visible organized internal structure; *and*
   B. Masses, which are noncemented concentrations of substances within the soil matrix; *and*
   C. Pore linings, i.e., zones of accumulation along pores that may be either coatings on pore surfaces or impregnations from the matrix adjacent to the pores.
2. Redoximorphic depletions.—These are zones of low chroma (chromas less than those in the matrix) where either iron-manganese oxides alone or both iron-manganese oxides and clay have been stripped out, including:
   A. Iron depletions, i.e., zones that contain low amounts of iron and manganese oxides but have a clay content similar to that of the adjacent matrix; *and*
   B. Clay depletions, i.e., zones that contain low amounts of iron, manganese, and clay (often referred to as silt coatings or skeletans).
3. Reduced matrix.—This is a soil matrix that has low chroma *in situ* but undergoes a change in hue or chroma within 30 minutes after the soil material has been exposed to air.

Reduced matrix

See Redoximorphic features.

Regolith

All unconsolidated earth materials above the solid bedrock. It includes material weathered in place from all kinds of bedrock and alluvial, glacial, eolian, lacustrine, and pyroclastic deposits.

Relief

The relative difference in elevation between the upland summits and the lowlands or valleys of a given region.

Residuum (residual soil material)

Unconsolidated, weathered or partly weathered mineral material that accumulated as bedrock disintegrated in place.

Rill

A very small, steep-sided channel resulting from erosion and cut in unconsolidated materials by concentrated but intermittent flow of water. A rill generally is not an obstacle to wheeled vehicles and is shallow enough to be smoothed over by ordinary tillage.

Riser

The vertical or steep side slope (e.g., escarpment) of terraces, flood-plain steps, or other stepped landforms; commonly a recurring part of a series of natural, steplike landforms, such as successive stream terraces.

Road cut

A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments

Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rock outcrop (map symbol)

An exposure of bedrock at the surface of the earth. Not used where the named soils of the surrounding map unit are shallow over bedrock or where “Rock outcrop” is a named component of the map unit.

Root zone

The part of the soil that can be penetrated by plant roots.

Runoff

The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil

A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Saline spot (map symbol)

An area where the surface layer has an electrical conductivity of 8 mmhos/cm more than the surface layer of the named soils in the surrounding map unit. The surface layer of the surrounding soils has an electrical conductivity of 2 mmhos/cm or less.

Sand

As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone

Sedimentary rock containing dominantly sand-sized particles.

Sandy spot (map symbol)

A spot where the surface layer is loamy fine sand or coarser in areas where the surface layer of the named soils in the surrounding map unit is very fine sandy loam or finer.

Sapric soil material (muck)

The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saturated hydraulic conductivity (Ksat)

The ease with which pores of a saturated soil transmit water. Formally, the proportionality coefficient that expresses the relationship of the rate of water movement to hydraulic gradient in Darcy's Law, a law that describes the rate of water movement through porous media. Commonly abbreviated as "Ksat." Terms describing saturated hydraulic conductivity are:

Very high: 100 or more micrometers per second (14.17 or more inches per hour)

High: 10 to 100 micrometers per second (1.417 to 14.17 inches per hour)

Moderately high: 1 to 10 micrometers per second (0.1417 inch to 1.417 inches per hour)

Moderately low: 0.1 to 1 micrometer per second (0.01417 to 0.1417 inch per hour)

Low: 0.01 to 0.1 micrometer per second (0.001417 to 0.01417 inch per hour)

Very low: Less than 0.01 micrometer per second (less than 0.001417 inch per hour).

To convert inches per hour to micrometers per second, multiply inches per hour by 7.0572. To convert micrometers per second to inches per hour, multiply micrometers per second by 0.1417.

Saturation

Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Scarification

The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Sedimentary rock

A consolidated deposit of clastic particles, chemical precipitates, or organic remains accumulated at or near the surface of the earth under normal low temperature and pressure conditions. Sedimentary rocks include consolidated equivalents of alluvium, colluvium, drift, and eolian, lacustrine, and marine deposits. Examples are sandstone, siltstone, mudstone, claystone, shale, conglomerate, limestone, dolomite, and coal.

Sequum

A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil

A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Severely eroded spot (map symbol)

An area where, on the average, 75 percent or more of the original surface layer has been lost because of accelerated erosion. Not used in map units in which “severely eroded,” “very severely eroded,” or “gullied” is part of the map unit name.

Shale

Sedimentary rock that formed by the hardening of a deposit of clay, silty clay, or silty clay loam and that has a tendency to split into thin layers.

Sheet erosion

The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Short, steep slope (map symbol)

A narrow area of soil having slopes that are at least two slope classes steeper than the slope class of the surrounding map unit.

Shoulder

The convex, erosional surface near the top of a hillslope. A shoulder is a transition from summit to backslope.

Shrink-swell

The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Shrub-coppice dune

A small, streamlined dune that forms around brush and clump vegetation.

Side slope (geomorphology)

A geomorphic component of hills consisting of a laterally planar area of a hillside. The overland waterflow is predominantly parallel. Side slopes are dominantly colluvium and slope-wash sediments.

Silica

A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio

The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt

As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone

An indurated silt having the texture and composition of shale but lacking its fine lamination or fissility; a massive mudstone in which silt predominates over clay.

Similar soils

Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole (map symbol)

A closed, circular or elliptical depression, commonly funnel shaped, characterized by subsurface drainage and formed either by dissolution of the surface of underlying bedrock (e.g., limestone, gypsum, or salt) or by collapse of underlying caves within bedrock. Complexes of sinkholes in carbonate-rock terrain are the main components of karst topography.

Site index

A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Slickensides (pedogenic)

Grooved, striated, and/or glossy (shiny) slip faces on structural peds, such as wedges; produced by shrink-swell processes, most commonly in soils that have a high content of expansive clays.

Slide or slip (map symbol)

A prominent landform scar or ridge caused by fairly recent mass movement or descent of earthy material resulting from failure of earth or rock under shear stress along one or several surfaces.

Slope

The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope alluvium

Sediment gradually transported down the slopes of mountains or hills primarily by nonchannel alluvial processes (i.e., slope-wash processes) and characterized by particle sorting. Lateral particle sorting is evident on long slopes. In a profile sequence, sediments may be distinguished by differences in size and/or specific gravity of rock fragments and may be separated by stone lines. Burnished peds and sorting of rounded or subrounded pebbles or cobbles distinguish these materials from unsorted colluvial deposits.

Slow refill

The slow filling of ponds, resulting from restricted water transmission in the soil.

Slow water movement

Restricted downward movement of water through the soil. See Saturated hydraulic conductivity.

Sodic (alkali) soil

A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Sodic spot (map symbol)

An area where the surface layer has a sodium adsorption ratio that is at least 10 more than that of the surface layer of the named soils in the surrounding map unit. The surface layer of the surrounding soils has a sodium adsorption ratio of 5 or less.

Sodicity

The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^{+} to $Ca^{++} + Mg^{++}$. The degrees of sodicity and their respective ratios are:

Slight: Less than 13:1
Moderate: 13-30:1
Strong: More than 30:1

Sodium adsorption ratio (SAR)

A measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration.

Soft bedrock

Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil

A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief and by the passage of time.

Soil separates

Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand: 2.0 to 1.0
Coarse sand: 1.0 to 0.5
Medium sand: 0.5 to 0.25
Fine sand: 0.25 to 0.10
Very fine sand: 0.10 to 0.05
Silt: 0.05 to 0.002
Clay: Less than 0.002

Solum

The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Spoil area (map symbol)

A pile of earthy materials, either smoothed or uneven, resulting from human activity.

Stone line

In a vertical cross section, a line formed by scattered fragments or a discrete layer of angular and subangular rock fragments (commonly a gravel- or cobble-sized lag concentration) that formerly was draped across a topographic surface and was later buried by additional sediments. A stone line generally caps material that was subject to weathering, soil formation, and erosion before burial. Many stone lines seem to be buried erosion pavements, originally formed by sheet and rill erosion across the land surface.

Stones

Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony

Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stony spot (map symbol)

A spot where 0.01 to 0.1 percent of the soil surface is covered by rock fragments that are more than 10 inches in diameter in areas where the surrounding soil has no surface stones.

Strath terrace

A type of stream terrace; formed as an erosional surface cut on bedrock and thinly mantled with stream deposits (alluvium).

Stream terrace

One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel, originally formed near the level of the stream; represents the remnants of an abandoned flood plain, stream bed, or valley floor produced during a former state of fluvial erosion or deposition.

Stripcropping

Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

Structure, soil

The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are:

Platy: Flat and laminated

Prismatic: Vertically elongated and having flat tops

Columnar: Vertically elongated and having rounded tops

Angular blocky: Having faces that intersect at sharp angles (planes)

Subangular blocky: Having subrounded and planar faces (no sharp angles)

Granular: Small structural units with curved or very irregular faces

Structureless soil horizons are defined as follows:

Single grained: Entirely noncoherent (each grain by itself), as in loose sand

Massive: Occurring as a coherent mass

Stubble mulch

Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil

Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling

Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum

The part of the soil below the solum.

Subsurface layer

Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow

The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Summit

The topographically highest position of a hillslope. It has a nearly level (planar or only slightly convex) surface.

Surface layer

The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the “plow layer,” or the “Ap horizon.”

Surface soil

The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Talus

Rock fragments of any size or shape (commonly coarse and angular) derived from and lying at the base of a cliff or very steep rock slope. The accumulated mass of such loose broken rock formed chiefly by falling, rolling, or sliding.

Taxadjuncts

Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named.

Terminal moraine

An end moraine that marks the farthest advance of a glacier. It typically has the form of a massive arcuate or concentric ridge, or complex of ridges, and is underlain by till and other types of drift.

Terrace (conservation)

An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field

generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geomorphology)

A steplike surface, bordering a valley floor or shoreline, that represents the former position of a flood plain, lake, or seashore. The term is usually applied both to the relatively flat summit surface (tread) that was cut or built by stream or wave action and to the steeper descending slope (scarp or riser) that has graded to a lower base level of erosion.

Terracettes

Small, irregular steplike forms on steep hillslopes, especially in pasture, formed by creep or erosion of surficial materials that may be induced or enhanced by trampling of livestock, such as sheep or cattle.

Texture, soil

The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying “coarse,” “fine,” or “very fine.”

Thin layer

Otherwise suitable soil material that is too thin for the specified use.

Till

Dominantly unsorted and nonstratified drift, generally unconsolidated and deposited directly by a glacier without subsequent reworking by meltwater, and consisting of a heterogeneous mixture of clay, silt, sand, gravel, stones, and boulders; rock fragments of various lithologies are embedded within a finer matrix that can range from clay to sandy loam.

Till plain

An extensive area of level to gently undulating soils underlain predominantly by till and bounded at the distal end by subordinate recessional or end moraines.

Tilth, soil

The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope

The gently inclined surface at the base of a hillslope. Toeslopes in profile are commonly gentle and linear and are constructional surfaces forming the lower part of a hillslope continuum that grades to valley or closed-depression floors.

Topsoil

The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements

Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Tread

The flat to gently sloping, topmost, laterally extensive slope of terraces, flood-plain steps, or other stepped landforms; commonly a recurring part of a series of natural steplike landforms, such as successive stream terraces.

Tuff

A generic term for any consolidated or cemented deposit that is 50 percent or more volcanic ash.

Upland

An informal, general term for the higher ground of a region, in contrast with a low-lying adjacent area, such as a valley or plain, or for land at a higher elevation than the flood plain or low stream terrace; land above the footslope zone of the hillslope continuum.

Valley fill

The unconsolidated sediment deposited by any agent (water, wind, ice, or mass wasting) so as to fill or partly fill a valley.

Variegation

Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve

A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Very stony spot (map symbol)

A spot where 0.1 to 3.0 percent of the soil surface is covered by rock fragments that are more than 10 inches in diameter in areas where the surface of the surrounding soil is covered by less than 0.01 percent stones.

Water bars

Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Weathering

All physical disintegration, chemical decomposition, and biologically induced changes in rocks or other deposits at or near the earth’s surface by atmospheric or biologic agents or by circulating surface waters but involving essentially no transport of the altered material.

Well graded

Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wet spot (map symbol)

A somewhat poorly drained to very poorly drained area that is at least two drainage classes wetter than the named soils in the surrounding map unit.

Wilting point (or permanent wilting point)

The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow

The uprooting and tipping over of trees by the wind.

APPENDIX

E NRCS GROUNDWATER MAP

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Water Features

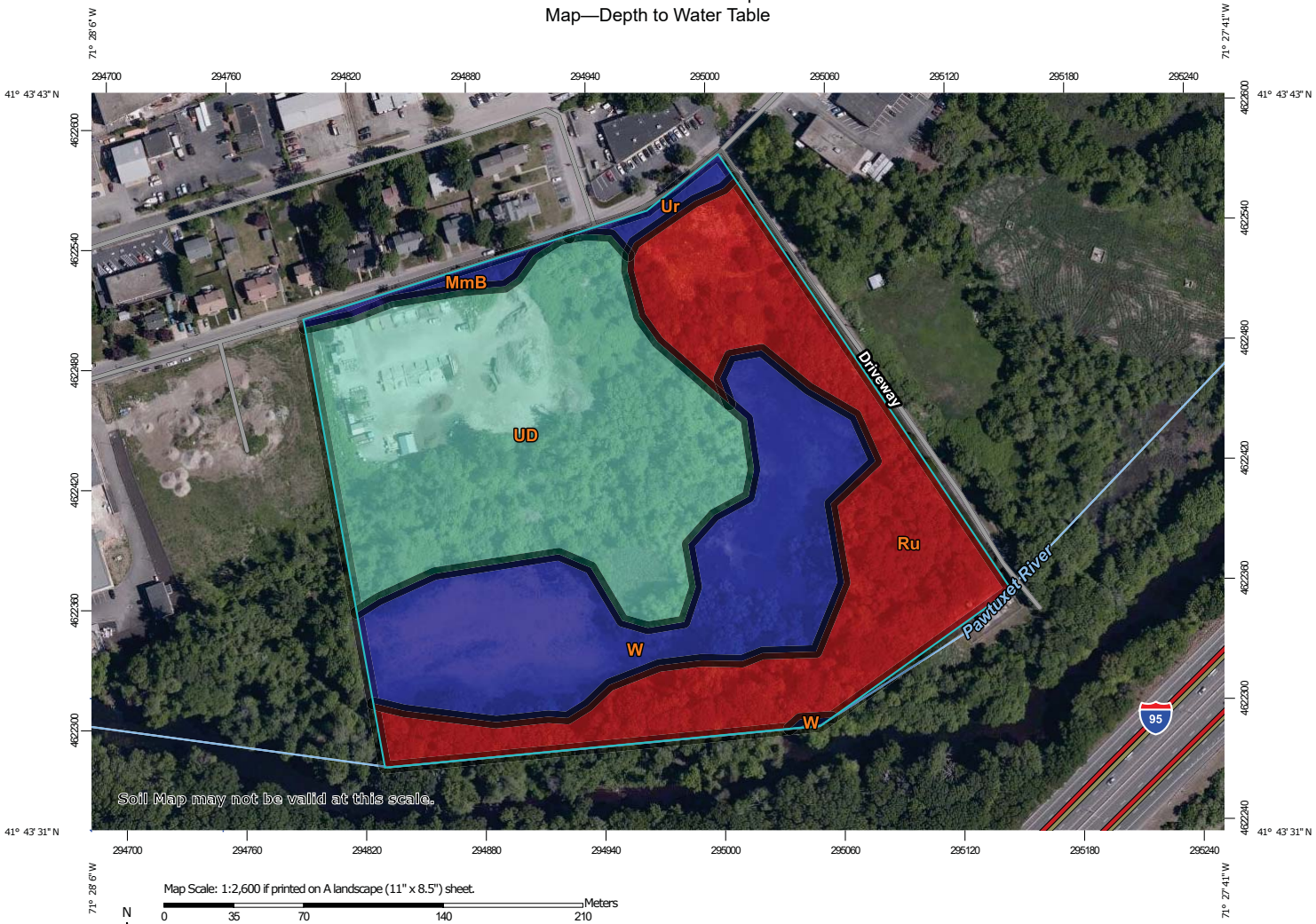
Water Features include ponding frequency, flooding frequency, and depth to water table.

Depth to Water Table

"Water table" refers to a saturated zone in the soil. It occurs during specified months. Estimates of the upper limit are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

This attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

Custom Soil Resource Report
Map—Depth to Water Table



Map Scale: 1:2,600 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 35 70 140 210

Feet
0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- Not rated or not available

Soil Rating Lines
- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- Not rated or not available

Soil Rating Points
- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- > 200
- Not rated or not available

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.

Table—Depth to Water Table

Map unit symbol	Map unit name	Rating (centimeters)	Acres in AOI	Percent of AOI
MmB	Merrimac fine sandy loam, 3 to 8 percent slopes	>200	0.2	1.4%
Ru	Rippowam fine sandy loam	23	5.3	30.3%
UD	Udorthents-Urban land complex	122	7.1	40.7%
Ur	Urban land	>200	0.2	1.3%
W	Water	>200	4.6	26.4%
Totals for Area of Interest			**17.5**	**100.0%**

Rating Options—Depth to Water Table

Units of Measure: centimeters

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Interpret Nulls as Zero: No

Beginning Month: January

Ending Month: December

Depth to Water Table

"Water table" refers to a saturated zone in the soil. It occurs during specified months. Estimates of the upper limit are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

This attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

APPENDIX

F

FLOOD INSURANCE RATE MAP (FIRM)

71°28'7.93"W 41°45'6.62"N

71°26'14.57"W 41°43'N

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
OTHER FEATURES	(B) 20.2	Cross Sections with 1% Annual Chance
	17.5	Water Surface Elevation
	(8)	Coastal Transect
		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature
		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 (1-877-336-2627) 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 basemap shown complies with FEMA's basemap accuracy standards. This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date.

ATTENTION: The levee, dike, or other structure that impacts flood hazards inside this boundary has not been shown to comply with Section 65.10 of the NFIP Regulations. As such, this FIRM panel will be revised at a later date to update the flood hazard information associated with this structure. The flood hazard data inside this boundary on the FIRM panel has been republished from the previous effective (historic) FIRM for this area, after being converted from NGVD 29 to NAVD 88.

SCALE

Map Projection:
GCS, Geodetic Reference System 1980;
Vertical Datum: NAVD88

For information about the specific vertical datum for elevation features, datum conversions, or vertical monuments used to create this map, please see the Flood Insurance Study (FIS) Report for your community at https://msc.fema.gov

1 inch = 500 feet 1:6,000

N

0 250 500 1,000 1,500 2,000 Feet

Meters 0 50 100 200 300 400

FEMA

National Flood Insurance Program

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

MAP NUMBER
44003C0127H
EFFECTIVE DATE
October 02, 2015

APPENDIX

G RIDEM LETTER TO CITY OF WARWICK, DIRECTOR OF PLANNING

RHODE ISLAND
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF LAND REVITALIZATION & SUSTAINABLE MATERIALS MANAGEMENT
235 Promenade Street, Room 380
Providence, Rhode Island 02908

October 17, 2022

Solar
Knight Street Landfill
180 Knight Street, Warwick
Plat 275, Lots 38 and 52
RIDEM File No. SR-35-1122C

Tom Kravitz
Director of Planning – City of Warwick, RI
65 Centerville Road
Warwick, RI 02835

Dear Mr. Kravitz:

The Rhode Island Department of Environmental Management (RIDEM) Office of Land Revitalization and Sustainable Materials Management (LRSMM) has been involved with the investigation and closure of the property listed above. Over recent years, there has been numerous discussions with the property owner as well as their environmental consultants about remediating the site, as well as reusing it for a solar development.

RIDEM has long supported using disturbed sites such as old landfills for renewable energy projects, including solar on landfills. Projects that we have approved include the former Forbes Street landfill in East Providence (2014, 2018), the former Cece Macera/A Street landfill in Johnston (2017), and the former North Providence landfill (2017). Other communities with landfills considering solar installations include Bristol, Cumberland and Hopkinton.

As the state regulator, RIDEM must consider and evaluate health, safety and environmental concerns. Certain actions must occur as part of this landfill closure to satisfy our regulations before reuse of the property can occur. Once RIDEM is satisfied with the investigation and remediation efforts, using the site as a solar development is a reuse that RIDEM encourages.

Sincerely,

Kasie McKenzie

Kasie McKenzie
Environmental Engineer II
Office of Land Revitalization and Sustainable Materials Management

cc: Brad Parsons, PE, PMP - Director of Design and Permitting – Verogy
Mark Dennen – Supervising Environmental Scientist – RIDEM/LRSMM
Julie Scott - Principal Engineer/Service Line Lead - WSP