L0700-026C
June 14, 2024

Mr. Rick Chellman, Chairman
City of Portsmouth Planning Board
1 Junkins Avenue
Portsmouth, New Hampshire 03801

Re: **Lonza Biologics – Proposed PV Solar Carports**
Amended Site Plan Review Application LU-23-108

Dear Chairman Chellman:

On behalf of Lonza Biologics, Inc. (Lonza), we are pleased to submit one (1) set of hard copies and one electronic file (.pdf) of the following information to support a request to the Planning Board for a recommendation for approval to the Pease Development Authority (PDA) for Amended Site Plan Review for proposed PV Solar Carports located at 5 Technology Way, (Formerly 70 Corporate Drive) on Pease International Tradeport:

- PDA Application for Site Review, dated May 20, 2024;
- Site Plan Set, last revised May 20, 2024;
- Drainage Memo, dated May 20, 2024;
- Glare Study Results, dated February 22, 2024;

PROJECT SUMMARY

Background

The existing project was granted Site Plan approval on January 17, 2019, and amended by administrative approvals on September 27, 2019, January 27, 2023, and Amended Site Plan Approval on November 16, 2023.

Existing Condition

The project is located on the portion of Lonza's 46-acre parcel refered to as the Iron Parcel. The following summarizes the work currently approved through the November 16, 2023 Amended Site Plan Approval:

- Daylighting of Hodgson Brook on the Iron Parcel
- Removal of the existing Hodgson Brook culvert
- Construction of the sidewalk and landscaping along Corporate Drive
- Completion of Soils Management Plan
- Construction of Building #1
- Construction of the Central Utility Building
- Construction site improvements for Building #1 such as drive aisles, fire lanes, utilities, lighting, sidewalks and stormwater management.
- Construction of a temporary 150-space surface parking lot, sidewalks and stormwater management.

Amended Site Plan

The requested Site Plan amendment includes the construction of Photovoltaic Cell (PV) Solar canopies over the previously approved temporary surface parking lot. The addition of these Solar Canopies is being requested to support Lonza Biologics green infrastructure and sustainability initiatives. The addition of these Solar canopies will not result in any dimensional changes to the previously approved parking lot. There is a slight increase in impervious surfaces (~672 SF) which will not cause any adverse impact to the previously approved Phase 2 Drainage design as outlined in the Drainage Memorandum.

The proposed PV Solar system will require additional electrical infrastructure and modifications to the photometric lighting design as depicted in the enclosed Site Plan Set. The proposed system is being designed to supplement and reduce the proposed project's overall electrical demand.

The project also received a recommendation for approval from the Technical Advisory Committee (TAC) at their June 4, 2024, meeting. We respectfully request to be placed on the Planning Board (PB) meeting agenda for July 18, 2024. If you have any questions or need any additional information, please contact Neil Hansen by phone at (603) 294-9213 or by email at nahansen@tighebond.com.

Sincerely,

TIGHE & BOND, INC.

Neil A. Hansen, PE
Project Manager

Patrick M. Crimmins, PE
Vice President

Copy: Lonza Biologics (via email)
Pease Development Authority

J:\L\L0700 Lonza Biologics Expansion was 1576F\026_Project Albacore\Report_Evaluations\Applications\City of Portsmouth\20240614_Solar PB Submission\L0700-026C_PB Cover Letter.docx

Pease Development Authority
55 International Drive, Portsmouth, NH 03801, (603) 433-6088

Application for Site Review

For PDA Use Only			
Date Submitted:_____	Municipal Review:_____	Fee:_____	
Application Complete:_____	Date Forwarded:_____	Paid:_____	Check #:_____

Applicant Information

Applicant: Lonza Biologics, Inc.	Agent: Tighe & Bond, Inc.
Address: 101 International Drive Portsmouth, NH 03801	Address: 177 Corporate Drive Portsmouth, NH 03801
Business Phone: 603-570-3625	Business Phone: 603-433-8818
Mobile Phone:	Mobile Phone:
Fax:	Fax:

Site Information

Portsmouth Tax Map: 305	Lot #: 006	Zone: Airport, Business, Commercial
Site Address / Location : 101 International Drive, Portsmouth, NH 03801		
Site Address / Location :		Area of On-site Wetlands: 4,087 SF

Activity Information

Change of Use: Yes [ ] No [X] Existing Use: Office/Research/Manufacturing

Proposed Use: Office/Research/Manufacturing

Description of Project:

The requested Site Plan amendment includes the construction of Photovoltaic Cell (PV) Solar canopies over the previously approved temporary surface parking lot.

All above information shall be shown on a site plan submitted with this application. Provide 3 full size hard copies and one PDF copy of all application materials as well as one half-size set of drawings to PDA. Applicant shall supply additional copies as may be required by applicable municipality. Refer to Chapter 400 of PDA land Use Controls for additional information.

Certification

I hereby certify under the penalties of perjury that the foregoing information and accompanying plans, documents, and supporting data are true and complete to the best of my knowledge. I hereby apply for Site Review and acknowledge I will comply with all regulations and any conditions established by the Review Committee(s) and PDA Board in the development and construction of this project.

Signature of Applicant — 20 May 24 — Date

Michael Feeney
Printed Name

N:\Engineer\ ApplicationforSiteReview.xlsx

IRON PARCEL DEVELOPMENT - SOLAR

5 TECHNOLOGY WAY

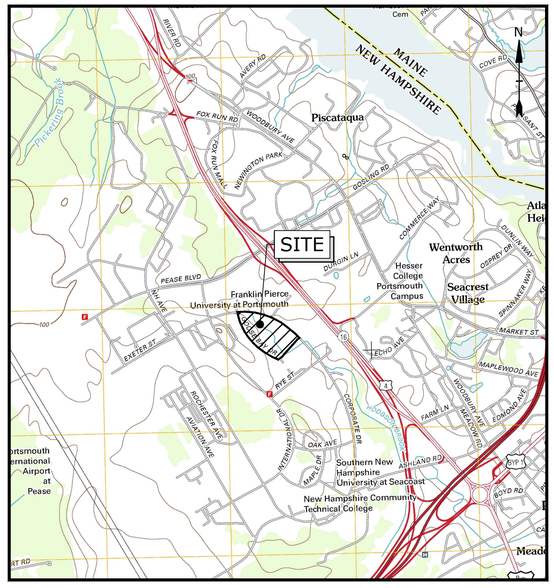
(FORMERLY 70 CORPORATE DRIVE)

PORTSMOUTH, NEW HAMPSHIRE

PROJECT NO: L-0700-26

MAY 20, 2024

LIST OF DRAWINGS		
SHEET NO.	SHEET TITLE	LAST REVISED
	COVER SHEET	5/20/2024
C-161	PHASE 2 DEMOLITION PLAN	5/20/2024
C-164	PHASE 2 OVERALL SITE PLAN	5/20/2024
C-165	PHASE 2 SITE PLAN	5/20/2024
C-168	PHASE 2 GRADING, DRAINAGE & EROSION CONTROL PLAN	5/20/2024
C-171	PHASE 2 UTILITIES PLAN	5/20/2024
C-174	PHASE 2 LANDSCAPE PLAN	5/20/2024
C-177	PHASE 2 PHOTOMETRIC LIGHTING PLAN	5/20/2024
C-501	EROSION CONTROL NOTES & DETAILS SHEET	5/20/2024
C-503	DETAILS SHEET	5/20/2024
8-046-3	SOLAR CANOPY DETAILS	5/20/2024



LOCATION MAP
SCALE: 1" = 2,000'

LESSOR:	PEASE DEVELOPMENT AUTHORITY 55 INTERNATIONAL DRIVE PORTSMOUTH, NEW HAMPSHIRE 03801
CLIENT:	LONZA BIOLOGICS 101 INTERNATIONAL DRIVE PORTSMOUTH, NH 03801
CIVIL ENGINEER:	Tighe&Bond 177 CORPORATE DRIVE PORTSMOUTH, NEW HAMPSHIRE 03801
SURVEYOR:	DOUCET SURVEY, INC. 102 KENT PLACE NEWMARKET, NEW HAMPSHIRE 03857
WETLAND SCIENTIST:	GOVE ENVIRONMENTAL SERVICES, INC. 8 CONTINENTAL DRIVE, UNIT H EXETER, NEW HAMPSHIRE 03833

LIST OF PERMITS		
LOCAL	STATUS	DATE
SITE PLAN REVIEW PERMIT	APPROVED	1/17/2019
AMENDED SITE PLAN REVIEW PERMIT	APPROVED	11/16/2023
AMENDED SITE PLAN REVIEW PERMIT - SOLAR		
STATE		
NHDES - ALTERATION OF TERRAIN PERMIT	ISSUED: AOT-1498	10/02/2018
NHDES - WETLANDS PERMIT	ISSUED: #2018-01731	12/21/2018
FEDERAL		
EPA - NPDES CGP (SWPPP)	ACTIVE: NHR1001SK	7/7/2023

STATE OF NEW HAMPSHIRE – NEIL A. HANSEN No. 15227 LICENSED PROFESSIONAL ENGINEER
05/20/2024

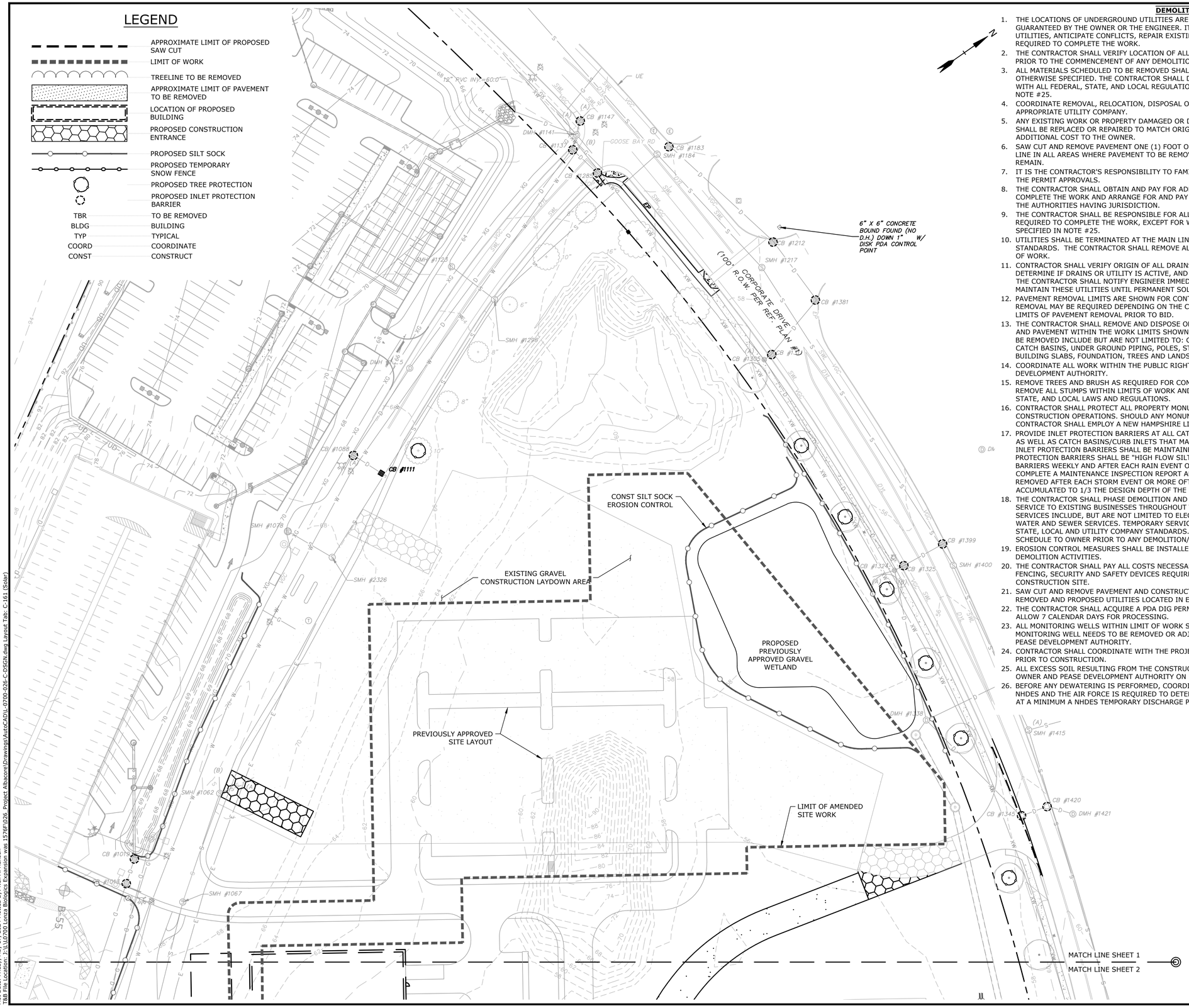
STATE OF NEW HAMPSHIRE – PATRICK CRIMMINS No. 12378 LICENSED PROFESSIONAL ENGINEER
5/20/24

ISSUED FOR AMENDED SITE REVIEW
COMPLETE SET 11 SHEETS

LEGEND

- APPROXIMATE LIMIT OF PROPOSED SAW CUT
- LIMIT OF WORK
- TREELINE TO BE REMOVED
- APPROXIMATE LIMIT OF PAVEMENT TO BE REMOVED
- LOCATION OF PROPOSED BUILDING
- PROPOSED CONSTRUCTION ENTRANCE
- PROPOSED SILT SOCK
- PROPOSED TEMPORARY SNOW FENCE
- PROPOSED TREE PROTECTION
- PROPOSED INLET PROTECTION BARRIER

TBR	TO BE REMOVED
BLDG	BUILDING
TYP	TYPICAL
COORD	COORDINATE
CONST	CONSTRUCT



DEMOLITION NOTES:

1. THE LOCATIONS OF UNDERGROUND UTILITIES ARE APPROXIMATE AND THE LOCATIONS ARE NOT GUARANTEED BY THE OWNER OR THE ENGINEER. IT IS THE CONTRACTOR'S RESPONSIBILITY TO LOCATE ALL UTILITIES, ANTICIPATE CONFLICTS, REPAIR EXISTING UTILITIES AND RELOCATE EXISTING UTILITIES REQUIRED TO COMPLETE THE WORK.
2. THE CONTRACTOR SHALL VERIFY LOCATION OF ALL EXISTING UTILITIES. CALL DIG SAFE AT LEAST 72 HOURS PRIOR TO THE COMMENCEMENT OF ANY DEMOLITION/CONSTRUCTION ACTIVITIES.
3. ALL MATERIALS SCHEDULED TO BE REMOVED SHALL BECOME THE PROPERTY OF THE CONTRACTOR UNLESS OTHERWISE SPECIFIED. THE CONTRACTOR SHALL DISPOSE OF ALL MATERIALS OFF-SITE IN ACCORDANCE WITH ALL FEDERAL, STATE, AND LOCAL REGULATIONS, ORDINANCES AND CODES EXCEPT AS SPECIFIED IN NOTE #25.
4. COORDINATE REMOVAL, RELOCATION, DISPOSAL OR SALVAGE OF UTILITIES WITH THE OWNER AND APPROPRIATE UTILITY COMPANY.
5. ANY EXISTING WORK OR PROPERTY DAMAGED OR DISRUPTED BY CONSTRUCTION/ DEMOLITION ACTIVITIES SHALL BE REPLACED OR REPAIRED TO MATCH ORIGINAL EXISTING CONDITIONS BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.
6. SAW CUT AND REMOVE PAVEMENT ONE (1) FOOT OFF PROPOSED EDGE OF PAVEMENT OR EXISTING CURB LINE IN ALL AREAS WHERE PAVEMENT TO BE REMOVED ABUTS EXISTING PAVEMENT OR CONCRETE TO REMAIN.
7. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FAMILIARIZE THEMSELVES WITH THE CONDITIONS OF ALL OF THE PERMIT APPROVALS.
8. THE CONTRACTOR SHALL OBTAIN AND PAY FOR ADDITIONAL PERMITS, NOTICES AND FEES NECESSARY TO COMPLETE THE WORK AND ARRANGE FOR AND PAY FOR NECESSARY INSPECTIONS AND APPROVALS FROM THE AUTHORITIES HAVING JURISDICTION.
9. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL DEMOLITION AND OFF-SITE DISPOSAL OF MATERIALS REQUIRED TO COMPLETE THE WORK, EXCEPT FOR WORK NOTED TO BE COMPLETED BY OTHERS AND AS SPECIFIED IN NOTE #25.
10. UTILITIES SHALL BE TERMINATED AT THE MAIN LINE PER UTILITY COMPANY AND THE CITY OF PORTSMOUTH STANDARDS. THE CONTRACTOR SHALL REMOVE ALL ABANDONED UTILITIES LOCATED WITHIN THE LIMITS OF WORK.
11. CONTRACTOR SHALL VERIFY ORIGIN OF ALL DRAINS AND UTILITIES PRIOR TO REMOVAL/TERMINATION TO DETERMINE IF DRAINS OR UTILITY IS ACTIVE, AND SERVICES ANY ON OR OFF-SITE STRUCTURE TO REMAIN. THE CONTRACTOR SHALL NOTIFY ENGINEER IMMEDIATELY OF ANY SUCH UTILITY FOUND AND SHALL MAINTAIN THESE UTILITIES UNTIL PERMANENT SOLUTION IS IN PLACE.
12. PAVEMENT REMOVAL LIMITS ARE SHOWN FOR CONTRACTOR'S CONVENIENCE. ADDITIONAL PAVEMENT REMOVAL MAY BE REQUIRED DEPENDING ON THE CONTRACTOR'S OPERATION. CONTRACTOR TO VERIFY FULL LIMITS OF PAVEMENT REMOVAL PRIOR TO BID.
13. THE CONTRACTOR SHALL REMOVE AND DISPOSE OF ALL EXISTING STRUCTURES, CONCRETE PADS, UTILITIES AND PAVEMENT WITHIN THE WORK LIMITS SHOWN UNLESS SPECIFICALLY IDENTIFIED TO REMAIN. ITEMS TO BE REMOVED INCLUDE BUT ARE NOT LIMITED TO: CONCRETE, PAVEMENT, CURBS, LIGHTING, MANHOLES, CATCH BASINS, UNDER GROUND PIPING, POLES, STAIRS, SIGNS, FENCES, RAMPS, WALLS, BOLLARDS, BUILDING SLABS, FOUNDATION, TREES AND LANDSCAPING.
14. COORDINATE ALL WORK WITHIN THE PUBLIC RIGHT OF WAYS WITH THE CITY OF PORTSMOUTH AND PEASE DEVELOPMENT AUTHORITY.
15. REMOVE TREES AND BRUSH AS REQUIRED FOR COMPLETION OF WORK. CONTRACTOR SHALL GRUB AND REMOVE ALL STUMPS WITHIN LIMITS OF WORK AND DISPOSE OF OFF SITE IN ACCORDANCE WITH FEDERAL, STATE, AND LOCAL LAWS AND REGULATIONS.
16. CONTRACTOR SHALL PROTECT ALL PROPERTY MONUMENTATION THROUGHOUT DEMOLITION AND CONSTRUCTION OPERATIONS. SHOULD ANY MONUMENTATION BE DISTURBED BY BY THE CONTRACTOR, THE CONTRACTOR SHALL EMPLOY A NEW HAMPSHIRE LICENSED SURVEYOR TO REPLACE DISTURBED MONUMENTS.
17. PROVIDE INLET PROTECTION BARRIERS AT ALL CATCH BASINS/CURB INLETS WITHIN CONSTRUCTION LIMITS AS WELL AS CATCH BASINS/CURB INLETS THAT MAY RECEIVE RUNOFF FROM CONSTRUCTION ACTIVITIES. INLET PROTECTION BARRIERS SHALL BE MAINTAINED FOR THE DURATION OF THE PROJECT. INLET PROTECTION BARRIERS SHALL BE "HIGH FLOW SILT SACK" BY ACF ENVIRONMENTAL OR EQUAL. INSPECT BARRIERS WEEKLY AND AFTER EACH RAIN EVENT OF 0.25 INCHES OR GREATER. CONTRACTOR SHALL COMPLETE A MAINTENANCE INSPECTION REPORT AFTER EACH INSPECTION. SEDIMENT DEPOSITS SHALL BE REMOVED AFTER EACH STORM EVENT OR MORE OFTEN IF THE FABRIC BECOMES CLOGGED OR SEDIMENT HAS ACCUMULATED TO 1/3 THE DESIGN DEPTH OF THE BARRIER.
18. THE CONTRACTOR SHALL PHASE DEMOLITION AND CONSTRUCTION AS REQUIRED TO PROVIDE CONTINUOUS SERVICE TO EXISTING BUSINESSES THROUGHOUT THE CONSTRUCTION PERIOD. EXISTING BUSINESS SERVICES INCLUDE, BUT ARE NOT LIMITED TO ELECTRICAL, COMMUNICATION, FIRE PROTECTION, DOMESTIC WATER AND SEWER SERVICES. TEMPORARY SERVICES, IF REQUIRED, SHALL COMPLY WITH ALL FEDERAL, STATE, LOCAL AND UTILITY COMPANY STANDARDS. CONTRACTOR SHALL PROVIDE DETAILED CONSTRUCTION SCHEDULE TO OWNER PRIOR TO ANY DEMOLITION/CONSTRUCTION ACTIVITIES.
19. EROSION CONTROL MEASURES SHALL BE INSTALLED PRIOR TO THE START OF ANY CLEARING OR DEMOLITION ACTIVITIES.
20. THE CONTRACTOR SHALL PAY ALL COSTS NECESSARY FOR TEMPORARY PARTITIONING, BARRICADING, FENCING, SECURITY AND SAFETY DEVICES REQUIRED FOR THE MAINTENANCE OF A CLEAN AND SAFE CONSTRUCTION SITE.
21. SAW CUT AND REMOVE PAVEMENT AND CONSTRUCT PAVEMENT TRENCH PATCH FOR ALL UTILITIES TO BE REMOVED AND PROPOSED UTILITIES LOCATED IN EXISTING PAVEMENT AREAS TO REMAIN.
22. THE CONTRACTOR SHALL ACQUIRE A PDA DIG PERMIT BEFORE ANY EARTH DISTURBANCE CAN TAKE PLACE. ALLOW 7 CALENDAR DAYS FOR PROCESSING.
23. ALL MONITORING WELLS WITHIN LIMIT OF WORK SHALL BE PROTECTED DURING CONSTRUCTION. IF ANY MONITORING WELL NEEDS TO BE REMOVED OR ADJUSTED THIS WORK SHALL BE COORDINATED WITH THE PEASE DEVELOPMENT AUTHORITY.
24. CONTRACTOR SHALL COORDINATE WITH THE PROJECT SURVEYOR FOR BENCHMARK AND CONTROL POINTS PRIOR TO CONSTRUCTION.
25. ALL EXCESS SOIL RESULTING FROM THE CONSTRUCTION SHALL REMAIN ON SITE. COORDINATE WITH OWNER AND PEASE DEVELOPMENT AUTHORITY ON FINAL LOCATION OF EXCESS MATERIALS.
26. BEFORE ANY DEWATERING IS PERFORMED, COORDINATION BETWEEN THE OWNER, CONTRACTOR, PDA, NHDES AND THE AIR FORCE IS REQUIRED TO DETERMINE PROPER PROCEDURES AND PERMITTING REQUIRED. AT A MINIMUM A NHDES TEMPORARY DISCHARGE PERMIT IS REQUIRED.

Tighe&Bond

STATE OF NEW HAMPSHIRE – PATRICK CRIMMINS No. 12378 LICENSED PROFESSIONAL ENGINEER
5/20/24

STATE OF NEW HAMPSHIRE – NEIL A. HANSEN No. 15227 LICENSED PROFESSIONAL ENGINEER
05/20/2024

SCALE IN FEET
0 40' 80'
GRAPHIC SCALE

Proposed Industrial Development

Lonza Biologics

Portsmouth,
New Hampshire

MARK	DATE	DESCRIPTION
Q	5/20/2024	Solar - Amended Approval
P	4/2/2024	Ph2 IFC Addendum #1
O	12/15/2023	Ph2 Issued for Construction
N	11/9/2023	Revised P.B. Submission
M	9/27/2023	P.B. Submission
L	9/1/2022	Issued for Construction
K	5/27/2022	Issued for Bid

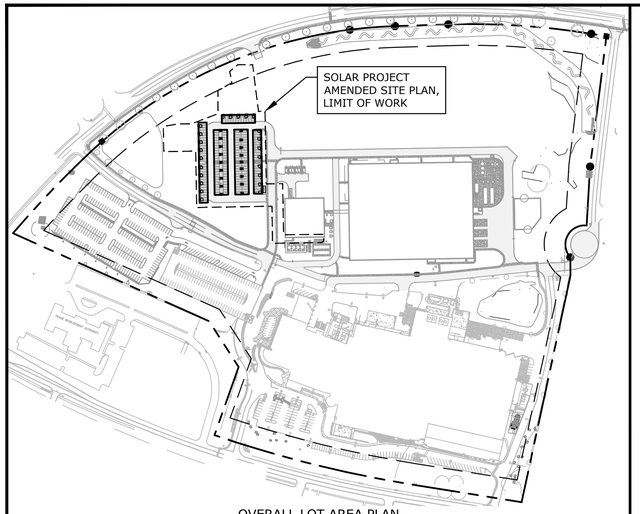
PROJECT NO:	L-0700-013
DATE:	04/03/2018
FILE:	L-0700-026-C-DSGN.dwg
DRAWN BY:	CJK
CHECKED:	NAH
APPROVED:	PMC

PHASE 2
DEMOLITION PLAN

SCALE: AS SHOWN

C-161

Last Save Date: May 17, 2024 3:51 PM By: NAHANSEN
Plot Date: May 17, 2024 3:52 PM By: Nathan A. Hansen
T&B File Location: J:\LL\L0700 Lonza Biologics Expansion was 1576F\026 Project Albacore\Drawings\AutoCAD\L-0700-026-C-DSGN.dwg Layout Tab: C-161 (Solar)



OVERALL LOT AREA PLAN
SCALE : 1" = 250'

SITE DATA

LOCATION: TAX MAP 305, LOTS 1 & 2 — 70 & 80 CORPORATE DRIVE, PORTSMOUTH, NH; TAX MAP 305, LOT 6 — 101 INTERNATIONAL DRIVE, PORTSMOUTH, NH

ZONING DISTRICT: AIRPORT, BUSINESS & COMMERCIAL (ABC)

DIMENSIONAL REQUIREMENTS:

	REQUIRED	PROVIDED
MINIMUM LOT AREA:	5 AC	43.4± AC
MINIMUM STREET FRONTAGE:	200 FT	1,038 FT
MINIMUM FRONT YARD SETBACK:	70 FT	70 FT
SIDE SETBACK	30 FT	30 FT
REAR SETBACK	50 FT	51 FT
MINIMUM OPEN SPACE	25 %	59.9± %

MAXIMUM STRUCTURE HEIGHT SHALL NOT EXCEED FAA CRITERIA.

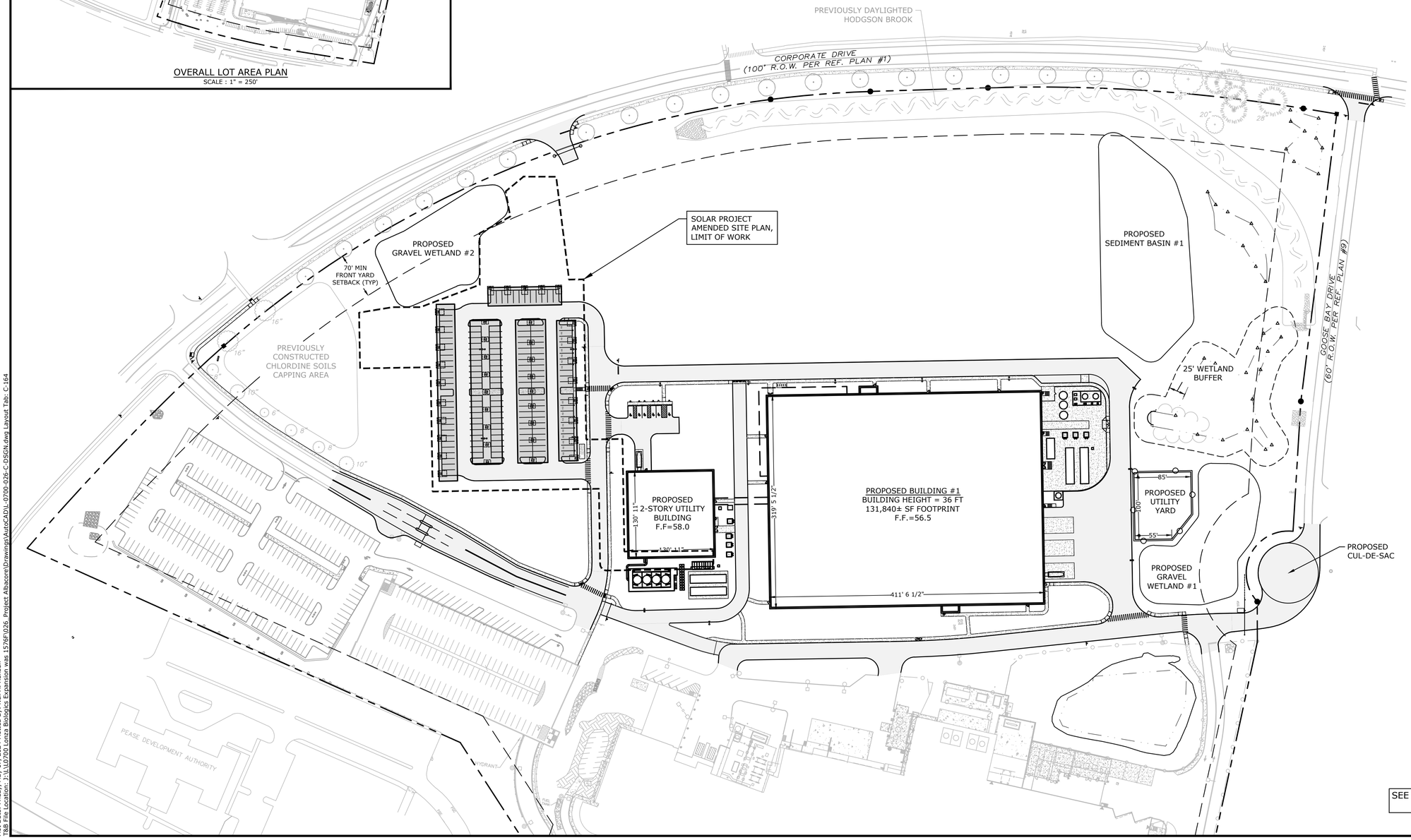
PARKING REQUIREMENTS:

REQUIRED PARKING
2 SPACES PER 3 EMPLOYEES ON LARGEST SHIFT

990 EXISTING EMPLOYEES	660 SPACES
180 ANTICIPATED EMPLOYEES	120 SPACES
TOTAL REQUIRED:	880 SPACES

PARKING PROVIDED

EXISTING SPACES:	801 SPACES
PROPOSED SURFACE PARKING:	156 SPACES
TOTAL:	957 SPACES



SEE SHEET C-165 FOR LEGEND AND SITE NOTES

Tighe&Bond

STATE OF NEW HAMPSHIRE – PATRICK CRIMMINS No. 12378 LICENSED PROFESSIONAL ENGINEER – 5/20/24

STATE OF NEW HAMPSHIRE – NEIL A. HANSEN No. 15227 LICENSED PROFESSIONAL ENGINEER – 05/20/2024

SCALE IN FEET
0 80' 160'
GRAPHIC SCALE

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Lonza Biologics

Portsmouth,
New Hampshire

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DRAWN BY:	CJK
CHECKED:	NAH
APPROVED:	PMC

PHASE 2 OVERALL SITE PLAN

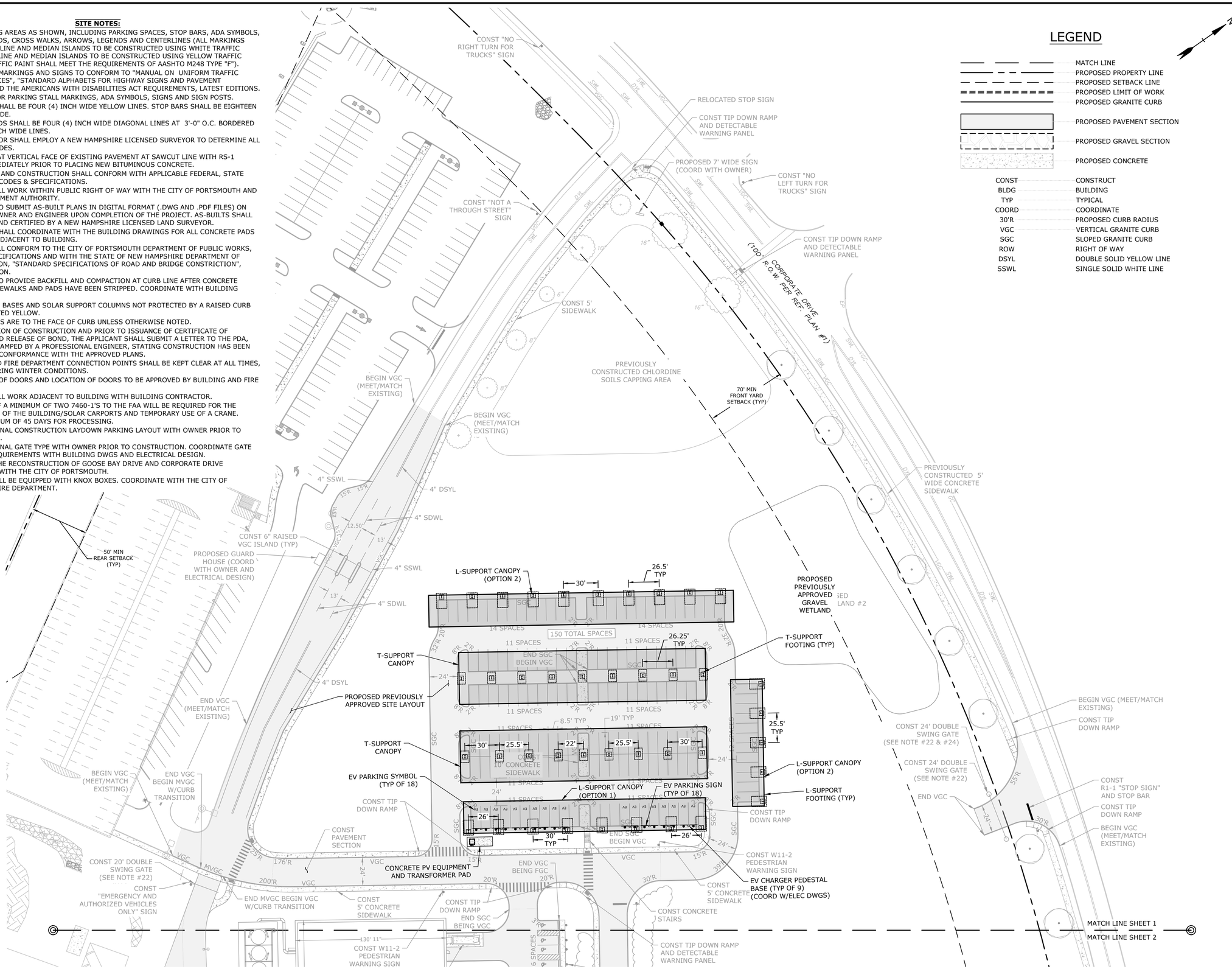
SCALE: AS SHOWN

C-164

Last Save Date: May 17, 2024 3:51 PM By: NAHANSEN
Plot Date: May 17, 2024 Plotted By: Neil A. Hansen
T&B File Location: J:\L\L0700 Lonza Biologics Expansion was 1576F\026. Project Albacore\Drawings\AutoCAD\L-0700-026-C-DSGN.dwg Layout Tab: C-164

SITE NOTES:

1. STRIPE PARKING AREAS AS SHOWN, INCLUDING PARKING SPACES, STOP BARS, ADA SYMBOLS, PAINTED ISLANDS, CROSS WALKS, ARROWS, LEGENDS AND CENTERLINES (ALL MARKINGS EXCEPT CENTERLINE AND MEDIAN ISLANDS TO BE CONSTRUCTED USING WHITE TRAFFIC PAINT. CENTERLINE AND MEDIAN ISLANDS TO BE CONSTRUCTED USING YELLOW TRAFFIC PAINT. ALL TRAFFIC PAINT SHALL MEET THE REQUIREMENTS OF AASHTO M248 TYPE "F").
2. ALL PAVEMENT MARKINGS AND SIGNS TO CONFORM TO "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES", "STANDARD ALPHABETS FOR HIGHWAY SIGNS AND PAVEMENT MARKINGS", AND THE AMERICANS WITH DISABILITIES ACT REQUIREMENTS, LATEST EDITIONS.
3. SEE DETAILS FOR PARKING STALL MARKINGS, ADA SYMBOLS, SIGNS AND SIGN POSTS.
4. CENTERLINES SHALL BE FOUR (4) INCH WIDE YELLOW LINES. STOP BARS SHALL BE EIGHTEEN (18) INCHES WIDE.
5. PAINTED ISLANDS SHALL BE FOUR (4) INCH WIDE DIAGONAL LINES AT 3'-0" O.C. BORDERED BY FOUR (4) INCH WIDE LINES.
6. THE CONTRACTOR SHALL EMPLOY A NEW HAMPSHIRE LICENSED SURVEYOR TO DETERMINE ALL LINES AND GRADES.
7. CLEAN AND COAT VERTICAL FACE OF EXISTING PAVEMENT AT SAWCUT LINE WITH RS-1 EMULSION IMMEDIATELY PRIOR TO PLACING NEW BITUMINOUS CONCRETE.
8. ALL MATERIALS AND CONSTRUCTION SHALL CONFORM WITH APPLICABLE FEDERAL, STATE AND/OR TOWN CODES & SPECIFICATIONS.
9. COORDINATE ALL WORK WITHIN PUBLIC RIGHT OF WAY WITH THE CITY OF PORTSMOUTH AND PEASE DEVELOPMENT AUTHORITY.
10. CONTRACTOR TO SUBMIT AS-BUILT PLANS IN DIGITAL FORMAT (.DWG AND .PDF FILES) ON DISK TO THE OWNER AND ENGINEER UPON COMPLETION OF THE PROJECT. AS-BUILTS SHALL BE PREPARED AND CERTIFIED BY A NEW HAMPSHIRE LICENSED LAND SURVEYOR.
11. CONTRACTOR SHALL COORDINATE WITH THE BUILDING DRAWINGS FOR ALL CONCRETE PADS & SIDEWALKS ADJACENT TO BUILDING.
12. ALL WORK SHALL CONFORM TO THE CITY OF PORTSMOUTH DEPARTMENT OF PUBLIC WORKS, STANDARD SPECIFICATIONS AND WITH THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION, "STANDARD SPECIFICATIONS OF ROAD AND BRIDGE CONSTRICTION", CURRENT EDITION.
13. CONTRACTOR TO PROVIDE BACKFILL AND COMPACTION AT CURB LINE AFTER CONCRETE FORMS FOR SIDEWALKS AND PADS HAVE BEEN STRIPPED. COORDINATE WITH BUILDING CONTRACTOR.
14. ALL LIGHT POLE BASES AND SOLAR SUPPORT COLUMNS NOT PROTECTED BY A RAISED CURB SHALL BE PAINTED YELLOW.
15. ALL DIMENSIONS ARE TO THE FACE OF CURB UNLESS OTHERWISE NOTED.
16. UPON COMPLETION OF CONSTRUCTION AND PRIOR TO ISSUANCE OF CERTIFICATE OF OCCUPANCY AND RELEASE OF BOND, THE APPLICANT SHALL SUBMIT A LETTER TO THE PDA, SIGNED AND STAMPED BY A PROFESSIONAL ENGINEER, STATING CONSTRUCTION HAS BEEN COMPLETED IN CONFORMANCE WITH THE APPROVED PLANS.
17. FIRE LANES AND FIRE DEPARTMENT CONNECTION POINTS SHALL BE KEPT CLEAR AT ALL TIMES, INCLUDING DURING WINTER CONDITIONS.
18. FINAL NUMBER OF DOORS AND LOCATION OF DOORS TO BE APPROVED BY BUILDING AND FIRE DEPARTMENTS.
19. COORDINATE ALL WORK ADJACENT TO BUILDING WITH BUILDING CONTRACTOR.
20. SUBMISSION OF A MINIMUM OF TWO 7460-1'S TO THE FAA WILL BE REQUIRED FOR THE CONSTRUCTION OF THE BUILDING/SOLAR CARPORTS AND TEMPORARY USE OF A CRANE. ALLOW A MINIMUM OF 45 DAYS FOR PROCESSING.
21. COORDINATE FINAL CONSTRUCTION LAYDOWN PARKING LAYOUT WITH OWNER PRIOR TO CONSTRUCTION.
22. COORDINATE FINAL GATE TYPE WITH OWNER PRIOR TO CONSTRUCTION. COORDINATE GATE ELECTRICAL REQUIREMENTS WITH BUILDING DWGS AND ELECTRICAL DESIGN.
23. COORDINATE THE RECONSTRUCTION OF GOOSE BAY DRIVE AND CORPORATE DRIVE INTERSECTION WITH THE CITY OF PORTSMOUTH.
24. ALL GATES SHALL BE EQUIPPED WITH KNOX BOXES. COORDINATE WITH THE CITY OF PORTSMOUTH FIRE DEPARTMENT.



LEGEND

- MATCH LINE
- PROPOSED PROPERTY LINE
- PROPOSED SETBACK LINE
- PROPOSED LIMIT OF WORK
- PROPOSED GRANITE CURB
- PROPOSED PAVEMENT SECTION
- PROPOSED GRAVEL SECTION
- PROPOSED CONCRETE

CONST	CONSTRUCT
BLDG	BUILDING
TYP	TYPICAL
COORD	COORDINATE
30'R	PROPOSED CURB RADIUS
VGC	VERTICAL GRANITE CURB
SGC	SLOPED GRANITE CURB
ROW	RIGHT OF WAY
DSYL	DOUBLE SOLID YELLOW LINE
SSWL	SINGLE SOLID WHITE LINE

Tighe&Bond

STATE OF NEW HAMPSHIRE – PATRICK CRIMMINS No. 12378 LICENSED PROFESSIONAL ENGINEER
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DRAWN BY:	CJK
CHECKED:	NAH
APPROVED:	PMC

PHASE 2
SITE PLAN

SCALE: AS SHOWN

C-165

Last Save Date: May 17, 2024 3:51 PM By: NAHANSEN
Plot Date: May 17, 2024 3:51 PM By: Neil A. Hansen
T&B File Location: J:\LU\0700 Lonza Biologics Expansion was 1576F\026. Project Albacore\Drawings\AutoCAD\L-0700-026-C-DSGN.dwg Layout Tab: C-165

PCB100
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INV.OUT=49.65 SW

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POS102
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PYD103
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INV.OUT=45.55 E

PYD104
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PYD201
RIM=62.00
INV.IN=55.50 NW
INV.OUT=55.40 S

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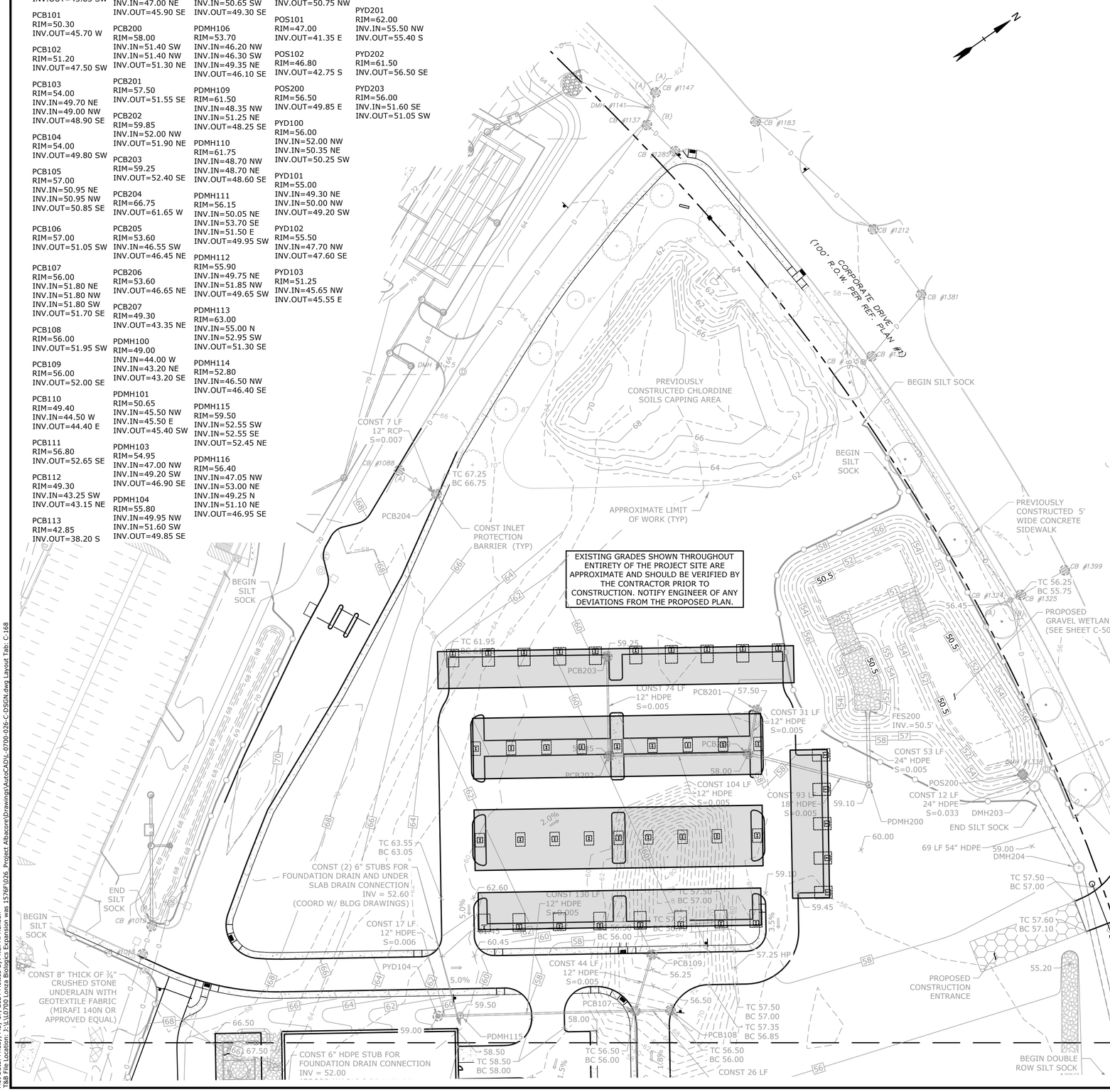

GRADING AND DRAINAGE NOTES:

1. COMPACTION REQUIREMENTS:

BELOW PAVED OR CONCRETE AREAS	95%
TRENCH BEDDING MATERIAL AND SAND BLANKET BACKFILL	95%
BELOW LOAM AND SEED AREAS	90%

* ALL PERCENTAGES OF COMPACTION SHALL BE OF THE MAXIMUM DRY DENSITY AT THE OPTIMUM MOISTURE CONTENT AS DETERMINED AND CONTROLLED IN ACCORDANCE WITH ASTM D-1557, METHOD C FIELD DENSITY TESTS SHALL BE MADE IN ACCORDANCE WITH ASTM D-1556 OR ASTM-2922.

2. ALL STORM DRAINAGE PIPES SHALL BE HIGH DENSITY POLYETHYLENE (HANCOR HI-Q, ADS N-12 OR APPROVED EQUAL), UNLESS OTHERWISE SPECIFIED.
3. SEE UTILITIES PLAN FOR ALL SITE UTILITY INFORMATION.
4. ADJUST ALL MANHOLES, CATCHBASINS, CURB BOXES, ETC. WITHIN LIMITS OF WORK TO FINISH GRADE.
5. CONTRACTOR SHALL PROVIDE A FINISH PAVEMENT SURFACE AND LAWN AREAS FREE OF LOW SPOTS AND PONDING AREAS. CRITICAL AREAS INCLUDE BUILDING ENTRANCES, EXITS, RAMPS AND LOADING DOCK AREAS ADJACENT TO THE BUILDING.
6. CONTRACTOR SHALL THOROUGHLY CLEAN ALL CATCHBASINS AND DRAIN LINES, WITHIN THE LIMIT OF WORK, OF SEDIMENT IMMEDIATELY UPON COMPLETION OF CONSTRUCTION.
7. ALL MATERIALS AND CONSTRUCTION SHALL CONFORM WITH APPLICABLE FEDERAL, STATE AND LOCAL CODES.
8. ALL DISTURBED AREAS NOT TO BE PAVED OR OTHERWISE TREATED SHALL RECEIVE 6" LOAM, SEED FERTILIZER AND MULCH.
9. ALL STORM DRAIN CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE NHDOT STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES, LATEST EDITION.
10. ALL PROPOSED CATCHBASINS SHALL BE EQUIPPED WITH OIL/GAS SEPARATOR HOODS AND 4' SUMPS.
11. CONTRACTOR TO SUBMIT AS-BUILT PLANS IN DIGITAL FORMAT (.DWG AND .PDF FILES) ON DISK TO THE OWNER AND ENGINEER UPON COMPLETION OF THE PROJECT. AS-BUILTS SHALL BE PREPARED AND CERTIFIED BY A NEW HAMPSHIRE LICENSED LAND SURVEYOR.
12. CONTRACTOR SHALL COORDINATE WITH THE PROJECT SURVEYOR FOR BENCHMARK AND CONTROL POINTS PRIOR TO CONSTRUCTION.
13. ALL WORK SHALL CONFORM TO THE CITY OF PORTSMOUTH DEPARTMENT OF PUBLIC WORKS, STANDARD SPECIFICATIONS, AND WITH THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION, "STANDARD SPECIFICATIONS OF ROAD AND BRIDGE CONSTRUCTION", CURRENT EDITION.
14. PER COORDINATION WITH THE PDA, GROUNDWATER DISCHARGE FROM THE PROPOSED FOUNDATION DRAIN AND UNDER-SLAB DRAIN OF BUILDING 1 AND THE CENTRAL UTILITY BUILDING WILL BE CONNECTED TO THE ONSITE DRAINAGE SYSTEM. IF TREATMENT OF THE GROUNDWATER DISCHARGE IS DETERMINED TO BE REQUIRED DURING THE BUILDING PERMITTING PROCESS AND RE-INFILTRATION IS NOT PERMITTED, A CARBON FILTRATION SYSTEM WILL BE NEEDED.

EROSION CONTROL NOTES:

1. INSTALL EROSION CONTROL BARRIERS AS SHOWN AS FIRST ORDER OF WORK.
2. SEE GENERAL EROSION CONTROL NOTES ON DETAIL SHEETS.
3. PROVIDE INLET PROTECTION AROUND ALL EXISTING AND PROPOSED CATCHBASIN INLETS WITHIN THE WORK LIMITS. MAINTAIN FOR THE DURATION OF THE PROJECT UNTIL PAVEMENT HAS BEEN INSTALLED.
4. INSTALL STABILIZED CONSTRUCTION ENTRANCES.
5. INSPECT INLET PROTECTION AND SILT FENCES DAILY AND AFTER EACH RAIN STORM OF 0.25 INCH OR GREATER. REPAIR/MODIFY PROTECTION AS NECESSARY TO MAXIMIZE EFFICIENCY OF FILTER. REPLACE ALL FILTERS WHEN SEDIMENT IS 1/3 THE FILTER HEIGHT.
6. ALL DISTURBED AREAS NOT TO BE PAVED OR OTHERWISE TREATED SHALL RECEIVE 6" LOAM, SEED, FERTILIZER AND MULCH.
7. CONSTRUCT EXCELSIOR MAT ON ALL SLOPES STEEPER THAN 3:1.
8. PRIOR TO ANY WORK OR SOIL DISTURBANCE COMMENCING ON THE SUBJECT PROPERTY, INCLUDING MOVING OF EARTH, THE APPLICANT SHALL INSTALL ALL EROSION AND SILTATION MITIGATION AND CONTROL MEASURES AS REQUIRED BY STATE AND LOCAL PERMITS AND APPROVALS.
9. CONTRACTOR SHALL BE RESPONSIBLE TO CONTROL DUST AND WIND EROSION THROUGHOUT THE CONSTRUCTION PERIOD. DUST CONTROL MEASURES SHALL INCLUDE, BUT NOT LIMITED TO, SPRINKLING WATER ON UNSTABLE SOILS SUBJECT TO ARID CONDITIONS.
10. THE CONTRACTOR SHALL REMOVE AND PROPERLY DISPOSE OF ALL TEMPORARY EROSION CONTROL DEVICES UPON COMPLETION OF CONSTRUCTION AND FINAL STABALIZATION.
11. ALL CATCHBASIN SUMPS AND PIPING SHALL BE THOROUGHLY CLEANED TO REMOVE ALL SEDIMENT AND DEBRIS AFTER THE PROJECT HAS BEEN PAVED.
12. TEMPORARY SOIL STOCKPILE SHALL BE SURROUNDED BY SILT FENCE AND SHALL BE STABILIZED BY TEMPORARY EROSION CONTROL SEEDING. STOCKPILE AREAS TO BE LOCATED AS FAR AS POSSIBLE FROM THE DELINEATED EDGE OF WETLAND.
13. SAFETY FENCING SHALL BE PROVIDED AROUND STOCKPILES OVER 10 FT.
14. CONCRETE TRUCKS WILL BE REQUIRED TO WASH OUT (IF NECESSARY) SHOOTS ONLY WITHIN AREAS WHERE CONCRETE HAS BEEN PLACED. NO OTHER WASH OUT WILL BE ALLOWED.

LEGEND

- MATCH LINE
- PROPOSED PROPERTY LINE
- 56 PROPOSED CONTOUR LINE
- PROPOSED DRAIN LINE (TYP)
- PROPOSED SILT SOCK
- INLET PROTECTION SILT SACK
- PROPOSED CATCHBASIN
- PROPOSED DOUBLE GRATE CATCHBASIN
- PROPOSED DRAIN MANHOLE

CONST	CONSTRUCT
BLDG	BUILDING
TYP	TYPICAL
COORD	COORDINATE
RD	ROOF DRAIN
VIF	VERIFY IN FIELD
TC	TOP OF CURB
BC	BOTTOM OF CURB

Tighe&Bond

STATE OF NEW HAMPSHIRE – PROFESSIONAL ENGINEER – PATRICK CRIMMINS No. 12378 LICENSED
5/20/24

STATE OF NEW HAMPSHIRE – PROFESSIONAL ENGINEER – NEIL A. HANSEN No. 15227 LICENSED
05/20/2024

SCALE IN FEET
0 40' 80'
GRAPHIC SCALE

Proposed Industrial Development

Lonza Biologics

Portsmouth, New Hampshire

MARK	DATE	DESCRIPTION
Q	5/20/2024	Solar - Amended Approval
P	4/2/2024	Ph2 IFC Addendum #1
O	12/15/2023	Ph2 Issued for Construction
N	11/9/2023	Revised P.B. Submission
M	9/27/2023	P.B. Submission
L	9/1/2022	Issued for Construction
K	5/27/2022	Issued for Bid

PROJECT NO:	L-0700-013
DATE:	04/03/2018
FILE:	L-0700-026-C-DSGN.dwg
DRAWN BY:	CJK
CHECKED:	NAH
APPROVED:	PMC

PHASE 2 GRADING, DRAINAGE & EROSION CONTROL PLAN

SCALE: AS SHOWN

C-168

Last Save Date: May 17, 2024 3:51 PM By: NAHANSEN
Plot Date: May 17, 2024 3:52 PM By: Neil A. Hansen
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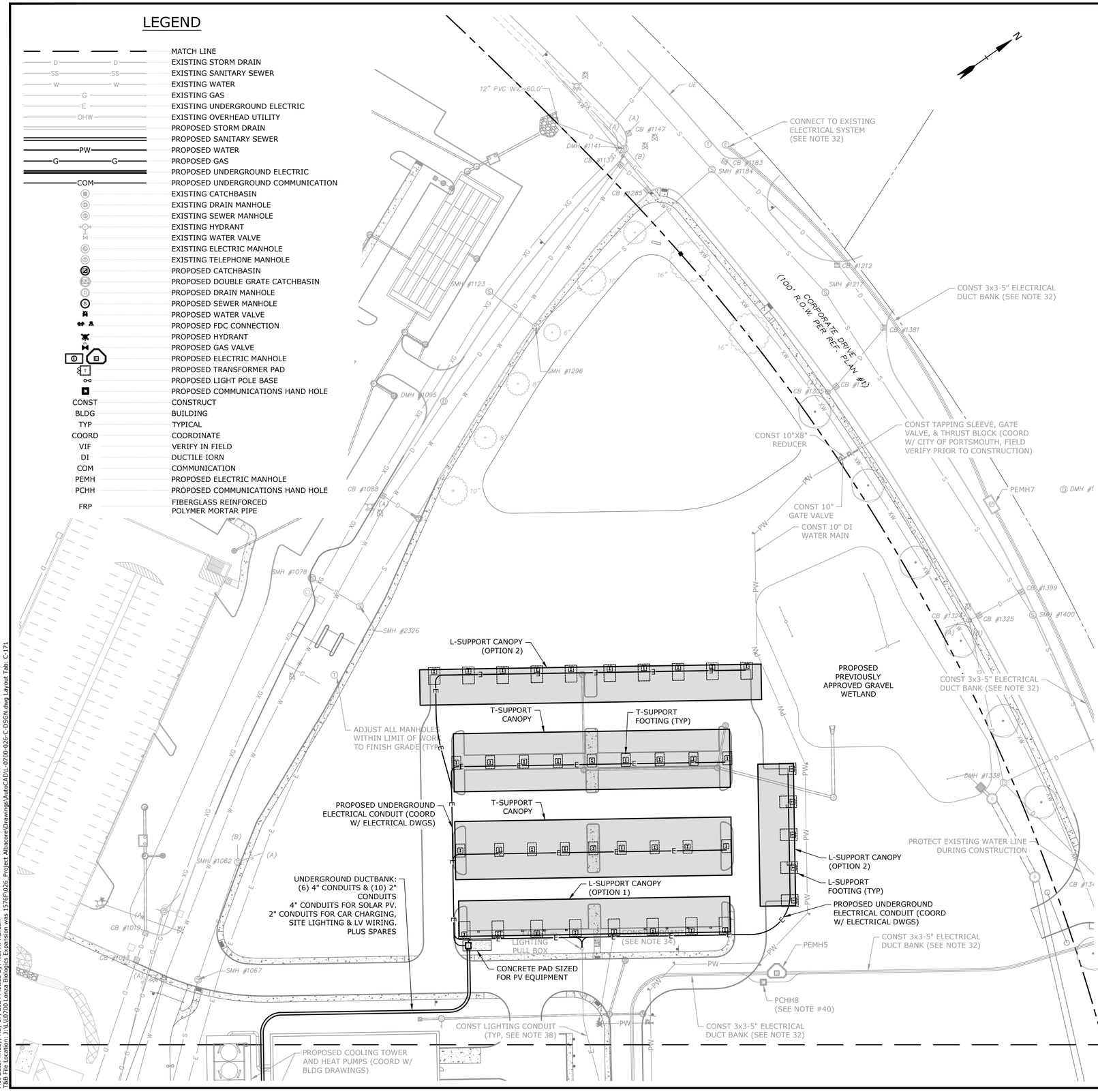
LEGEND

	MATCH LINE
D	EXISTING STORM DRAIN
SS	EXISTING SANITARY SEWER
W	EXISTING WATER
G	EXISTING GAS
E	EXISTING UNDERGROUND ELECTRIC
OHW	EXISTING OVERHEAD UTILITY
	PROPOSED STORM DRAIN
	PROPOSED SANITARY SEWER
PW	PROPOSED WATER
G	PROPOSED GAS
	PROPOSED UNDERGROUND ELECTRIC
COM	PROPOSED UNDERGROUND COMMUNICATION
	EXISTING CATCHBASIN
	EXISTING DRAIN MANHOLE
	EXISTING SEWER MANHOLE
	EXISTING HYDRANT
	EXISTING WATER VALVE
	EXISTING ELECTRIC MANHOLE
	EXISTING TELEPHONE MANHOLE
	PROPOSED CATCHBASIN
	PROPOSED DOUBLE GRATE CATCHBASIN
	PROPOSED DRAIN MANHOLE
S	PROPOSED SEWER MANHOLE
	PROPOSED WATER VALVE
	PROPOSED FDC CONNECTION
	PROPOSED HYDRANT
	PROPOSED GAS VALVE
	PROPOSED ELECTRIC MANHOLE
T	PROPOSED TRANSFORMER PAD
	PROPOSED LIGHT POLE BASE
	PROPOSED COMMUNICATIONS HAND HOLE
CONST	CONSTRUCT
BLDG	BUILDING
TYP	TYPICAL
COORD	COORDINATE
VIF	VERIFY IN FIELD
DI	DUCTILE IORN
COM	COMMUNICATION
PEMH	PROPOSED ELECTRIC MANHOLE
PCHH	PROPOSED COMMUNICATIONS HAND HOLE
FRP	FIBERGLASS REINFORCED POLYMER MORTAR PIPE



UTILITY NOTES:

1. THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE APPROXIMATE AND THE LOCATIONS ARE NOT GUARANTEED BY THE OWNER OR ENGINEER. IT IS THE CONTRACTOR'S RESPONSIBILITY TO LOCATE ALL UTILITIES, ANTICIPATE CONFLICTS, REPAIR EXISTING UTILITIES, AND RELOCATE EXISTING UTILITIES REQUIRED TO COMPLETE THE WORK AT NO ADDITIONAL COST TO THE OWNER.
2. COORDINATE ALL UTILITY WORK WITH APPROPRIATE UTILITY COMPANY.
   NATURAL GAS - UNITIL
   WATER - CITY OF PORTSMOUTH DPW
   SEWER - CITY OF PORTSMOUTH DPW
   ELECTRIC - EVERSOURCE
   COMMUNICATIONS - FAIRPOINT, COMCAST, FIRSTLIGHT
3. SEE EXISTING CONDITIONS PLAN FOR BENCHMARK INFORMATION.
4. SEE GRADING, DRAINAGE & EROSION CONTROL PLAN FOR PROPOSED GRADING AND EROSION CONTROL MEASURES.
5. ALL WATER MAIN INSTALLATIONS SHALL BE CLASS 52, CEMENT LINED DUCTILE IRON PIPE.
6. ALL WATER MAIN INSTALLATIONS SHALL BE PRESSURE TESTED AND CHLORINATED AFTER CONSTRUCTION PRIOR TO ACTIVATING THE SYSTEM. CONTRACTOR SHALL COORDINATE CHLORINATION AND TESTING WITH THE CITY OF PORTSMOUTH WATER DEPARTMENT.
7. ALL SEWER PIPE SHALL BE FIBERGLASS REINFORCED POLYMER MORTAR (FRP) PIPE UNLESS OTHERWISE STATED.
8. ALL WORK WITHIN PORTSMOUTH ROWS SHALL BE COORDINATED WITH CITY OF PORTSMOUTH AND THE PEASE DEVELOPMENT AUTHORITY.
9. CONTRACTOR SHALL MAINTAIN UTILITY SERVICES TO ABUTTING PROPERTIES THROUGHOUT CONSTRUCTION.
10. CONNECTIONS TO EXISTING WATER MAIN SHALL BE CONSTRUCTED TO CITY OF PORTSMOUTH STANDARDS.
11. EXISTING UTILITIES TO BE REMOVED SHALL BE CAPPED AT THE MAIN AND MEET THE CITY OF PORTSMOUTH DEPARTMENT OF PUBLIC WORKS STANDARDS FOR CAPPING OF WATER AND SEWER SERVICES.
12. ALL ELECTRICAL MATERIAL WORKMANSHIP SHALL CONFORM TO THE NATIONAL ELECTRIC CODE, LATEST EDITION, AND ALL APPLICABLE STATE AND LOCAL CODES.
13. THE EXACT LOCATION OF NEW UTILITY SERVICES AND CONNECTIONS SHALL BE COORDINATED WITH THE BUILDING DRAWINGS AND THE UTILITY COMPANIES.
14. ADJUST ALL MANHOLES, CATCH BASINS, CURB BOXES, ETC. WITHIN LIMITS OF WORK TO FINISH GRADE.
15. ALL UNDERGROUND CONDUITS SHALL HAVE NYLON PULL ROPES TO FACILITATE PULLING CABLES.
16. THE CONTRACTOR SHALL OBTAIN, PAY FOR, AND COMPLY WITH ALL REQUIRED PERMITS, ARRANGE FOR ALL INSPECTIONS, AND SUBMIT COPIES OF ACCEPTANCE CERTIFICATES TO THE OWNER PRIOR TO THE COMPLETION OF THIS PROJECT.
17. THE CONTRACTOR SHALL PROVIDE AND INSTALL ALL MANHOLES, BOXES, FITTINGS, CONNECTORS, COVER PLATES, AND OTHER MISCELLANEOUS ITEMS NOT NECESSARILY DETAILED ON THESE DRAWINGS TO RENDER INSTALLATION OF UTILITIES COMPLETE AND OPERATIONAL.
18. CONTRACTOR SHALL PROVIDE EXCAVATION, BEDDING, BACKFILL AND COMPACTION FOR NATURAL GAS SERVICES.
19. A 10-FOOT MINIMUM EDGE TO EDGE HORIZONTAL SEPARATION SHALL BE PROVIDED BETWEEN ALL WATER AND SANITARY SEWER LINES. AN 18-INCH MINIMUM OUTSIDE TO OUTSIDE VERTICAL SEPARATION SHALL BE PROVIDED AT ALL WATER/SANITARY SEWER CROSSINGS.
20. THE CONTRACTOR SHALL CONTACT "DIG-SAFE" 72 HOURS PRIOR TO COMMENCING CONSTRUCTION. THE CONTRACTOR SHALL HAVE THE "DIG-SAFE" NUMBER ON SITE AT ALL TIMES.
21. CONTRACTOR TO SUBMIT AS-BUILT PLANS IN DIGITAL FORMAT (.DWG AND .PDF FILES) ON DISK TO THE OWNER AND ENGINEER UPON COMPLETION OF THE PROJECT. AS-BUILTS SHALL BE PREPARED AND CERTIFIED BY A NEW HAMPSHIRE LICENSED LAND SURVEYOR.
22. SAWCUT AND REMOVE PAVEMENT AND CONSTRUCT PAVEMENT TRENCH PATCH FOR ALL PROPOSED UTILITIES LOCATED IN EXISTING PAVEMENT AREAS TO REMAIN.
23. HYDRANTS, GATE VALVES, FITTINGS, ETC. SHALL MEET THE REQUIREMENTS OF THE CITY OF PORTSMOUTH AND THE PEASE DEVELOPMENT AUTHORITY.
24. COORDINATE TESTING OF SEWER CONSTRUCTION WITH THE CITY OF PORTSMOUTH.
25. ALL SEWER PIPE WITH LESS THAN 6' OF COVER IN PAVED AREAS OR LESS THAN 4' OF COVER IN UNPAVED AREAS SHALL BE INSULATED.
26. CONTRACTOR SHALL COORDINATE ALL ELECTRIC WORK INCLUDING BUT NOT LIMITED TO: CONDUIT CONSTRUCTION, MANHOLE CONSTRUCTION, UTILITY POLE CONSTRUCTION, OVERHEAD WIRE RELOCATION, AND TRANSFORMER CONSTRUCTION WITH POWER COMPANY.
27. CONTRACTOR SHALL PHASE UTILITY CONSTRUCTION, PARTICULARLY WATER MAIN AND GAS MAIN CONSTRUCTION, AS TO MAINTAIN CONTINUOUS SERVICE TO ABUTTING PROPERTIES. CONTRACTOR SHALL COORDINATE TEMPORARY SERVICES TO ABUTTERS WITH THE UTILITY COMPANY AND AFFECTED ABUTTER.
28. SITE LIGHTING SPECIFICATIONS, CONDUIT LAYOUT AND CIRCUITRY FOR PROPOSED SITE LIGHTING AND SIGN ILLUMINATION SHALL BE PROVIDED BY THE PROJECT ELECTRICAL ENGINEER.
29. CONTRACTOR SHALL CONSTRUCT ALL UTILITIES AND DRAINS TO WITHIN 10' OF THE FOUNDATION WALLS AND CONNECT THESE TO SERVICE STUBS FROM THE BUILDING.
30. EXISTING SEWER MAIN AND STRUCTURES IN GOOSE BAY DRIVE ARE BASED ON A PROPOSED DESIGN BY UNDERWOOD ENGINEERS, DATED JULY 28, 2017, AND WAS CONSTRUCTED IN SUMMER 2018. THE PROPOSED ON-SITE SEWER DESIGN ELEVATIONS ARE BASED ON THE UNDERWOOD PLAN DURING CONSTRUCTION. THE CONTRACTOR SHALL COORDINATE SEWER CONSTRUCTION WITH THE CITY OF PORTSMOUTH, AND VERIFY ALL INVERTS PRIOR TO CONSTRUCTION.
31. LOCATION SHOWN IS APPROXIMATE ONLY. FINAL DESIGN OF NATURAL GAS SERVICE TO BE COMPLETED BY UNITIL. WORK IN CORPORATE DRIVE MAY NEED TO BE COMPLETED IN CONJUNCTION WITH FUTURE RECONSTRUCTION OF CORPORATE DRIVE. COORDINATE WITH CITY OF PORTSMOUTH AND UNITIL.
32. LOCATION AND TYPE SHOWN IS APPROXIMATE ONLY. FINAL DESIGN OF ELECTRIC SERVICE AND ASSOCIATED INFRASTRUCTURE TO BE COMPLETED BY EVERSOURCE. WORK IN CORPORATE DRIVE MAY NEED TO BE COMPLETED IN CONJUNCTION WITH FUTURE RECONSTRUCTION OF CORPORATE DRIVE. COORDINATE WITH CITY OF PORTSMOUTH AND EVERSOURCE.
33. FINAL LOCATION OF ALL WATER METER AND VALVES SHALL BE COORDINATED WITH THE CITY OF PORTSMOUTH DPW PRIOR TO CONSTRUCTION.
34. FINAL LOCATION OF FIRE HYDRANTS, FIRE DEPARTMENT CONNECTIONS AND DRY STAND PIPES WILL BE COORDINATED WITH THE BUILDING DRAWINGS AND APPROVED BY THE PORTSMOUTH FIRE DEPARTMENT PRIOR TO CONSTRUCTION.
35. THE APPLICANT SHALL HAVE A SITE SURVEY CONDUCTED BY A RADIO COMMUNICATIONS CARRIER APPROVED BY THE CITY'S COMMUNICATIONS DIVISION. THE RADIO COMMUNICATIONS CARRIER MUST BE FAMILIAR AND CONVERSANT WITH THE POLICE AND RADIO CONFIGURATION. IF THE SITE SURVEY INDICATES IT IS NECESSARY TO INSTALL A SIGNAL REPEATER EITHER ON OR NEAR THE PROPOSED PROJECT, THOSE COSTS SHALL BE THE RESPONSIBILITY OF THE PROPERTY OWNER. THE OWNER SHALL COORDINATE WITH THE SUPERVISOR OF RADIO COMMUNICATIONS FOR THE CITY.
36. CONTRACTOR SHALL PERFORM TEST PITS TO VERIFY INVERT ELEVATIONS IN FIELD PRIOR TO CONSTRUCTION AND SHALL NOTIFY ENGINEER IF ELEVATION DIFFERS FROM PLAN.
37. CONTRACTOR SHALL DISPOSE OF ASBESTOS CEMENT PIPES IN ACCORDANCE WITH ALL FEDERAL, STATE, AND LOCAL REGULATIONS SHOULD ANY BE FOUND DURING CONSTRUCTION.
38. COORDINATE LIGHTING CONDUIT QUANTITY AND SIZE REQUIREMENTS WITH ELECTRICAL DESIGNS.
39. ABANDON EXISTING SEWERS, WHERE NOTED ON DRAWINGS ONCE PROPOSED SEWERS HAVE BEEN INSTALLED, TESTED, AND ACCEPTED BY THE CITY. EXISTING SEWERS LESS THAN 24" DIAMETER SHALL BE ABANDONED BY PLACING CONCRETE PLUGS IN THE OPEN ENDS, IN ACCORDANCE WITH SPECIFICATION SECTION 02280.
40. CONTRACTOR SHALL COORDINATE FINAL COMMUNICATIONS HAND HOLD LOCATIONS, CONDUIT SIZE AND QUANTITY WITH COMMUNICATIONS COMPANIES PRIOR TO CONSTRUCTION.

Tighe&Bond

STATE OF NEW HAMPSHIRE – PROFESSIONAL ENGINEER – PATRICK CRIMMINS No. 12378 LICENSED
5/20/24

STATE OF NEW HAMPSHIRE – PROFESSIONAL ENGINEER – NEIL A. HANSEN No. 15227 LICENSED
05/20/2024

SCALE IN FEET
0 40' 80'
GRAPHIC SCALE

Proposed Industrial Development

Lonza Biologics

Portsmouth, New Hampshire

MARK	DATE	DESCRIPTION
Q	5/20/2024	Solar - Amended Approval
P	4/2/2024	Ph2 IFC Addendum #1
O	12/15/2023	Ph2 Issued for Construction
N	11/9/2023	Revised P.B. Submission
M	9/27/2023	P.B. Submission
L	9/1/2022	Issued for Construction
K	5/27/2022	Issued for Bid

PROJECT NO:	L-0700-013
DATE:	04/03/2018
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DRAWN BY:	CJK
CHECKED:	NAH
APPROVED:	PMC

PHASE 2
UTILITIES PLAN

SCALE: AS SHOWN

C-171

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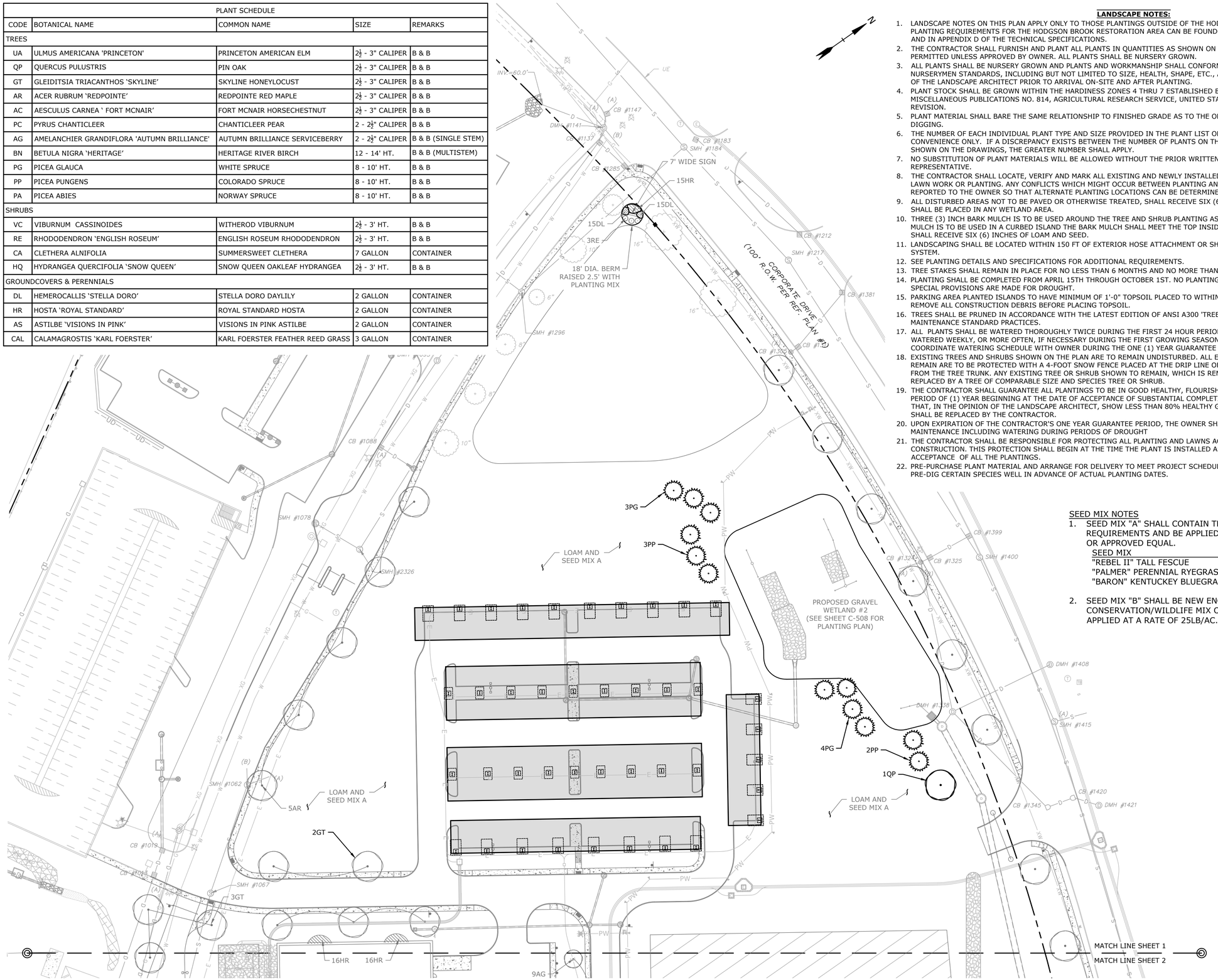
Plot Date: May 17, 2024 3:52 PM By: NAHANSEN
T&B File Location: J:\LL\0700 Lonza Biologics Expansion was 1576F\026_Project Albacore\Drawings\AutoCAD\L-0700-026-C-DSGN.dwg Layout Tab: C-171

PLANT SCHEDULE				
CODE	BOTANICAL NAME	COMMON NAME	SIZE	REMARKS
TREES				
UA	ULMUS AMERICANA 'PRINCETON'	PRINCETON AMERICAN ELM	2½ - 3" CALIPER	B & B
QP	QUERCUS PULUSTRIS	PIN OAK	2½ - 3" CALIPER	B & B
GT	GLEIDITSIA TRIACANTHOS 'SKYLINE'	SKYLINE HONEYLOCUST	2½ - 3" CALIPER	B & B
AR	ACER RUBRUM 'REDPOINTE'	REDPOINTE RED MAPLE	2½ - 3" CALIPER	B & B
AC	AESCULUS CARNEA ' FORT MCNAIR'	FORT MCNAIR HORSECHESTNUT	2½ - 3" CALIPER	B & B
PC	PYRUS CHANTICLEER	CHANTICLEER PEAR	2 - 2½" CALIPER	B & B
AG	AMELANCHIER GRANDIFLORA 'AUTUMN BRILLIANCE'	AUTUMN BRILLIANCE SERVICEBERRY	2 - 2½" CALIPER	B & B (SINGLE STEM)
BN	BETULA NIGRA 'HERITAGE'	HERITAGE RIVER BIRCH	12 - 14' HT.	B & B (MULTISTEM)
PG	PICEA GLAUCA	WHITE SPRUCE	8 - 10' HT.	B & B
PP	PICEA PUNGENS	COLORADO SPRUCE	8 - 10' HT.	B & B
PA	PICEA ABIES	NORWAY SPRUCE	8 - 10' HT.	B & B
SHRUBS				
VC	VIBURNUM CASSINOIDES	WITHEROD VIBURNUM	2½ - 3' HT.	B & B
RE	RHODODENDRON 'ENGLISH ROSEUM'	ENGLISH ROSEUM RHODODENDRON	2½ - 3' HT.	B & B
CA	CLETHERA ALNIFOLIA	SUMMERSWEET CLETHERA	7 GALLON	CONTAINER
HQ	HYDRANGEA QUERCIFOLIA 'SNOW QUEEN'	SNOW QUEEN OAKLEAF HYDRANGEA	2½ - 3' HT.	B & B
GROUNDCOVERS & PERENNIALS				
DL	HEMEROCALLIS 'STELLA DORO'	STELLA DORO DAYLILY	2 GALLON	CONTAINER
HR	HOSTA 'ROYAL STANDARD'	ROYAL STANDARD HOSTA	2 GALLON	CONTAINER
AS	ASTILBE 'VISIONS IN PINK'	VISIONS IN PINK ASTILBE	2 GALLON	CONTAINER
CAL	CALAMAGROSTIS 'KARL FOERSTER'	KARL FOERSTER FEATHER REED GRASS	3 GALLON	CONTAINER



LANDSCAPE NOTES:

1. LANDSCAPE NOTES ON THIS PLAN APPLY ONLY TO THOSE PLANTINGS OUTSIDE OF THE HODGSON BROOK RESTORATION AREA. PLANTING REQUIREMENTS FOR THE HODGSON BROOK RESTORATION AREA CAN BE FOUND ON PLAN SHEETS C-701 THROUGH C-714 AND IN APPENDIX D OF THE TECHNICAL SPECIFICATIONS.
2. THE CONTRACTOR SHALL FURNISH AND PLANT ALL PLANTS IN QUANTITIES AS SHOWN ON THIS PLAN. NO SUBSTITUTIONS WILL BE PERMITTED UNLESS APPROVED BY OWNER. ALL PLANTS SHALL BE NURSERY GROWN.
3. ALL PLANTS SHALL BE NURSERY GROWN AND PLANTS AND WORKMANSHIP SHALL CONFORM TO THE AMERICAN ASSOCIATION OF NURSERYMEN STANDARDS, INCLUDING BUT NOT LIMITED TO SIZE, HEALTH, SHAPE, ETC., AND SHALL BE SUBJECT TO THE APPROVAL OF THE LANDSCAPE ARCHITECT PRIOR TO ARRIVAL ON-SITE AND AFTER PLANTING.
4. PLANT STOCK SHALL BE GROWN WITHIN THE HARDINESS ZONES 4 THRU 7 ESTABLISHED BY THE PLANT HARDINESS ZONE MAP, MISCELLANEOUS PUBLICATIONS NO. 814, AGRICULTURAL RESEARCH SERVICE, UNITED STATES DEPARTMENT AGRICULTURE, LATEST REVISION.
5. PLANT MATERIAL SHALL BARE THE SAME RELATIONSHIP TO FINISHED GRADE AS TO THE ORIGINAL PLANTING GRADE PRIOR TO DIGGING.
6. THE NUMBER OF EACH INDIVIDUAL PLANT TYPE AND SIZE PROVIDED IN THE PLANT LIST OR ON THE PLAN IS FOR THE CONTRACTOR'S CONVENIENCE ONLY. IF A DISCREPANCY EXISTS BETWEEN THE NUMBER OF PLANTS ON THE LABEL AND THE NUMBER OF SYMBOLS SHOWN ON THE DRAWINGS, THE GREATER NUMBER SHALL APPLY.
7. NO SUBSTITUTION OF PLANT MATERIALS WILL BE ALLOWED WITHOUT THE PRIOR WRITTEN APPROVAL OF THE OWNER'S REPRESENTATIVE.
8. THE CONTRACTOR SHALL LOCATE, VERIFY AND MARK ALL EXISTING AND NEWLY INSTALLED UNDERGROUND UTILITIES PRIOR TO ANY LAWN WORK OR PLANTING. ANY CONFLICTS WHICH MIGHT OCCUR BETWEEN PLANTING AND UTILITIES SHALL IMMEDIATELY BE REPORTED TO THE OWNER SO THAT ALTERNATE PLANTING LOCATIONS CAN BE DETERMINED.
9. ALL DISTURBED AREAS NOT TO BE PAVED OR OTHERWISE TREATED, SHALL RECEIVE SIX (6) INCHES OF LOAM AND SEED. NO FILL SHALL BE PLACED IN ANY WETLAND AREA.
10. THREE (3) INCH BARK MULCH IS TO BE USED AROUND THE TREE AND SHRUB PLANTING AS SPECIFIED IN THE DETAILS. WHERE BARK MULCH IS TO BE USED IN A CURBED ISLAND THE BARK MULCH SHALL MEET THE TOP INSIDE EDGE OF THE CURB. ALL OTHER AREAS SHALL RECEIVE SIX (6) INCHES OF LOAM AND SEED.
11. LANDSCAPING SHALL BE LOCATED WITHIN 150 FT OF EXTERIOR HOSE ATTACHMENT OR SHALL BE PROVIDED WITH AN IRRIGATION SYSTEM.
12. SEE PLANTING DETAILS AND SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
13. TREE STAKES SHALL REMAIN IN PLACE FOR NO LESS THAN 6 MONTHS AND NO MORE THAN 1 YEAR.
14. PLANTING SHALL BE COMPLETED FROM APRIL 15TH THROUGH OCTOBER 1ST. NO PLANTING DURING JULY AND AUGUST UNLESS SPECIAL PROVISIONS ARE MADE FOR DROUGHT.
15. PARKING AREA PLANTED ISLANDS TO HAVE MINIMUM OF 1'-0" TOPSOIL PLACED TO WITHIN 3 INCHES OF THE TOP OF CURB ELEVATION REMOVE ALL CONSTRUCTION DEBRIS BEFORE PLACING TOPSOIL.
16. TREES SHALL BE PRUNED IN ACCORDANCE WITH THE LATEST EDITION OF ANSI A300 'TREES, SHRUBS AND OTHER WOOD PLANT MAINTENANCE STANDARD PRACTICES.
17. ALL PLANTS SHALL BE WATERED THOROUGHLY TWICE DURING THE FIRST 24 HOUR PERIOD AFTER PLANTING. ALL PLANTS SHALL BE WATERED WEEKLY, OR MORE OFTEN, IF NECESSARY DURING THE FIRST GROWING SEASON. LANDSCAPE CONTRACTOR SHALL COORDINATE WATERING SCHEDULE WITH OWNER DURING THE ONE (1) YEAR GUARANTEE PERIOD.
18. EXISTING TREES AND SHRUBS SHOWN ON THE PLAN ARE TO REMAIN UNDISTURBED. ALL EXISTING TREES AND SHRUBS SHOWN TO REMAIN ARE TO BE PROTECTED WITH A 4-FOOT SNOW FENCE PLACED AT THE DRIP LINE OF THE BRANCHES OR AT 8 FEET MINIMUM FROM THE TREE TRUNK. ANY EXISTING TREE OR SHRUB SHOWN TO REMAIN, WHICH IS REMOVED DURING CONSTRUCTION, SHALL BE REPLACED BY A TREE OF COMPARABLE SIZE AND SPECIES TREE OR SHRUB.
19. THE CONTRACTOR SHALL GUARANTEE ALL PLANTINGS TO BE IN GOOD HEALTHY, FLOURISHING AND ACCEPTABLE CONDITION FOR A PERIOD OF (1) YEAR BEGINNING AT THE DATE OF ACCEPTANCE OF SUBSTANTIAL COMPLETION. ALL GRASSES, TREES AND SHRUBS THAT, IN THE OPINION OF THE LANDSCAPE ARCHITECT, SHOW LESS THAN 80% HEALTHY GROWTH AT THE END OF ONE YEAR PERIOD SHALL BE REPLACED BY THE CONTRACTOR.
20. UPON EXPIRATION OF THE CONTRACTOR'S ONE YEAR GUARANTEE PERIOD, THE OWNER SHALL BE RESPONSIBLE FOR LANDSCAPE MAINTENANCE INCLUDING WATERING DURING PERIODS OF DROUGHT
21. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING ALL PLANTING AND LAWNS AGAINST DAMAGE FROM ONGOING CONSTRUCTION. THIS PROTECTION SHALL BEGIN AT THE TIME THE PLANT IS INSTALLED AND CONTINUE UNTIL THE FORMAL ACCEPTANCE OF ALL THE PLANTINGS.
22. PRE-PURCHASE PLANT MATERIAL AND ARRANGE FOR DELIVERY TO MEET PROJECT SCHEDULE AS REQUIRED IT MAY BE NECESSARY TO PRE-DIG CERTAIN SPECIES WELL IN ADVANCE OF ACTUAL PLANTING DATES.

SEED MIX NOTES

1. SEED MIX "A" SHALL CONTAIN THE FOLLOWING SEED REQUIREMENTS AND BE APPLIED AT A RATE OF 40LB/AC OR APPROVED EQUAL.

SEED MIX	% BY WEIGHT
"REBEL II" TALL FESCUE	70%
"PALMER" PERENNIAL RYEGRASS	20%
"BARON" KENTUCKEY BLUEGRASS	10%

2. SEED MIX "B" SHALL BE NEW ENGLAND CONSERVATION/WILDLIFE MIX OR APPROVED EQUAL APPLIED AT A RATE OF 25LB/AC.

SEE SHEET C-176 FOR PLANT SCHEDULE

Tighe&Bond

STATE OF NEW HAMPSHIRE - PATRICK CRIMMINS - No. 12378 - LICENSED PROFESSIONAL ENGINEER
5/20/24

STATE OF NEW HAMPSHIRE - NEIL A. HANSEN - No. 15227 - LICENSED PROFESSIONAL ENGINEER
05/20/2024

SCALE IN FEET
0 40' 80'
GRAPHIC SCALE

Proposed Industrial Development

Lonza Biologics

Portsmouth, New Hampshire

MARK	DATE	DESCRIPTION
Q	5/20/2024	Solar - Amended Approval
P	4/2/2024	Ph2 IFC Addendum #1
O	12/15/2023	Ph2 Issued for Construction
N	11/9/2023	Revised P.B. Submission
M	9/27/2023	P.B. Submission
L	9/1/2022	Issued for Construction
K	5/27/2022	Issued for Bid

PROJECT NO:	L-0700-013
DATE:	04/03/2018
FILE:	L-0700-026-C-DSGN.dwg
DRAWN BY:	CJK
CHECKED:	NAH
APPROVED:	PMC

PHASE 2
LANDSCAPE PLAN

SCALE: AS SHOWN

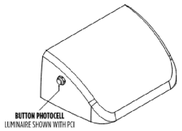
C-174

Last Save Date: May 17, 2024 - 3:31 PM By: NAHANSEN
Plot Date: May 17, 2024 - 3:31 PM By: Neil A. Hansen
T&B File Location: J:\LU\700 Lonza Biologics Expansion was 1576F\026. Project Albacore\Drawings\AutoCAD\L-0700-026-C-DSGN.dwg Layout Tab: C-174

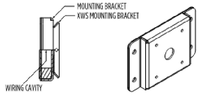
Battery Backup

- Emergency battery system provides 90-minutes of constant power to the LED system, ensuring code compliance.
- A test switch/indicator button is installed on the housing for ease of maintenance.
- 10w battery delivers ~1,500 lumens during emergency mode.
- 20w battery delivers ~3,000 lumens during emergency mode.

Luminaire shown with sensor & battery backup



BUTTON PHOTOCELL
LUMINAIRE SHOWN WITH PC1



Luminaire Schedule					
Symbol	Qty	Label	Arrangement	Description	[MANUFAC]
	3	S3	Single	MRM-LED-09L-SIL-3-UNV-DIM-30-70CRI-CXX / 48Q B3 S11G 25 S GA 4BC (25' AFG)	LSI INDUSTRIES, INC.
	4	P5-2	Back-Back	MRM-LED-12L-SIL-5W-UNV-DIM-30-70CRI-CXX / 48Q B3 S11G 20 D180 GA 4BC (20' AFG)	LSI INDUSTRIES, INC.
	7	S3	Single	MRM-LED-09L-SIL-3-UNV-DIM-30-70CRI-CXX / 48Q B3 S11G 20 S GA 4BC (20' AFG)	LSI INDUSTRIES, INC.
	1	S5-1	Single	MRM-LED-09L-SIL-5W-UNV-DIM-30-70CRI-CXX / 48Q B3 S11G 20 S GA 4BC (20' AFG)	LSI INDUSTRIES, INC.
	3	W3	Single	XWM-3-LED-12L-30-UE-CXX / WALL MTD 20' AFG	LSI INDUSTRIES, INC.
	10	W4	Single	XWM-FT-LED-12L-30-UE-CXX / WALL MTD 20' AFG	LSI INDUSTRIES, INC.
	36	WS	Single	XWS-LED-03L-SIL-FT-UNV-DIM-30-70CRI-CXX-EH / MTD 12' AFG	LSI INDUSTRIES, INC.
	3	WS2	Single	XWS-LED-03L-SIL-3-UNV-DIM-30-70CRI-CXX-EH / MTD 12' AFG	LSI INDUSTRIES, INC.

(100' R.O.W. PER REF. PLAN #7)
CORPORATE DRIVE

CONST COLUMN
MOUNTED FIXTURE (TYP)
(SEE ELEC DWGS)

MATCH LINE SHEET 1
MATCH LINE SHEET 2

Tighe&Bond

STATE OF NEW HAMPSHIRE
PATRICK CRIMMINS
No. 12378
LICENSED
PROFESSIONAL ENGINEER
5/20/24

STATE OF NEW HAMPSHIRE
NEIL A. HANSEN
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LICENSED
PROFESSIONAL ENGINEER
05/20/2024

SCALE IN FEET
0 40' 80'
GRAPHIC SCALE

Proposed Industrial Development

Lonza Biologics

Portsmouth,
New Hampshire

MARK	DATE	DESCRIPTION
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PROJECT NO:	L-0700-013
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DRAWN BY:	CJK
CHECKED:	NAH
APPROVED:	PMC

PHASE 2 PHOTOMETRIC LIGHTING PLAN

SCALE: AS SHOWN

C-177

Last Save Date: May 17, 2024 3:51 PM By: NAHANSEN
Plot Date: May 17, 2024 4:04 PM By: Neil A. Hansen
T&B File Location: J:\L\L0700 Lonza Biologics Expansion was 1576F\026. Project Albacore\Drawings\AutoCAD\L-0700-026-C-DSGN.dwg Layout Tab: C-177

GENERAL PROJECT INFORMATION

PROJECT LESSOR:	PEASE DEVELOPMENT AUTHORITY 55 INTERNATIONAL DRIVE PORTSMOUTH, NH 03801
PROJECT OWNER/ APPLICANT:	LONZA BIOLOGICS 101 INTERNATIONAL DRIVE PORTSMOUTH, NH 03801
PROJECT ADDRESS:	70 & 80 CORPORATE DRIVE PORTSMOUTH, NH 03801
PROJECT LATITUDE:	43°-04'-59.0"N
PROJECT LONGITUDE:	71°-48'-09.7"W

PROJECT DESCRIPTION

THE PROJECT CONSISTS OF THE EXPANSION OF LONZA BIOLOGICS, WHICH INCLUDES THE CONSTRUCTION OF 4 PROPOSED BUILDINGS, 1 PARKING GARAGE, AND ASSOCIATED SITE IMPROVEMENTS.

DISTURBED AREA

THE TOTAL AREA TO BE DISTURBED IS APPROXIMATELY 21.3 ACRES.

SOIL CHARACTERISTICS

BASED ON THE HIGH INTENSITY SOIL SURVEY PREPARED BY GOVE ENVIRONMENTAL SERVICES, INC. IN DECEMBER 2015, THE SITE SOILS VARY FROM WELL DRAINED TO VERY POORLY DRAINED AND PRIMARILY CONSIST OF SOMEWHAT POORLY DRAINED SOILS.

NAME OF RECEIVING WATERS

THE STORM WATER RUNOFF WILL ULTIMATELY DISCHARGE INTO HODGSON BROOK

CONSTRUCTION SEQUENCE OF MAJOR ACTIVITIES:

1. CUT AND CLEAR TREES.
2. CONSTRUCT TEMPORARY AND PERMANENT SEDIMENT, EROSION AND DETENTION CONTROL FACILITIES. EROSION, SEDIMENT AND DETENTION MEASURES SHALL BE INSTALLED PRIOR TO ANY EARTH MOVING OPERATIONS THAT WILL INFLUENCE STORMWATER RUNOFF SUCH AS:
   - NEW CONSTRUCTION
   - CONTROL OF DUST
   - NEARNESS OF CONSTRUCTION SITE TO RECEIVING WATERS
   - CONSTRUCTION DURING LATE WINTER AND EARLY SPRING
3. ALL PERMANENT DITCHES, SWALES, DETENTION, RETENTION AND SEDIMENTATION BASINS TO BE STABILIZED USING THE VEGETATIVE AND NON-STRUCTURAL BMPS PRIOR TO DIRECTING RUNOFF TO THEM.
4. CLEAR AND DISPOSE OF DEBRIS.
5. CONSTRUCT TEMPORARY CULVERTS AND DIVERSION CHANNELS AS REQUIRED.
6. GRADE AND GRAVEL ROADWAYS AND PARKING AREAS - ALL ROADS AND PARKING AREA SHALL BE STABILIZED WITHIN 72 HOURS OF ACHIEVING FINISHED GRADE.
7. BEGIN PERMANENT AND TEMPORARY SEEDING AND MULCHING. ALL CUT AND FILL SLOPES SHALL BE SEEDED AND MULCHED WITHIN 72 HOURS OF ACHIEVING FINISHED GRADE.
8. DAILY, OR AS REQUIRED, CONSTRUCT TEMPORARY BERMS, DRAINS, DITCHES, PERIMETER EROSION CONTROL MEASURES, SEDIMENT TRAPS, ETC., MULCH AND SEED AS REQUIRED.
9. SEDIMENT TRAPS AND/OR BASINS SHALL BE USED AS NECESSARY TO CONTAIN RUNOFF UNTIL SOILS ARE STABILIZED.
10. FINISH PAVING ALL ROADWAYS AND PARKING LOTS.
11. INSPECT AND MAINTAIN ALL EROSION AND SEDIMENT CONTROL MEASURES.
12. COMPLETE PERMANENT SEEDING AND LANDSCAPING.
13. REMOVE TRAPPED SEDIMENTS FROM COLLECTOR DEVICES AS APPROPRIATE AND THEN REMOVE TEMPORARY EROSION CONTROL MEASURES.

SPECIAL CONSTRUCTION NOTES:

1. THE CONSTRUCTION SEQUENCE MUST LIMIT THE DURATION AND AREA OF DISTURBANCE.
2. THE PROJECT IS TO BE MANAGED IN A MANNER THAT MEETS THE REQUIREMENTS AND INTENT OF RSA 430:53 AND CHAPTER AGR 3800 RELATIVE TO INVASIVE SPECIES.

EROSION CONTROL NOTES:

1. ALL EROSION CONTROL MEASURES AND PRACTICES SHALL CONFORM TO THE "NEW HAMPSHIRE STORMWATER MANUAL VOLUME 3: EROSION AND SEDIMENT CONTROLS DURING CONSTRUCTION" PREPARED BY THE NHDES.
2. PRIOR TO ANY WORK OR SOIL DISTURBANCE, CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR EROSION CONTROL MEASURES AS REQUIRED IN THE PROJECT MANUAL.
3. CONTRACTOR SHALL INSTALL TEMPORARY EROSION CONTROL BARRIERS, INCLUDING HAY BALES, SILT FENCES, MULCH BERMS, SILT SACKS AND SILT SOCKS AS SHOWN IN THESE DRAWINGS AS THE FIRST ORDER OF WORK.
4. SILT SACK INLET PROTECTION SHALL BE INSTALLED IN ALL EXISTING AND PROPOSED CATCH BASIN INLETS WITHIN THE WORK LIMITS AND BE MAINTAINED FOR THE DURATION OF THE PROJECT.
5. PERIMETER CONTROLS INCLUDING SILT FENCES, MULCH BERM, SILT SOCK, AND/OR HAY BALE BARRIERS SHALL BE MAINTAINED FOR THE DURATION OF THE PROJECT UNTIL NON-PAVED AREAS HAVE BEEN STABILIZED.
6. THE CONTRACTOR SHALL REMOVE AND PROPERLY DISPOSE OF ALL TEMPORARY EROSION CONTROL DEVICES UPON COMPLETION OF CONSTRUCTION.
7. ALL DISTURBED AREAS NOT OTHERWISE BEING TREATED SHALL RECEIVE 6" LOAM, SEED AND FERTILIZER.
8. INSPECT ALL INLET PROTECTION AND PERIMETER CONTROLS WEEKLY AND AFTER EACH RAIN STORM OF 0.25 INCH OR GREATER. REPAIR/MODIFY PROTECTION AS NECESSARY TO MAXIMIZE EFFICIENCY OF FILTER. REPLACE ALL FILTERS WHEN SEDIMENT IS 1/3 THE FILTER HEIGHT.
9. CONSTRUCT EROSION CONTROL BLANKETS ON ALL SLOPES STEEPER THAN 3:1.

STABILIZATION:

1. AN AREA SHALL BE CONSIDERED STABLE WHEN ONE OF THE FOLLOWING HAS OCCURRED:
   A. BASE COURSE GRAVELS HAVE BEEN INSTALLED IN AREAS TO BE PAVED;
   B. A MINIMUM OF 85% VEGETATED GROWTH HAS BEEN ESTABLISHED;
   C. A MINIMUM OF 3" OF NON-EROSIVE MATERIAL SUCH AS STONE OR RIPRAP HAS BEEN INSTALLED;
   D. EROSION CONTROL BLANKETS HAVE BEEN PROPERLY INSTALLED.;
   E. IN AREAS TO BE PAVED, "STABLE" MEANS THAT BASE COURSE GRAVELS MEETING THE REQUIREMENTS OF NHDOT STANDARD FOR ROAD AND BRIDGE CONSTRUCTION, 2016, ITEM 304.2 HAVE BEEN INSTALLED.
2. WINTER STABILIZATION PRACTICES:
   A. ALL PROPOSED VEGETATED AREAS THAT DO NOT EXHIBIT A MINIMUM OF 85 PERCENT VEGETATIVE GROWTH BY OCTOBER 15, OR WHICH ARE DISTURBED AFTER OCTOBER 15, SHALL BE STABILIZED BY SEEDING AND INSTALLING EROSION CONTROL BLANKETS ON SLOPES GREATER THAN 3:1, AND SEEDING AND PLACING 3 TO 4 TONS OF MULCH PER ACRE, SECURED WITH ANCHORED NETTING, ELSEWHERE. THE INSTALLATION OF EROSION CONTROL BLANKETS OR MULCH AND NETTING SHALL NOT OCCUR OVER ACCUMULATED SNOW OR ON FROZEN GROUND AND SHALL BE COMPLETED IN ADVANCE OF THAW OR SPRING MELT EVENTS;
   B. ALL DITCHES OR SWALES WHICH DO NOT EXHIBIT A MINIMUM OF 85 PERCENT VEGETATIVE GROWTH BY OCTOBER 15, OR WHICH ARE DISTURBED AFTER OCTOBER 15, SHALL BE STABILIZED TEMPORARILY WITH STONE OR EROSION CONTROL BLANKETS APPROPRIATE FOR THE DESIGN FLOW CONDITIONS;
   C. AFTER NOVEMBER 15, INCOMPLETE ROAD OR PARKING SURFACES, WHERE WORK HAS STOPPED FOR THE WINTER SEASON, SHALL BE PROTECTED WITH A MINIMUM OF 3 INCHES OF CRUSHED GRAVEL PER NHDOT ITEM 304.3, OR IF CONSTRUCTION IS TO CONTINUE THROUGH THE WINTER SEASON BE CLEARED OF ANY ACCUMULATED SNOW AFTER EACH STORM EVENT;
3. STABILIZATION SHALL BE INITIATED ON ALL LOAM STOCKPILES, AND DISTURBED AREAS, WHERE CONSTRUCTION ACTIVITY SHALL NOT OCCUR FOR MORE THAN TWENTY-ONE (21) CALENDAR DAYS BY THE FOURTEENTH (14TH) DAY AFTER CONSTRUCTION ACTIVITY HAS PERMANENTLY OR TEMPORARILY CEASED IN THAT AREA. STABILIZATION MEASURES TO BE USED INCLUDE:
   A. TEMPORARY SEEDING;
   B. MULCHING.
4. ALL AREAS SHALL BE STABILIZED WITHIN 45 DAYS OF INITIAL DISTURBANCE.
5. WHEN CONSTRUCTION ACTIVITY PERMANENTLY OR TEMPORARILY CEASES WITHIN 100 FEET OF NEARBY SURFACE WATERS OR DELINEATED WETLANDS, THE AREA SHALL BE STABILIZED WITHIN SEVEN (7) DAYS OR PRIOR TO A RAIN EVENT. ONCE CONSTRUCTION ACTIVITY CEASES PERMANENTLY IN AN THESE AREAS, SILT FENCES, MULCH BERMS, HAY BALE BARRIERS AND ANY EARTH/DIKES SHALL BE REMOVED ONCE PERMANENT MEASURES ARE ESTABLISHED.
6. DURING CONSTRUCTION, RUNOFF WILL BE DIVERTED AROUND THE SITE WITH EARTH DIKES, PIPING OR STABILIZED CHANNELS WHERE POSSIBLE. SHEET RUNOFF FROM THE SITE WILL BE FILTERED THROUGH SILT FENCES, MULCH BERMS, HAY BALE BARRIERS, OR SILT SOCKS. ALL STORM DRAIN BASIN INLETS SHALL BE PROVIDED WITH FLARED END SECTIONS AND TRASH RACKS. THE SITE SHALL BE STABILIZED FOR THE WINTER BY NOVEMBER 15.

DUST CONTROL:

1. THE CONTRACTOR SHALL BE RESPONSIBLE TO CONTROL DUST THROUGHOUT THE CONSTRUCTION PERIOD.
2. DUST CONTROL METHODS SHALL INCLUDE, BUT BE NOT LIMITED TO SPRINKLING WATER ON EXPOSED AREAS, COVERING LOADED DUMP TRUCKS LEAVING THE SITE, AND TEMPORARY MULCHING.
3. DUST CONTROL MEASURES SHALL BE UTILIZED SO AS TO PREVENT THE MIGRATION OF DUST FROM THE SITE TO ABUTTING AREAS.

STOCKPILES:

1. LOCATE STOCKPILES A MINIMUM OF 50 FEET AWAY FROM CATCH BASINS, SWALES, AND CULVERTS.
2. ALL STOCKPILES SHOULD BE SURROUNDED WITH TEMPORARY EROSION CONTROL MEASURES PRIOR TO THE ONSET OF PRECIPITATION.
3. PERIMETER BARRIERS SHOULD BE MAINTAINED AT ALL TIMES, AND ADJUSTED AS NEEDED TO ACCOMMODATE THE DELIVERY AND REMOVAL OF MATERIALS FROM THE STOCKPILE. THE INTEGRITY OF THE BARRIER SHOULD BE INSPECTED AT THE END OF EACH WORKING DAY.
4. PROTECT ALL STOCKPILES FROM STORMWATER RUN-OFF USING TEMPORARY EROSION CONTROL MEASURES SUCH AS BERMS, SILT SOCK, OR OTHER APPROVED PRACTICE TO PREVENT MIGRATION OF MATERIAL BEYOND THE IMMEDIATE CONFINES OF THE STOCKPILES.

OFF SITE VEHICLE TRACKING:

1. THE CONTRACTOR SHALL CONSTRUCT STABILIZED CONSTRUCTION ENTRANCE(S) PRIOR TO ANY EXCAVATION ACTIVITIES.

VEGETATION:

1. TEMPORARY GRASS COVER:
   A. SEEDBED PREPARATION:
      a. APPLY FERTILIZER AT THE RATE OF 600 POUNDS PER ACRE OF 10-10-10. APPLY LIMESTONE (EQUIVALENT TO 50 PERCENT CALCIUM PLUS MAGNESIUM OXIDE) AT A RATE OF THREE (3) TONS PER ACRE;
   B. SEEDING:
      a. UTILIZE ANNUAL RYE GRASS AT A RATE OF 40 LBS/ACRE;
      b. WHERE THE SOIL HAS BEEN COMPACTED BY CONSTRUCTION OPERATIONS, LOOSEN SOIL TO A DEPTH OF TWO (2) INCHES BEFORE APPLYING FERTILIZER, LIME AND SEED;
      c. APPLY SEED UNIFORMLY BY HAND, CYCLONE SEEDER, OR HYDROSEEDER (SLURRY INCLUDING SEED AND FERTILIZER). HYDROSEEDINGS, WHICH INCLUDE MULCH, MAY BE LEFT ON SOIL SURFACE. SEEDING RATES MUST BE INCREASED 10% WHEN HYDROSEEDING;
   C. MAINTENANCE:
      a. TEMPORARY SEEDING SHALL BE PERIODICALLY INSPECTED. AT A MINIMUM, 95% OF THE SOIL SURFACE SHOULD BE COVERED BY VEGETATION. IF ANY EVIDENCE OF EROSION OR SEDIMENTATION IS APPARENT, REPAIRS SHALL BE MADE AND OTHER TEMPORARY MEASURES USED IN THE INTERIM (MULCH, FILTER BARRIERS, CHECK DAMS, ETC.).
2. VEGETATIVE PRACTICE:
   A. FOR PERMANENT MEASURES AND PLANTINGS:
      a. LIMESTONE SHALL BE THOROUGHLY INCORPORATED INTO THE LOAM LAYER AT A RATE OF THREE (3) TONS PER ACRE IN ORDER TO PROVIDE A PH VALUE OF 5.5 TO 6.5;
      b. FERTILIZER SHALL BE SPREAD ON THE TOP LAYER OF LOAM AND WORKED INTO THE SURFACE. FERTILIZER APPLICATION RATE SHALL BE 800 POUNDS PER ACRE OF 10-20-20 FERTILIZER;
      c. SOIL CONDITIONERS AND FERTILIZER SHALL BE APPLIED AT THE RECOMMENDED RATES AND SHALL BE THOROUGHLY WORKED INTO THE LOAM. LOAM SHALL BE RAKED UNTIL THE SURFACE IS FINELY PULVERIZED, SMOOTH AND EVEN, AND THEN COMPACTED TO AN EVEN SURFACE CONFORMING TO THE REQUIRED LINES AND GRADES WITH APPROVED ROLLERS WEIGHING BETWEEN 4-1/2 POUNDS AND 5-1/2 POUNDS PER INCH OF WIDTH;
      d. SEED SHALL BE SOWN AT THE RATE SHOWN BELOW. SOWING SHALL BE DONE ON A CALM, DRY DAY, PREFERABLY BY MACHINE, BUT IF BY HAND, ONLY BY EXPERIENCED WORKMEN. IMMEDIATELY BEFORE SEEDING, THE SOIL SHALL BE LIGHTLY RAKED. ONE HALF THE SEED SHALL BE SOWN IN ONE DIRECTION AND THE OTHER HALF AT RIGHT ANGLES TO THE ORIGINAL DIRECTION. IT SHALL BE LIGHTLY RAKED INTO THE SOIL TO A DEPTH NOT OVER 1/4 INCH AND ROLLED WITH A HAND ROLLER WEIGHING NOT OVER 100 POUNDS PER LINEAR FOOT OF WIDTH;
      e. HAY MULCH SHALL BE APPLIED IMMEDIATELY AFTER SEEDING AS INDICATED ABOVE;
      f. THE SURFACE SHALL BE WATERED AND KEPT MOIST WITH A FINE SPRAY AS REQUIRED, WITHOUT WASHING AWAY THE SOIL, UNTIL THE GRASS IS WELL ESTABLISHED. ANY AREAS WHICH ARE NOT SATISFACTORILY COVERED WITH GRASS SHALL BE RESEEDED, AND ALL NOXIOUS WEEDS REMOVED;
      g. THE CONTRACTOR SHALL PROTECT AND MAINTAIN THE SEEDED AREAS UNTIL ACCEPTED;
      h. A GRASS SEED MIXTURE CONTAINING THE FOLLOWING SEED REQUIREMENTS SHALL BE APPLIED AT A RATE OF 40 LB/AC OR APPROVED EUQAL:

SEED MIX	APPLICATION RATE
"REBEL II" TALL FESCUE	70%
"PALMER" PERENNIAL RYEGRASS	20%
"BARON" KENTUCKEY BLUEGRASS	10%

      IN NO CASE SHALL THE WEED CONTENT EXCEED ONE (1) PERCENT BY WEIGHT. ALL SEED SHALL COMPLY WITH STATE AND FEDERAL SEED LAWS. SEEDING SHALL BE DONE NO LATER THAN SEPTEMBER 15. IN NO CASE SHALL SEEDING TAKE PLACE OVER SNOW.
3. DORMANT SEEDING (SEPTEMBER 15 TO FIRST SNOWFALL):
   A. FOLLOW PERMANENT MEASURES SLOPE, LIME, FERTILIZER AND GRADING REQUIREMENTS. APPLY SEED MIXTURE AT TWICE THE INDICATED RATE. APPLY MULCH AS INDICATED FOR PERMANENT MEASURES.

CONCRETE WASHOUT AREA:

1. THE CONCRETE DELIVERY TRUCKS SHALL, WHENEVER POSSIBLE, USE WASHOUT FACILITIES AT THEIR OWN PLANT OR DISPATCH FACILITY;
2. IF IT IS NECESSARY, SITE CONTRACTOR SHALL DESIGNATE SPECIFIC WASHOUT AREAS AND DESIGN FACILITIES TO HANDLE ANTICIPATED WASHOUT WATER;
3. CONTRACTOR SHALL LOCATE WASHOUT AREAS AT LEAST 150 FEET AWAY FROM STORM DRAINS, SWALES AND SURFACE WATERS OR DELINEATED WETLANDS;
4. INSPECT WASHOUT FACILITIES DAILY TO DETECT LEAKS OR TEARS AND TO IDENTIFY WHEN MATERIALS NEED TO BE REMOVED.

ALLOWABLE NON-STORMWATER DISCHARGES:

1. THE FOLLOWING ARE THE ONLY NON-STORMWATER DISCHARGES ALLOWED. ALL OTHER NON-STORMWATER DISCHARGES ARE PROHIBITED ON SITE:
   A. FIRE-FIGHTING ACTIVITIES;
   B. FIRE HYDRANT FLUSHING;
   C. WATERS USED TO WASH VEHICLES WHERE DETERGENTS ARE NOT USED;
   D. WATER USED TO CONTROL DUST;
   E. POTABLE WATER INCLUDING UNCONTAMINATED WATER LINE FLUSHING;
   F. ROUTINE EXTERNAL BUILDING WASH DOWN WHERE DETERGENTS ARE NOT USED;
   G. PAVEMENT WASH WATERS WHERE DETERGENTS ARE NOT USED;
   H. UNCONTAMINATED AIR CONDITIONING/COMPRESSOR CONDENSATION;
   I. UNCONTAMINATED GROUND WATER OR SPRING WATER;
   J. FOUNDATION OR FOOTING DRAINS WHICH ARE UNCONTAMINATED;
   K. LANDSCAPE IRRIGATION.

WASTE DISPOSAL:

1. WASTE MATERIAL:
   A. ALL WASTE MATERIALS SHALL BE COLLECTED AND STORED IN SECURELY LIDDED RECEPTACLES. ALL TRASH AND CONSTRUCTION DEBRIS FROM THE SITE SHALL BE DEPOSITED IN A DUMPSTER;
   B. NO CONSTRUCTION WASTE MATERIALS SHALL BE BURIED ON SITE;
   C. ALL PERSONNEL SHALL BE INSTRUCTED REGARDING THE CORRECT PROCEDURE FOR WASTE DISPOSAL BY THE SUPERINTENDENT.
2. HAZARDOUS WASTE:
   A. ALL HAZARDOUS WASTE MATERIALS SHALL BE DISPOSED OF IN THE MANNER SPECIFIED BY LOCAL OR STATE REGULATION OR BY THE MANUFACTURER;
   B. SITE PERSONNEL SHALL BE INSTRUCTED IN THESE PRACTICES BY THE SUPERINTENDENT.
3. SANITARY WASTE:
   A. ALL SANITARY WASTE SHALL BE COLLECTED FROM THE PORTABLE UNITS A MINIMUM OF ONCE PER WEEK BY A LICENSED SANITARY WASTE MANAGEMENT CONTRACTOR.

SPILL PREVENTION:

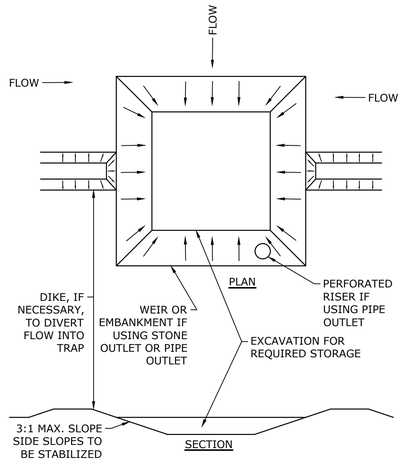
1. CONTRACTOR SHALL BE FAMILIAR WITH SPILL PREVENTION MEASURES REQUIRED BY LOCAL, STATE AND FEDERAL AGENCIES. AT A MINIMUM, CONTRACTOR SHALL FOLLOW THE BEST MANAGEMENT SPILL PREVENTION PRACTICES OUTLINED BELOW.
2. THE FOLLOWING ARE THE MATERIAL MANAGEMENT PRACTICES THAT SHALL BE USED TO REDUCE THE RISK OF SPILLS OR OTHER ACCIDENTAL EXPOSURE OF MATERIALS AND SUBSTANCES DURING CONSTRUCTION TO STORMWATER RUNOFF:
   A. GOOD HOUSEKEEPING - THE FOLLOWING GOOD HOUSEKEEPING PRACTICE SHALL BE FOLLOWED ON SITE DURING CONSTRUCTION:
      a. ONLY SUFFICIENT AMOUNTS OF PRODUCTS TO DO THE JOB SHALL BE STORED ON SITE;
      b. ALL MATERIALS STORED ON SITE SHALL BE STORED IN A NEAT, ORDERLY MANNER IN THEIR PROPER (ORIGINAL IF POSSIBLE) CONTAINERS AND, IF POSSIBLE, UNDER A ROOF OR OTHER ENCLOSURE;
      c. MANUFACTURER'S RECOMMENDATIONS FOR PROPER USE AND DISPOSAL SHALL BE FOLLOWED;
      d. THE SITE SUPERINTENDENT SHALL INSPECT DAILY TO ENSURE PROPER USE AND DISPOSAL OF MATERIALS;
      e. SUBSTANCES SHALL NOT BE MIXED WITH ONE ANOTHER UNLESS RECOMMENDED BY THE MANUFACTURER;
      f. WHENEVER POSSIBLE ALL OF A PRODUCT SHALL BE USED UP BEFORE DISPOSING OF THE CONTAINER.
   B. HAZARDOUS PRODUCTS - THE FOLLOWING PRACTICES SHALL BE USED TO REDUCE THE RISKS ASSOCIATED WITH HAZARDOUS MATERIALS:
      g. PRODUCTS SHALL BE KEPT IN THEIR ORIGINAL CONTAINERS UNLESS THEY ARE NOT RESEALABLE;
      h. ORIGINAL LABELS AND MATERIAL SAFETY DATA SHALL BE RETAINED FOR IMPORTANT PRODUCT INFORMATION;
      i. SURPLUS PRODUCT THAT MUST BE DISPOSED OF SHALL BE DISCARDED ACCORDING TO THE MANUFACTURER'S RECOMMENDED METHODS OF DISPOSAL.
   C. PRODUCT SPECIFIC PRACTICES - THE FOLLOWING PRODUCT SPECIFIC PRACTICES SHALL BE FOLLOWED ON SITE:
      a. PETROLEUM PRODUCTS:
         - ALL ON SITE VEHICLES SHALL BE MONITORED FOR LEAKS AND RECEIVE REGULAR PREVENTIVE MAINTENANCE TO REDUCE LEAKAGE;
         - PETROLEUM PRODUCTS SHALL BE STORED IN TIGHTLY SEALED CONTAINERS WHICH ARE CLEARLY LABELED. ANY ASPHALT BASED SUBSTANCES USED ON SITE SHALL BE APPLIED ACCORDING TO THE MANUFACTURER'S RECOMMENDATIONS.
      b. FERTILIZERS:
         - FERTILIZERS USED SHALL BE APPLIED ONLY IN THE MINIMUM AMOUNTS DIRECTED BY THE SPECIFICATIONS;
         - ONCE APPLIED FERTILIZER SHALL BE WORKED INTO THE SOIL TO LIMIT EXPOSURE TO STORMWATER;
         - STORAGE SHALL BE IN A COVERED SHED OR ENCLOSED TRAILERS. THE CONTENTS OF ANY PARTIALLY USED BAGS OF FERTILIZER SHALL BE TRANSFERRED TO A SEALABLE PLASTIC BIN TO AVOID SPILLS.
      c. PAINTS:
         - ALL CONTAINERS SHALL BE TIGHTLY SEALED AND STORED WHEN NOT REQUIRED FOR USE;
         - EXCESS PAINT SHALL NOT BE DISCHARGED TO THE STORM SEWER SYSTEM;
         - EXCESS PAINT SHALL BE DISPOSED OF PROPERLY ACCORDING TO MANUFACTURER'S INSTRUCTIONS OR STATE AND LOCAL REGULATIONS.
   D. SPILL CONTROL PRACTICES - IN ADDITION TO GOOD HOUSEKEEPING AND MATERIAL MANAGEMENT PRACTICES DISCUSSED IN THE PREVIOUS SECTION, THE FOLLOWING PRACTICES SHALL BE FOLLOWED FOR SPILL PREVENTION AND CLEANUP:
      a. MANUFACTURER'S RECOMMENDED METHODS FOR SPILL CLEANUP SHALL BE CLEARLY POSTED AND SITE PERSONNEL SHALL BE MADE AWARE OF THE PROCEDURES AND THE LOCATION OF THE INFORMATION AND CLEANUP SUPPLIES;
      b. MATERIALS AND EQUIPMENT NECESSARY FOR SPILL CLEANUP SHALL BE KEPT IN THE MATERIAL STORAGE AREA ON SITE. EQUIPMENT AND MATERIALS SHALL INCLUDE BUT NOT BE LIMITED TO BROOMS, DUSTPANS, MOPS, RAGS, GLOVES, GOGGLES, KITTY LITTER, SAND, SAWDUST AND PLASTIC OR METAL TRASH CONTAINERS SPECIFICALLY FOR THIS PURPOSE;
      c. ALL SPILLS SHALL BE CLEANED UP IMMEDIATELY AFTER DISCOVERY;
      d. THE SPILL AREA SHALL BE KEPT WELL VENTILATED AND PERSONNEL SHALL WEAR APPROPRIATE PROTECTIVE CLOTHING TO PREVENT INJURY FROM CONTACT WITH A HAZARDOUS SUBSTANCE;
      e. SPILLS OF TOXIC OR HAZARDOUS MATERIAL SHALL BE REPORTED TO THE APPROPRIATE LOCAL, STATE OR FEDERAL AGENCIES AS REQUIRED;
      f. THE SITE SUPERINTENDENT RESPONSIBLE FOR DAY-TO-DAY SITE OPERATIONS SHALL BE THE SPILL PREVENTION AND CLEANUP COORDINATOR.
   E. VEHICLE FUELING AND MAINTENANCE PRACTICE:
      a. CONTRACTOR SHALL MAKE AN EFFORT TO PERFORM EQUIPTMENT/VEHICAL FUELING AND MAINTENANCE AT AN OFF-SITE FACILITY;
      b. CONTRACTOR SHALL PROVIDE AN ON-SITE FUELING AND MAINTENANCE AREA THAT IS CLEAN AND DRY;
      c. IF POSSIBLE THE CONTRACTOR SHALL KEEP AREA COVERED;
      d. CONTRACTOR SHALL KEEP A SPILL KIT AT THE FUELING AND MAINTENANCE AREA;
      e. CONTRACTOR SHALL REGULARLY INSPECT VEHICLES FOR LEAKS AND DAMAGE;
      f. CONTRACTOR SHALL USE DRIP PANS, DRIP CLOTHS, OR ABSORBENT PADS WHEN REPLACING SPENT FLUID.

EROSION CONTROL OBSERVATIONS AND MAINTENANCE PRACTICES

THIS PROJECT EXCEEDS ONE (1) ACRE OF DISTURBANCE AND THUS REQUIRES A SWPPP. THE SWPPP SHALL BE PREPARED BY THE CONTRACTOR. THE CONTRACTOR SHALL BE FAMILIAR WITH THE SWPPP AND KEEP AN UPDATED COPY OF THE SWPPP ONSITE AT ALL TIMES.

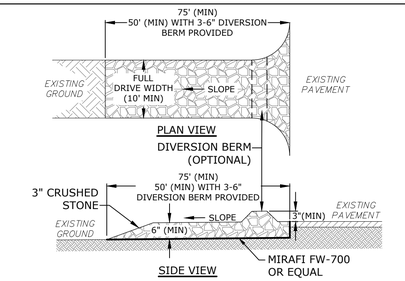
THE FOLLOWING REPRESENTS THE GENERAL OBSERVATION AND REPORTING PRACTICES THAT SHALL BE FOLLOWED AS PART OF THIS PROJECT:

1. OBSERVATIONS OF THE PROJECT FOR COMPLIANCE WITH THE SWPPP SHALL BE MADE BY THE CONTRACTOR AT LEAST ONCE A WEEK OR WITHIN 24 HOURS OF A STORM 0.25 INCHES OR GREATER;
2. AN OBSERVATION REPORT SHALL BE MADE AFTER EACH OBSERVATION AND DISTRIBUTED TO THE ENGINEER, THE OWNER, AND THE CONTRACTOR;
3. A REPRESENTATIVE OF THE SITE CONTRACTOR, SHALL BE RESPONSIBLE FOR MAINTENANCE AND REPAIR ACTIVITIES;
4. IF A REPAIR IS NECESSARY, IT SHALL BE INITIATED WITHIN 24 HOURS OF REPORT.



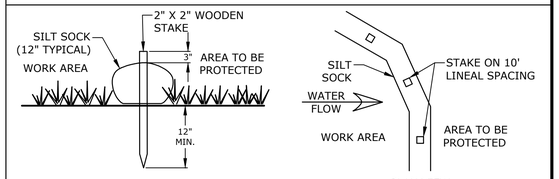
NOTES:
1. THE TRAP SHALL BE INSTALLED AS CLOSE TO THE DISTURBED AREA AS POSSIBLE.
2. THE MAXIMUM CONTRIBUTING AREA TO A SINGLE TRAP SHALL BE LESS THAN 5 ACRES.
3. THE MINIMUM VOLUME OF THE TRAP SHALL BE 3,600 CUBIC FEET OF STORAGE FOR EACH ACRE OF DRAINAGE AREA.
4. TRAP OUTLET SHALL BE MINIMUM OF ONE FOOT BELOW THE CREST OF THE TRAP.
5. TRAP SHALL DISCHARGE TO A STABILIZED AREA.
6. TRAP SHALL BE CLEANED WHEN 50 PERCENT OF THE ORIGINAL VOLUME IS FILLED.
7. MATERIALS REMOVED FROM THE TRAP SHALL BE PROPERLY DISPOSED OF AND STABILIZED.

SEDIMENT TRAP
NO SCALE



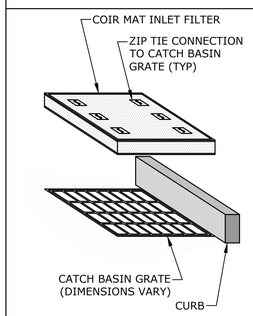
NOTES:
1. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OF SEDIMENT FROM THE SITE. WHEN WASHING IS REQUIRED, IT SHALL BE DONE SO RUNOFF DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE. ALL SEDIMENT SHALL BE PREVENTED FROM ENTERING STORM DRAINS, DITCHES, OR WATERWAYS

STABILIZED CONSTRUCTION ENTRANCE
NO SCALE



NOTES:
1. SILT SOCK SHALL BE SILT SOXX NATURAL ORIGINAL BY FILTREXX OR APPROVED EQUAL.
2. INSTALL SILT SOCK IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.

SILT SOCK
NO SCALE



NOTES:
1. COIR MAT INLET FILTER SHALL BE STORM WATER INLET FILTER BY BLOCKSOM & CO. OR APPROVED EQUAL.
2. INSTALL AND MAINTAIN INLET PROTECTION IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.

INLET PROTECTION
NO SCALE

Tighe&Bond

STATE OF NEW HAMPSHIRE - PATRICK CRIMMINS - No. 12378 - LICENSED PROFESSIONAL ENGINEER
5/20/24

STATE OF NEW HAMPSHIRE - NEIL A. HANSEN - No. 15227 - LICENSED PROFESSIONAL ENGINEER
05/20/2024

Proposed Industrial Development

Lonza Biologics

Portsmouth, New Hampshire

MARK	DATE	DESCRIPTION
Q	3/4/2024	Amended Site Plan Review
P	1/29/2024	Ph2 Updated Drainage
O	12/15/2023	Ph2 Issued for Construction
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L	9/1/2022	Issued for Construction
K	5/27/2022	Issued for Bid
J	5/23/2022	Third Party Rev. Comments

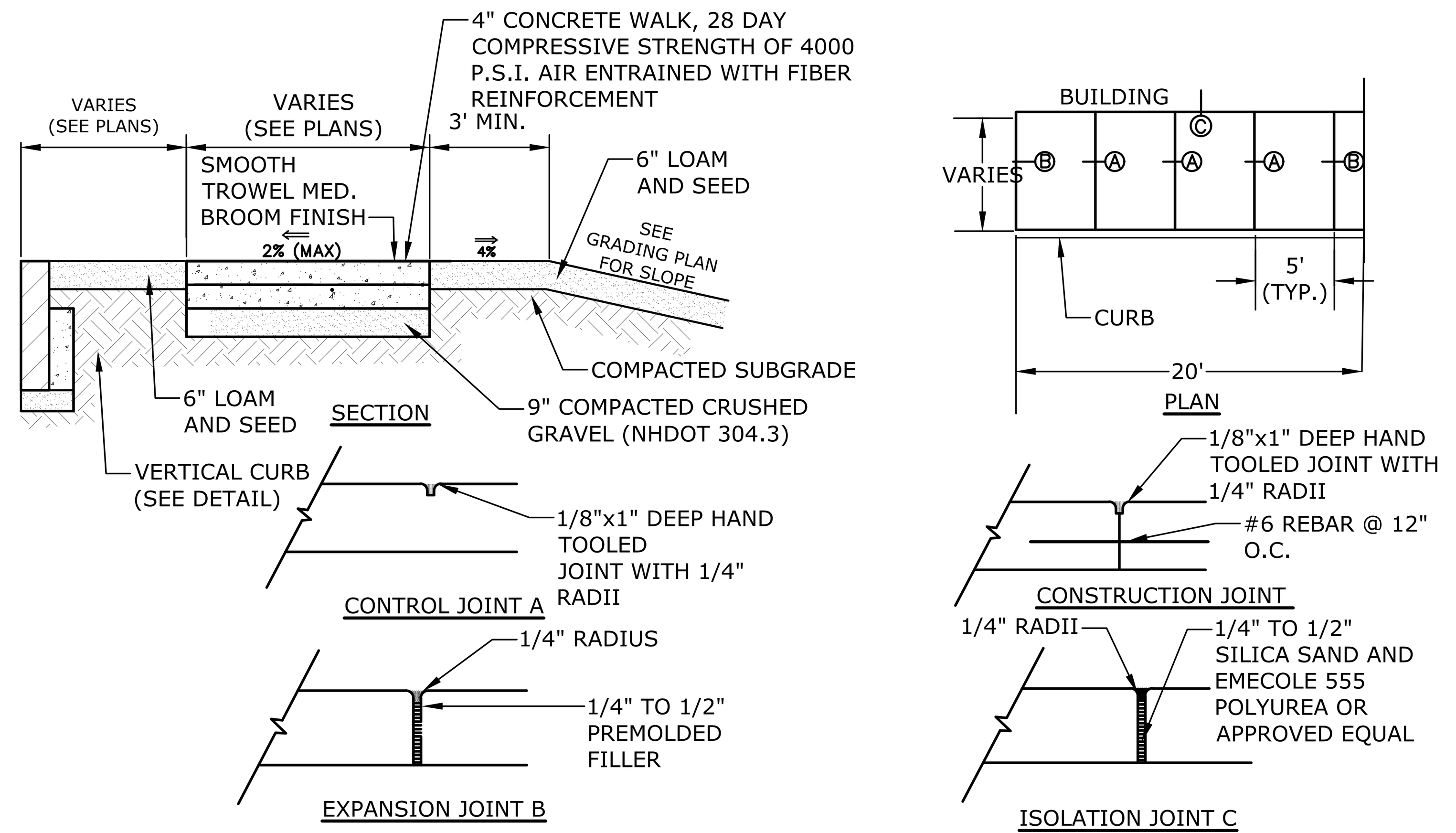
PROJECT NO:	L-0700-013
DATE:	04/03/2018
FILE:	L-0700-026C-C-DTLS.dwg
DRAWN BY:	CJK
CHECKED:	NAH
APPROVED:	PMC

EROSION CONTROL NOTES & DETAILS SHEET

SCALE: AS SHOWN

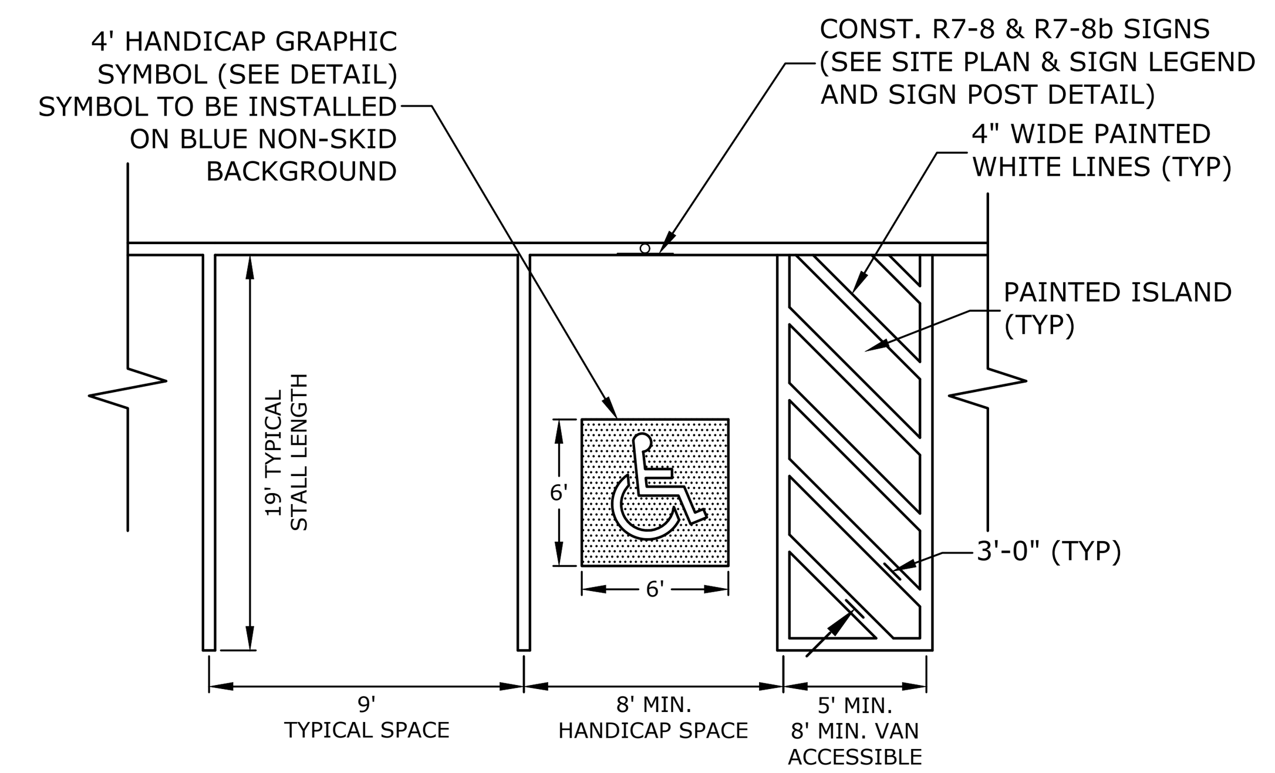
C-501

Last Save Date: March 1, 2024 11:29 AM By: CKRZCUIK
Plot Date: March 1, 2024 11:29 AM By: CKRZCUIK
T&B File Location: J:\LU\700 Lonza Biologics Expansion was 1576FU\026 Project Albacore\Drawings\AutoCAD_Solar\L-0700-026C-C-DTLS.dwg Layout Tab: C-501



CONCRETE SIDEWALK WITH GRANITE CURB ALONG CORPORATE DRIVE

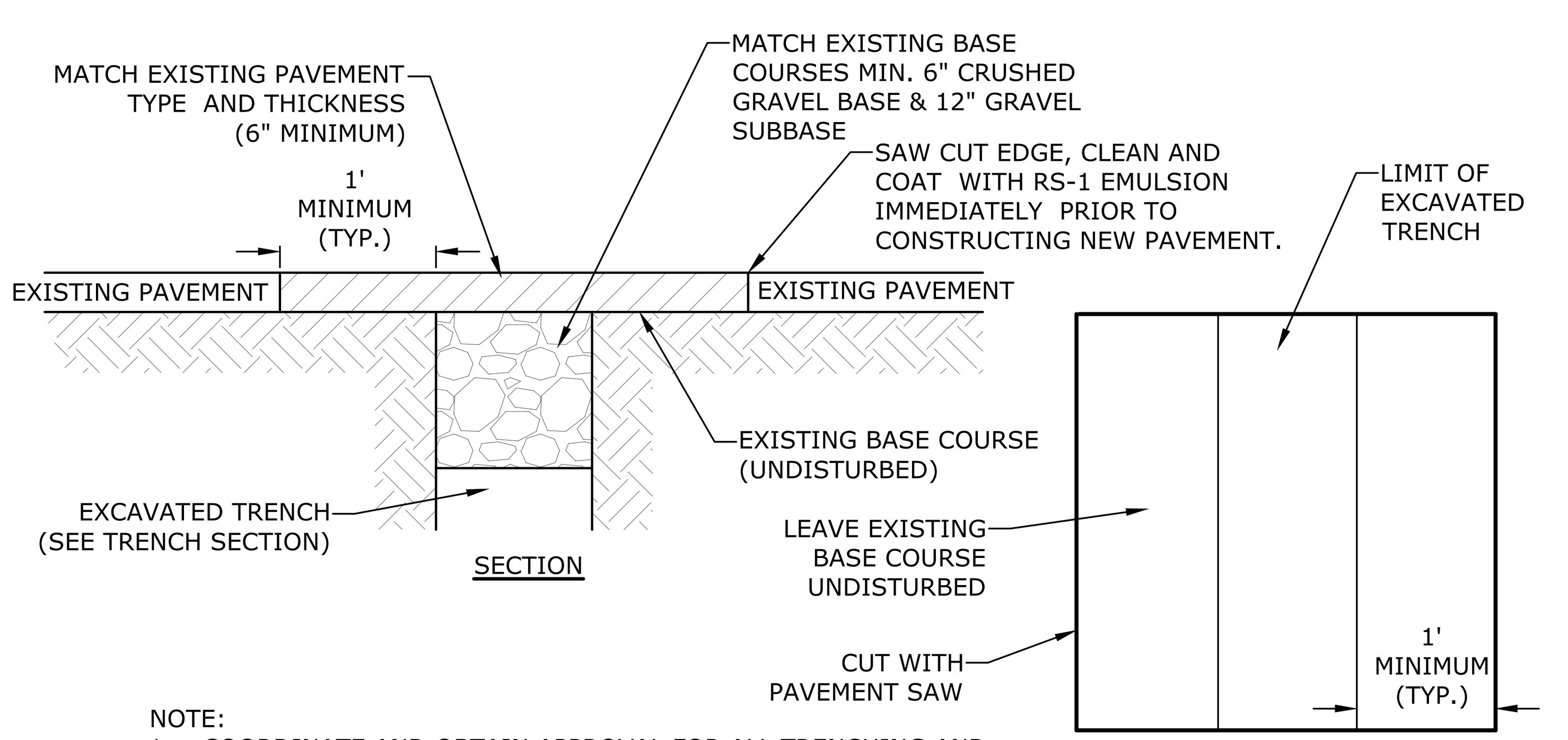
NO SCALE



NOTE:
1. ALL PAINT SHALL BE FAST DRYING TRAFFIC PAINT, MEETING THE REQUIREMENTS OF AASHTO M248-TYPE F. PAINT SHALL BE APPLIED AS SPECIFIED BY MANUFACTURER.
2. SYMBOLS & PARKING STALLS SHALL CONFORM TO THE REQUIREMENTS OF THE AMERICANS WITH DISABILITIES ACT AND LOCAL AND STATE REQUIREMENTS.
3. FINISH PAVEMENT GRADES AT ALL HANDICAP ACCESSIBLE STALLS AND PAINTED ACCESS AISLES SHALL NOT EXCEED 2% IN ANY DIRECTION.

STALL STRIPING-SINGLE STRIPE

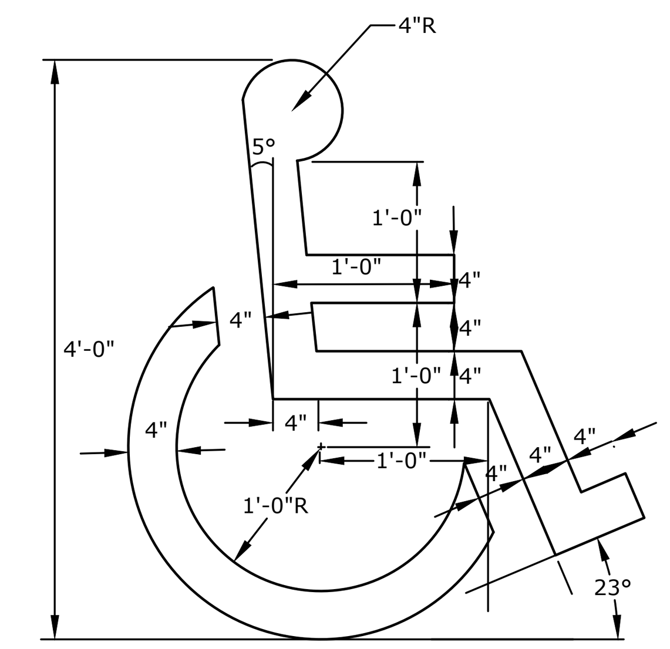
NO SCALE



NOTE:
1. COORDINATE AND OBTAIN APPROVAL FOR ALL TRENCHING AND PATCHING WITHIN CITY RIGHT OF WAY WITH CITY OF PORTSMOUTH DPW PRIOR TO COMMENCING WORK.

ROADWAY TRENCH PATCH

NO SCALE

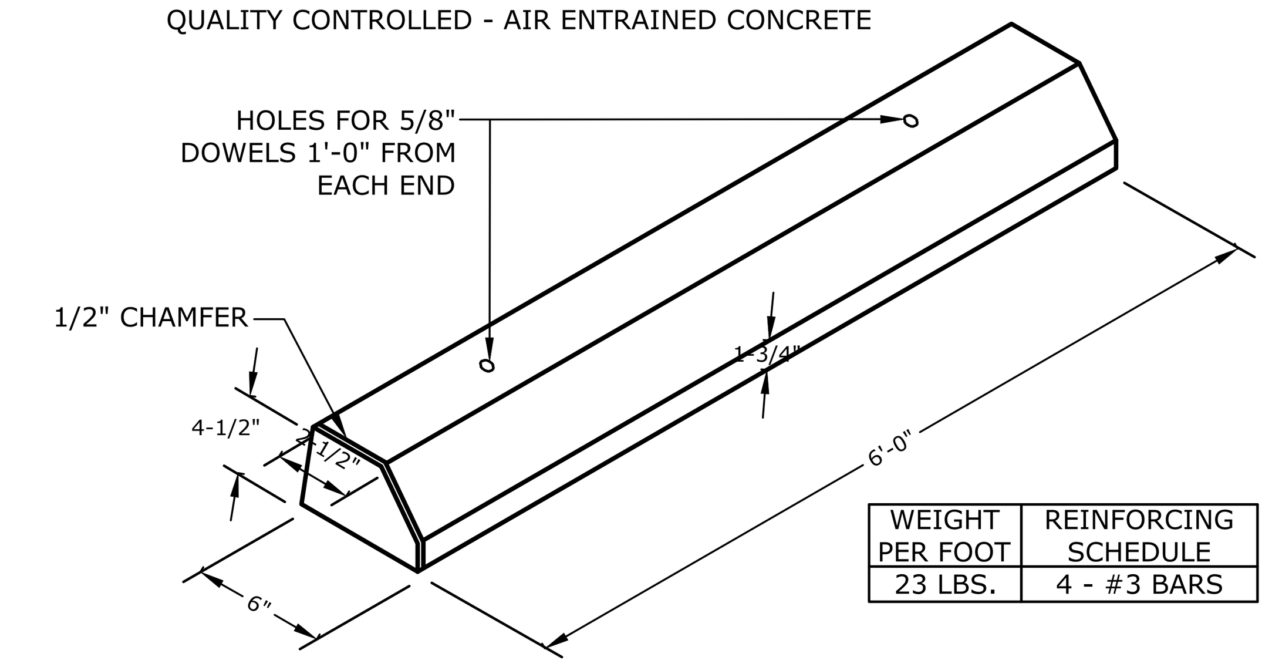


NOTES:
1. SYMBOL SHALL BE CONSTRUCTED IN ALL ACCESSIBLE SPACES USING WHITE THERMOPLASTIC, REFLECTORIZED PAVEMENT PARKING MATERAL MEETING THE REQUIREMENTS OF ASTM D 4505.
2. SYMBOL SHALL BE CONSTRUCTED TO THE LATEST ADA, STATE AND LOCAL REQUIREMENTS.

ACCESSIBLE SYMBOL

NO SCALE

QUALITY CONTROLLED - AIR ENTRAINED CONCRETE

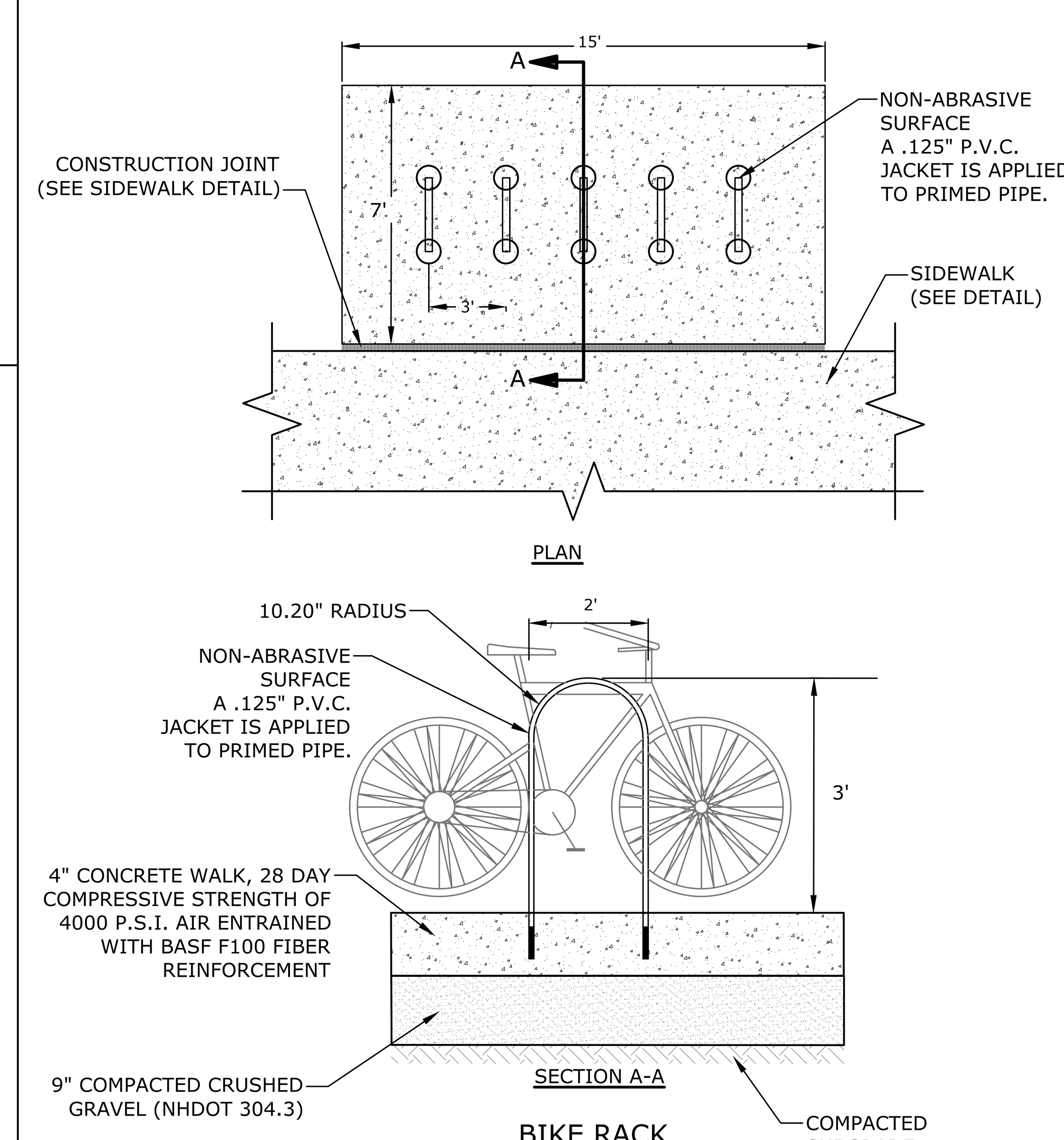


WEIGHT PER FOOT	REINFORCING SCHEDULE
23 LBS.	4 - #3 BARS

NOTE:
1. CURBING TO BE PINNED THROUGH ASPHALT PAVEMENT.

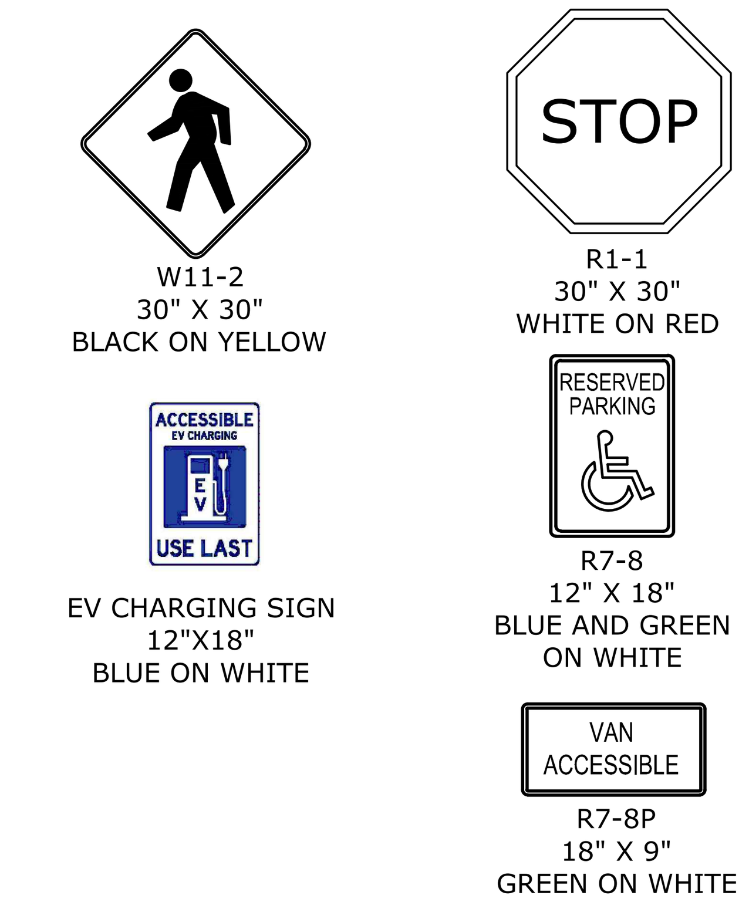
CONCRETE WHEEL STOP

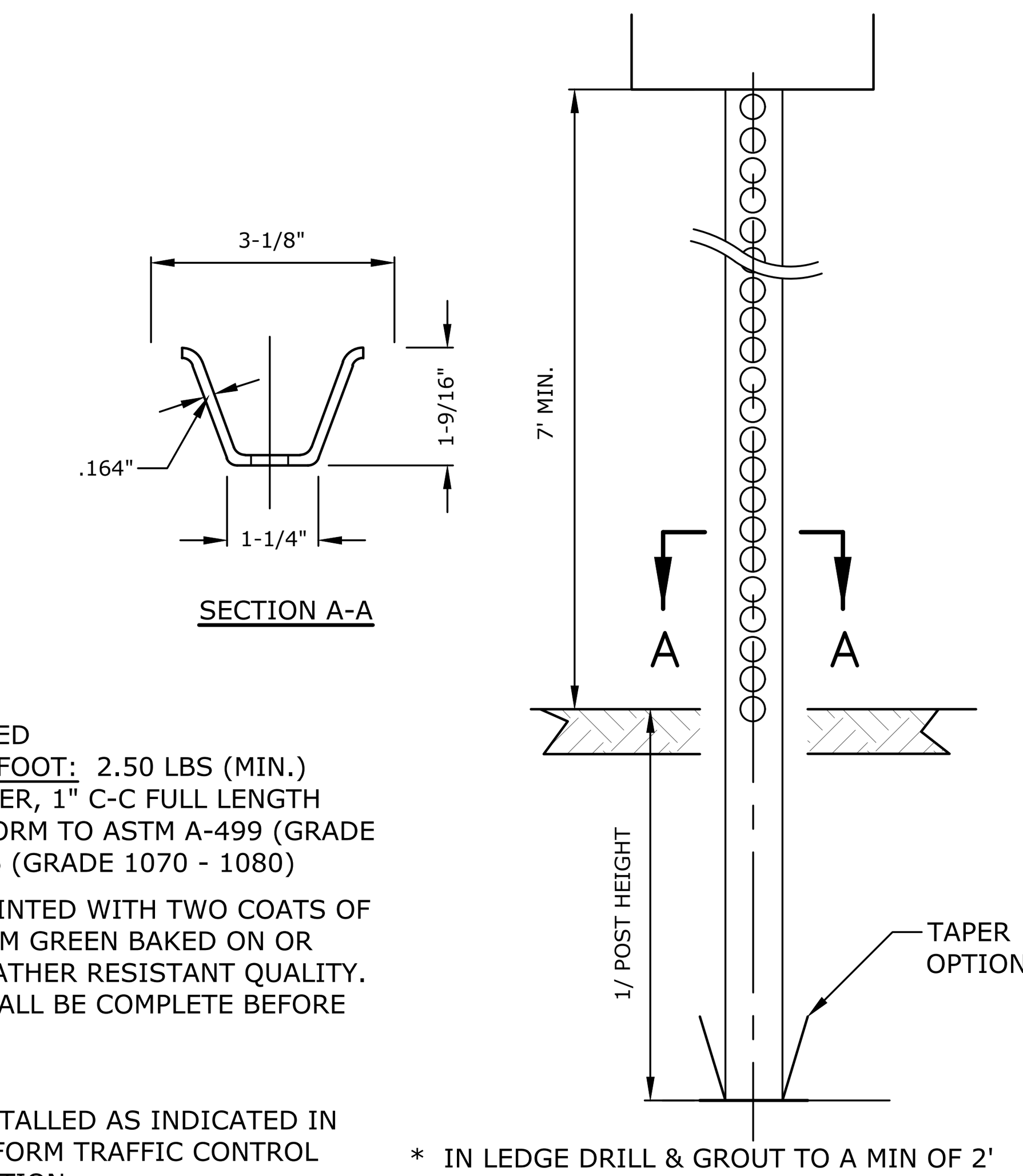
NO SCALE



BIKE RACK

NO SCALE





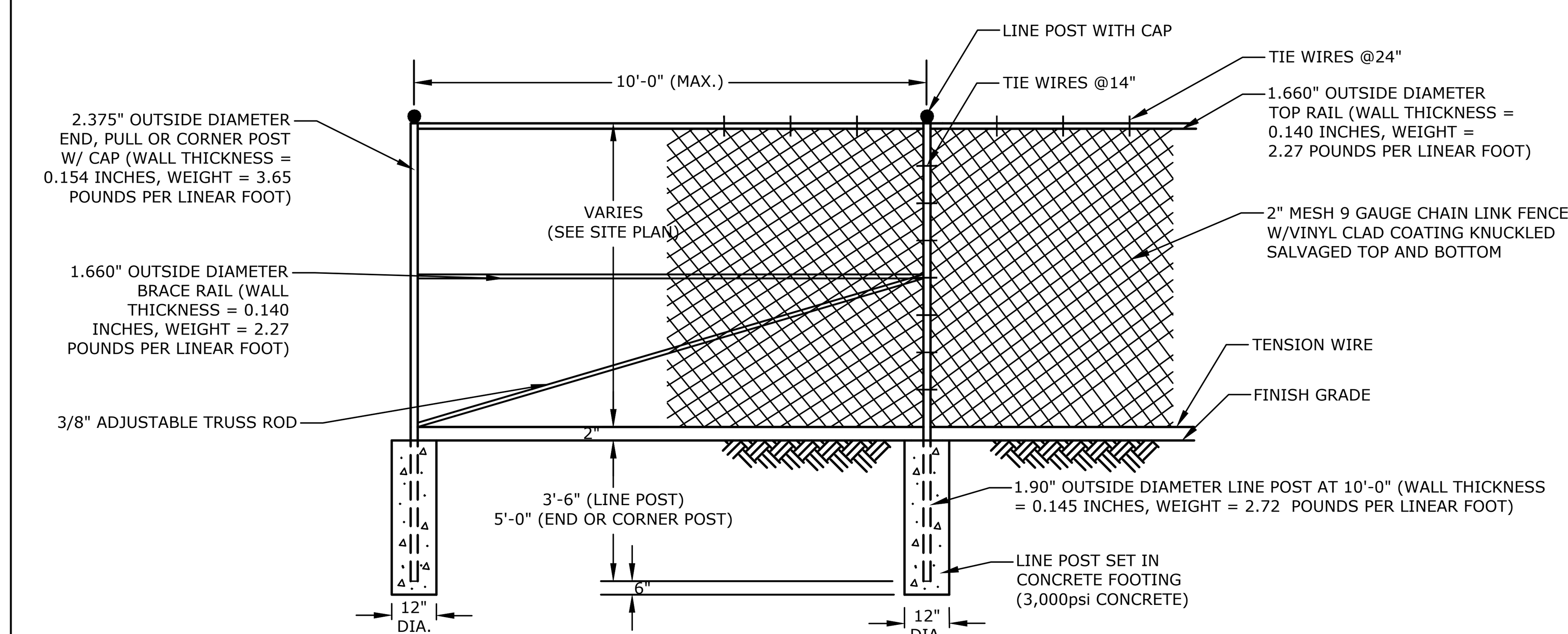
LENGTH: AS REQUIRED
WEIGHT PER LINEAR FOOT: 2.50 LBS (MIN.)
HOLES: 3/8" DIAMETER, 1" C-C FULL LENGTH
STEEL: SHALL CONFORM TO ASTM A-499 (GRADE 60) OR ASSTM A-576 (GRADE 1070 - 1080)
FINISH: SHALL BE PAINTED WITH TWO COATS OF AN APPROVED MEDIUM GREEN BAKED ON OR DRIED, PAINT OF WEATHER RESISTANT QUALITY. ALL FABRICATION SHALL BE COMPLETE BEFORE PAINTING.

NOTE:
ALL SIGNS TO BE INSTALLED AS INDICATED IN THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, LATEST EDITION.

* IN LEDGE DRILL & GROUT TO A MIN OF 2'

SIGN LEGEND & SIGN POST

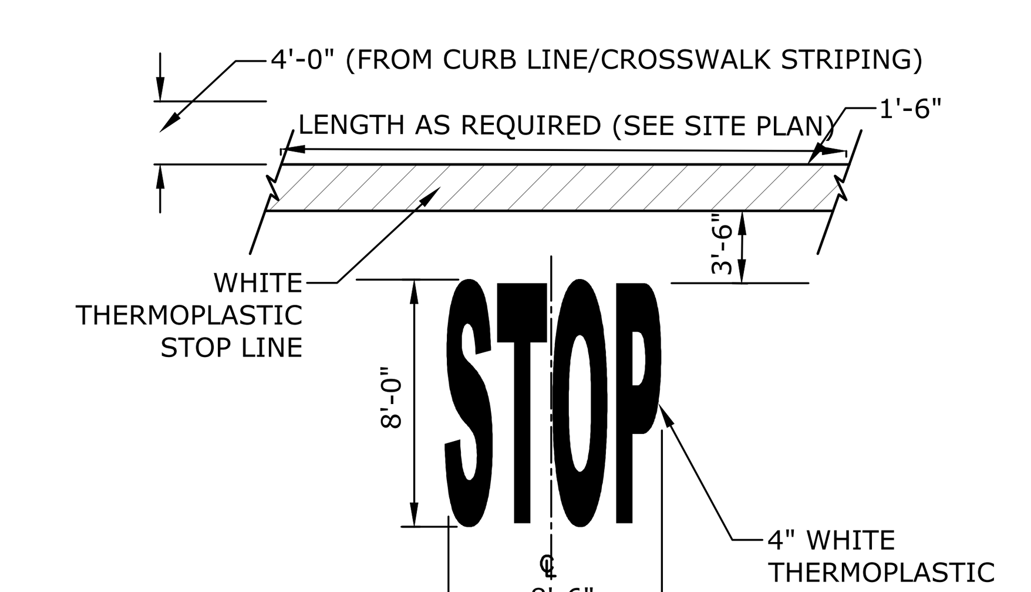
NO SCALE



NOTES:
1. CORNER POSTS SHALL BE USED AT SHARP BREAKS IN GRADE AND CHANGES IN HORIZONTAL ALIGNMENT OF 15' OR MORE.
2. POSTS, RAILS & BRACES SHALL BE TYPE I, SCHEDULE 40 BLACK VINYL COATED PIPE.
3. FABRIC TO BE BLACK VINYL COATED.
4. TIE WIRES SHALL BE 9 GAUGE GALVANIZED STEEL WIRE FOR ATTACHMENT OF FABRIC TO LINE POSTS.
5. TIE WIRES SHALL BE 13 GAUGE GALVANIZED STEEL WIRE FOR ATTACHMENT OF FABRIC TO RAILS AND BRACES.
6. HOG RING TIES SHALL BE 12- 1/2 GAUGE GALVANIZED STEEL WIRE FOR ATTACHMENT OF FABRIC TO TENSION WIRE.
7. COORDINATE FINAL CHAIN LINK FENCE DESIGN WITH BUILDING DRAWINGS AND UTILITY YARD CONCRETE SLAB DESIGN.

CHAIN LINK FENCE

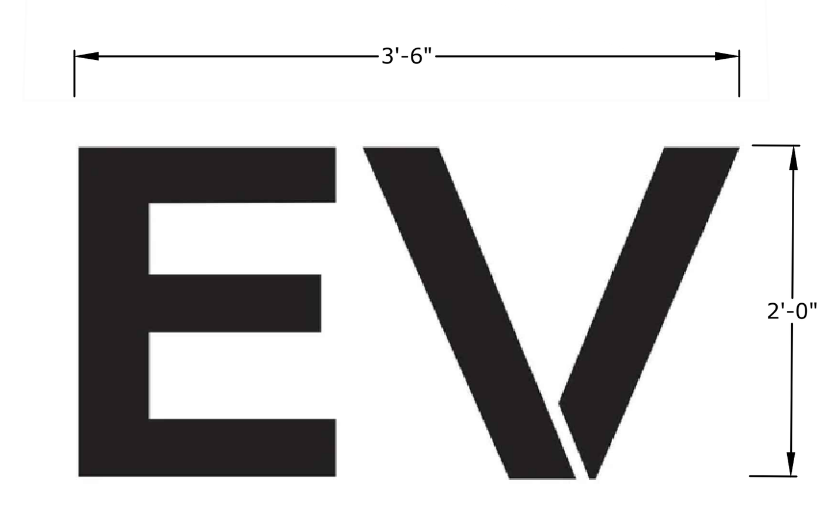
NO SCALE



NOTE:
1. PAVEMENT MARKINGS TO BE INSTALLED IN LOCATIONS AS SHOWN ON SITE PLAN.
2. STRIPING SHALL BE CONSTRUCTED USING WHITE THERMO PLASTIC, REFLECTERIZED PAVEMENT MARKING MATERIAL MEETING THE REQUIREMENTS OF ASTM D 4505

STOP BAR AND LEGEND

NO SCALE

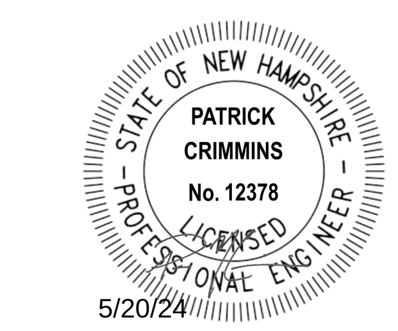


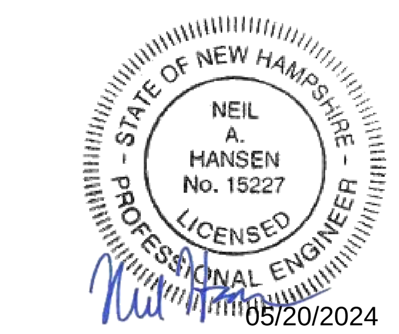
NOTES:
1. SYMBOL SHALL BE CONSTRUCTED IN ALL ELECTRIC VEHICLE SPACES USING FAST DRYING TRAFFIC PAINT, MEETING THE REQUIREMENTS OF AASHTO M248-TYPE F. PAINT SHALL BE APPLIED AS SPECIFIED BY MANUFACTURER.
2. SYMBOL SHALL BE CONSTRUCTED TO THE LATEST STATE AND LOCAL REQUIREMENTS.

EV CHARGING SYMBOL

NO SCALE

Tighe&Bond





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Lonza Biologics

Portsmouth, New Hampshire

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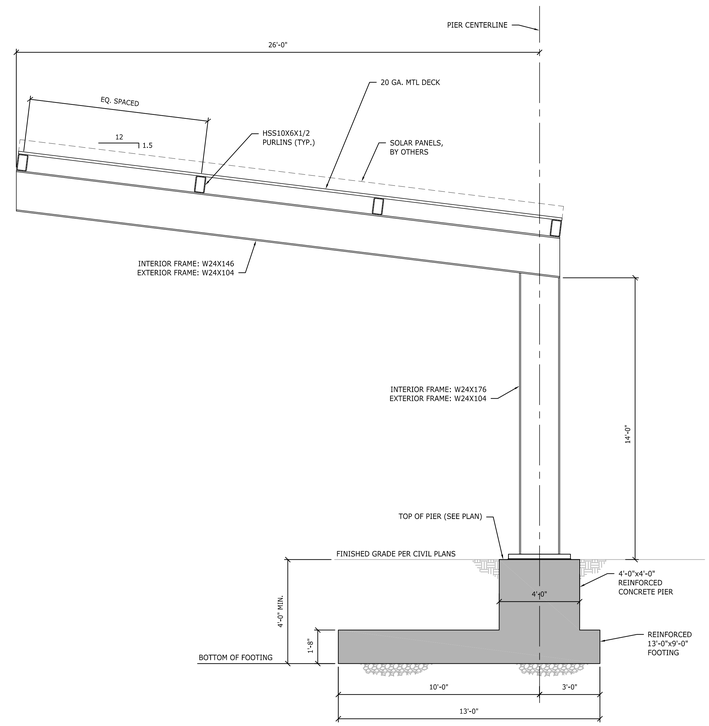
CHECKED:	NAH
APPROVED:	PMC

DETAILS SHEET

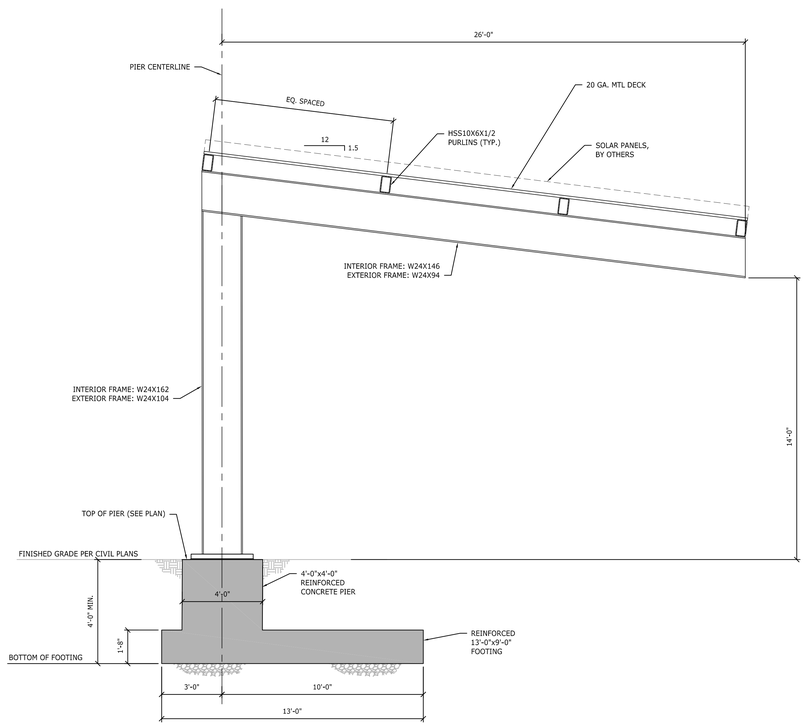
SCALE: AS SHOWN

C-503

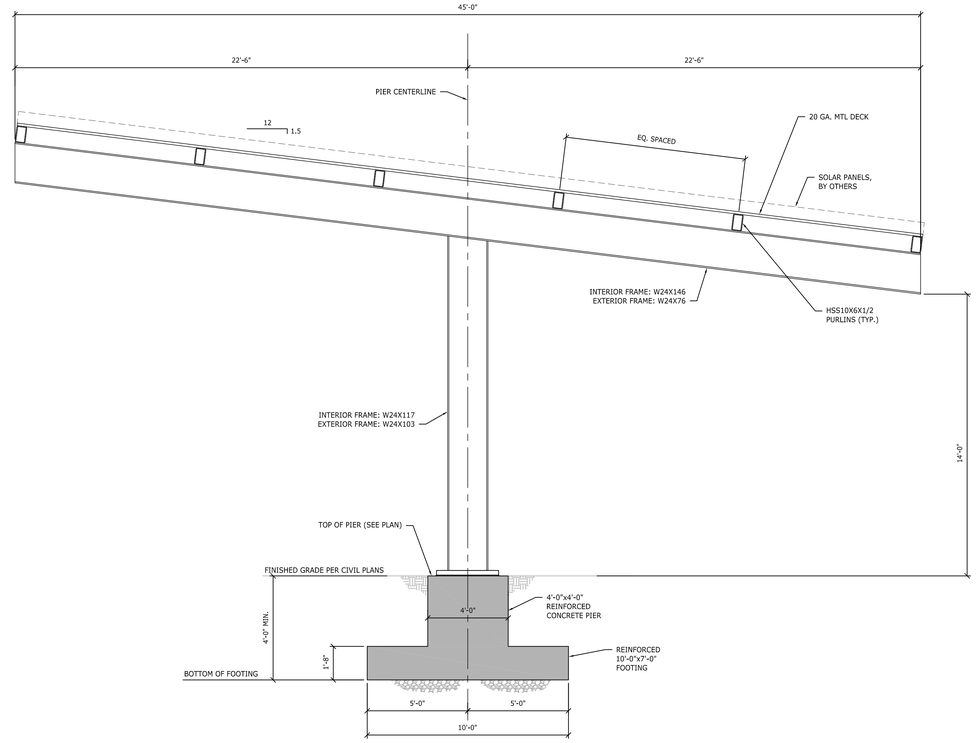
Last Save Date: March 1, 2024 11:29 AM By: CKRZCUIK
Plot Date: Friday, May 17, 2024 Plotted By: Neil A. Hansen
T&B File Location: J:\L\L0700 Lonza Biologics Expansion was 1576\026_Project Albacore\Drawings\AutoCAD_Solar\L-0700-026C-C-DTLS.dwg Layout Tab: C-503



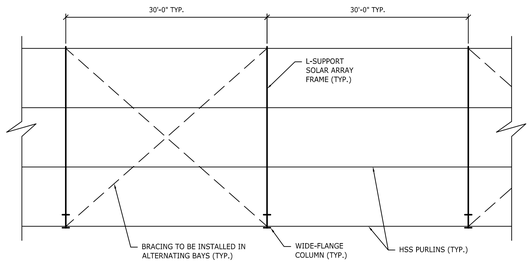
1 L-SUPPORT CANOPY FRAME SECTION - OPTION 1
8-018-3-2120 3/8" = 1'-0"



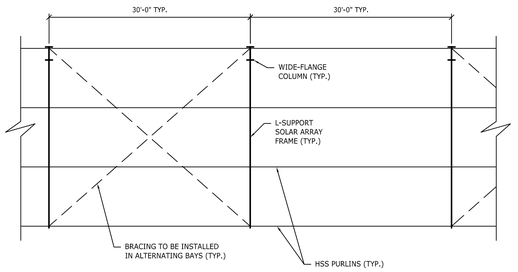
2 L-SUPPORT CANOPY FRAME SECTION - OPTION 2
8-018-3-2120 3/8" = 1'-0"



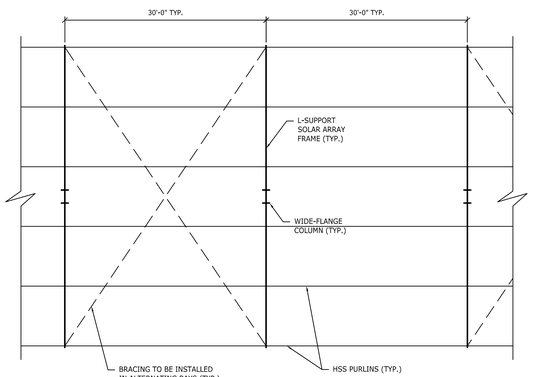
3 T-SUPPORT CANOPY FRAME SECTION
8-018-3-2120 3/8" = 1'-0"



4 L-SUPPORT CANOPY FRAME PLAN - OPTION 1
8-018-3-2120 3/8" = 1'-0"



5 L-SUPPORT CANOPY FRAME PLAN - OPTION 2
8-018-3-2120 3/8" = 1'-0"



6 T-SUPPORT CANOPY FRAME PLAN
8-018-3-2120 3/8" = 1'-0"

SOLAR CANOPY NOTES:

1. CONCEPTUAL FRAME IS DESIGNED FOR MAX SPACING OF 30'-0" O.C. BETWEEN SUPPORTS.
2. OVERALL CANOPY DIMENSIONS SHOWN ARE APPROXIMATE. NEW HSS PURLINS TO BE POSITIVELY ATTACHED ON TOP FLANGE OF CANOPY FRAMES WITH MAX SPACING OF 8'-0".
3. 20 GA. ROOF DECK AND TO BE INSTALLED SPANNING OVER PURLINS, SOLAR PANELS TO BE PROVIDED BY OTHERS.

PRELIMINARY NOT FOR CONSTRUCTION

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REVISION	DATE	DESCRIPTION	BY
A	23-FEB-24	PV BID ISSUE	MGM
B	20-MAY-24	PV BID ISSUE	MGM

CLIENT

LONZA

ALBACORE PROJECT

SCALE
1" = 1'-0" 1/2" = 1'-0" 0
3/8" = 1'-0" 1/8" = 1'-0" 0
3" = 1'-0"
3/16" = 1'-0" 3/32" = 1'-0" 0
1/16" = 1'-0" 1/32" = 1'-0" 0
3" = 1'-0"
1 1/2" = 1'-0" 3/4" = 1'-0" 0

CONFIDENTIAL

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XREF FILE(S)

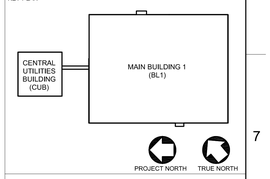
ENGINEER

ARCHITECT

DESIGNER

PARE

KEY PLAN



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DATE:

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DRAWING TITLE

SOLAR CANOPY CONCEPT DETAILS

Tags

Drawn By	Date Drawn	Project Number	P&ID Number	DWG Filename	Revision
JDB	02-23-24	MAD23047.03			B
Checked By	Date Checked	Scale	Drawing Number		
MGM	05-20-24	AS NOTED	8-018-3-2120		

Drainage Memorandum

TO: Pease Development Authority (PDA)

FROM: Neil A. Hansen, PE
Patrick M. Crimmins, PE

COPY: Lonza Biologics

DATE: May 20, 2024

1.0 Project Description

The proposed work includes the addition of Solar Canopies over the previously approved 150-space surface parking lot associated with Phase 2 of the Iron Parcel Development project. These Solar Canopies are planned to be removed along with the 150-space parking lot before the execution of the Master Plan, therefore there will be no changes to the Master Plan Drainage Design.

The Phase 2 drainage analysis has been updated and revised to include the 4'x4' concrete footings and 8'x22' concrete equipment pad. The proposed change includes the addition of approximately 672 SF of impervious surfaces. Although the addition of this area is very minimal in perspective to the whole watershed area (1,376,888 SF), we have prepared this technical memo to confirm that the previously approved Phase 2 drainage design and gravel wetlands are sized appropriately to accommodate this slight increase in impervious area.

2.0 Drainage Analysis

The previously approved Phase 2 Drainage Calculation has been updated to analyze the slight increase in impervious area and can be found in Attachment A. Subcatchment 1.0 has been updated to convert 304 SF of the previously grass surface to impervious surface. This additional 304 SF is approximately 0.09% of the total impervious area (314,795 SF) for this watershed.

Subcatchment 1.1 has been updated to convert 368 SF of the previously grass surface to impervious surface. This addition of 368 SF is approximately 0.7% of the total impervious area (48,674 SF) for this watershed.

STATE OF NEW HAMPSHIRE – NEIL A. HANSEN No. 15227 LICENSED PROFESSIONAL ENGINEER –
5/20/2024

STATE OF NEW HAMPSHIRE – PATRICK CRIMMINS No. 12378 LICENSED PROFESSIONAL ENGINEER –
5/20/2024

2.1 Peak Rate Comparisons

The following table summarizes and compares the Phase-2 2023 Approved, proposed Phase-2 2024 Amendment, and Master Plan pre- and post-development peak runoff rates for the 2-year, 10-year, 25-year and 50-year storm events at each point of analysis. These points of analysis remain unchanged from the previously prepared and approved drainage analysis.

Table 2.1 – Peak Flow Rate Comparison

Point of Analysis	Phase	Pre 1-Year Storm (cfs)	Pre/**Post** 2-Year Storm (cfs)	Pre/**Post** 10-Year Storm (cfs)	Pre/**Post** 25-Year Storm (cfs)	Pre/**Post** 50-Year Storm (cfs)
PA1	Phase 2 (2023 Approval)	16.58	24.86/**9.25**	52.70/**31.22**	76.06/**56.26**	98.56/**74.09**
	Phase 2 (2024 Amendment)	16.58	24.86/**9.25**	52.70/**31.22**	76.06/**56.26**	98.56/**74.09**
	Master	16.58	24.86/**9.41**	52.70/**39.92**	76.06/**66.14**	98.56/**83.35**
PA2	Phase 2 (2023 Approval)	3.38	4.41/**3.10**	7.49/**5.36**	9.90/**7.12**	12.13/**8.76**
	Phase 2 (2024 Amendment)	3.38	4.41/**3.10**	7.49/**5.36**	9.90/**7.12**	12.13/**8.76**
	Master	3.38	4.41/**3.72**	7.49/**5.94**	9.90/**7.66**	12.13/**9.25**

2.2 Stormwater Treatment

Runoff from the newly created impervious surfaces will be directed to either of the previously approved Gravel Wetland 1 (POND 1.0) or Gravel Wetland 2 (POND 1.1). The following sections outline the treatment capacities of both gravel wetlands.

Gravel Wetland 1

Gravel Wetland 1 has a design capacity to treat 333,950 SF of impervious area for its 462,599 SF watershed area. The proposed change is to add 304 SF of impervious surface to the previously approved 314,491 SF of impervious surface for an amended total of 314,795 SF of impervious surface. This 314,795 SF is well within the gravel wetland design capacity of 333,950 SF of impervious surface.

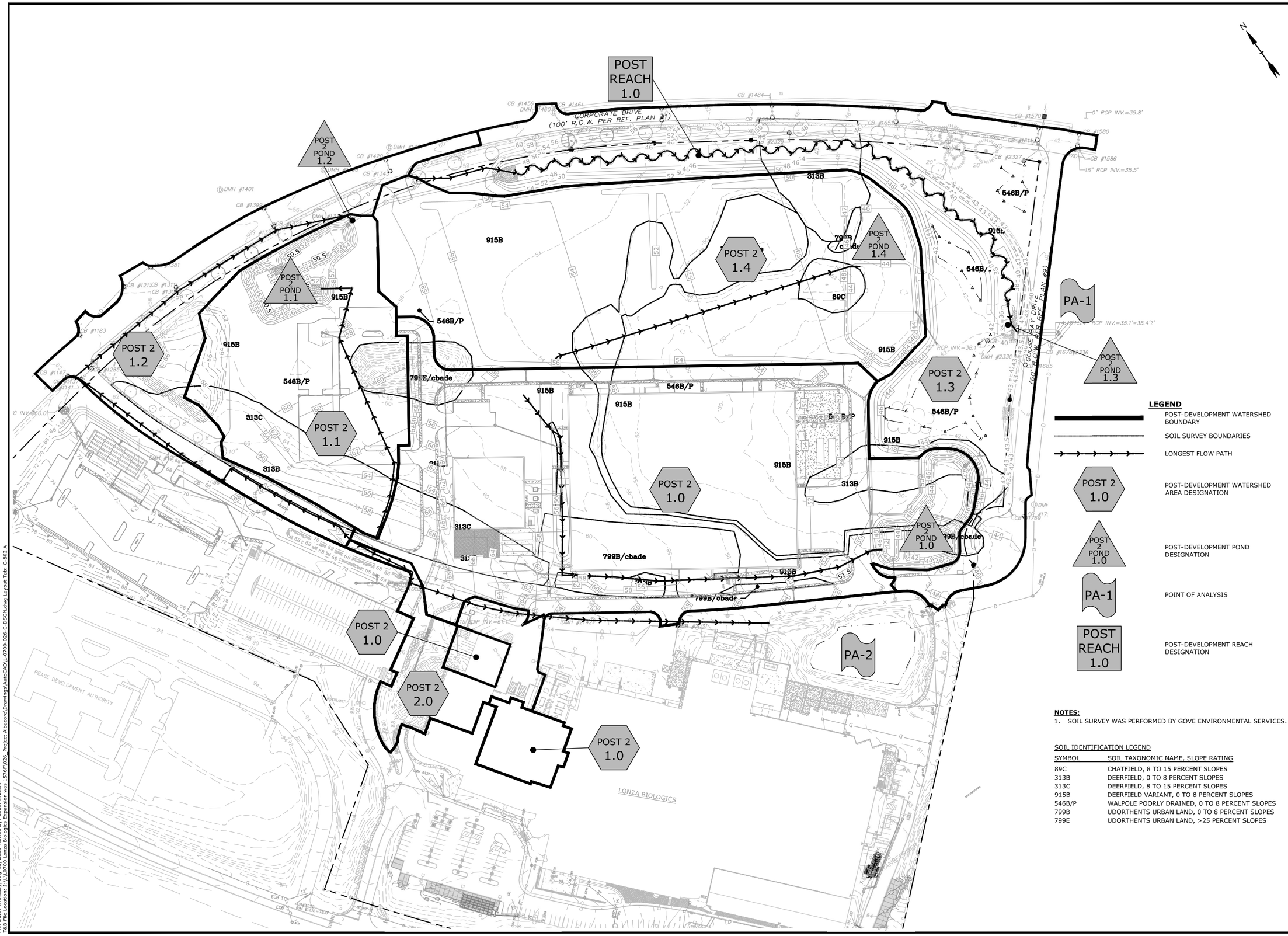
Gravel Wetland 2

Gravel Wetland 2 has a design capacity to treat 142,418 SF of impervious area for its 242,496 SF watershed area. The proposed change is to add 368 SF of impervious surface to the previously approved 48,306 SF of impervious surface for an amended total of 48,674 SF of impervious surface. This 48,674 SF is well within the gravel wetland design capacity of 142,418 SF of impervious surface.

3.0 Conclusion

The proposed amendment will result in no change to the previously approved post-development peak runoff rates for Phase 2 and does not affect the Master Plan Drainage design. The net increase in impervious areas resulting from the proposed work will be directed to either Gravel Wetland 1 or Gravel Wetland 2 which both have the capacity to treat the slight increase in impervious surfaces.

Phase 2 (2023 Approval) Post-Development Calculations



LEGEND

- POST-DEVELOPMENT WATERSHED BOUNDARY
- SOIL SURVEY BOUNDARIES
- LONGEST FLOW PATH
- POST 2 1.0 — POST-DEVELOPMENT WATERSHED AREA DESIGNATION
- POST 2 POND 1.0 — POST-DEVELOPMENT POND DESIGNATION
- PA-1 — POINT OF ANALYSIS
- POST REACH 1.0 — POST-DEVELOPMENT REACH DESIGNATION

SCALE IN FEET
0 80' 160'
GRAPHIC SCALE

NOTES:

1. SOIL SURVEY WAS PERFORMED BY GOVE ENVIRONMENTAL SERVICES.

SOIL IDENTIFICATION LEGEND

SYMBOL	SOIL TAXONOMIC NAME, SLOPE RATING
89C	CHATFIELD, 8 TO 15 PERCENT SLOPES
313B	DEERFIELD, 0 TO 8 PERCENT SLOPES
313C	DEERFIELD, 8 TO 15 PERCENT SLOPES
915B	DEERFIELD VARIANT, 0 TO 8 PERCENT SLOPES
546B/P	WALPOLE POORLY DRAINED, 0 TO 8 PERCENT SLOPES
799B	UDORTHENTS URBAN LAND, 0 TO 8 PERCENT SLOPES
799E	UDORTHENTS URBAN LAND, >25 PERCENT SLOPES

Tighe&Bond

Proposed Industrial Development

Lonza Biologics

Portsmouth, New Hampshire

MARK	DATE	DESCRIPTION
L	7/17/2023	Amended Site Plan Review
K	5/5/2023	Phase 1B Issued for Bid
J	3/15/2023	Phase 1B Issued for Preliminary Pricing
I	1/9/2023	Admin. Approval Submission
H	12/10/2021	Planning Board Stipulation
G	8/19/2019	Admin. Approval Submission
F	11/6/2018	P.B. Submission

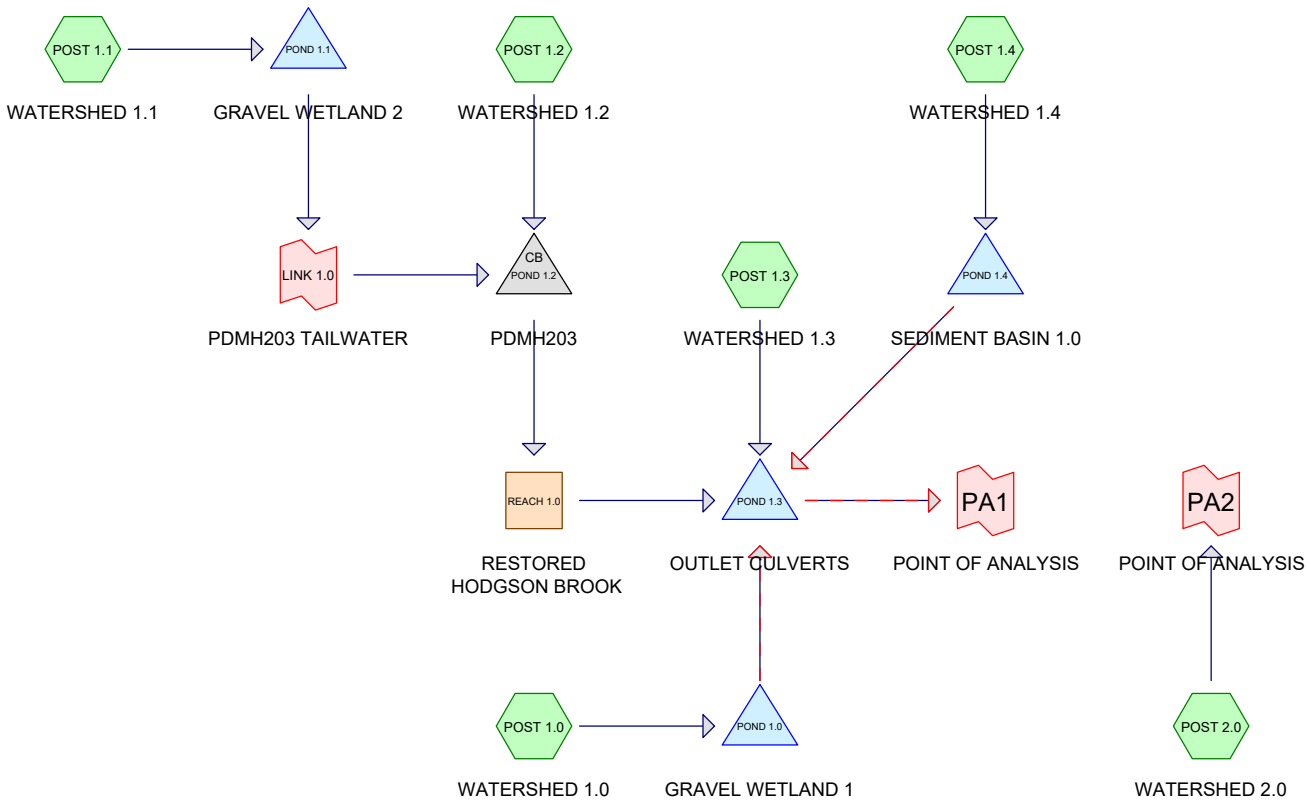
PROJECT NO:	L-0700-013
DATE:	04/03/2018
FILE:	L-0700-026-C-DSGN.dwg
DRAWN BY:	CJK
CHECKED:	NAH
APPROVED:	PMC

PHASE 2
POST-DEVELOPMENT
WATERSHED AREA PLAN

SCALE: AS SHOWN

C-802 A

Last Save Date: July 13, 2023 3:42 PM By: CKRZCUIK
Plot Date: Thursday, July 13, 2023 3:43 PM By: CKRZCUIK
T&B File Location: J:\L\L0700 Lonza Biologics Expansion was 1576F\026_Project Albacore\Drawings\AutoCAD\L-0700-026-C-DSGN.dwg Layout Tab: C-802 A



Subcat Reach Pond Link

Routing Diagram for L-0700-26 POST P2
Prepared by Tighe & Bond, Printed 7/13/2023

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.312	61	>75% Grass cover, Good, HSG B (POST 1.0, POST 1.1, POST 1.2, POST 1.3, POST 1.4)
13.558	74	>75% Grass cover, Good, HSG C (POST 1.0, POST 1.1, POST 1.2, POST 1.3, POST 1.4, POST 2.0)
1.467	80	>75% Grass cover, Good, HSG D (POST 1.0, POST 1.3, POST 1.4)
0.514	58	Meadow, non-grazed, HSG B (POST 1.3)
1.662	71	Meadow, non-grazed, HSG C (POST 1.3)
0.639	98	Paved parking, HSG B (POST 1.0, POST 1.1, POST 1.2, POST 1.3)
6.959	98	Paved parking, HSG C (POST 1.0, POST 1.1, POST 1.2, POST 1.3, POST 1.4, POST 2.0)
0.137	98	Paved parking, HSG D (POST 1.0, POST 1.3)
0.120	98	Roofs, HSG B (POST 1.0)
3.526	98	Roofs, HSG C (POST 1.0, POST 2.0)
0.714	98	Roofs, HSG D (POST 1.0)
31.609	**82**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
3.586	HSG B	POST 1.0, POST 1.1, POST 1.2, POST 1.3, POST 1.4
25.705	HSG C	POST 1.0, POST 1.1, POST 1.2, POST 1.3, POST 1.4, POST 2.0
2.318	HSG D	POST 1.0, POST 1.3, POST 1.4
0.000	Other	
31.609		**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment POST 1.0: WATERSHED Runoff Area=440,332 sf 71.42% Impervious Runoff Depth>2.61"
Flow Length=933' Tc=11.4 min CN=90 Runoff=25.38 cfs 2.201 af

Subcatchment POST 1.1: WATERSHED Runoff Area=157,428 sf 30.68% Impervious Runoff Depth>1.63"
Flow Length=464' Tc=8.3 min CN=78 Runoff=6.25 cfs 0.492 af

Subcatchment POST 1.2: WATERSHED Runoff Area=113,979 sf 58.28% Impervious Runoff Depth>2.34"
Flow Length=1,191' Tc=6.4 min CN=87 Runoff=6.94 cfs 0.511 af

Subcatchment POST 1.3: WATERSHED Runoff Area=300,100 sf 23.27% Impervious Runoff Depth>1.62"
Flow Length=1,525' Tc=45.9 min CN=78 Runoff=5.96 cfs 0.929 af

Subcatchment POST 1.4: WATERSHED 1.4 Runoff Area=315,727 sf 0.42% Impervious Runoff Depth>1.36"
Flow Length=585' Tc=13.5 min CN=74 Runoff=8.76 cfs 0.822 af

Subcatchment POST 2.0: WATERSHED 2.0 Runoff Area=49,336 sf 53.76% Impervious Runoff Depth>2.34"
Flow Length=758' Tc=5.0 min CN=87 Runoff=3.10 cfs 0.221 af

Reach REACH 1.0: RESTORED Avg. Flow Depth=0.63' Max Vel=2.08 fps Inflow=6.94 cfs 0.511 af
n=0.040 L=1,309.0' S=0.0092 '/' Capacity=2,720.29 cfs Outflow=4.97 cfs 0.507 af

Pond POND 1.0: GRAVEL WETLAND 1 Peak Elev=46.02' Storage=67,987 cf Inflow=25.38 cfs 2.201 af
Primary=0.96 cfs 0.874 af Secondary=0.00 cfs 0.000 af Outflow=0.96 cfs 0.874 af

Pond POND 1.1: GRAVEL WETLAND 2 Peak Elev=52.38' Storage=21,415 cf Inflow=6.25 cfs 0.492 af
Outflow=0.00 cfs 0.000 af

Pond POND 1.2: PDMH203 Peak Elev=50.38' Inflow=6.94 cfs 0.511 af
48.0" Round Culvert n=0.013 L=269.0' S=0.0050 '/' Outflow=6.94 cfs 0.511 af

Pond POND 1.3: OUTLET CULVERTS Peak Elev=38.16' Storage=8,981 cf Inflow=9.25 cfs 3.060 af
Primary=9.25 cfs 2.856 af Secondary=0.00 cfs 0.000 af Outflow=9.25 cfs 2.856 af

Pond POND 1.4: SEDIMENT BASIN 1.0 Peak Elev=44.62' Storage=21,007 cf Inflow=8.76 cfs 0.822 af
Primary=0.51 cfs 0.751 af Secondary=0.00 cfs 0.000 af Outflow=0.51 cfs 0.751 af

Link LINK 1.0: PDMH203 TAILWATER Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link PA1: POINT OF ANALYSIS Inflow=9.25 cfs 2.856 af
Primary=9.25 cfs 2.856 af

Link PA2: POINT OF ANALYSIS Inflow=3.10 cfs 0.221 af
Primary=3.10 cfs 0.221 af

Total Runoff Area = 31.609 ac Runoff Volume = 5.176 af Average Runoff Depth = 1.96"
61.73% Pervious = 19.513 ac 38.27% Impervious = 12.096 ac

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment POST 1.0: WATERSHED Runoff Area=440,332 sf 71.42% Impervious Runoff Depth>4.43"
Flow Length=933' Tc=11.4 min CN=90 Runoff=42.01 cfs 3.732 af

Subcatchment POST 1.1: WATERSHED Runoff Area=157,428 sf 30.68% Impervious Runoff Depth>3.21"
Flow Length=464' Tc=8.3 min CN=78 Runoff=12.40 cfs 0.966 af

Subcatchment POST 1.2: WATERSHED Runoff Area=113,979 sf 58.28% Impervious Runoff Depth>4.11"
Flow Length=1,191' Tc=6.4 min CN=87 Runoff=11.94 cfs 0.897 af

Subcatchment POST 1.3: WATERSHED Runoff Area=300,100 sf 23.27% Impervious Runoff Depth>3.18"
Flow Length=1,525' Tc=45.9 min CN=78 Runoff=11.87 cfs 1.826 af

Subcatchment POST 1.4: WATERSHED 1.4 Runoff Area=315,727 sf 0.42% Impervious Runoff Depth>2.83"
Flow Length=585' Tc=13.5 min CN=74 Runoff=18.77 cfs 1.708 af

Subcatchment POST 2.0: WATERSHED 2.0 Runoff Area=49,336 sf 53.76% Impervious Runoff Depth>4.11"
Flow Length=758' Tc=5.0 min CN=87 Runoff=5.36 cfs 0.388 af

Reach REACH 1.0: RESTORED Avg. Flow Depth=0.82' Max Vel=2.20 fps Inflow=11.94 cfs 0.897 af
n=0.040 L=1,309.0' S=0.0092 '/' Capacity=2,720.29 cfs Outflow=6.12 cfs 0.891 af

Pond POND 1.0: GRAVEL WETLAND 1 Peak Elev=46.78' Storage=83,438 cf Inflow=42.01 cfs 3.732 af
Primary=9.22 cfs 2.105 af Secondary=5.86 cfs 0.170 af Outflow=15.08 cfs 2.275 af

Pond POND 1.1: GRAVEL WETLAND 2 Peak Elev=54.11' Storage=42,049 cf Inflow=12.40 cfs 0.966 af
Outflow=0.00 cfs 0.000 af

Pond POND 1.2: PDMH203 Peak Elev=50.72' Inflow=11.94 cfs 0.897 af
48.0" Round Culvert n=0.013 L=269.0' S=0.0050 '/' Outflow=11.94 cfs 0.897 af

Pond POND 1.3: OUTLET CULVERTS Peak Elev=38.77' Storage=13,560 cf Inflow=31.34 cfs 5.942 af
Primary=31.22 cfs 5.655 af Secondary=0.00 cfs 0.000 af Outflow=31.22 cfs 5.655 af

Pond POND 1.4: SEDIMENT BASIN 1.0 Peak Elev=45.79' Storage=50,580 cf Inflow=18.77 cfs 1.708 af
Primary=0.68 cfs 0.950 af Secondary=0.00 cfs 0.000 af Outflow=0.68 cfs 0.950 af

Link LINK 1.0: PDMH203 TAILWATER Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link PA1: POINT OF ANALYSIS Inflow=31.22 cfs 5.655 af
Primary=31.22 cfs 5.655 af

Link PA2: POINT OF ANALYSIS Inflow=5.36 cfs 0.388 af
Primary=5.36 cfs 0.388 af

Total Runoff Area = 31.609 ac Runoff Volume = 9.517 af Average Runoff Depth = 3.61"
61.73% Pervious = 19.513 ac 38.27% Impervious = 12.096 ac

Summary for Subcatchment POST 1.0: WATERSHED 1.0

Runoff = 42.01 cfs @ 12.16 hrs, Volume= 3.732 af, Depth> 4.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
5,235	98	Roofs, HSG B
29,148	61	>75% Grass cover, Good, HSG B
18,966	98	Paved parking, HSG B
143,455	98	Roofs, HSG C
82,022	74	>75% Grass cover, Good, HSG C
110,236	98	Paved parking, HSG C
31,119	98	Roofs, HSG D
14,671	80	>75% Grass cover, Good, HSG D
5,480	98	Paved parking, HSG D
440,332	90	Weighted Average
125,841		28.58% Pervious Area
314,491		71.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	70	0.0150	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.68"
0.2	32	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	19	0.0200	2.12		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.8	162	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.4	84	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.5	113	0.0050	3.72	4.57	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
1.2	299	0.0050	4.20	7.43	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
0.4	94	0.0050	4.20	7.43	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
0.1	46	0.0240	11.16	35.05	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
0.0	5	0.0800	7.16	0.98	**Pipe Channel,** 5.0" Round Area= 0.1 sf Perim= 1.3' r= 0.10' n= 0.013
0.0	9	0.0110	9.90	69.95	**Pipe Channel,**

36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75'
n= 0.013

11.4	933	Total

Summary for Subcatchment POST 1.1: WATERSHED 1.1

Runoff = 12.40 cfs @ 12.12 hrs, Volume= 0.966 af, Depth> 3.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
36,403	61	>75% Grass cover, Good, HSG B
3,210	98	Paved parking, HSG B
72,719	74	>75% Grass cover, Good, HSG C
45,096	98	Paved parking, HSG C
157,428	78	Weighted Average
109,122		69.32% Pervious Area
48,306		30.68% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	100	0.0625	0.29		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.68"
2.2	312	0.0220	2.39		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	33	0.0150	1.84		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.0	19	0.3300	8.62		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.3	464	Total			

Summary for Subcatchment POST 1.2: WATERSHED 1.2

Runoff = 11.94 cfs @ 12.09 hrs, Volume= 0.897 af, Depth> 4.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
9,848	61	>75% Grass cover, Good, HSG B
4,784	98	Paved parking, HSG B
37,701	74	>75% Grass cover, Good, HSG C
61,646	98	Paved parking, HSG C
113,979	87	Weighted Average
47,549		41.72% Pervious Area
66,430		58.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0100	1.12		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.68"
1.0	153	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.6	343	0.0050	3.47	2.73	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
0.1	13	0.0050	3.72	4.57	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Corrugated PE, smooth interior
1.8	453	0.0050	4.20	7.43	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
0.4	129	0.0050	5.91	29.00	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Corrugated PE, smooth interior
6.4	1,191	Total			

Summary for Subcatchment POST 1.3: WATERSHED 1.3

Runoff = 11.87 cfs @ 12.63 hrs, Volume= 1.826 af, Depth> 3.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
1,830	61	>75% Grass cover, Good, HSG B
22,404	58	Meadow, non-grazed, HSG B
896	98	Paved parking, HSG B
131,991	74	>75% Grass cover, Good, HSG C
68,446	98	Paved parking, HSG C
72,396	71	Meadow, non-grazed, HSG C
1,638	80	>75% Grass cover, Good, HSG D
499	98	Paved parking, HSG D
300,100	78	Weighted Average
230,259		76.73% Pervious Area
69,841		23.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	100	0.0130	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.68"
1.1	52	0.0130	0.80		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	27	0.2720	7.82		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
33.8	1,346	0.0090	0.66		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
45.9	1,525	Total			

Summary for Subcatchment POST 1.4: WATERSHED 1.4

Runoff = 18.77 cfs @ 12.19 hrs, Volume= 1.708 af, Depth> 2.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
23,477	61	>75% Grass cover, Good, HSG B
243,330	74	>75% Grass cover, Good, HSG C
1,334	98	Paved parking, HSG C
47,586	80	>75% Grass cover, Good, HSG D
0	96	Gravel surface, HSG D
315,727	74	Weighted Average
314,393		99.58% Pervious Area
1,334		0.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	100	0.0245	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.68"
5.1	465	0.0103	1.52		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.0	20	0.3300	8.62		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
13.5	585	Total			

Summary for Subcatchment POST 2.0: WATERSHED 2.0

[49] Hint: Tc<2dt may require smaller dt

Runoff = 5.36 cfs @ 12.07 hrs, Volume= 0.388 af, Depth> 4.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
10,145	98	Roofs, HSG C
22,815	74	>75% Grass cover, Good, HSG C
16,376	98	Paved parking, HSG C
49,336	87	Weighted Average
22,815		46.24% Pervious Area
26,521		53.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0164	1.36		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.68"
0.3	48	0.0164	2.60		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.3	130	0.0140	7.03	12.43	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
0.5	70	0.0250	2.37		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
1.3	410	0.0050	5.09	16.00	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
3.6	758	Total, Increased to minimum Tc = 5.0 min			

Summary for Reach REACH 1.0: RESTORED HODGSON BROOK

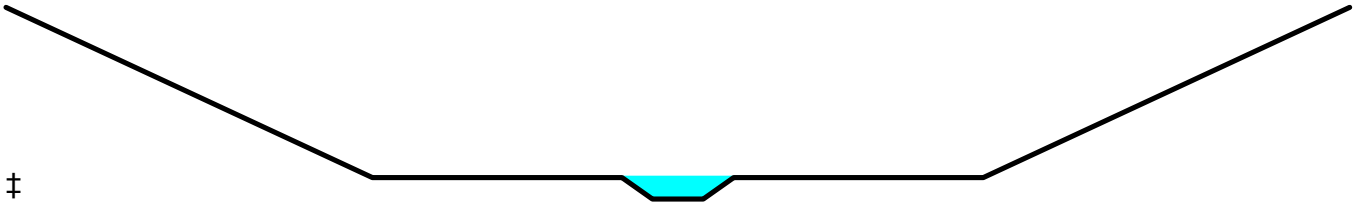
[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=2)

Inflow Area = 6.231 ac, 42.27% Impervious, Inflow Depth > 1.73" for 10 Year event
Inflow = 11.94 cfs @ 12.09 hrs, Volume= 0.897 af
Outflow = 6.12 cfs @ 12.86 hrs, Volume= 0.891 af, Atten= 49%, Lag= 45.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.20 fps, Min. Travel Time= 9.9 min
Avg. Velocity = 0.85 fps, Avg. Travel Time= 25.6 min

Peak Storage= 6,846 cf @ 12.27 hrs
Average Depth at Peak Storage= 0.82'
Bank-Full Depth= 6.75' Flow Area= 291.0 sf, Capacity= 2,720.29 cfs

Custom cross-section, Length= 1,309.0' Slope= 0.0092 '/' (101 Elevation Intervals)
Constant n= 0.040 Winding stream, pools & shoals
Inlet Invert= 48.00', Outlet Invert= 36.00'



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Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	12.00	0.00
18.00	6.00	6.00
30.25	6.00	6.00
31.75	5.25	6.75
34.25	5.25	6.75
35.75	6.00	6.00
48.00	6.00	6.00
66.00	12.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	2.5	0	0.00
0.75	3.0	30.4	3,927	2.28
6.75	291.0	68.3	380,919	2,720.29

Summary for Pond POND 1.0: GRAVEL WETLAND 1

[95] Warning: Outlet Device #4 rise exceeded

Inflow Area = 10.109 ac, 71.42% Impervious, Inflow Depth > 4.43" for 10 Year event
Inflow = 42.01 cfs @ 12.16 hrs, Volume= 3.732 af
Outflow = 15.08 cfs @ 12.50 hrs, Volume= 2.275 af, Atten= 64%, Lag= 20.8 min
Primary = 9.22 cfs @ 12.50 hrs, Volume= 2.105 af
Secondary = 5.86 cfs @ 12.50 hrs, Volume= 0.170 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 46.78' @ 12.50 hrs Surf.Area= 21,240 sf Storage= 83,438 cf
Flood Elev= 48.00' Surf.Area= 23,557 sf Storage= 110,845 cf

Plug-Flow detention time= 226.3 min calculated for 2.275 af (61% of inflow)
Center-of-Mass det. time= 125.2 min (916.2 - 791.0)

Volume	Invert	Avail.Storage	Storage Description
#1	39.05'	110,845 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
39.05	9,855	0.0	0	0
41.35	9,855	30.0	6,800	6,800
42.00	9,855	45.0	2,883	9,683
43.00	11,943	100.0	10,899	20,582
44.00	14,202	100.0	13,073	33,654
45.00	16,891	100.0	15,547	49,201
46.00	19,752	100.0	18,322	67,522
47.00	21,668	100.0	20,710	88,232
48.00	23,557	100.0	22,613	110,845

Device	Routing	Invert	Outlet Devices
#1	Primary	41.35'	**18.0" Round Culvert** L= 30.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 41.35' / 41.20' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	41.35'	**3.5" Vert. Orifice/Grate** C= 0.600
#3	Device 1	45.00'	**3.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	46.00'	**4.0' long x 0.50' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height
#5	Device 1	47.00'	**4.0" x 4.0" Horiz. Orifice/Grate X 106.00** C= 0.600 Limited to weir flow at low heads
#6	Secondary	46.50'	**15.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=9.22 cfs @ 12.50 hrs HW=46.78' TW=38.77' (Dynamic Tailwater)
└─**1=Culvert** (Passes 9.22 cfs of 18.40 cfs potential flow)
  ├─**2=Orifice/Grate** (Orifice Controls 0.74 cfs @ 11.06 fps)
  ├─**3=Orifice/Grate** (Orifice Controls 0.30 cfs @ 6.19 fps)
  ├─**4=Sharp-Crested Rectangular Weir** (Orifice Controls 8.17 cfs @ 4.19 fps)
  └─**5=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=5.85 cfs @ 12.50 hrs HW=46.78' TW=38.77' (Dynamic Tailwater)
└─**6=Broad-Crested Rectangular Weir** (Weir Controls 5.85 cfs @ 1.41 fps)

Summary for Pond POND 1.1: GRAVEL WETLAND 2

Inflow Area = 3.614 ac, 30.68% Impervious, Inflow Depth > 3.21" for 10 Year event
Inflow = 12.40 cfs @ 12.12 hrs, Volume= 0.966 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 54.11' @ 24.00 hrs Surf.Area= 14,115 sf Storage= 42,049 cf
Flood Elev= 57.00' Surf.Area= 21,643 sf Storage= 94,743 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	47.55'	117,304 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
47.55	6,269	0.0	0	0
49.85	6,269	30.0	4,326	4,326
50.50	6,269	45.0	1,834	6,159
51.00	7,199	100.0	3,367	9,526
52.00	9,187	100.0	8,193	17,719
53.00	11,345	100.0	10,266	27,985
54.00	13,814	100.0	12,580	40,565
55.00	16,645	100.0	15,230	55,794
56.00	19,805	100.0	18,225	74,019
58.00	23,480	100.0	43,285	117,304

Device	Routing	Invert	Outlet Devices
#1	Primary	49.85'	**24.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 49.85' / 49.45' S= 0.0333 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	49.85'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	53.50'	**4.0' long x 2.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	56.50'	**4.0" x 4.0" Horiz. Orifice/Grate X 106.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=47.55' TW=55.07' (Dynamic Tailwater)
↑**1=Culvert** (Controls 0.00 cfs)
↑**2=Orifice/Grate** (Controls 0.00 cfs)
3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)
4=Orifice/Grate (Controls 0.00 cfs)

Summary for Pond POND 1.2: PDMH203

Inflow Area = 6.231 ac, 42.27% Impervious, Inflow Depth > 1.73" for 10 Year event
Inflow = 11.94 cfs @ 12.09 hrs, Volume= 0.897 af
Outflow = 11.94 cfs @ 12.09 hrs, Volume= 0.897 af, Atten= 0%, Lag= 0.0 min
Primary = 11.94 cfs @ 12.09 hrs, Volume= 0.897 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 50.72' @ 12.09 hrs
Flood Elev= 57.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	49.35'	**48.0" Round Culvert** L= 269.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 49.35' / 48.00' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 12.57 sf

Primary OutFlow Max=11.76 cfs @ 12.09 hrs HW=50.71' TW=48.76' (Dynamic Tailwater)
↑**1=Culvert** (Inlet Controls 11.76 cfs @ 3.13 fps)

Summary for Pond POND 1.3: OUTLET CULVERTS

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=12)
[62] Hint: Exceeded Reach REACH 1.0 OUTLET depth by 2.58' @ 23.95 hrs

Inflow Area = 30.477 ac, 37.69% Impervious, Inflow Depth > 2.34" for 10 Year event
Inflow = 31.34 cfs @ 12.51 hrs, Volume= 5.942 af
Outflow = 31.22 cfs @ 12.53 hrs, Volume= 5.655 af, Atten= 0%, Lag= 1.3 min
Primary = 31.22 cfs @ 12.53 hrs, Volume= 5.655 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 38.77' @ 12.53 hrs Surf.Area= 8,870 sf Storage= 13,560 cf
Flood Elev= 43.50' Surf.Area= 95,977 sf Storage= 236,017 cf

Plug-Flow detention time= 56.2 min calculated for 5.642 af (95% of inflow)
Center-of-Mass det. time= 29.8 min (900.3 - 870.4)

Volume	Invert	Avail.Storage	Storage Description
#1	35.00'	236,017 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
35.00	960	0	0
36.00	1,428	1,194	1,194
38.00	5,418	6,846	8,040
40.00	14,354	19,772	27,812
42.00	66,884	81,238	109,050
43.00	92,707	79,796	188,846
43.50	95,977	47,171	236,017

Device	Routing	Invert	Outlet Devices
#1	Primary	35.60'	**42.0" W x 29.0" H, R=21.5"/66.1" Pipe Arch CMP_Arch_1/2 42x29 X 3.00** L= 68.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 35.60' / 35.30' S= 0.0044 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 6.72 sf
#2	Secondary	43.00'	**143.1 deg x 18.0' long x 0.50' rise Sharp-Crested Vee/Trap Weir** Cv= 2.47 (C= 3.09)

Primary OutFlow Max=31.11 cfs @ 12.53 hrs HW=38.77' TW=38.65' (Dynamic Tailwater)
↑—**1=CMP_Arch_1/2 42x29** (Outlet Controls 31.11 cfs @ 1.55 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=35.04' TW=38.65' (Dynamic Tailwater)
↑—**2=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Summary for Pond POND 1.4: SEDIMENT BASIN 1.0

Inflow Area = 7.248 ac, 0.42% Impervious, Inflow Depth > 2.83" for 10 Year event
Inflow = 18.77 cfs @ 12.19 hrs, Volume= 1.708 af
Outflow = 0.68 cfs @ 17.24 hrs, Volume= 0.950 af, Atten= 96%, Lag= 303.1 min
Primary = 0.68 cfs @ 17.24 hrs, Volume= 0.950 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Starting Elev= 44.15' Surf.Area= 18,132 sf Storage= 11,702 cf
Peak Elev= 45.79' @ 17.24 hrs Surf.Area= 29,244 sf Storage= 50,580 cf (38,878 cf above start)
Flood Elev= 48.50' Surf.Area= 38,802 sf Storage= 127,441 cf (115,739 cf above start)

Plug-Flow detention time= 356.9 min calculated for 0.681 af (40% of inflow)
Center-of-Mass det. time= 9.2 min (846.8 - 837.5)

Volume	Invert	Avail.Storage	Storage Description
#1	43.00'	127,441 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
43.00	1,000	0	0
44.00	17,117	9,059	9,059
46.00	30,657	47,774	56,833
47.00	35,879	33,268	90,101
48.00	38,802	37,341	127,441

Device	Routing	Invert	Outlet Devices
#1	Primary	42.75'	**12.0" Round Culvert** L= 66.0' Ke= 0.500 Inlet / Outlet Invert= 42.75' / 42.40' S= 0.0053 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	43.00'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	46.80'	**10.0" x 17.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	47.40'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.10 Width (feet) 8.00 14.60

Primary OutFlow Max=0.68 cfs @ 17.24 hrs HW=45.79' TW=38.65' (Dynamic Tailwater)
└**1=Culvert** (Passes 0.68 cfs of 5.16 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.68 cfs @ 7.80 fps)
  └**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=44.15' TW=35.04' (Dynamic Tailwater)
└**4=Custom Weir/Orifice** (Controls 0.00 cfs)

Summary for Link LINK 1.0: PDMH203 TAILWATER

This link takes into account the tailwater condition in PDMH203 which the outlet of gravel wetland 2 connects. The purpose of this is to determine the effects of any surcharging caused by the tailwater of Hodgson Brook entering the structure. These tailwater elevations were determined by Streamworks, PLLC as part of the overall watershed analysis they performed.

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[80] Warning: Exceeded Pond POND 1.1 by 7.52' @ 0.00 hrs (23.95 cfs 41.618 af)

Inflow Area = 3.614 ac, 30.68% Impervious, Inflow Depth = 0.00" for 10 Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

10 Year 25 Point manual elevation table, To= 0.00 hrs, dt= 1.00 hrs, feet =

55.07	55.07	55.07	55.07	55.07	55.07	55.07	55.07	55.07
55.07	55.07	55.07	55.07	55.07	55.07	55.07	55.07	55.07
55.07	55.07	55.07	55.07	55.07	55.07	55.07		

Summary for Link PA1: POINT OF ANALYSIS

This link takes into account the tailwater condition in roadside swale along Goose Bay Drive which the existing culverts discharge into. These tailwater elevations were determined by Streamworks, PLLC as part of the overall watershed analysis they performed.

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[80] Warning: Exceeded Pond POND 1.3 by 3.61' @ 0.00 hrs (92.51 cfs 60.023 af)

Inflow Area = 30.477 ac, 37.69% Impervious, Inflow Depth > 2.23" for 10 Year event
Inflow = 31.22 cfs @ 12.53 hrs, Volume= 5.655 af
Primary = 31.22 cfs @ 12.53 hrs, Volume= 5.655 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

10 Year 2 Point manual elevation table, To= 0.00 hrs, dt= 24.00 hrs, feet =

38.65	38.65

Summary for Link PA2: POINT OF ANALYSIS

Inflow Area = 1.133 ac, 53.76% Impervious, Inflow Depth > 4.11" for 10 Year event
Inflow = 5.36 cfs @ 12.07 hrs, Volume= 0.388 af
Primary = 5.36 cfs @ 12.07 hrs, Volume= 0.388 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment POST 1.0: WATERSHED Runoff Area=440,332 sf 71.42% Impervious Runoff Depth>5.88"
Flow Length=933' Tc=11.4 min CN=90 Runoff=54.93 cfs 4.956 af

Subcatchment POST 1.1: WATERSHED Runoff Area=157,428 sf 30.68% Impervious Runoff Depth>4.53"
Flow Length=464' Tc=8.3 min CN=78 Runoff=17.44 cfs 1.365 af

Subcatchment POST 1.2: WATERSHED Runoff Area=113,979 sf 58.28% Impervious Runoff Depth>5.54"
Flow Length=1,191' Tc=6.4 min CN=87 Runoff=15.85 cfs 1.209 af

Subcatchment POST 1.3: WATERSHED Runoff Area=300,100 sf 23.27% Impervious Runoff Depth>4.50"
Flow Length=1,525' Tc=45.9 min CN=78 Runoff=16.75 cfs 2.583 af

Subcatchment POST 1.4: WATERSHED 1.4 Runoff Area=315,727 sf 0.42% Impervious Runoff Depth>4.09"
Flow Length=585' Tc=13.5 min CN=74 Runoff=27.23 cfs 2.472 af

Subcatchment POST 2.0: WATERSHED 2.0 Runoff Area=49,336 sf 53.76% Impervious Runoff Depth>5.54"
Flow Length=758' Tc=5.0 min CN=87 Runoff=7.12 cfs 0.523 af

Reach REACH 1.0: RESTORED Avg. Flow Depth=0.87' Max Vel=2.22 fps Inflow=15.85 cfs 1.209 af
n=0.040 L=1,309.0' S=0.0092 '/' Capacity=2,720.29 cfs Outflow=8.65 cfs 1.202 af

Pond POND 1.0: GRAVEL WETLAND 1 Peak Elev=47.10' Storage=90,424 cf Inflow=54.93 cfs 4.956 af
Primary=19.03 cfs 2.766 af Secondary=18.86 cfs 0.671 af Outflow=37.88 cfs 3.437 af

Pond POND 1.1: GRAVEL WETLAND 2 Peak Elev=55.22' Storage=59,446 cf Inflow=17.44 cfs 1.365 af
Outflow=0.00 cfs 0.000 af

Pond POND 1.2: PDMH203 Peak Elev=50.94' Inflow=15.85 cfs 1.209 af
48.0" Round Culvert n=0.013 L=269.0' S=0.0050 '/' Outflow=15.85 cfs 1.209 af

Pond POND 1.3: OUTLET CULVERTS Peak Elev=39.17' Storage=17,433 cf Inflow=57.33 cfs 8.292 af
Primary=56.26 cfs 7.985 af Secondary=0.00 cfs 0.000 af Outflow=56.26 cfs 7.985 af

Pond POND 1.4: SEDIMENT BASIN 1.0 Peak Elev=46.65' Storage=77,792 cf Inflow=27.23 cfs 2.472 af
Primary=0.78 cfs 1.070 af Secondary=0.00 cfs 0.000 af Outflow=0.78 cfs 1.070 af

Link LINK 1.0: PDMH203 TAILWATER Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link PA1: POINT OF ANALYSIS Inflow=56.26 cfs 7.985 af
Primary=56.26 cfs 7.985 af

Link PA2: POINT OF ANALYSIS Inflow=7.12 cfs 0.523 af
Primary=7.12 cfs 0.523 af

Total Runoff Area = 31.609 ac Runoff Volume = 13.108 af Average Runoff Depth = 4.98"
61.73% Pervious = 19.513 ac 38.27% Impervious = 12.096 ac

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment POST 1.0: WATERSHED Runoff Area=440,332 sf 71.42% Impervious Runoff Depth>7.25"
Flow Length=933' Tc=11.4 min CN=90 Runoff=66.89 cfs 6.105 af

Subcatchment POST 1.1: WATERSHED Runoff Area=157,428 sf 30.68% Impervious Runoff Depth>5.81"
Flow Length=464' Tc=8.3 min CN=78 Runoff=22.21 cfs 1.750 af

Subcatchment POST 1.2: WATERSHED Runoff Area=113,979 sf 58.28% Impervious Runoff Depth>6.89"
Flow Length=1,191' Tc=6.4 min CN=87 Runoff=19.47 cfs 1.503 af

Subcatchment POST 1.3: WATERSHED Runoff Area=300,100 sf 23.27% Impervious Runoff Depth>5.77"
Flow Length=1,525' Tc=45.9 min CN=78 Runoff=21.37 cfs 3.312 af

Subcatchment POST 1.4: WATERSHED 1.4 Runoff Area=315,727 sf 0.42% Impervious Runoff Depth>5.33"
Flow Length=585' Tc=13.5 min CN=74 Runoff=35.32 cfs 3.218 af

Subcatchment POST 2.0: WATERSHED 2.0 Runoff Area=49,336 sf 53.76% Impervious Runoff Depth>6.89"
Flow Length=758' Tc=5.0 min CN=87 Runoff=8.76 cfs 0.651 af

Reach REACH 1.0: RESTORED Avg. Flow Depth=0.92' Max Vel=2.24 fps Inflow=19.47 cfs 1.503 af
n=0.040 L=1,309.0' S=0.0092 '/' Capacity=2,720.29 cfs Outflow=11.76 cfs 1.495 af

Pond POND 1.0: GRAVEL WETLAND 1 Peak Elev=47.39' Storage=96,897 cf Inflow=66.89 cfs 6.105 af
Primary=19.58 cfs 3.347 af Secondary=33.37 cfs 1.209 af Outflow=52.94 cfs 4.556 af

Pond POND 1.1: GRAVEL WETLAND 2 Peak Elev=56.11' Storage=76,209 cf Inflow=22.21 cfs 1.750 af
Outflow=0.00 cfs 0.000 af

Pond POND 1.2: PDMH203 Peak Elev=51.13' Inflow=19.47 cfs 1.503 af
48.0" Round Culvert n=0.013 L=269.0' S=0.0050 '/' Outflow=19.47 cfs 1.503 af

Pond POND 1.3: OUTLET CULVERTS Peak Elev=39.58' Storage=22,150 cf Inflow=76.91 cfs 10.982 af
Primary=74.09 cfs 10.655 af Secondary=0.00 cfs 0.000 af Outflow=74.09 cfs 10.655 af

Pond POND 1.4: SEDIMENT BASIN 1.0 Peak Elev=47.02' Storage=90,878 cf Inflow=35.32 cfs 3.218 af
Primary=2.39 cfs 1.619 af Secondary=0.00 cfs 0.000 af Outflow=2.39 cfs 1.619 af

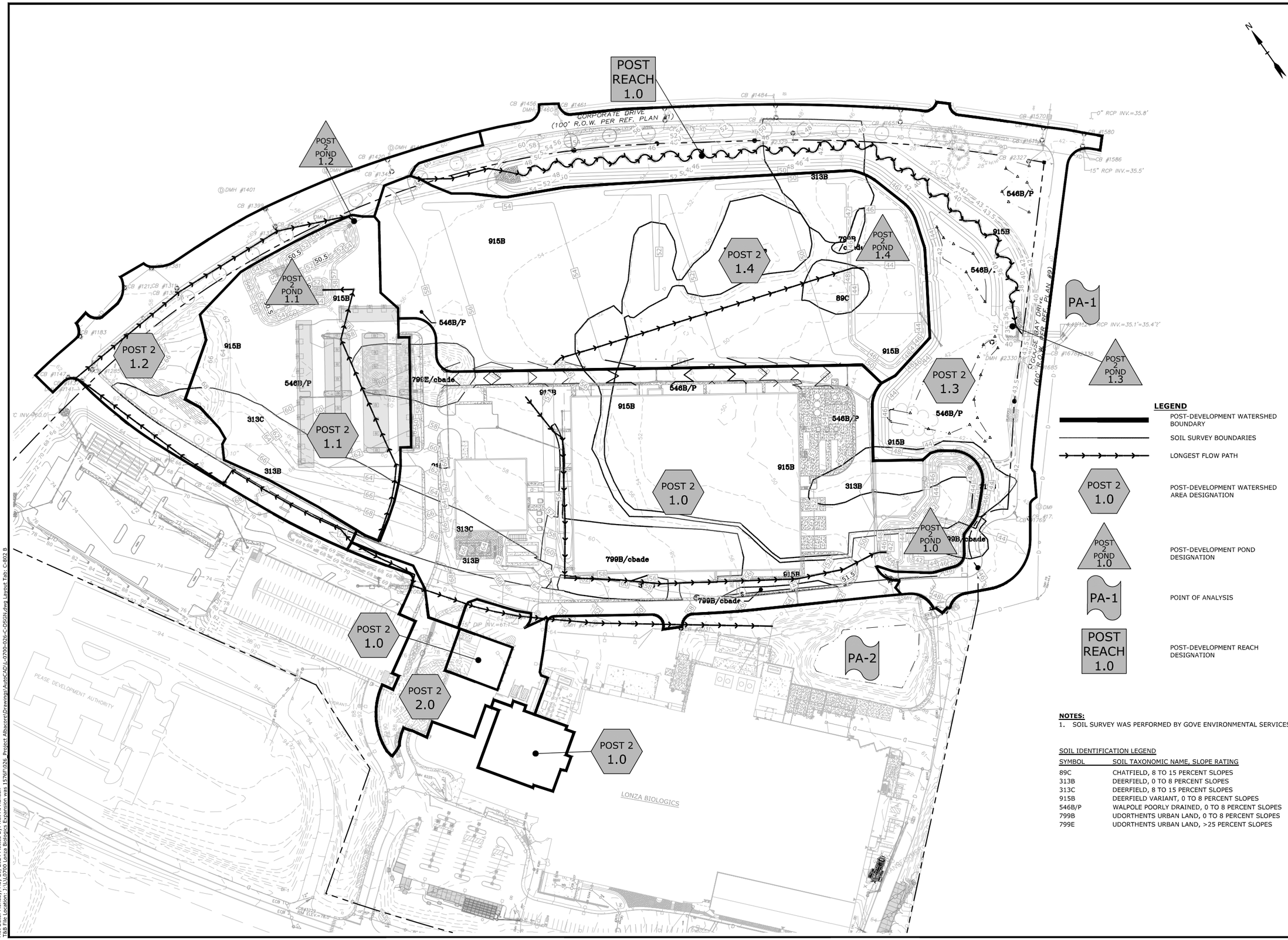
Link LINK 1.0: PDMH203 TAILWATER Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link PA1: POINT OF ANALYSIS Inflow=74.09 cfs 10.655 af
Primary=74.09 cfs 10.655 af

Link PA2: POINT OF ANALYSIS Inflow=8.76 cfs 0.651 af
Primary=8.76 cfs 0.651 af

Total Runoff Area = 31.609 ac Runoff Volume = 16.539 af Average Runoff Depth = 6.28"
61.73% Pervious = 19.513 ac 38.27% Impervious = 12.096 ac

Phase 2 (2024 Amended) Post-Development Calculations



LEGEND

- POST-DEVELOPMENT WATERSHED BOUNDARY
- SOIL SURVEY BOUNDARIES
- LONGEST FLOW PATH
- POST-DEVELOPMENT WATERSHED AREA DESIGNATION (POST 2 1.0)
- POST-DEVELOPMENT POND DESIGNATION (POST 2 POND 1.0)
- POINT OF ANALYSIS (PA-1)
- POST-DEVELOPMENT REACH DESIGNATION (POST REACH 1.0)

SCALE IN FEET
0 80' 160'
GRAPHIC SCALE

NOTES:

1. SOIL SURVEY WAS PERFORMED BY GOVE ENVIRONMENTAL SERVICES.

SOIL IDENTIFICATION LEGEND

SYMBOL	SOIL TAXONOMIC NAME, SLOPE RATING
89C	CHATFIELD, 8 TO 15 PERCENT SLOPES
313B	DEERFIELD, 0 TO 8 PERCENT SLOPES
313C	DEERFIELD, 8 TO 15 PERCENT SLOPES
915B	DEERFIELD VARIANT, 0 TO 8 PERCENT SLOPES
546B/P	WALPOLE POORLY DRAINED, 0 TO 8 PERCENT SLOPES
799B	UDORTHENTS URBAN LAND, 0 TO 8 PERCENT SLOPES
799E	UDORTHENTS URBAN LAND, >25 PERCENT SLOPES

Tighe&Bond

Proposed Industrial Development

Lonza Biologics

Portsmouth, New Hampshire

MARK	DATE	DESCRIPTION
Q	5/20/2024	Solar - Amended Approval
P	4/2/2024	Ph2 IFC Addendum #1
O	12/15/2023	Ph2 Issued for Construction
N	11/9/2023	Revised P.B. Submission
M	9/27/2023	P.B. Submission
L	9/1/2022	Issued for Construction
K	5/27/2022	Issued for Bid

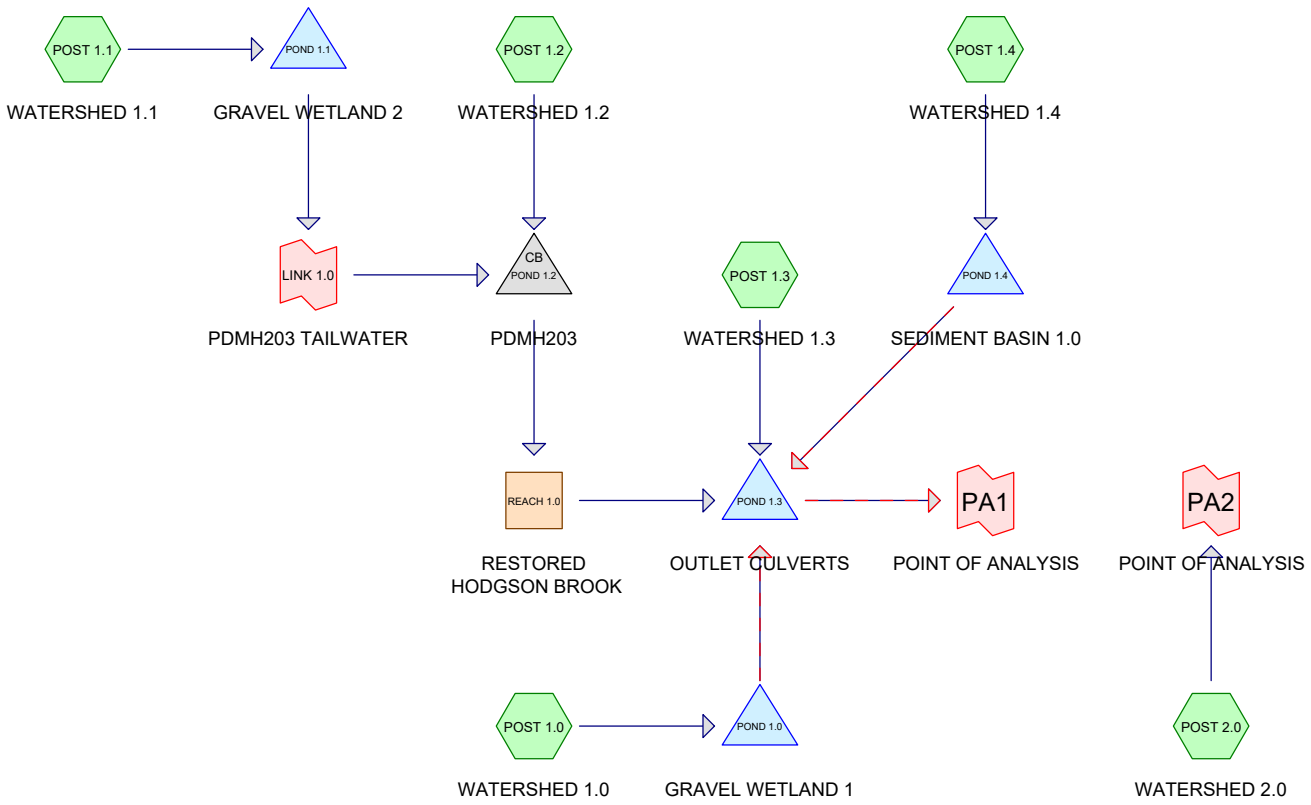
PROJECT NO:	L-0700-013
DATE:	04/03/2018
FILE:	L-0700-026-C-DSGN.dwg
DRAWN BY:	CJK
CHECKED:	NAH
APPROVED:	PMC

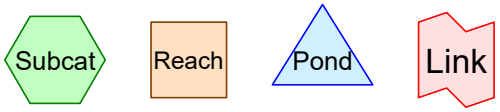
PHASE 2
POST-DEVELOPMENT
WATERSHED AREA PLAN

SCALE: AS SHOWN

C-802 B

Last Save Date: May 17, 2024 4:43 PM By: NAHANSEN
Plot Date: May 20, 2024 7:44 AM By: Nicholas Hansen
T&B File Location: J:\LL\L0700 Lonza Biologics Expansion was 1576F\026_Project Albacore\Drawings\AutoCAD\L-0700-026-C-DSGN.dwg Layout Tab: C-802 B





Routing Diagram for L-0700-26 POST P2
Prepared by Tighe & Bond Consulting, Printed 3/1/2024

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
2.312	61	>75% Grass cover, Good, HSG B (POST 1.0, POST 1.1, POST 1.2, POST 1.3, POST 1.4)
13.542	74	>75% Grass cover, Good, HSG C (POST 1.0, POST 1.1, POST 1.2, POST 1.3, POST 1.4, POST 2.0)
1.467	80	>75% Grass cover, Good, HSG D (POST 1.0, POST 1.3, POST 1.4)
0.514	58	Meadow, non-grazed, HSG B (POST 1.3)
1.662	71	Meadow, non-grazed, HSG C (POST 1.3)
0.639	98	Paved parking, HSG B (POST 1.0, POST 1.1, POST 1.2, POST 1.3)
6.974	98	Paved parking, HSG C (POST 1.0, POST 1.1, POST 1.2, POST 1.3, POST 1.4, POST 2.0)
0.137	98	Paved parking, HSG D (POST 1.0, POST 1.3)
0.120	98	Roofs, HSG B (POST 1.0)
3.526	98	Roofs, HSG C (POST 1.0, POST 2.0)
0.714	98	Roofs, HSG D (POST 1.0)
31.609	**82**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
3.586	HSG B	POST 1.0, POST 1.1, POST 1.2, POST 1.3, POST 1.4
25.705	HSG C	POST 1.0, POST 1.1, POST 1.2, POST 1.3, POST 1.4, POST 2.0
2.318	HSG D	POST 1.0, POST 1.3, POST 1.4
0.000	Other	
31.609		**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment POST 1.0: WATERSHED Runoff Area=440,332 sf 71.49% Impervious Runoff Depth>2.61"
Flow Length=933' Tc=11.4 min CN=90 Runoff=25.38 cfs 2.201 af

Subcatchment POST 1.1: WATERSHED Runoff Area=157,428 sf 30.92% Impervious Runoff Depth>1.63"
Flow Length=464' Tc=8.3 min CN=78 Runoff=6.25 cfs 0.492 af

Subcatchment POST 1.2: WATERSHED Runoff Area=113,979 sf 58.28% Impervious Runoff Depth>2.34"
Flow Length=1,191' Tc=6.4 min CN=87 Runoff=6.94 cfs 0.511 af

Subcatchment POST 1.3: WATERSHED Runoff Area=300,100 sf 23.27% Impervious Runoff Depth>1.62"
Flow Length=1,525' Tc=45.9 min CN=78 Runoff=5.96 cfs 0.929 af

Subcatchment POST 1.4: WATERSHED 1.4 Runoff Area=315,727 sf 0.42% Impervious Runoff Depth>1.36"
Flow Length=585' Tc=13.5 min CN=74 Runoff=8.76 cfs 0.822 af

Subcatchment POST 2.0: WATERSHED 2.0 Runoff Area=49,336 sf 53.76% Impervious Runoff Depth>2.34"
Flow Length=758' Tc=5.0 min CN=87 Runoff=3.10 cfs 0.221 af

Reach REACH 1.0: RESTORED Avg. Flow Depth=0.63' Max Vel=2.08 fps Inflow=6.94 cfs 0.511 af
n=0.040 L=1,309.0' S=0.0092 '/' Capacity=2,720.29 cfs Outflow=4.97 cfs 0.507 af

Pond POND 1.0: GRAVEL WETLAND 1 Peak Elev=46.02' Storage=67,987 cf Inflow=25.38 cfs 2.201 af
Primary=0.96 cfs 0.874 af Secondary=0.00 cfs 0.000 af Outflow=0.96 cfs 0.874 af

Pond POND 1.1: GRAVEL WETLAND 2 Peak Elev=52.38' Storage=21,415 cf Inflow=6.25 cfs 0.492 af
Outflow=0.00 cfs 0.000 af

Pond POND 1.2: PDMH203 Peak Elev=50.38' Inflow=6.94 cfs 0.511 af
48.0" Round Culvert n=0.013 L=269.0' S=0.0050 '/' Outflow=6.94 cfs 0.511 af

Pond POND 1.3: OUTLET CULVERTS Peak Elev=38.16' Storage=8,981 cf Inflow=9.25 cfs 3.060 af
Primary=9.25 cfs 2.856 af Secondary=0.00 cfs 0.000 af Outflow=9.25 cfs 2.856 af

Pond POND 1.4: SEDIMENT BASIN 1.0 Peak Elev=44.62' Storage=21,007 cf Inflow=8.76 cfs 0.822 af
Primary=0.51 cfs 0.751 af Secondary=0.00 cfs 0.000 af Outflow=0.51 cfs 0.751 af

Link LINK 1.0: PDMH203 TAILWATER Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link PA1: POINT OF ANALYSIS Inflow=9.25 cfs 2.856 af
Primary=9.25 cfs 2.856 af

Link PA2: POINT OF ANALYSIS Inflow=3.10 cfs 0.221 af
Primary=3.10 cfs 0.221 af

Total Runoff Area = 31.609 ac Runoff Volume = 5.176 af Average Runoff Depth = 1.96"
61.68% Pervious = 19.497 ac 38.32% Impervious = 12.112 ac

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment POST 1.0: WATERSHED Runoff Area=440,332 sf 71.49% Impervious Runoff Depth>4.43"
Flow Length=933' Tc=11.4 min CN=90 Runoff=42.01 cfs 3.732 af

Subcatchment POST 1.1: WATERSHED Runoff Area=157,428 sf 30.92% Impervious Runoff Depth>3.21"
Flow Length=464' Tc=8.3 min CN=78 Runoff=12.40 cfs 0.966 af

Subcatchment POST 1.2: WATERSHED Runoff Area=113,979 sf 58.28% Impervious Runoff Depth>4.11"
Flow Length=1,191' Tc=6.4 min CN=87 Runoff=11.94 cfs 0.897 af

Subcatchment POST 1.3: WATERSHED Runoff Area=300,100 sf 23.27% Impervious Runoff Depth>3.18"
Flow Length=1,525' Tc=45.9 min CN=78 Runoff=11.87 cfs 1.826 af

Subcatchment POST 1.4: WATERSHED 1.4 Runoff Area=315,727 sf 0.42% Impervious Runoff Depth>2.83"
Flow Length=585' Tc=13.5 min CN=74 Runoff=18.77 cfs 1.708 af

Subcatchment POST 2.0: WATERSHED 2.0 Runoff Area=49,336 sf 53.76% Impervious Runoff Depth>4.11"
Flow Length=758' Tc=5.0 min CN=87 Runoff=5.36 cfs 0.388 af

Reach REACH 1.0: RESTORED Avg. Flow Depth=0.82' Max Vel=2.20 fps Inflow=11.94 cfs 0.897 af
n=0.040 L=1,309.0' S=0.0092 '/' Capacity=2,720.29 cfs Outflow=6.12 cfs 0.891 af

Pond POND 1.0: GRAVEL WETLAND 1 Peak Elev=46.78' Storage=83,438 cf Inflow=42.01 cfs 3.732 af
Primary=9.22 cfs 2.105 af Secondary=5.86 cfs 0.170 af Outflow=15.08 cfs 2.275 af

Pond POND 1.1: GRAVEL WETLAND 2 Peak Elev=54.11' Storage=42,049 cf Inflow=12.40 cfs 0.966 af
Outflow=0.00 cfs 0.000 af

Pond POND 1.2: PDMH203 Peak Elev=50.72' Inflow=11.94 cfs 0.897 af
48.0" Round Culvert n=0.013 L=269.0' S=0.0050 '/' Outflow=11.94 cfs 0.897 af

Pond POND 1.3: OUTLET CULVERTS Peak Elev=38.77' Storage=13,560 cf Inflow=31.34 cfs 5.942 af
Primary=31.22 cfs 5.655 af Secondary=0.00 cfs 0.000 af Outflow=31.22 cfs 5.655 af

Pond POND 1.4: SEDIMENT BASIN 1.0 Peak Elev=45.79' Storage=50,580 cf Inflow=18.77 cfs 1.708 af
Primary=0.68 cfs 0.950 af Secondary=0.00 cfs 0.000 af Outflow=0.68 cfs 0.950 af

Link LINK 1.0: PDMH203 TAILWATER Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link PA1: POINT OF ANALYSIS Inflow=31.22 cfs 5.655 af
Primary=31.22 cfs 5.655 af

Link PA2: POINT OF ANALYSIS Inflow=5.36 cfs 0.388 af
Primary=5.36 cfs 0.388 af

Total Runoff Area = 31.609 ac Runoff Volume = 9.517 af Average Runoff Depth = 3.61"
61.68% Pervious = 19.497 ac 38.32% Impervious = 12.112 ac

Summary for Subcatchment POST 1.0: WATERSHED 1.0

[47] Hint: Peak is 1668% of capacity of segment #4
[47] Hint: Peak is 1668% of capacity of segment #5
[47] Hint: Peak is 920% of capacity of segment #6
[47] Hint: Peak is 566% of capacity of segment #7
[47] Hint: Peak is 566% of capacity of segment #8
[47] Hint: Peak is 120% of capacity of segment #9
[47] Hint: Peak is 4305% of capacity of segment #10

Runoff = 42.01 cfs @ 12.16 hrs, Volume= 3.732 af, Depth> 4.43"
Routed to Pond POND 1.0 : GRAVEL WETLAND 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
5,235	98	Roofs, HSG B
29,148	61	>75% Grass cover, Good, HSG B
18,966	98	Paved parking, HSG B
143,455	98	Roofs, HSG C
81,718	74	>75% Grass cover, Good, HSG C
110,540	98	Paved parking, HSG C
31,119	98	Roofs, HSG D
14,671	80	>75% Grass cover, Good, HSG D
5,480	98	Paved parking, HSG D
440,332	90	Weighted Average
125,537		28.51% Pervious Area
314,795		71.49% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	70	0.0150	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.68"
0.2	32	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	19	0.0200	2.12		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.8	162	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.4	84	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.5	113	0.0050	3.72	4.57	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
1.2	299	0.0050	4.20	7.43	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
0.4	94	0.0050	4.20	7.43	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
0.1	46	0.0240	11.16	35.05	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
0.0	5	0.0800	7.16	0.98	**Pipe Channel,** 5.0" Round Area= 0.1 sf Perim= 1.3' r= 0.10' n= 0.013
0.0	9	0.0110	9.90	69.95	**Pipe Channel,** 36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.013
11.4	933	Total			

Summary for Subcatchment POST 1.1: WATERSHED 1.1

Runoff = 12.40 cfs @ 12.12 hrs, Volume= 0.966 af, Depth> 3.21"
Routed to Pond POND 1.1 : GRAVEL WETLAND 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
36,403	61	>75% Grass cover, Good, HSG B
3,210	98	Paved parking, HSG B
72,351	74	>75% Grass cover, Good, HSG C
45,464	98	Paved parking, HSG C
157,428	78	Weighted Average
108,754		69.08% Pervious Area
48,674		30.92% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.8	100	0.0625	0.29		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.68"
2.2	312	0.0220	2.39		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.3	33	0.0150	1.84		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.0	19	0.3300	8.62		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
8.3	464	Total			

Summary for Subcatchment POST 1.2: WATERSHED 1.2

[47] Hint: Peak is 437% of capacity of segment #3
[47] Hint: Peak is 261% of capacity of segment #4
[47] Hint: Peak is 161% of capacity of segment #5

Runoff = 11.94 cfs @ 12.09 hrs, Volume= 0.897 af, Depth> 4.11"
Routed to Pond POND 1.2 : PDMH203

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
9,848	61	>75% Grass cover, Good, HSG B
4,784	98	Paved parking, HSG B
37,701	74	>75% Grass cover, Good, HSG C
61,646	98	Paved parking, HSG C
113,979	87	Weighted Average
47,549		41.72% Pervious Area
66,430		58.28% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0100	1.12		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.68"
1.0	153	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.6	343	0.0050	3.47	2.73	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
0.1	13	0.0050	3.72	4.57	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Corrugated PE, smooth interior
1.8	453	0.0050	4.20	7.43	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
0.4	129	0.0050	5.91	29.00	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Corrugated PE, smooth interior

6.4 1,191 Total

Summary for Subcatchment POST 1.3: WATERSHED 1.3

Runoff = 11.87 cfs @ 12.63 hrs, Volume= 1.826 af, Depth> 3.18"
Routed to Pond POND 1.3 : OUTLET CULVERTS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
1,830	61	>75% Grass cover, Good, HSG B
22,404	58	Meadow, non-grazed, HSG B
896	98	Paved parking, HSG B
131,991	74	>75% Grass cover, Good, HSG C
68,446	98	Paved parking, HSG C
72,396	71	Meadow, non-grazed, HSG C
1,638	80	>75% Grass cover, Good, HSG D
499	98	Paved parking, HSG D
300,100	78	Weighted Average
230,259		76.73% Pervious Area
69,841		23.27% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	100	0.0130	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.68"
1.1	52	0.0130	0.80		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	27	0.2720	7.82		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
33.8	1,346	0.0090	0.66		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
45.9	1,525	Total			

Summary for Subcatchment POST 1.4: WATERSHED 1.4

Runoff = 18.77 cfs @ 12.19 hrs, Volume= 1.708 af, Depth> 2.83"
Routed to Pond POND 1.4 : SEDIMENT BASIN 1.0

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
23,477	61	>75% Grass cover, Good, HSG B
243,330	74	>75% Grass cover, Good, HSG C
1,334	98	Paved parking, HSG C
47,586	80	>75% Grass cover, Good, HSG D
0	96	Gravel surface, HSG D
315,727	74	Weighted Average
314,393		99.58% Pervious Area
1,334		0.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.4	100	0.0245	0.20		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.68"
5.1	465	0.0103	1.52		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.0	20	0.3300	8.62		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
13.5	585	Total			

Summary for Subcatchment POST 2.0: WATERSHED 2.0

[49] Hint: Tc<2dt may require smaller dt

Runoff = 5.36 cfs @ 12.07 hrs, Volume= 0.388 af, Depth> 4.11"
Routed to Link PA2 : POINT OF ANALYSIS

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
10,145	98	Roofs, HSG C
22,815	74	>75% Grass cover, Good, HSG C
16,376	98	Paved parking, HSG C
49,336	87	Weighted Average
22,815		46.24% Pervious Area
26,521		53.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0164	1.36		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.68"
0.3	48	0.0164	2.60		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.3	130	0.0140	7.03	12.43	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
0.5	70	0.0250	2.37		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
1.3	410	0.0050	5.09	16.00	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50'

n= 0.013

3.6 758 Total, Increased to minimum Tc = 5.0 min

Summary for Reach REACH 1.0: RESTORED HODGSON BROOK

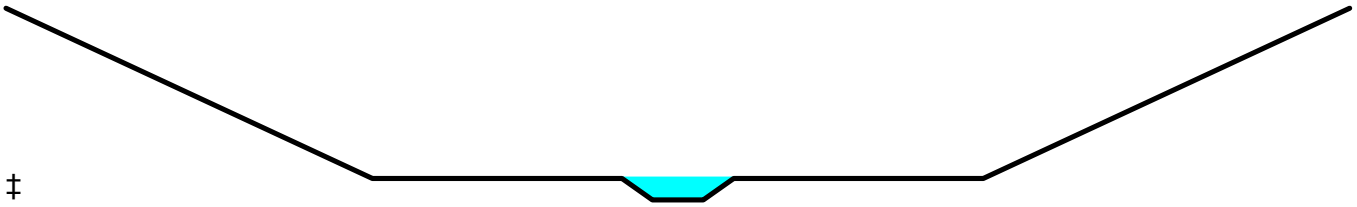
[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=2)

Inflow Area = 6.231 ac, 42.41% Impervious, Inflow Depth > 1.73" for 10 Year event
Inflow = 11.94 cfs @ 12.09 hrs, Volume= 0.897 af
Outflow = 6.12 cfs @ 12.86 hrs, Volume= 0.891 af, Atten= 49%, Lag= 45.9 min
Routed to Pond POND 1.3 : OUTLET CULVERTS

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.20 fps, Min. Travel Time= 9.9 min
Avg. Velocity = 0.85 fps, Avg. Travel Time= 25.6 min

Peak Storage= 6,846 cf @ 12.27 hrs
Average Depth at Peak Storage= 0.82' , Surface Width= 30.44'
Bank-Full Depth= 6.75' Flow Area= 291.0 sf, Capacity= 2,720.29 cfs

Custom cross-section, Length= 1,309.0' Slope= 0.0092 '/' (101 Elevation Intervals)
Constant n= 0.040 Winding stream, pools & shoals
Inlet Invert= 48.00', Outlet Invert= 36.00'



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Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	12.00	0.00
18.00	6.00	6.00
30.25	6.00	6.00
31.75	5.25	6.75
34.25	5.25	6.75
35.75	6.00	6.00
48.00	6.00	6.00
66.00	12.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	2.5	0.0	0	0.00
0.75	3.0	30.4	30.0	3,927	2.28
6.75	291.0	68.3	66.0	380,919	2,720.29

Summary for Pond POND 1.0: GRAVEL WETLAND 1

[95] Warning: Outlet Device #4 rise exceeded

Inflow Area = 10.109 ac, 71.49% Impervious, Inflow Depth > 4.43" for 10 Year event
Inflow = 42.01 cfs @ 12.16 hrs, Volume= 3.732 af
Outflow = 15.08 cfs @ 12.50 hrs, Volume= 2.275 af, Atten= 64%, Lag= 20.8 min
Primary = 9.22 cfs @ 12.50 hrs, Volume= 2.105 af
Routed to Pond POND 1.3 : OUTLET CULVERTS
Secondary = 5.86 cfs @ 12.50 hrs, Volume= 0.170 af
Routed to Pond POND 1.3 : OUTLET CULVERTS

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 46.78' @ 12.50 hrs Surf.Area= 21,240 sf Storage= 83,438 cf
Flood Elev= 48.00' Surf.Area= 23,557 sf Storage= 110,845 cf

Plug-Flow detention time= 226.3 min calculated for 2.275 af (61% of inflow)
Center-of-Mass det. time= 125.2 min (916.2 - 791.0)

Volume	Invert	Avail.Storage	Storage Description
#1	39.05'	110,845 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
39.05	9,855	0.0	0	0
41.35	9,855	30.0	6,800	6,800
42.00	9,855	45.0	2,883	9,683
43.00	11,943	100.0	10,899	20,582
44.00	14,202	100.0	13,073	33,654
45.00	16,891	100.0	15,547	49,201
46.00	19,752	100.0	18,322	67,522
47.00	21,668	100.0	20,710	88,232
48.00	23,557	100.0	22,613	110,845

Device	Routing	Invert	Outlet Devices
#1	Primary	41.35'	**18.0" Round Culvert** L= 30.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 41.35' / 41.20' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	41.35'	**3.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	45.00'	**3.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Device 1	46.00'	**4.0' long x 0.50' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s) 0.5' Crest Height
#5	Device 1	47.00'	**4.0" x 4.0" Horiz. Orifice/Grate X 106.00** C= 0.600 Limited to weir flow at low heads
#6	Secondary	46.50'	**15.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=9.22 cfs @ 12.50 hrs HW=46.78' TW=38.77' (Dynamic Tailwater)
- **1=Culvert** (Passes 9.22 cfs of 18.40 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 0.74 cfs @ 11.06 fps)
  - **3=Orifice/Grate** (Orifice Controls 0.30 cfs @ 6.19 fps)
  - **4=Sharp-Crested Rectangular Weir** (Orifice Controls 8.17 cfs @ 4.19 fps)
  - **5=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=5.85 cfs @ 12.50 hrs HW=46.78' TW=38.77' (Dynamic Tailwater)
- **6=Broad-Crested Rectangular Weir** (Weir Controls 5.85 cfs @ 1.41 fps)

Summary for Pond POND 1.1: GRAVEL WETLAND 2

Inflow Area = 3.614 ac, 30.92% Impervious, Inflow Depth > 3.21" for 10 Year event
Inflow = 12.40 cfs @ 12.12 hrs, Volume= 0.966 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link LINK 1.0 : PDMH203 TAILWATER

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 54.11' @ 24.00 hrs Surf.Area= 14,115 sf Storage= 42,049 cf
Flood Elev= 57.00' Surf.Area= 21,643 sf Storage= 94,743 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no outflow)

Volume	Invert	Avail.Storage	Storage Description
#1	47.55'	117,304 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
47.55	6,269	0.0	0	0
49.85	6,269	30.0	4,326	4,326
50.50	6,269	45.0	1,834	6,159
51.00	7,199	100.0	3,367	9,526
52.00	9,187	100.0	8,193	17,719
53.00	11,345	100.0	10,266	27,985
54.00	13,814	100.0	12,580	40,565
55.00	16,645	100.0	15,230	55,794
56.00	19,805	100.0	18,225	74,019
58.00	23,480	100.0	43,285	117,304

Device	Routing	Invert	Outlet Devices
#1	Primary	49.85'	**24.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 49.85' / 49.45' S= 0.0333 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	49.85'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	53.50'	**4.0' long x 2.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	56.50'	**4.0" x 4.0" Horiz. Orifice/Grate X 106.00** C= 0.600

Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=47.55' TW=55.07' (Dynamic Tailwater)
└─**1=Culvert** (Controls 0.00 cfs)
  └─**2=Orifice/Grate** (Controls 0.00 cfs)
  └─**3=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond POND 1.2: PDMH203

Inflow Area = 6.231 ac, 42.41% Impervious, Inflow Depth > 1.73" for 10 Year event
Inflow = 11.94 cfs @ 12.09 hrs, Volume= 0.897 af
Outflow = 11.94 cfs @ 12.09 hrs, Volume= 0.897 af, Atten= 0%, Lag= 0.0 min
Primary = 11.94 cfs @ 12.09 hrs, Volume= 0.897 af
Routed to Reach REACH 1.0 : RESTORED HODGSON BROOK

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 50.72' @ 12.09 hrs
Flood Elev= 57.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	49.35'	**48.0" Round Culvert** L= 269.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 49.35' / 48.00' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 12.57 sf

Primary OutFlow Max=11.76 cfs @ 12.09 hrs HW=50.71' TW=48.76' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 11.76 cfs @ 3.13 fps)

Summary for Pond POND 1.3: OUTLET CULVERTS

[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=12)
[62] Hint: Exceeded Reach REACH 1.0 OUTLET depth by 2.58' @ 23.95 hrs

Inflow Area = 30.477 ac, 37.74% Impervious, Inflow Depth > 2.34" for 10 Year event
Inflow = 31.34 cfs @ 12.51 hrs, Volume= 5.942 af
Outflow = 31.22 cfs @ 12.53 hrs, Volume= 5.655 af, Atten= 0%, Lag= 1.3 min
Primary = 31.22 cfs @ 12.53 hrs, Volume= 5.655 af
Routed to Link PA1 : POINT OF ANALYSIS
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link PA1 : POINT OF ANALYSIS

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 38.77' @ 12.53 hrs Surf.Area= 8,870 sf Storage= 13,560 cf
Flood Elev= 43.50' Surf.Area= 95,977 sf Storage= 236,017 cf

Plug-Flow detention time= 56.2 min calculated for 5.642 af (95% of inflow)
Center-of-Mass det. time= 29.8 min (900.3 - 870.4)

Volume	Invert	Avail.Storage	Storage Description
#1	35.00'	236,017 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
35.00	960	0	0
36.00	1,428	1,194	1,194
38.00	5,418	6,846	8,040
40.00	14,354	19,772	27,812
42.00	66,884	81,238	109,050
43.00	92,707	79,796	188,846
43.50	95,977	47,171	236,017

Device	Routing	Invert	Outlet Devices
#1	Primary	35.60'	**42.0" W x 29.0" H, R=21.5"/66.1" Pipe Arch CMP_Arch_1/2 42x29 X 3.00** L= 68.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 35.60' / 35.30' S= 0.0044 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 6.72 sf
#2	Secondary	43.00'	**143.1 deg x 18.0' long x 0.50' rise Sharp-Crested Vee/Trap Weir** Cv= 2.47 (C= 3.09)

Primary OutFlow Max=31.11 cfs @ 12.53 hrs HW=38.77' TW=38.65' (Dynamic Tailwater)
↑—**1=CMP_Arch_1/2 42x29** (Outlet Controls 31.11 cfs @ 1.55 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=35.04' TW=38.65' (Dynamic Tailwater)
↑—**2=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Summary for Pond POND 1.4: SEDIMENT BASIN 1.0

Inflow Area = 7.248 ac, 0.42% Impervious, Inflow Depth > 2.83" for 10 Year event
Inflow = 18.77 cfs @ 12.19 hrs, Volume= 1.708 af
Outflow = 0.68 cfs @ 17.24 hrs, Volume= 0.950 af, Atten= 96%, Lag= 303.1 min
Primary = 0.68 cfs @ 17.24 hrs, Volume= 0.950 af
Routed to Pond POND 1.3 : OUTLET CULVERTS
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Pond POND 1.3 : OUTLET CULVERTS

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Starting Elev= 44.15' Surf.Area= 18,132 sf Storage= 11,702 cf
Peak Elev= 45.79' @ 17.24 hrs Surf.Area= 29,244 sf Storage= 50,580 cf (38,878 cf above start)
Flood Elev= 48.50' Surf.Area= 38,802 sf Storage= 127,441 cf (115,739 cf above start)

Plug-Flow detention time= 356.2 min calculated for 0.680 af (40% of inflow)
Center-of-Mass det. time= 9.2 min (846.8 - 837.5)

Volume	Invert	Avail.Storage	Storage Description
#1	43.00'	127,441 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
43.00	1,000	0	0
44.00	17,117	9,059	9,059
46.00	30,657	47,774	56,833
47.00	35,879	33,268	90,101
48.00	38,802	37,341	127,441

Device	Routing	Invert	Outlet Devices
#1	Primary	42.75'	**12.0" Round Culvert** L= 66.0' Ke= 0.500 Inlet / Outlet Invert= 42.75' / 42.40' S= 0.0053 '/' Cc= 0.900 n= 0.013, Flow Area= 0.79 sf
#2	Device 1	43.00'	**4.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	46.80'	**10.0" x 17.5" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	47.40'	**Custom Weir/Orifice, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.10 Width (feet) 8.00 14.60

Primary OutFlow Max=0.68 cfs @ 17.24 hrs HW=45.79' TW=38.65' (Dynamic Tailwater)
↑**1=Culvert** (Passes 0.68 cfs of 5.16 cfs potential flow)
↑**2=Orifice/Grate** (Orifice Controls 0.68 cfs @ 7.80 fps)
3=Orifice/Grate (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=44.15' TW=35.04' (Dynamic Tailwater)
↑**4=Custom Weir/Orifice** (Controls 0.00 cfs)

Summary for Link LINK 1.0: PDMH203 TAILWATER

This link takes into account the tailwater condition in PDMH203 which the outlet of gravel wetland 2 connects. The purpose of this is to determine the effects of any surcharging caused by the tailwater of Hodgson Brook entering the structure. These tailwater elevations were determined by Streamworks, PLLC as part of the overall watershed analysis they performed.

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[80] Warning: Exceeded Pond POND 1.1 by 7.52' @ 0.00 hrs (23.95 cfs 41.618 af)

Inflow Area = 3.614 ac, 30.92% Impervious, Inflow Depth = 0.00" for 10 Year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Routed to Pond POND 1.2 : PDMH203

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

10 Year 25 Point manual elevation table, To= 0.00 hrs, dt= 1.00 hrs, feet =

55.07	55.07	55.07	55.07	55.07	55.07	55.07	55.07	55.07
55.07	55.07	55.07	55.07	55.07	55.07	55.07	55.07	55.07
55.07	55.07	55.07	55.07	55.07	55.07	55.07		

Summary for Link PA1: POINT OF ANALYSIS

This link takes into account the tailwater condition in roadside swale along Goose Bay Drive which the existing culverts discharge into. These tailwater elevations were determined by Streamworks, PLLC as part of the overall watershed analysis they performed.

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[80] Warning: Exceeded Pond POND 1.3 by 3.61' @ 0.00 hrs (92.51 cfs 60.023 af)

Inflow Area = 30.477 ac, 37.74% Impervious, Inflow Depth > 2.23" for 10 Year event
Inflow = 31.22 cfs @ 12.53 hrs, Volume= 5.655 af
Primary = 31.22 cfs @ 12.53 hrs, Volume= 5.655 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

10 Year 2 Point manual elevation table, To= 0.00 hrs, dt= 24.00 hrs, feet =
38.65 38.65

Summary for Link PA2: POINT OF ANALYSIS

Inflow Area = 1.133 ac, 53.76% Impervious, Inflow Depth > 4.11" for 10 Year event
Inflow = 5.36 cfs @ 12.07 hrs, Volume= 0.388 af
Primary = 5.36 cfs @ 12.07 hrs, Volume= 0.388 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment POST 1.0: WATERSHED Runoff Area=440,332 sf 71.49% Impervious Runoff Depth>5.88"
Flow Length=933' Tc=11.4 min CN=90 Runoff=54.93 cfs 4.956 af

Subcatchment POST 1.1: WATERSHED Runoff Area=157,428 sf 30.92% Impervious Runoff Depth>4.53"
Flow Length=464' Tc=8.3 min CN=78 Runoff=17.44 cfs 1.365 af

Subcatchment POST 1.2: WATERSHED Runoff Area=113,979 sf 58.28% Impervious Runoff Depth>5.54"
Flow Length=1,191' Tc=6.4 min CN=87 Runoff=15.85 cfs 1.209 af

Subcatchment POST 1.3: WATERSHED Runoff Area=300,100 sf 23.27% Impervious Runoff Depth>4.50"
Flow Length=1,525' Tc=45.9 min CN=78 Runoff=16.75 cfs 2.583 af

Subcatchment POST 1.4: WATERSHED 1.4 Runoff Area=315,727 sf 0.42% Impervious Runoff Depth>4.09"
Flow Length=585' Tc=13.5 min CN=74 Runoff=27.23 cfs 2.472 af

Subcatchment POST 2.0: WATERSHED 2.0 Runoff Area=49,336 sf 53.76% Impervious Runoff Depth>5.54"
Flow Length=758' Tc=5.0 min CN=87 Runoff=7.12 cfs 0.523 af

Reach REACH 1.0: RESTORED Avg. Flow Depth=0.87' Max Vel=2.22 fps Inflow=15.85 cfs 1.209 af
n=0.040 L=1,309.0' S=0.0092 '/' Capacity=2,720.29 cfs Outflow=8.65 cfs 1.202 af

Pond POND 1.0: GRAVEL WETLAND 1 Peak Elev=47.10' Storage=90,424 cf Inflow=54.93 cfs 4.956 af
Primary=19.03 cfs 2.766 af Secondary=18.86 cfs 0.671 af Outflow=37.88 cfs 3.437 af

Pond POND 1.1: GRAVEL WETLAND 2 Peak Elev=55.22' Storage=59,446 cf Inflow=17.44 cfs 1.365 af
Outflow=0.00 cfs 0.000 af

Pond POND 1.2: PDMH203 Peak Elev=50.94' Inflow=15.85 cfs 1.209 af
48.0" Round Culvert n=0.013 L=269.0' S=0.0050 '/' Outflow=15.85 cfs 1.209 af

Pond POND 1.3: OUTLET CULVERTS Peak Elev=39.17' Storage=17,433 cf Inflow=57.33 cfs 8.292 af
Primary=56.26 cfs 7.985 af Secondary=0.00 cfs 0.000 af Outflow=56.26 cfs 7.985 af

Pond POND 1.4: SEDIMENT BASIN 1.0 Peak Elev=46.65' Storage=77,792 cf Inflow=27.23 cfs 2.472 af
Primary=0.78 cfs 1.070 af Secondary=0.00 cfs 0.000 af Outflow=0.78 cfs 1.070 af

Link LINK 1.0: PDMH203 TAILWATER Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link PA1: POINT OF ANALYSIS Inflow=56.26 cfs 7.985 af
Primary=56.26 cfs 7.985 af

Link PA2: POINT OF ANALYSIS Inflow=7.12 cfs 0.523 af
Primary=7.12 cfs 0.523 af

Total Runoff Area = 31.609 ac Runoff Volume = 13.108 af Average Runoff Depth = 4.98"
61.68% Pervious = 19.497 ac 38.32% Impervious = 12.112 ac

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment POST 1.0: WATERSHED Runoff Area=440,332 sf 71.49% Impervious Runoff Depth>7.25"
Flow Length=933' Tc=11.4 min CN=90 Runoff=66.89 cfs 6.105 af

Subcatchment POST 1.1: WATERSHED Runoff Area=157,428 sf 30.92% Impervious Runoff Depth>5.81"
Flow Length=464' Tc=8.3 min CN=78 Runoff=22.21 cfs 1.750 af

Subcatchment POST 1.2: WATERSHED Runoff Area=113,979 sf 58.28% Impervious Runoff Depth>6.89"
Flow Length=1,191' Tc=6.4 min CN=87 Runoff=19.47 cfs 1.503 af

Subcatchment POST 1.3: WATERSHED Runoff Area=300,100 sf 23.27% Impervious Runoff Depth>5.77"
Flow Length=1,525' Tc=45.9 min CN=78 Runoff=21.37 cfs 3.312 af

Subcatchment POST 1.4: WATERSHED 1.4 Runoff Area=315,727 sf 0.42% Impervious Runoff Depth>5.33"
Flow Length=585' Tc=13.5 min CN=74 Runoff=35.32 cfs 3.218 af

Subcatchment POST 2.0: WATERSHED 2.0 Runoff Area=49,336 sf 53.76% Impervious Runoff Depth>6.89"
Flow Length=758' Tc=5.0 min CN=87 Runoff=8.76 cfs 0.651 af

Reach REACH 1.0: RESTORED Avg. Flow Depth=0.92' Max Vel=2.24 fps Inflow=19.47 cfs 1.503 af
n=0.040 L=1,309.0' S=0.0092 '/' Capacity=2,720.29 cfs Outflow=11.76 cfs 1.495 af

Pond POND 1.0: GRAVEL WETLAND 1 Peak Elev=47.39' Storage=96,897 cf Inflow=66.89 cfs 6.105 af
Primary=19.58 cfs 3.347 af Secondary=33.37 cfs 1.209 af Outflow=52.94 cfs 4.556 af

Pond POND 1.1: GRAVEL WETLAND 2 Peak Elev=56.11' Storage=76,209 cf Inflow=22.21 cfs 1.750 af
Outflow=0.00 cfs 0.000 af

Pond POND 1.2: PDMH203 Peak Elev=51.13' Inflow=19.47 cfs 1.503 af
48.0" Round Culvert n=0.013 L=269.0' S=0.0050 '/' Outflow=19.47 cfs 1.503 af

Pond POND 1.3: OUTLET CULVERTS Peak Elev=39.58' Storage=22,150 cf Inflow=76.91 cfs 10.982 af
Primary=74.09 cfs 10.655 af Secondary=0.00 cfs 0.000 af Outflow=74.09 cfs 10.655 af

Pond POND 1.4: SEDIMENT BASIN 1.0 Peak Elev=47.02' Storage=90,878 cf Inflow=35.32 cfs 3.218 af
Primary=2.39 cfs 1.619 af Secondary=0.00 cfs 0.000 af Outflow=2.39 cfs 1.619 af

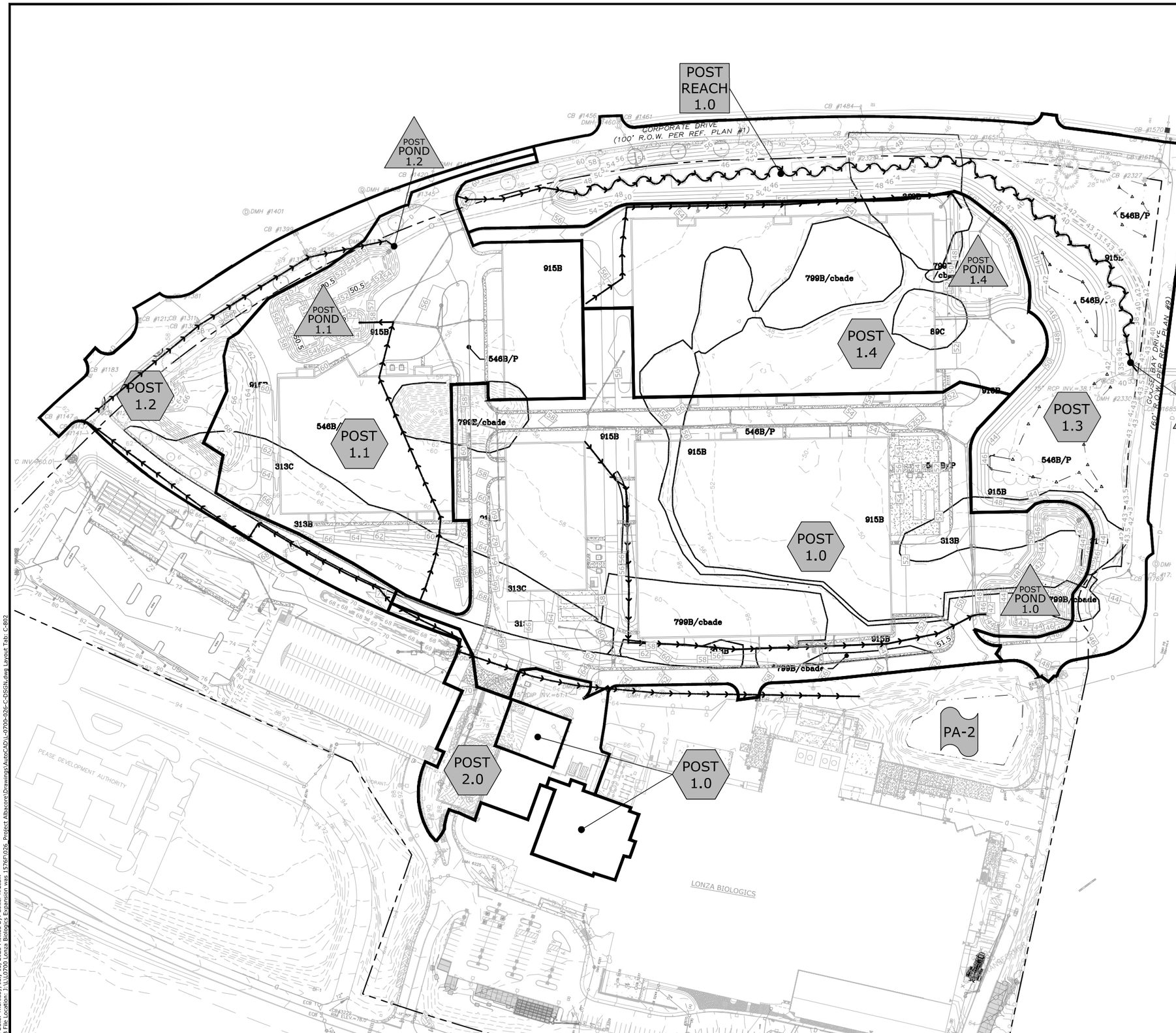
Link LINK 1.0: PDMH203 TAILWATER Inflow=0.00 cfs 0.000 af
Primary=0.00 cfs 0.000 af

Link PA1: POINT OF ANALYSIS Inflow=74.09 cfs 10.655 af
Primary=74.09 cfs 10.655 af

Link PA2: POINT OF ANALYSIS Inflow=8.76 cfs 0.651 af
Primary=8.76 cfs 0.651 af

Total Runoff Area = 31.609 ac Runoff Volume = 16.539 af Average Runoff Depth = 6.28"
61.68% Pervious = 19.497 ac 38.32% Impervious = 12.112 ac

Master Post-Development Calculations



LEGEND

- POST-DEVELOPMENT WATERSHED BOUNDARY
- SOIL SURVEY BOUNDARIES
- LONGEST FLOW PATH
- POST 1.0 — POST-DEVELOPMENT WATERSHED AREA DESIGNATION
- POST POND 1 — POST-DEVELOPMENT POND DESIGNATION
- PA-1 — POINT OF ANALYSIS
- POST REACH 1 — POST-DEVELOPMENT REACH DESIGNATION

SCALE IN FEET
0 80' 160'
GRAPHIC SCALE

NOTES:

1. SOIL SURVEY WAS PERFORMED BY GOVE ENVIRONMENTAL SERVICES.

SOIL IDENTIFICATION LEGEND

SYMBOL	SOIL TAXONOMIC NAME, SLOPE RATING
89C	CHATFIELD, 8 TO 15 PERCENT SLOPES
313B	DEERFIELD, 0 TO 8 PERCENT SLOPES
313C	DEERFIELD, 8 TO 15 PERCENT SLOPES
915B	DEERFIELD VARIANT, 0 TO 8 PERCENT SLOPES
546B/P	WALPOLE POORLY DRAINED, 0 TO 8 PERCENT SLOPES
799B	UDORTHENTS URBAN LAND, 0 TO 8 PERCENT SLOPES
799E	UDORTHENTS URBAN LAND, >25 PERCENT SLOPES

Tighe&Bond

Proposed Industrial Development

Lonza Biologics

Portsmouth, New Hampshire

MARK	DATE	DESCRIPTION
L	7/17/2023	Amended Site Plan Review
K	5/5/2023	Phase 1B Issued for Bid
J	3/15/2023	Phase 1B Issued for Preliminary Pricing
I	1/9/2023	Admin. Approval Submission
H	12/10/2021	Planning Board Stipulation
G	8/19/2019	Admin. Approval Submission
F	11/6/2018	P.B. Submission

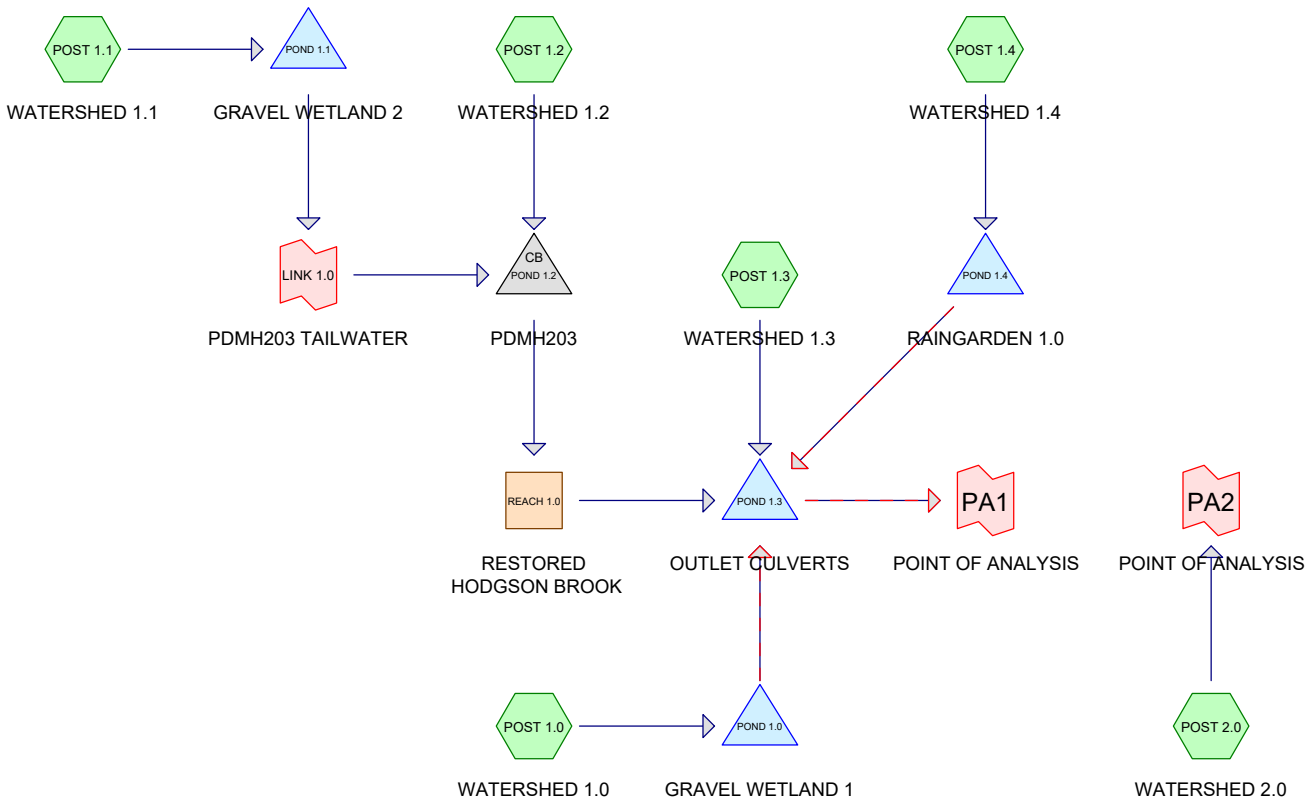
PROJECT NO:	L-0700-013
DATE:	04/03/2018
FILE:	L-0700-026-C-DSGN.dwg
DRAWN BY:	CJK
CHECKED:	NAH
APPROVED:	PMC

POST-DEVELOPMENT WATERSHED AREA PLAN

SCALE: AS SHOWN

C-802

Last Save Date: July 13, 2023 3:42 PM By: CKRZCUIK
Plot Date: Thursday, July 13, 2023 3:42 PM By: CKRZCUIK
T&B File Location: J:\L\0700 Lonza Biologics Expansion was 1576\026_Project Albacore\Drawings\AutoCAD\L-0700-026-C-DSGN.dwg Layout Tab: C-802



Subcat Reach Pond Link

Routing Diagram for L-0700-26 POST
Prepared by Tighe & Bond, Printed 6/6/2023

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.776	61	>75% Grass cover, Good, HSG B (POST 1.0, POST 1.1, POST 1.2, POST 1.3, POST 1.4)
6.801	74	>75% Grass cover, Good, HSG C (POST 1.0, POST 1.1, POST 1.2, POST 1.3, POST 1.4, POST 2.0)
0.436	80	>75% Grass cover, Good, HSG D (POST 1.0, POST 1.3, POST 1.4)
0.323	58	Meadow, non-grazed, HSG B (POST 1.3)
3.143	71	Meadow, non-grazed, HSG C (POST 1.3)
0.799	98	Paved parking, HSG B (POST 1.0, POST 1.1, POST 1.2, POST 1.3, POST 1.4)
7.546	98	Paved parking, HSG C (POST 1.0, POST 1.1, POST 1.2, POST 1.3, POST 1.4, POST 2.0)
0.146	98	Paved parking, HSG D (POST 1.0, POST 1.3, POST 1.4)
0.688	98	Roofs, HSG B (POST 1.0, POST 1.1, POST 1.4)
8.166	98	Roofs, HSG C (POST 1.0, POST 1.1, POST 1.4, POST 2.0)
1.737	98	Roofs, HSG D (POST 1.0, POST 1.4)
0.049	76	Woods/grass comb., Fair, HSG C (POST 1.3)
31.609	**87**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
3.586	HSG B	POST 1.0, POST 1.1, POST 1.2, POST 1.3, POST 1.4
25.705	HSG C	POST 1.0, POST 1.1, POST 1.2, POST 1.3, POST 1.4, POST 2.0
2.318	HSG D	POST 1.0, POST 1.3, POST 1.4
0.000	Other	
31.609		**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment POST 1.0: WATERSHED Runoff Area=462,599 sf 72.19% Impervious Runoff Depth>2.71"
Flow Length=933' Tc=11.4 min CN=91 Runoff=27.46 cfs 2.396 af

Subcatchment POST 1.1: WATERSHED Runoff Area=242,496 sf 58.73% Impervious Runoff Depth>2.25"
Flow Length=750' Tc=10.3 min CN=86 Runoff=12.60 cfs 1.046 af

Subcatchment POST 1.2: WATERSHED Runoff Area=101,204 sf 62.15% Impervious Runoff Depth>2.43"
Flow Length=1,191' Tc=6.4 min CN=88 Runoff=6.37 cfs 0.471 af

Subcatchment POST 1.3: WATERSHED Runoff Area=306,549 sf 22.64% Impervious Runoff Depth>1.55"
Flow Length=1,525' Tc=45.9 min CN=77 Runoff=5.81 cfs 0.908 af

Subcatchment POST 1.4: WATERSHED Runoff Area=214,764 sf 85.05% Impervious Runoff Depth>3.01"
Flow Length=717' Tc=7.5 min CN=94 Runoff=15.51 cfs 1.236 af

Subcatchment POST 2.0: WATERSHED 2.0 Runoff Area=49,290 sf 80.99% Impervious Runoff Depth>2.91"
Flow Length=758' Tc=5.0 min CN=93 Runoff=3.72 cfs 0.274 af

Reach REACH 1.0: RESTORED Avg. Flow Depth=0.60' Max Vel=2.03 fps Inflow=6.37 cfs 0.617 af
n=0.040 L=1,309.0' S=0.0092 '/' Capacity=2,720.29 cfs Outflow=4.54 cfs 0.608 af

Pond POND 1.0: GRAVEL WETLAND 1 Peak Elev=46.16' Storage=70,734 cf Inflow=27.46 cfs 2.396 af
Primary=1.57 cfs 1.041 af Secondary=0.00 cfs 0.000 af Outflow=1.57 cfs 1.041 af

Pond POND 1.1: GRAVEL WETLAND 2 Peak Elev=53.90' Storage=39,230 cf Inflow=12.60 cfs 1.046 af
Outflow=0.40 cfs 0.146 af

Pond POND 1.2: PDMH203 Peak Elev=50.33' Inflow=6.37 cfs 0.617 af
48.0" Round Culvert n=0.013 L=269.0' S=0.0050 '/' Outflow=6.37 cfs 0.617 af

Pond POND 1.3: OUTLET CULVERTS Peak Elev=38.16' Storage=8,984 cf Inflow=9.25 cfs 3.255 af
Primary=9.41 cfs 3.050 af Secondary=0.00 cfs 0.000 af Outflow=9.41 cfs 3.050 af

Pond POND 1.4: RAINGARDEN1.0 Peak Elev=47.27' Storage=34,235 cf Inflow=15.51 cfs 1.236 af
Primary=1.31 cfs 0.699 af Secondary=0.00 cfs 0.000 af Outflow=1.31 cfs 0.699 af

Link LINK 1.0: PDMH203 TAILWATER Inflow=0.40 cfs 0.146 af
Primary=0.40 cfs 0.146 af

Link PA1: POINT OF ANALYSIS Inflow=9.41 cfs 3.050 af
Primary=9.41 cfs 3.050 af

Link PA2: POINT OF ANALYSIS Inflow=3.72 cfs 0.274 af
Primary=3.72 cfs 0.274 af

Total Runoff Area = 31.609 ac Runoff Volume = 6.331 af Average Runoff Depth = 2.40"
39.63% Pervious = 12.527 ac 60.37% Impervious = 19.083 ac

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment POST 1.0: WATERSHED Runoff Area=462,599 sf 72.19% Impervious Runoff Depth>4.54"
Flow Length=933' Tc=11.4 min CN=91 Runoff=44.88 cfs 4.017 af

Subcatchment POST 1.1: WATERSHED Runoff Area=242,496 sf 58.73% Impervious Runoff Depth>4.01"
Flow Length=750' Tc=10.3 min CN=86 Runoff=22.02 cfs 1.858 af

Subcatchment POST 1.2: WATERSHED Runoff Area=101,204 sf 62.15% Impervious Runoff Depth>4.22"
Flow Length=1,191' Tc=6.4 min CN=88 Runoff=10.81 cfs 0.817 af

Subcatchment POST 1.3: WATERSHED Runoff Area=306,549 sf 22.64% Impervious Runoff Depth>3.09"
Flow Length=1,525' Tc=45.9 min CN=77 Runoff=11.76 cfs 1.810 af

Subcatchment POST 1.4: WATERSHED Runoff Area=214,764 sf 85.05% Impervious Runoff Depth>4.88"
Flow Length=717' Tc=7.5 min CN=94 Runoff=24.45 cfs 2.004 af

Subcatchment POST 2.0: WATERSHED 2.0 Runoff Area=49,290 sf 80.99% Impervious Runoff Depth>4.77"
Flow Length=758' Tc=5.0 min CN=93 Runoff=5.94 cfs 0.449 af

Reach REACH 1.0: RESTORED Avg. Flow Depth=0.81' Max Vel=2.20 fps Inflow=10.81 cfs 1.367 af
n=0.040 L=1,309.0' S=0.0092 '/' Capacity=2,720.29 cfs Outflow=6.07 cfs 1.355 af

Pond POND 1.0: GRAVEL WETLAND 1 Peak Elev=46.94' Storage=86,832 cf Inflow=44.88 cfs 4.017 af
Primary=7.09 cfs 2.106 af Secondary=11.63 cfs 0.435 af Outflow=18.72 cfs 2.541 af

Pond POND 1.1: GRAVEL WETLAND 2 Peak Elev=55.08' Storage=57,197 cf Inflow=22.02 cfs 1.858 af
Outflow=1.76 cfs 0.550 af

Pond POND 1.2: PDMH203 Peak Elev=50.65' Inflow=10.81 cfs 1.367 af
48.0" Round Culvert n=0.013 L=269.0' S=0.0050 '/' Outflow=10.81 cfs 1.367 af

Pond POND 1.3: OUTLET CULVERTS Peak Elev=38.86' Storage=14,364 cf Inflow=40.12 cfs 7.107 af
Primary=39.92 cfs 6.819 af Secondary=0.00 cfs 0.000 af Outflow=39.92 cfs 6.819 af

Pond POND 1.4: RAINGARDEN1.0 Peak Elev=48.07' Storage=45,635 cf Inflow=24.45 cfs 2.004 af
Primary=6.60 cfs 1.401 af Secondary=0.00 cfs 0.000 af Outflow=6.60 cfs 1.401 af

Link LINK 1.0: PDMH203 TAILWATER Inflow=1.76 cfs 0.550 af
Primary=1.76 cfs 0.550 af

Link PA1: POINT OF ANALYSIS Inflow=39.92 cfs 6.819 af
Primary=39.92 cfs 6.819 af

Link PA2: POINT OF ANALYSIS Inflow=5.94 cfs 0.449 af
Primary=5.94 cfs 0.449 af

Total Runoff Area = 31.609 ac Runoff Volume = 10.955 af Average Runoff Depth = 4.16"
39.63% Pervious = 12.527 ac 60.37% Impervious = 19.083 ac

Summary for Subcatchment POST 1.0: WATERSHED 1.0

Runoff = 44.88 cfs @ 12.15 hrs, Volume= 4.017 af, Depth> 4.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
5,235	98	Roofs, HSG B
22,410	61	>75% Grass cover, Good, HSG B
19,146	98	Paved parking, HSG B
157,967	98	Roofs, HSG C
90,117	74	>75% Grass cover, Good, HSG C
114,873	98	Paved parking, HSG C
31,357	98	Roofs, HSG D
16,138	80	>75% Grass cover, Good, HSG D
5,356	98	Paved parking, HSG D
462,599	91	Weighted Average
128,665		27.81% Pervious Area
333,934		72.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	70	0.0150	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.68"
0.2	32	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.1	19	0.0200	2.12		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
0.8	162	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.4	84	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.5	113	0.0050	3.72	4.57	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013
1.2	299	0.0050	4.20	7.43	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
0.4	94	0.0050	4.20	7.43	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
0.1	46	0.0240	11.16	35.05	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
0.0	5	0.0800	7.16	0.98	**Pipe Channel,** 5.0" Round Area= 0.1 sf Perim= 1.3' r= 0.10' n= 0.013
0.0	9	0.0110	9.90	69.95	**Pipe Channel,**

36.0" Round Area= 7.1 sf Perim= 9.4' r= 0.75'
n= 0.013

11.4	933	Total

Summary for Subcatchment POST 1.1: WATERSHED 1.1

Runoff = 22.02 cfs @ 12.14 hrs, Volume= 1.858 af, Depth> 4.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
13,692	98	Roofs, HSG B
32,710	61	>75% Grass cover, Good, HSG B
2,729	98	Paved parking, HSG B
88,019	98	Roofs, HSG C
67,375	74	>75% Grass cover, Good, HSG C
37,971	98	Paved parking, HSG C
242,496	86	Weighted Average
100,085		41.27% Pervious Area
142,411		58.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0380	0.24		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.68"
1.2	163	0.0245	2.35		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
1.5	283	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.1	81	0.0240	9.21	16.27	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
0.4	123	0.0050	5.09	16.00	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
10.3	750	Total			

Summary for Subcatchment POST 1.2: WATERSHED 1.2

Runoff = 10.81 cfs @ 12.09 hrs, Volume= 0.817 af, Depth> 4.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
6,874	61	>75% Grass cover, Good, HSG B
4,785	98	Paved parking, HSG B
31,436	74	>75% Grass cover, Good, HSG C
58,109	98	Paved parking, HSG C
101,204	88	Weighted Average
38,310		37.85% Pervious Area
62,894		62.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0100	1.12		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.68"
1.0	153	0.0150	2.49		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.6	343	0.0050	3.47	2.73	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012 Concrete pipe, finished
0.1	13	0.0050	3.72	4.57	**Pipe Channel,** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.013 Corrugated PE, smooth interior
1.8	453	0.0050	4.20	7.43	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013 Corrugated PE, smooth interior
0.4	129	0.0050	5.91	29.00	**Pipe Channel,** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Corrugated PE, smooth interior
6.4	1,191	Total			

Summary for Subcatchment POST 1.3: WATERSHED 1.3

Runoff = 11.76 cfs @ 12.63 hrs, Volume= 1.810 af, Depth> 3.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
11,450	61	>75% Grass cover, Good, HSG B
14,068	58	Meadow, non-grazed, HSG B
908	98	Paved parking, HSG B
70,956	74	>75% Grass cover, Good, HSG C
136,905	71	Meadow, non-grazed, HSG C
2,120	76	Woods/grass comb., Fair, HSG C
68,005	98	Paved parking, HSG C
1,638	80	>75% Grass cover, Good, HSG D
499	98	Paved parking, HSG D
306,549	77	Weighted Average
237,137		77.36% Pervious Area
69,412		22.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	100	0.0130	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.68"
1.1	52	0.0130	0.80		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	27	0.2720	7.82		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
33.8	1,346	0.0090	0.66		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
45.9	1,525	Total			

Summary for Subcatchment POST 1.4: WATERSHED 1.4

Runoff = 24.45 cfs @ 12.10 hrs, Volume= 2.004 af, Depth> 4.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
11,051	98	Roofs, HSG B
3,902	61	>75% Grass cover, Good, HSG B
7,241	98	Paved parking, HSG B
86,748	98	Roofs, HSG C
26,995	74	>75% Grass cover, Good, HSG C
32,822	98	Paved parking, HSG C
44,300	98	Roofs, HSG D
1,206	80	>75% Grass cover, Good, HSG D
499	98	Paved parking, HSG D
214,764	94	Weighted Average
32,103		14.95% Pervious Area
182,661		85.05% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.9	40	0.0150	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.68"
0.3	53	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.3	65	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
0.4	115	0.0100	4.54	3.56	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.7	140	0.0050	3.21	2.52	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013
0.9	275	0.0070	4.97	8.79	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013

0.0	29	0.0550	13.94	24.63	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
7.5	717	Total			

Summary for Subcatchment POST 2.0: WATERSHED 2.0

[49] Hint: Tc<2dt may require smaller dt

Runoff = 5.94 cfs @ 12.07 hrs, Volume= 0.449 af, Depth> 4.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Rainfall=5.58"

Area (sf)	CN	Description
22,995	98	Roofs, HSG C
9,368	74	>75% Grass cover, Good, HSG C
16,927	98	Paved parking, HSG C
49,290	93	Weighted Average
9,368		19.01% Pervious Area
39,922		80.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0164	1.36		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.68"
0.3	48	0.0164	2.60		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
0.3	130	0.0140	7.03	12.43	**Pipe Channel,** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.013
0.5	70	0.0250	2.37		**Shallow Concentrated Flow,** Grassed Waterway Kv= 15.0 fps
1.3	410	0.0050	5.09	16.00	**Pipe Channel,** 24.0" Round Area= 3.1 sf Perim= 6.3' r= 0.50' n= 0.013
3.6	758	Total, Increased to minimum Tc = 5.0 min			

Summary for Reach REACH 1.0: RESTORED HODGSON BROOK

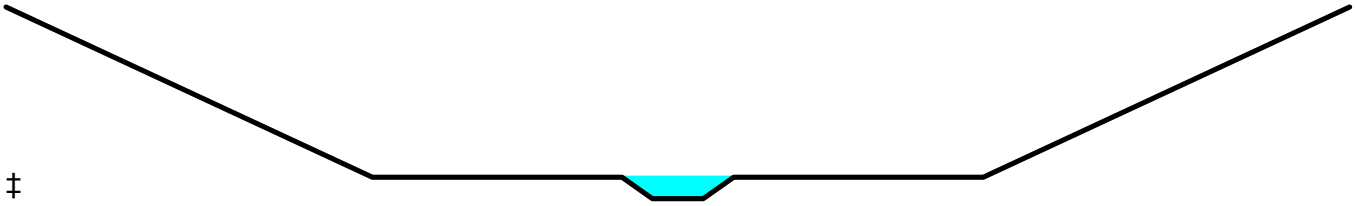
[87] Warning: Oscillations may require smaller dt or Finer Routing (severity=2)

Inflow Area = 7.890 ac, 59.73% Impervious, Inflow Depth > 2.08" for 10 Year event
Inflow = 10.81 cfs @ 12.09 hrs, Volume= 1.367 af
Outflow = 6.07 cfs @ 12.81 hrs, Volume= 1.355 af, Atten= 44%, Lag= 42.9 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.20 fps, Min. Travel Time= 9.9 min
Avg. Velocity = 1.04 fps, Avg. Travel Time= 21.0 min

Peak Storage= 6,364 cf @ 12.27 hrs
Average Depth at Peak Storage= 0.81'
Bank-Full Depth= 6.75' Flow Area= 291.0 sf, Capacity= 2,720.29 cfs

Custom cross-section, Length= 1,309.0' Slope= 0.0092 '/' (101 Elevation Intervals)
Constant n= 0.040 Winding stream, pools & shoals
Inlet Invert= 48.00', Outlet Invert= 36.00'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	12.00	0.00
18.00	6.00	6.00
30.25	6.00	6.00
31.75	5.25	6.75
34.25	5.25	6.75
35.75	6.00	6.00
48.00	6.00	6.00
66.00	12.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	2.5	0	0.00
0.75	3.0	30.4	3,927	2.28
6.75	291.0	68.3	380,919	2,720.29

Summary for Pond POND 1.0: GRAVEL WETLAND 1

[95] Warning: Outlet Device #4 rise exceeded

Inflow Area = 10.620 ac, 72.19% Impervious, Inflow Depth > 4.54" for 10 Year event
Inflow = 44.88 cfs @ 12.15 hrs, Volume= 4.017 af
Outflow = 18.72 cfs @ 12.45 hrs, Volume= 2.541 af, Atten= 58%, Lag= 18.0 min
Primary = 7.09 cfs @ 12.45 hrs, Volume= 2.106 af
Secondary = 11.63 cfs @ 12.45 hrs, Volume= 0.435 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 46.94' @ 12.45 hrs Surf.Area= 21,544 sf Storage= 86,832 cf
Flood Elev= 48.00' Surf.Area= 23,557 sf Storage= 110,845 cf

Plug-Flow detention time= 216.6 min calculated for 2.536 af (63% of inflow)
Center-of-Mass det. time= 118.8 min (906.1 - 787.3)

Volume	Invert	Avail.Storage	Storage Description
#1	39.05'	110,845 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
39.05	9,855	0.0	0	0
41.35	9,855	30.0	6,800	6,800
42.00	9,855	45.0	2,883	9,683
43.00	11,943	100.0	10,899	20,582
44.00	14,202	100.0	13,073	33,654
45.00	16,891	100.0	15,547	49,201
46.00	19,752	100.0	18,322	67,522
47.00	21,668	100.0	20,710	88,232
48.00	23,557	100.0	22,613	110,845

Device	Routing	Invert	Outlet Devices
#1	Primary	41.35'	**18.0" Round Culvert** L= 30.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 41.35' / 41.20' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#2	Device 1	41.35'	**3.5" Vert. Orifice/Grate** C= 0.600
#3	Device 1	45.00'	**3.0" Vert. Orifice/Grate** C= 0.600
#4	Device 1	46.00'	**3.0' long x 0.50' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s) 4.0' Crest Height
#5	Device 1	47.00'	**4.0" x 4.0" Horiz. Orifice/Grate X 106.00** C= 0.600 Limited to weir flow at low heads
#6	Secondary	46.50'	**15.0' long x 15.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=7.09 cfs @ 12.45 hrs HW=46.93' TW=38.85' (Dynamic Tailwater)
- **1=Culvert** (Passes 7.09 cfs of 18.71 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 0.75 cfs @ 11.23 fps)
  - **3=Orifice/Grate** (Orifice Controls 0.32 cfs @ 6.48 fps)
  - **4=Sharp-Crested Rectangular Weir** (Orifice Controls 6.02 cfs @ 4.15 fps)
  - **5=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=11.59 cfs @ 12.45 hrs HW=46.93' TW=38.85' (Dynamic Tailwater)
- **6=Broad-Crested Rectangular Weir** (Weir Controls 11.59 cfs @ 1.78 fps)

Summary for Pond POND 1.1: GRAVEL WETLAND 2

Inflow Area = 5.567 ac, 58.73% Impervious, Inflow Depth > 4.01" for 10 Year event
Inflow = 22.02 cfs @ 12.14 hrs, Volume= 1.858 af
Outflow = 1.76 cfs @ 13.65 hrs, Volume= 0.550 af, Atten= 92%, Lag= 90.5 min
Primary = 1.76 cfs @ 13.65 hrs, Volume= 0.550 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 55.08' @ 13.65 hrs Surf.Area= 16,909 sf Storage= 57,197 cf
Flood Elev= 57.00' Surf.Area= 21,643 sf Storage= 94,743 cf

Plug-Flow detention time= 357.2 min calculated for 0.550 af (30% of inflow)
Center-of-Mass det. time= 218.3 min (1,021.7 - 803.4)

Volume	Invert	Avail.Storage	Storage Description
#1	47.55'	117,304 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
47.55	6,269	0.0	0	0
49.85	6,269	30.0	4,326	4,326
50.50	6,269	45.0	1,834	6,159
51.00	7,199	100.0	3,367	9,526
52.00	9,187	100.0	8,193	17,719
53.00	11,345	100.0	10,266	27,985
54.00	13,814	100.0	12,580	40,565
55.00	16,645	100.0	15,230	55,794
56.00	19,805	100.0	18,225	74,019
58.00	23,480	100.0	43,285	117,304

Device	Routing	Invert	Outlet Devices
#1	Primary	49.85'	**24.0" Round Culvert** L= 12.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 49.85' / 49.45' S= 0.0333 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	49.85'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	53.50'	**4.0' long x 2.00' rise Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#4	Device 1	56.50'	**4.0" x 4.0" Horiz. Orifice/Grate X 106.00** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.76 cfs @ 13.65 hrs HW=55.08' TW=55.07' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 1.76 cfs @ 0.56 fps)
  ├─**2=Orifice/Grate** (Passes < 0.01 cfs potential flow)
  ├─**3=Sharp-Crested Rectangular Weir** (Passes < 3.33 cfs potential flow)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond POND 1.2: PDMH203

Inflow Area = 7.890 ac, 59.73% Impervious, Inflow Depth > 2.08" for 10 Year event
Inflow = 10.81 cfs @ 12.09 hrs, Volume= 1.367 af
Outflow = 10.81 cfs @ 12.09 hrs, Volume= 1.367 af, Atten= 0%, Lag= 0.0 min
Primary = 10.81 cfs @ 12.09 hrs, Volume= 1.367 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 50.65' @ 12.09 hrs
Flood Elev= 57.00'

Device	Routing	Invert	Outlet Devices
#1	Primary	49.35'	**48.0" Round Culvert** L= 269.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 49.35' / 48.00' S= 0.0050 '/' Cc= 0.900

n= 0.013 Corrugated PE, smooth interior, Flow Area= 12.57 sf

Primary OutFlow Max=10.64 cfs @ 12.09 hrs HW=50.64' TW=48.75' (Dynamic Tailwater)
1=Culvert (Inlet Controls 10.64 cfs @ 3.05 fps)

Summary for Pond POND 1.3: OUTLET CULVERTS

[62] Hint: Exceeded Reach REACH 1.0 OUTLET depth by 2.50' @ 23.95 hrs

Inflow Area = 30.478 ac, 59.60% Impervious, Inflow Depth > 2.80" for 10 Year event
Inflow = 40.12 cfs @ 12.47 hrs, Volume= 7.107 af
Outflow = 39.92 cfs @ 12.50 hrs, Volume= 6.819 af, Atten= 0%, Lag= 1.8 min
Primary = 39.92 cfs @ 12.50 hrs, Volume= 6.819 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 38.86' @ 12.50 hrs Surf.Area= 9,266 sf Storage= 14,364 cf
Flood Elev= 43.50' Surf.Area= 95,977 sf Storage= 236,017 cf

Plug-Flow detention time= 32.3 min calculated for 6.819 af (96% of inflow)
Center-of-Mass det. time= 11.6 min (905.1 - 893.5)

Volume	Invert	Avail.Storage	Storage Description
#1	35.00'	236,017 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
35.00	960	0	0
36.00	1,428	1,194	1,194
38.00	5,418	6,846	8,040
40.00	14,354	19,772	27,812
42.00	66,884	81,238	109,050
43.00	92,707	79,796	188,846
43.50	95,977	47,171	236,017

Device	Routing	Invert	Outlet Devices
#1	Primary	35.60'	**42.0" W x 29.0" H, R=21.5"/66.1" Pipe Arch CMP_Arch_1/2 42x29 X 3.00** L= 68.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 35.60' / 35.30' S= 0.0044 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 6.72 sf
#2	Secondary	43.00'	**143.1 deg x 18.0' long x 0.50' rise Sharp-Crested Vee/Trap Weir** Cv= 2.47 (C= 3.09)

Primary OutFlow Max=39.88 cfs @ 12.50 hrs HW=38.86' TW=38.65' (Dynamic Tailwater)
1=CMP_Arch_1/2 42x29 (Outlet Controls 39.88 cfs @ 1.98 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=35.00' TW=38.65' (Dynamic Tailwater)
2=Sharp-Crested Vee/Trap Weir (Controls 0.00 cfs)

Summary for Pond POND 1.4: RAINGARDEN 1.0

Inflow Area = 4.930 ac, 85.05% Impervious, Inflow Depth > 4.88" for 10 Year event
Inflow = 24.45 cfs @ 12.10 hrs, Volume= 2.004 af
Outflow = 6.60 cfs @ 12.48 hrs, Volume= 1.401 af, Atten= 73%, Lag= 22.2 min
Primary = 6.60 cfs @ 12.48 hrs, Volume= 1.401 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 48.07' @ 12.48 hrs Surf.Area= 14,774 sf Storage= 45,635 cf
Flood Elev= 50.00' Surf.Area= 17,790 sf Storage= 77,050 cf

Plug-Flow detention time= 233.7 min calculated for 1.398 af (70% of inflow)
Center-of-Mass det. time= 143.1 min (914.3 - 771.2)

Volume	Invert	Avail.Storage	Storage Description
#1	42.17'	77,050 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
42.17	10,418	0.0	0	0
43.50	10,418	40.0	5,542	5,542
45.00	10,418	10.0	1,563	7,105
46.00	11,745	100.0	11,082	18,187
48.00	14,664	100.0	26,409	44,596
50.00	17,790	100.0	32,454	77,050

Device	Routing	Invert	Outlet Devices
#1	Primary	42.42'	**12.0" Round Culvert** L= 48.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 42.42' / 42.20' S= 0.0046 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	42.42'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 2	45.00'	**10.000 in/hr Exfiltration over Surface area above 45.00'** Excluded Surface area = 10,418 sf
#4	Device 1	47.15'	**13.2" x 13.2" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Secondary	49.35'	**7.0' long x 8.9' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.46 2.55 2.70 2.69 2.68 2.68 2.67 2.64 2.64 2.64 2.65 2.64 2.65 2.65 2.66 2.67 2.69

Primary OutFlow Max=6.59 cfs @ 12.48 hrs HW=48.07' TW=38.86' (Dynamic Tailwater)
- **1=Culvert** (Passes 6.59 cfs of 6.77 cfs potential flow)
  - **2=Orifice/Grate** (Passes 1.01 cfs of 2.20 cfs potential flow)
    - **3=Exfiltration** (Exfiltration Controls 1.01 cfs)
  - **4=Orifice/Grate** (Orifice Controls 5.58 cfs @ 4.62 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=42.17' TW=35.00' (Dynamic Tailwater)
- **5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link LINK 1.0: PDMH203 TAILWATER

This link takes into account the tailwater condition in PDMH203 which the outlet of gravel wetland 2 connects. The purpose of this is to determine the effects of any surcharging caused by the tailwater of Hodgson Brook entering the structure. These tailwater elevations were determined by Streamworks, PLLC as part of the overall watershed analysis they performed.

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[80] Warning: Exceeded Pond POND 1.1 by 7.52' @ 0.00 hrs (23.95 cfs 25.099 af)

Inflow Area = 5.567 ac, 58.73% Impervious, Inflow Depth > 1.19" for 10 Year event
Inflow = 1.76 cfs @ 13.65 hrs, Volume= 0.550 af
Primary = 1.76 cfs @ 13.65 hrs, Volume= 0.550 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

10 Year 25 Point manual elevation table, To= 0.00 hrs, dt= 1.00 hrs, feet =

55.07	55.07	55.07	55.07	55.07	55.07	55.07	55.07	55.07
55.07	55.07	55.07	55.07	55.07	55.07	55.07	55.07	55.07
55.07	55.07	55.07	55.07	55.07	55.07	55.07		

Summary for Link PA1: POINT OF ANALYSIS

This link takes into account the tailwater condition in roadside swale along Goose Bay Drive which the existing culverts discharge into. These tailwater elevations were determined by Streamworks, PLLC as part of the overall watershed analysis they performed.

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[80] Warning: Exceeded Pond POND 1.3 by 3.65' @ 0.00 hrs (92.51 cfs 86.028 af)

Inflow Area = 30.478 ac, 59.60% Impervious, Inflow Depth > 2.69" for 10 Year event
Inflow = 39.92 cfs @ 12.50 hrs, Volume= 6.819 af
Primary = 39.92 cfs @ 12.50 hrs, Volume= 6.819 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

10 Year 2 Point manual elevation table, To= 0.00 hrs, dt= 24.00 hrs, feet =

38.65	38.65

Summary for Link PA2: POINT OF ANALYSIS

Inflow Area = 1.132 ac, 80.99% Impervious, Inflow Depth > 4.77" for 10 Year event
Inflow = 5.94 cfs @ 12.07 hrs, Volume= 0.449 af
Primary = 5.94 cfs @ 12.07 hrs, Volume= 0.449 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment POST 1.0: WATERSHED Runoff Area=462,599 sf 72.19% Impervious Runoff Depth>6.00"
Flow Length=933' Tc=11.4 min CN=91 Runoff=58.40 cfs 5.309 af

Subcatchment POST 1.1: WATERSHED Runoff Area=242,496 sf 58.73% Impervious Runoff Depth>5.43"
Flow Length=750' Tc=10.3 min CN=86 Runoff=29.42 cfs 2.517 af

Subcatchment POST 1.2: WATERSHED Runoff Area=101,204 sf 62.15% Impervious Runoff Depth>5.66"
Flow Length=1,191' Tc=6.4 min CN=88 Runoff=14.27 cfs 1.095 af

Subcatchment POST 1.3: WATERSHED Runoff Area=306,549 sf 22.64% Impervious Runoff Depth>4.39"
Flow Length=1,525' Tc=45.9 min CN=77 Runoff=16.72 cfs 2.574 af

Subcatchment POST 1.4: WATERSHED Runoff Area=214,764 sf 85.05% Impervious Runoff Depth>6.35"
Flow Length=717' Tc=7.5 min CN=94 Runoff=31.40 cfs 2.610 af

Subcatchment POST 2.0: WATERSHED 2.0 Runoff Area=49,290 sf 80.99% Impervious Runoff Depth>6.24"
Flow Length=758' Tc=5.0 min CN=93 Runoff=7.66 cfs 0.588 af

Reach REACH 1.0: RESTORED Avg. Flow Depth=0.86' Max Vel=2.20 fps Inflow=14.27 cfs 2.076 af
n=0.040 L=1,309.0' S=0.0092 '/' Capacity=2,720.29 cfs Outflow=7.67 cfs 2.061 af

Pond POND 1.0: GRAVEL WETLAND 1 Peak Elev=47.21' Storage=92,932 cf Inflow=58.40 cfs 5.309 af
Primary=19.23 cfs 2.787 af Secondary=24.16 cfs 0.988 af Outflow=43.41 cfs 3.776 af

Pond POND 1.1: GRAVEL WETLAND 2 Peak Elev=55.71' Storage=68,356 cf Inflow=29.42 cfs 2.517 af
Outflow=4.20 cfs 0.981 af

Pond POND 1.2: PDMH203 Peak Elev=50.86' Inflow=14.27 cfs 2.076 af
48.0" Round Culvert n=0.013 L=269.0' S=0.0050 '/' Outflow=14.27 cfs 2.076 af

Pond POND 1.3: OUTLET CULVERTS Peak Elev=39.33' Storage=19,198 cf Inflow=67.56 cfs 10.378 af
Primary=66.14 cfs 10.071 af Secondary=0.00 cfs 0.000 af Outflow=66.14 cfs 10.071 af

Pond POND 1.4: RAINGARDEN1.0 Peak Elev=48.89' Storage=58,248 cf Inflow=31.40 cfs 2.610 af
Primary=7.29 cfs 1.966 af Secondary=0.00 cfs 0.000 af Outflow=7.29 cfs 1.966 af

Link LINK 1.0: PDMH203 TAILWATER Inflow=4.20 cfs 0.981 af
Primary=4.20 cfs 0.981 af

Link PA1: POINT OF ANALYSIS Inflow=66.14 cfs 10.071 af
Primary=66.14 cfs 10.071 af

Link PA2: POINT OF ANALYSIS Inflow=7.66 cfs 0.588 af
Primary=7.66 cfs 0.588 af

Total Runoff Area = 31.609 ac Runoff Volume = 14.693 af Average Runoff Depth = 5.58"
39.63% Pervious = 12.527 ac 60.37% Impervious = 19.083 ac

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment POST 1.0: WATERSHED Runoff Area=462,599 sf 72.19% Impervious Runoff Depth>7.37"
Flow Length=933' Tc=11.4 min CN=91 Runoff=70.91 cfs 6.521 af

Subcatchment POST 1.1: WATERSHED Runoff Area=242,496 sf 58.73% Impervious Runoff Depth>6.77"
Flow Length=750' Tc=10.3 min CN=86 Runoff=36.28 cfs 3.140 af

Subcatchment POST 1.2: WATERSHED Runoff Area=101,204 sf 62.15% Impervious Runoff Depth>7.01"
Flow Length=1,191' Tc=6.4 min CN=88 Runoff=17.48 cfs 1.358 af

Subcatchment POST 1.3: WATERSHED Runoff Area=306,549 sf 22.64% Impervious Runoff Depth>5.65"
Flow Length=1,525' Tc=45.9 min CN=77 Runoff=21.42 cfs 3.313 af

Subcatchment POST 1.4: WATERSHED Runoff Area=214,764 sf 85.05% Impervious Runoff Depth>7.73"
Flow Length=717' Tc=7.5 min CN=94 Runoff=37.84 cfs 3.177 af

Subcatchment POST 2.0: WATERSHED 2.0 Runoff Area=49,290 sf 80.99% Impervious Runoff Depth>7.62"
Flow Length=758' Tc=5.0 min CN=93 Runoff=9.25 cfs 0.718 af

Reach REACH 1.0: RESTORED Avg. Flow Depth=0.90' Max Vel=2.19 fps Inflow=17.48 cfs 2.679 af
n=0.040 L=1,309.0' S=0.0092 '/' Capacity=2,720.29 cfs Outflow=10.33 cfs 2.662 af

Pond POND 1.0: GRAVEL WETLAND 1 Peak Elev=47.48' Storage=98,793 cf Inflow=70.91 cfs 6.521 af
Primary=19.73 cfs 3.345 af Secondary=38.14 cfs 1.616 af Outflow=57.87 cfs 4.961 af

Pond POND 1.1: GRAVEL WETLAND 2 Peak Elev=56.45' Storage=83,107 cf Inflow=36.28 cfs 3.140 af
Outflow=6.58 cfs 1.321 af

Pond POND 1.2: PDMH203 Peak Elev=51.03' Inflow=17.48 cfs 2.679 af
48.0" Round Culvert n=0.013 L=269.0' S=0.0050 '/' Outflow=17.48 cfs 2.679 af

Pond POND 1.3: OUTLET CULVERTS Peak Elev=39.77' Storage=24,643 cf Inflow=87.04 cfs 13.437 af
Primary=83.35 cfs 13.109 af Secondary=0.00 cfs 0.000 af Outflow=83.35 cfs 13.109 af

Pond POND 1.4: RAINGARDEN1.0 Peak Elev=49.56' Storage=69,290 cf Inflow=37.84 cfs 3.177 af
Primary=7.69 cfs 2.462 af Secondary=1.60 cfs 0.039 af Outflow=9.29 cfs 2.500 af

Link LINK 1.0: PDMH203 TAILWATER Inflow=6.58 cfs 1.321 af
Primary=6.58 cfs 1.321 af

Link PA1: POINT OF ANALYSIS Inflow=83.35 cfs 13.109 af
Primary=83.35 cfs 13.109 af

Link PA2: POINT OF ANALYSIS Inflow=9.25 cfs 0.718 af
Primary=9.25 cfs 0.718 af

Total Runoff Area = 31.609 ac Runoff Volume = 18.227 af Average Runoff Depth = 6.92"
39.63% Pervious = 12.527 ac 60.37% Impervious = 19.083 ac

Portsmouth, NH Glare Study Results

Photovoltaic (Solar) Project in Portsmouth, Rockingham County, NH

February 22, 2024

Prepared for:

IPS - Integrated Project Services, LLC
721 Arbor Way, Suite 100
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Prepared by:

Elizabeth C. Myers, PMP
Certified Glare Analyst

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Colliers Engineering & Design

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Conclusion

Collier's Engineering & Design (CED) performed an analysis on the array areas of the proposed rooftop and carport solar project site in Portsmouth, Rockingham County, NH.

Through extensive cross-checking, it was found that at a 5-degree resting angle or above for the rooftop system panels, there is no predicted glare throughout the entire project area. Small amounts of green glare predicted from the carports onto a route directly next to the proposed project are easily mitigated.

The study area is presented in the graphic below. Red Markers represent Observation Points, Turquoise Lines are the roads in and around the proposed project area, and Brown Lines represent the existing foliage in the area and/or the proposed landscaping lines. The Brown Lines around the rooftop systems represent the parapets that run the entire perimeter of the buildings.

A closer view of the immediate project area:

The triangulation of the proposed project in relation to Portsmouth International Airport is provided below. Because of the proximity to the airport and the Air Traffic Control Tower, the client specifically requested a full study to be certain that no glare of any kind would affect the Tower.

To establish a worst-case scenario baseline, a 15-degree angle for the proposed rooftop system facing 214 degrees (azimuth) was programmed on the rooftops of two buildings. For the proposed carports, four array areas were programmed facing 124 degrees (azimuth) and one carport was programmed facing 214 degrees (azimuth). The project was modeled without local foliage lines and other large buildings between the proposed project and the ATCT in the area programmed.

The Air Traffic Control Tower was modeled at a dual height of 130 feet and 120 feet to cover broader possibilities of the proposed project's sightline to anyone in the tower structure.

With the above settings, the modelling predicts ZERO minutes of YELLOW glare over the course of an entire year and ~4,474 minutes of GREEN glare over the course of an entire year. The glare results include ~1,863 minutes of GREEN glare on the Air Traffic Control Tower at Portsmouth International Airport from Carports 1, 3 and 4. **No glare whatsoever is predicted from the rooftop systems onto the ATCT or onto any other point in the study.**

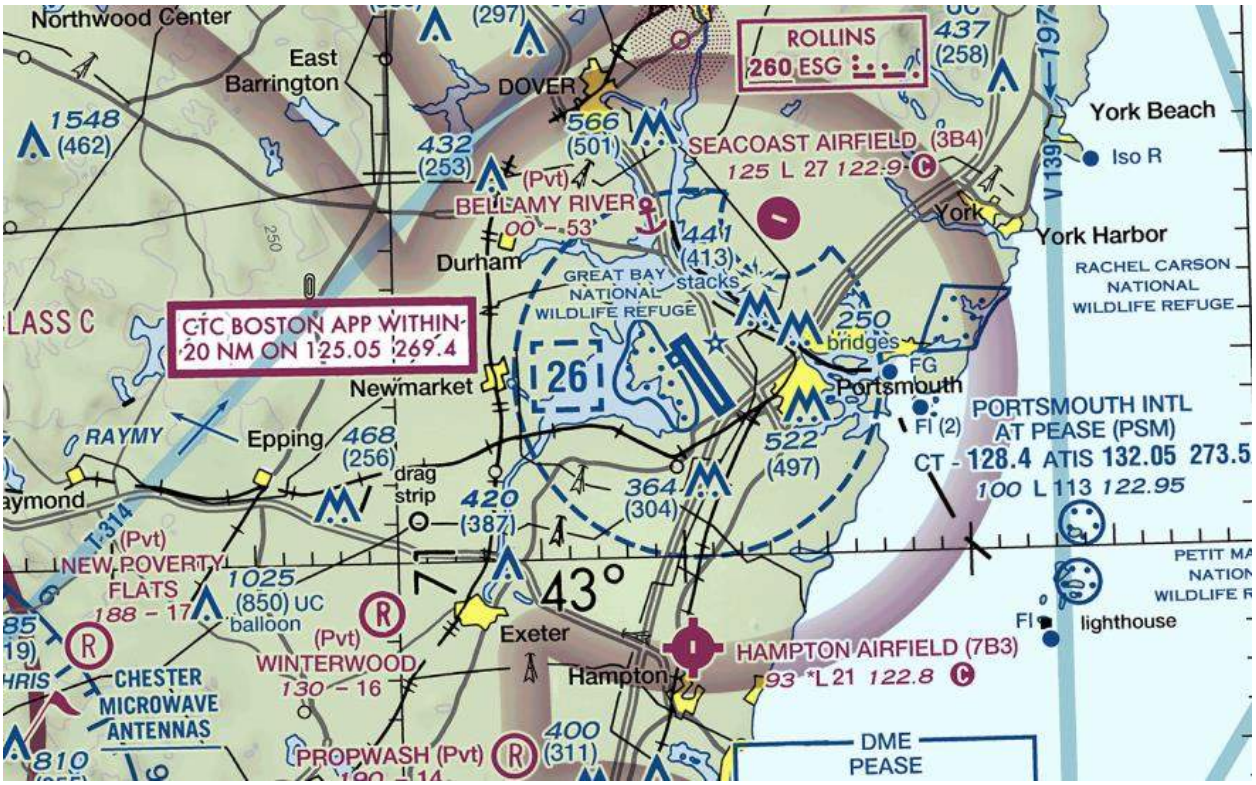
At the proposed working settings of a 5-degree racking tilt on the rooftop systems, and the same settings for the carports components, but WITH all local area foliage, buildings and other obstructions, the modelling predicts zero minutes of YELLOW glare over the course of an entire year and ~802 minutes of GREEN glare over the course of an entire year. This glare is exclusively from Carport 3 and Carport 4 onto Routes 3 (4.5 feet) and 4 (8.5 feet) which run directly in front of the proposed project area.

At the proposed working settings of a 10-degree racking tilt on the rooftop systems, and the same settings for the carports components, but WITH all local area foliage, buildings and other obstructions, the modelling predicts zero minutes of YELLOW glare over the course of an entire year and ~802 minutes of GREEN glare over the course of an entire year. This glare is exclusively from Carport 3 and Carport 4 onto Routes 3 (4.5 feet) and 4 (8.5 feet) which run directly in front of the proposed project area.

At the proposed working settings of a 13-degree racking tilt on the rooftop systems, and the same settings for the carports components, but WITH all local area foliage, buildings and other obstructions, the modelling predicts zero minutes of YELLOW glare over the course of an entire year and ~802 minutes of GREEN glare over the course of an entire year. This glare is exclusively from Carport 3 and Carport 4 onto Routes 3 (4.5 feet) and 4 (8.5 feet) which run directly in front of the proposed project area.

At the proposed working settings of a 15-degree racking tilt on the rooftop systems, and the same settings for the carports components, but WITH all local area foliage, buildings and other obstructions, the modelling predicts zero minutes of YELLOW glare over the course of an entire year and ~802 minutes of GREEN glare over the course of an entire year. This glare is exclusively from Carport 3 and Carport 4 onto Routes 3 (4.5 feet) and 4 (8.5 feet) which run directly in front of the proposed project area.

A review of the Federal Aviation Administration's (FAA) New York area Visual Flight Rules (VFR) charts shows no restricted airspace in or around the proposed project area.



A review of Military Training Route (MTR) charts was performed utilizing an additional online resource and the proposed project falls entirely **OUTSIDE** of known training route areas.

The above conclusion is arrived at by utilizing the worst-case scenario results provided by the *ForgeSolar* software, and then manually layering back into each modeling scenario all real-world factors in the area of the proposed site location.

Full technical reporting output by the *ForgeSolar* program is included in the Appendix of this report.

Sincerely,

Colliers Engineering & Design, Inc.
(DBA Maser Consulting)

Elizabeth Claire Myers, PMP
Project Manager, Electrical Engineering
Certified Glare Analyst through Sims Industries

cc: Lee Hill, PE, Colliers Engineering & Design (via email)

R:\Projects\2024\24000681A_IPS_Portsmouth\24000681A_IPS_PortsmouthNH_GlareStudy_DRAFTREPORT.docx

Resources

Federal Aviation Administration – Publicly Available Visual Flight Rules (VFR) Charts
https://www.faa.gov/air_traffic/flight_info/aeronav/digital_products/vfr/

- Utilized to obtain FAA-approved VFR charts of the project area for inclusion and consideration in this study.

U.S. Military Training Routes (MTRs) and buffers - May 4, 2018 (Last modified Oct 6, 2021) Uploaded by South Atlantic Blueprint
https://salcc.databasin.org/datasets/4c81852be18444b997f8f860ee568c54/

- Utilized to obtain detail and graphic of US-wide Military Training Routes and location specific data for this study.

Ho, C. K., Ghanbari, C. M., and Diver, R. B., 2011, **Methodology to Assess Potential Glint and Glare Hazards From Concentrating Solar Power Plants: Analytical Models and Experimental Validation**, *ASME J. Sol. Energy Eng., 133*.

Solar Glare Hazard Analysis Tool (SGHAT) Technical Reference Manual

Details of Glare Study

Methodology

(Source Information: https://forgesolar.com/help/#intro)

Collier's Engineering & Design (CED) offers staff specifically trained on glare analyses utilizing *ForgeSolar*, a web-based interactive software that provides a quantified assessment of (1) when and where glare is predicted to occur throughout the year for a prescribed solar installation, and (2) potential effects on the human eye at locations where glare is predicted to occur. *ForgeSolar* is based on the Solar Glare Hazard Analysis Tool ("SGHAT") licensed from Sandia National Laboratories.

These tools meet the FAA standards for glare analysis.

Determination of glare occurrence requires knowledge of the following: sun position, observer location, and the tilt, orientation, location, extent, and optical properties of the modules in the solar array. Vector algebra is then used to determine if glare is likely to be visible from the prescribed observation points.

If glare is predicted, the software calculates the retinal irradiance and subtended angle (size/distance) of the glare source to predict potential ocular hazards ranging from temporary after-image to more severe possible retinal damage. These results are presented in a simple, easy-to-interpret plot that specifies when glare is predicted to occur throughout the year, with color codes indicating the potential ocular hazard.

Background Information

Glint is typically defined as a momentary flash of bright light, often caused by a reflection off a moving source. A typical example of glint is a momentary solar reflection from a moving car, or "catching" something bright out of the corner of your eye.

Glare is defined as a continuous source of bright light. Glare is generally associated with stationary objects, which, due to the slow relative movement of the sun, reflect sunlight for a longer duration.

The difference between glint and glare is duration. Industry-standard glare analysis tools evaluate the occurrence of glare on a minute-by-minute basis; accordingly, they generally refer to solar hazards as 'glare.'

The ocular impact of solar glare is quantified into three categories (Ho, 2011):

1. Green – Unproblematic shine. Low potential to cause after-image. This type of glare can be compared to noticing something shiny in the distance.

2. Yellow - Potential to cause temporary after-image (flash blindness). This type of glare is much like sunrise and sunset glare for drivers who struggle to find the perfect angle for car visors so they can continue to operate their vehicle safely while traveling through areas of such glare.
   a. Standard levels of yellow glare can, for the most part, be handled with relative ease utilizing slatted fencing or local-foliage landscape mitigation measures.
   b. Only extremely high levels of this type of glare (in the area of the chart to the right labeled as "direct viewing of the sun" which is uncommon to find with PV installations) would be considered an insurmountable hurdle to a PV installation of any size.
   c. High levels/intensities and long durations are different factors.

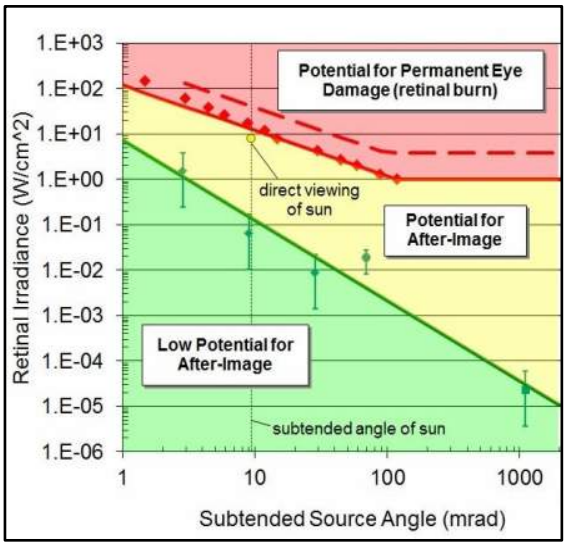


Figure 1 – From *ForgeSolar* website (sample glare hazard plot defining ocular impact as function of retinal irradiance and subtended source angle *(Ho, 2011)*)

3. Red - Potential to cause retinal burn (permanent eye damage). PV modules do not focus reflected sunlight and therefore retinal burn (RED glare) is typically not possible.
   d. This is the ONLY type of glare that would be considered an insurmountable hurdle to a PV installation of any size.

These categories assume a typical blink response in the observer.

Note that retinal burn is typically not possible for PV glare since PV modules do not focus reflected sunlight. They are, in fact, designed to absorb as much sunlight as possible.

To further put glare into perspective, the following is presented.

YELLOW glare such as in the graphic to the right could only be seen when standing directly next to project panels at the perfect angle when the sun is in a perfect place—indeed the point of a photographer standing directly by these panels and waiting for the perfect moment to capture this image. It is also possible that the panels in the picture shown do not have an anti-reflective coating.

Solar panel showing solar glare

GREEN glare, as illustrated directly to the right, is the more common occurrence with solar projects—a noticeable shiny area (in the northwest area) as compared to panels where the sun is not quite in perfect alignment yet.

Even so, the effect of this noticeable shine to certain areas of the project area is still seen from a relatively close up vantage point and at the optimal height this image was captured, possibly by a drone. A similarly sized project in the distance, closer to the horizon of the photo would be unlikely to show even the levels of green glare that the system in the foreground reflects.

Executive Summary

The purpose of the glare study requested by IPS – Integrated Project Service, LLC (IPS) and their client is to closely examine a proposed solar project in Portsmouth, Rockingham County, NH and to provide feedback regarding areas that may warrant closer examination in order to mitigate possible problematic predicted glare to the businesses, residences, and roads surrounding the project area.

Information was provided by IPS and their client in order to complete this study. The project's rooftop PV systems were programmed to a 15-degree tilt axis facing 214 degrees at a height of 88 feet for the smaller structure and 93.83 feet for the larger building. The parapets for these buildings were programmed at heights of 93.21 feet and 99.3 feet respectively.

Four of the projects five carport systems were programmed with two top heights (20.17 feet and 22.48 feet) and a lower edge of 14 feet, facing 124 degrees southeast. A final carport was programmed with a 20.17 foot high edge, a 14 foot lower edge and facing 214 degrees.

It was further assumed that the panels used throughout the proposed project are constructed of Smooth Glass with an Anti-Reflective coating.

Seven (7) Observation Points were placed at different points around the site and programmed to an average height of 5 and a half (5.5) feet to model someone standing in these spots, and to a height of 15 to 20 feet to model a 5.5-foot person standing on the second floor of a home/business with 8-foot ceilings and a 1.5-foot plenum space.

The building directly southwest of the proposed project is industrial in nature, and an examination of the portion that will be facing the project shows that it is industrial in nature with very few windows. One OP was programmed here at a height of 40 feet.

Two Observation Points representing the Air Traffic Control Tower at Portsmouth International Airport were programmed to heights of 130 feet and 120 feet.

Six (6) Route Receptors were programmed for two-way traffic to heights of 4.5 feet and 8.5 feet, effectively representing the eyeline of an average person sitting on/in any vehicle from a bike to a motorcycle, a standard car or SUV, through to the approximated seated height in the cab of an 18-wheeler truck.

While it is impossible to study every possible point and/or angle surrounding a photovoltaic (solar) project, Collier's Engineering & Design (CED) has modeled the project and surrounding areas as best as possible with the most likely points of concern.

PV modules do not focus reflected sunlight and therefore retinal burn is typically not possible. They are, in fact, designed to absorb as much sunlight as possible. Modern photovoltaic panels actually cause less glare than standard home window glass; and research has shown that they reflect less light than snow, white concrete and energy-efficient white rooftops.

The YELLOW glare we are looking to identified with this study is much like sunrise and sunset glare for drivers who struggle to find the perfect angle for car visors so they can continue to operate their vehicle safely while traveling through areas of such glare. In general, photovoltaic panel systems of any size produce some glare predominately during early sunrise and sunset throughout the Spring

through Fall months—although glare is possible throughout each day as well as throughout the entire year.

ForgeSolar now allows the programming of obstructions. It was utilized in this study to model in existing treelines, local warehouses and other buildings and the parapets of the proposed new buildsings for this project with estimated heights. Local foliage lines were modeled at a conservative height of 17 to 30 feet in height. Local warehouses were modeled conservatively at 20 to 30 feet high.

After examining each point and then factoring in additionally recommended foliage, distance, and elevation changes, points where predicted glare is blocked by natural obstructions were removed from the listing of points to be examined more closely. Finally, if any glare continues to be predicted in any area, this analyst will address the areas that present the most possibility for likely glare.

ASSUMPTIONS

- Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.*
- Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.
- Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
- Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
- Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.

Results of this Study

WORST CASE SCENARIO without Local Foliage - RESULTS at 15 Degree Resting Angle

To establish a worst-case scenario baseline, the project was modeled without any local foliage lines or building obstructions between the proposed project and the Air Traffic Control Tower at the Portsmouth International Airport. The modelling predicts ZERO minutes of YELLOW glare over the course of an entire year and ~4,474 minutes of GREEN glare over the course of an entire year. The glare results include ~1,855 minutes of GREEN glare on the Air Traffic Control Tower at Portsmouth International Airport from Carports 1, 3 and 4. No glare whatsoever is predicted from the rooftop systems onto the ATCT or onto any other point in the study.

RESULTS at 5 Degree Angle

At the proposed working settings of a 5-degree racking tilt on the rooftop systems, and the same settings for the carports components, the modelling predicts zero minutes of YELLOW glare over the course of an entire year and ~802 minutes of GREEN glare over the course of an entire year. This glare is exclusively from Carport 3 and Carport 4 onto Routes 3 (4.5 feet) and 4 (8.5 feet) which run directly in front of the proposed project area.

RESULTS at 10 Degree Resting Angle

At the proposed working settings of a 10-degree racking tilt on the rooftop systems, and the same settings for the carports components, the modelling predicts zero minutes of YELLOW glare over the course of an entire year and ~802 minutes of GREEN glare over the course of an entire year. This glare is exclusively from Carport 3 and Carport 4 onto Routes 3 (4.5 feet) and 4 (8.5 feet) which run directly in front of the proposed project area.

RESULTS at 13 Degree Resting Angle

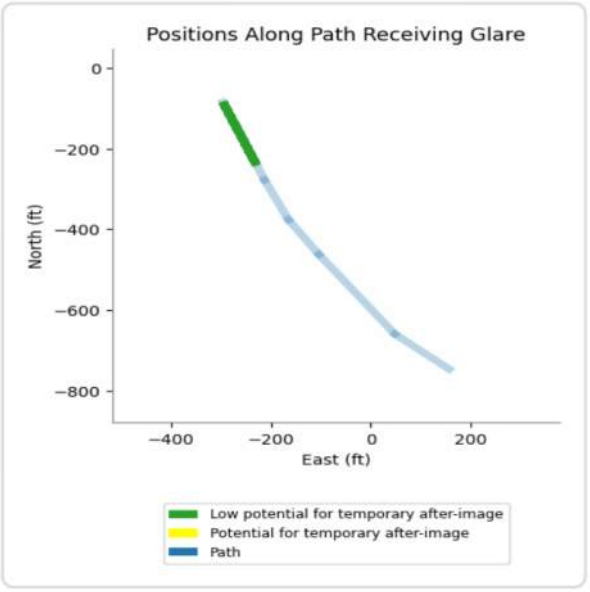
At the proposed working settings of a 13-degree racking tilt on the rooftop systems, and the same settings for the carports components, the modelling predicts zero minutes of YELLOW glare over the course of an entire year and ~802 minutes of GREEN glare over the course of an entire year. This glare is exclusively from Carport 3 and Carport 4 onto Routes 3 (4.5 feet) and 4 (8.5 feet) which run directly in front of the proposed project area.

RESULTS at 15 Degree Resting Angle

At the proposed working settings of a 15-degree racking tilt on the rooftop systems, and the same settings for the carports components, the modelling predicts zero minutes of YELLOW glare over the course of an entire year and ~802 minutes of GREEN glare over the course of an entire year. This glare is exclusively from Carport 3 and Carport 4 onto Routes 3 (4.5 feet) and 4 (8.5 feet) which run directly in front of the proposed project area.

AREAS OF GLARE

In ALL results, the areas of glare from Carport 3 and Carport 4 onto Routes 3 (4.5 feet) and 4 (8.5 feet) which run directly in front of the proposed project area.



A final run scenario with a small planting of trees at the area marked in green in the "Positions Along Path Receiving Glare" shows that a screen of 9 feet at initial planting will completely mitigate any glare shown.

Summary of Results No glare predicted!

PV Name	Tilt	Orientation	"Green" Glare
	deg	deg	min
CRPRT1	0.0	124.0	0
CRPRT2	0.0	124.0	0
CRPRT3	0.0	124.0	0
CRPRT4	0.0	124.0	0
CRPRT5	0.0	214.0	0
LGBLDG	10.0	214.0	0
SMBLDG	10.0	214.0	0

Summary of FAA-Level Flight Path Screening Results

Portsmouth International Airport sits under 1mile away from the project on the western side. All obstructions were kept in place for the FAA screening and the project was modeled at the 10 degree rooftop PV system tilt.

FEDERAL AVIATION ADMINISTRATION (FAA) SCREENS

An FAA-level glare analysis was performed and a report specific to this request can be found in Appendix A of this report. The Air Traffic Control Tower at Portsmouth International Airport is modeled for this study at its height of 130 feet. Additionally, a second point was modeled at 120 feet to be certain of the glare study results.

Per the FAA's most recent 2021 policy regarding solar around airports, this project PASSES.

Project: **ALBACORE, Portsmouth, NH**
Site configuration: **Albacore_10DegreeTilt_124Carports_ATCT_FAAReport**

Created 22 Feb, 2024
Updated 22 Feb, 2024
Time-step 1 minute
Timezone offset UTC-5
Minimum sun altitude 0.0 deg
DNI peaks at 1,000.0 W/m^2
Site ID 112738.19298

Ocular transmission coefficient 0.5
Pupil diameter 0.002 m
Eye focal length 0.017 m
Sun subtended angle 9.3 mrad
PV analysis methodology V2

Glare Policy Adherence

The following table estimates the policy adherence of this glare analysis according to the **2021** U.S. Federal Aviation Administration Policy:

Review of Solar Energy System Projects on Federally-Obligated Airports

This policy may require the following criteria be met for solar energy systems on airport property:

- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics, including 1-minute time step.

ForgeSolar is not affiliated with the U.S. FAA and does not represent or speak officially for the U.S. FAA. ForgeSolar cannot approve or deny projects - results are informational only. Contact the relevant airport and FAA district office for information on policy and requirements.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
ATCT(s)	PASS	Receptor(s) marked as ATCT do not receive glare

The complete updated FAA Policy can be read at: https://www.federalregister.gov/d/2021-09862

NOTE: ForgeSolar does not represent or speak officially for the FAA and cannot approve or deny projects. Results are informational only.

On May 26, 2021, the Federal Aviation Administration updated their policies regarding the installation of solar on and/or near regulated airports/airstrips.

While this policy of the Federal Aviation Administeration does not apply to solar energy systems on airports that do not have an Air Traffic Control Tower (ATCT), airports that are not federally-obligated, or solar energy systems not located on airport property—it does provide a high benchmark to meet to ensure that proposed solar installations do not create glare that poses any sort of safety hazard for pilots.

The brief of this FAA policy update states:

"The Federal Aviation Administration (FAA) published a final policy aimed at ensuring that airport solar projects don't create hazardous glare. The policy requires airports to measure the visual impact of such projects on pilots and air traffic control personnel.

The policy applies to proposed solar energy systems at federally obligated airports with control towers. Federally obligated airports are public airports that have accepted federal assistance either in the form of grants of property conveyances

As more airports invests in this technology for environmental and economic benefits, the FAA wants to make sure that the reflection from the systems' glass surfaces do not create a glare that poses a safety hazard for pilots and air traffic controllers.

Under the final policy, airports are no longer required to submit the results of an ocular analysis to FAA. Instead, the airport must file a Notice of Proposed Construction or Alteration Form 7460-1 that includes a statement that the project will not cause any visual impact. The airport submits the form to the FAA for review and approval.

The FAA relies on the airport to confirm via the form that it has sufficiently analyzed the potential for glint and glare and determined there is no potential for ocular impact to the airport traffic control tower cab. If any impacts are discovered after construction, the airport must mitigate the impact at its expense. The airport may also face compliance action for failure to address visual impacts that create aviation safety hazards. As such, the agency encourages an airport to conduct sufficient analysis before installing a solar energy system.

The FAA is also withdrawing the recommended tool for measuring the ocular impact of potential glint and glare effects on pilots and air traffic controllers."

Additionally:
"Initially, FAA believed that solar energy systems could introduce a novel glint and glare effect to pilots on final approach. FAA has subsequently concluded that in most cases, the glint and glare from solar energy systems to pilots on final approach is similar to glint and glare pilots routinely experience from water bodies, glass-façade buildings, parking lots, and similar features. However, FAA has continued to receive reports of potential glint and glare from on-airport solar energy systems on personnel working in ATCT cabs. Therefore, FAA has determined the scope of agency policy should be focused on the impact of on-airport solar energy systems to federally-obligated towered airports, specifically the airport's ATCT cab."

Colliers Engineering & Design

Appendix

Appendix A | Detailed Glare Study Result Reports

The following pages are the full reporting results delivered directly from *ForgeSolar*.

FORGESOLAR GLARE ANALYSIS

Project: **ALBACORE, Portsmouth, NH**
Site configuration: **Albacore_10DegreeTilt_124Carports_ATCT_FAAReport**

Client: Lonza

Created 22 Feb, 2024
Updated 22 Feb, 2024
Time-step 1 minute
Timezone offset UTC-5
Minimum sun altitude 0.0 deg
DNI peaks at 1,000.0 W/m^2
Site ID 112738.19298

Ocular transmission coefficient 0.5
Pupil diameter 0.002 m
Eye focal length 0.017 m
Sun subtended angle 9.3 mrad
PV analysis methodology V2

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- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics, including 1-minute time step.

ForgeSolar is not affiliated with the U.S. FAA and does not represent or speak officially for the U.S. FAA. ForgeSolar cannot approve or deny projects - results are informational only. Contact the relevant airport and FAA district office for information on policy and requirements.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
ATCT(s)	PASS	Receptor(s) marked as ATCT do not receive glare

The referenced policy can be read at https://www.federalregister.gov/d/2021-09862

Component Data

This report includes results for PV arrays and Observation Point ("OP") receptors marked as ATCTs. Components that are not pertinent to the policy, such as routes, flight paths, and vertical surfaces, are excluded.

PV Arrays

Name: CRPRT1
Axis tracking: Fixed (no rotation)
Tilt: 0.0°
Orientation: 124.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	43.085650	-70.803723	57.92	20.17	78.09
2	43.085595	-70.803619	57.81	14.00	71.81
3	43.085032	-70.804187	64.54	14.00	78.54
4	43.085084	-70.804291	66.68	20.17	86.85

Name: CRPRT2
Axis tracking: Fixed (no rotation)
Tilt: 0.0°
Orientation: 124.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	43.085519	-70.803626	57.88	22.48	80.36
2	43.085431	-70.803461	56.75	14.00	70.75
3	43.084981	-70.803912	58.98	14.00	72.98
4	43.085070	-70.804083	59.73	22.48	82.20

Name: CRPRT3
Axis tracking: Fixed (no rotation)
Tilt: 0.0°
Orientation: 124.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	43.085400	-70.803418	56.90	22.48	79.38
2	43.085325	-70.803271	56.23	14.00	70.23
3	43.084876	-70.803716	58.56	14.00	72.56
4	43.084953	-70.803866	59.01	22.48	81.49

Name: CRPRT4
Axis tracking: Fixed (no rotation)
Tilt: 0.0°
Orientation: 124.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	43.085298	-70.803223	56.02	20.17	76.19
2	43.085253	-70.803139	56.21	14.00	70.21
3	43.084808	-70.803572	58.45	14.00	72.45
4	43.084851	-70.803658	58.35	20.17	78.52

Name: CRPRT5
Axis tracking: Fixed (no rotation)
Tilt: 0.0°
Orientation: 214.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	43.085549	-70.803405	56.86	20.17	77.02
2	43.085404	-70.803116	55.16	20.17	75.32
3	43.085334	-70.803188	55.25	14.00	69.25
4	43.085478	-70.803470	57.01	14.00	71.01

Name: LGBLDG
Axis tracking: Fixed (no rotation)
Tilt: 10.0°
Orientation: 214.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	43.084344	-70.802133	51.60	93.83	145.44
2	43.084054	-70.801543	49.18	93.83	143.01
3	43.083901	-70.801690	49.39	93.83	143.22
4	43.083859	-70.801609	49.20	93.83	143.03
5	43.083897	-70.801574	49.27	93.83	143.10
6	43.083839	-70.801453	47.35	93.83	141.18
7	43.083345	-70.801919	51.93	93.83	145.76
8	43.083906	-70.803019	59.40	93.83	153.23
9	43.084395	-70.802537	54.24	93.83	148.07
10	43.084315	-70.802368	51.53	93.83	145.36
11	43.084337	-70.802347	51.04	93.83	144.87
12	43.084303	-70.802278	52.48	93.83	146.31
13	43.084336	-70.802245	52.51	93.83	146.34
14	43.084297	-70.802171	51.69	93.83	145.52

Name: SMBLDG
Axis tracking: Fixed (no rotation)
Tilt: 10.0°
Orientation: 214.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	43.084480	-70.803051	56.19	88.00	144.19
2	43.084450	-70.803081	56.31	88.00	144.31
3	43.084506	-70.803193	56.74	88.00	144.74
4	43.084466	-70.803232	56.81	88.00	144.81
5	43.084412	-70.803118	56.55	88.00	144.55
6	43.084252	-70.803275	58.91	88.00	146.91
7	43.084414	-70.803594	61.58	88.00	149.58
8	43.084643	-70.803375	58.79	88.00	146.79

Observation Point ATCT Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (ft)	Height (ft)
1-ATCT	1	43.084384	-70.818882	89.93	130.00
6-ATCT	6	43.084349	-70.818856	89.97	120.00

Map image of 1-ATCT

Map image of 6-ATCT

Obstruction Components

Name: BLDG1
Top height: 12.0 ft

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)
1	43.084600	-70.810084	76.71
2	43.084703	-70.809846	77.63
3	43.084534	-70.809702	77.38
4	43.084428	-70.809944	77.34
5	43.084600	-70.810084	76.71

Name: BLDG2
Top height: 20.0 ft

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)
1	43.084955	-70.806346	99.52
2	43.085031	-70.806408	98.08
3	43.084866	-70.806801	99.55
4	43.084555	-70.806565	99.98
5	43.084608	-70.806439	99.85
6	43.084444	-70.806325	99.64
7	43.084592	-70.806011	99.08
8	43.084965	-70.806346	99.43

Name: HighEdge1
Top height: 22.0 ft

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)
1	43.085534	-70.803609	57.89
2	43.085267	-70.803116	55.50

Name: HighEdge2
Top height: 22.5 ft

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)
1	43.085593	-70.803598	57.75
2	43.085019	-70.804161	63.07

Name: HighEdge3
Top height: 22.5 ft

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)
1	43.085424	-70.803445	56.71
2	43.084960	-70.803895	59.16

Name: HighEdge4
Top height: 20.2 ft

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)
1	43.085307	-70.803260	56.28
2	43.084860	-70.803684	58.42

Name: PRPT1
Top height: 93.2 ft

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)
1	43.084674	-70.803390	58.96
2	43.084478	-70.802983	56.11
3	43.084211	-70.803240	59.29
4	43.084415	-70.803648	62.46
5	43.084674	-70.803390	58.96

Name: PRPT2
Top height: 99.3 ft

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)
1	43.084580	-70.802457	53.31
2	43.083953	-70.801212	46.09
3	43.083224	-70.801856	52.36
4	43.083866	-70.803165	61.10
5	43.084580	-70.802457	53.31

Name: TREELINE
Top height: 35.0 ft

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)
1	43.085164	-70.808848	82.83
2	43.085454	-70.807942	81.22
3	43.085373	-70.807765	82.86
4	43.085040	-70.807564	86.97

Name: Trees
Top height: 30.0 ft

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)
1	43.083891	-70.811509	72.86
2	43.084095	-70.811240	67.62

Name: Trees
Top height: 17.0 ft

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)
1	43.085036	-70.807176	92.20
2	43.084131	-70.806567	95.41

Name: Trees1
Top height: 40.0 ft

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)
1	43.085261	-70.816979	84.00
2	43.084955	-70.816877	84.48
3	43.084477	-70.817247	78.24

Name: Trees2
Top height: 60.0 ft

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)
1	43.084443	-70.818109	84.34
2	43.084602	-70.818167	84.74
3	43.084354	-70.818474	88.75

Name: Trees3
Top height: 100.0 ft

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)
1	43.084287	-70.810576	72.89
2	43.084550	-70.810195	75.28

Name: Trees4
Top height: 30.0 ft

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)
1	43.085793	-70.815175	77.90
2	43.085354	-70.814585	81.00
3	43.086098	-70.812858	77.64

Name: Trees5
Top height: 45.0 ft

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)
1	43.084411	-70.807233	89.30
2	43.084554	-70.807316	89.33
3	43.084677	-70.807358	89.54
4	43.084730	-70.807552	87.97

Name: Trees6
Top height: 20.0 ft

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)
1	43.085286	-70.814633	80.07
2	43.083793	-70.813418	79.96

Name: Trees7
Top height: 30.0 ft

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)
1	43.083527	-70.812571	74.50
2	43.083829	-70.811932	72.49

Name: WRHSE1
Top height: 30.0 ft

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)
1	43.085129	-70.813496	81.26
2	43.085227	-70.813254	81.50
3	43.085137	-70.813085	81.35
4	43.084986	-70.813064	81.23
5	43.084886	-70.813292	81.62
6	43.085129	-70.813496	81.26

Name: WRHSE2
Top height: 30.0 ft

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)
1	43.084916	-70.813107	81.43
2	43.084740	-70.813499	81.62
3	43.084705	-70.813466	81.64
4	43.084630	-70.813662	81.71
5	43.084174	-70.813292	81.76
6	43.084399	-70.812785	81.68
7	43.084501	-70.812860	81.70
8	43.084540	-70.812758	81.66
9	43.084916	-70.813107	81.43

Glare Analysis Results

Summary of Results No glare predicted

PV Array	Tilt	Orient	Annual Green Glare		Annual Yellow Glare		Energy
	°	°	min	hr	min	hr	kWh
CRPRT1	0.0	124.0	0	0.0	0	0.0	-
CRPRT2	0.0	124.0	0	0.0	0	0.0	-
CRPRT3	0.0	124.0	0	0.0	0	0.0	-
CRPRT4	0.0	124.0	0	0.0	0	0.0	-
CRPRT5	0.0	214.0	0	0.0	0	0.0	-
LGBLDG	10.0	214.0	0	0.0	0	0.0	-
SMBLDG	10.0	214.0	0	0.0	0	0.0	-

Total annual glare received by each receptor; may include duplicate times of glare from multiple reflective surfaces.

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
1-ATCT	0	0.0	0	0.0
6-ATCT	0	0.0	0	0.0

PV: CRPRT1

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
1-ATCT	0	0.0	0	0.0
6-ATCT	0	0.0	0	0.0

CRPRT1 and 1-ATCT

Receptor type: ATCT Observation Point
No glare found

CRPRT1 and 6-ATCT

Receptor type: ATCT Observation Point
No glare found

PV: CRPRT2

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
1-ATCT	0	0.0	0	0.0
6-ATCT	0	0.0	0	0.0

CRPRT2 and 1-ATCT

Receptor type: ATCT Observation Point
No glare found

CRPRT2 and 6-ATCT

Receptor type: ATCT Observation Point
No glare found

PV: CRPRT3

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
1-ATCT	0	0.0	0	0.0
6-ATCT	0	0.0	0	0.0

CRPRT3 and 1-ATCT

Receptor type: ATCT Observation Point
No glare found

CRPRT3 and 6-ATCT

Receptor type: ATCT Observation Point
No glare found

PV: CRPRT4

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
1-ATCT	0	0.0	0	0.0
6-ATCT	0	0.0	0	0.0

CRPRT4 and 1-ATCT

Receptor type: ATCT Observation Point
No glare found

CRPRT4 and 6-ATCT

Receptor type: ATCT Observation Point
No glare found

PV: CRPRT5

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
1-ATCT	0	0.0	0	0.0
6-ATCT	0	0.0	0	0.0

CRPRT5 and 1-ATCT

Receptor type: ATCT Observation Point
No glare found

CRPRT5 and 6-ATCT

Receptor type: ATCT Observation Point
No glare found

PV: LGBLDG

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
1-ATCT	0	0.0	0	0.0
6-ATCT	0	0.0	0	0.0

LGBLDG and 1-ATCT

Receptor type: ATCT Observation Point
No glare found

LGBLDG and 6-ATCT

Receptor type: ATCT Observation Point
No glare found

PV: SMBLDG

Receptor	Annual Green Glare		Annual Yellow Glare	
	min	hr	min	hr
1-ATCT	0	0.0	0	0.0
6-ATCT	0	0.0	0	0.0

SMBLDG and 1-ATCT

Receptor type: ATCT Observation Point
No glare found

SMBLDG and 6-ATCT

Receptor type: ATCT Observation Point
No glare found

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
The algorithm does not rigorously represent the detailed geometry of a system; detailed features such as gaps between modules, variable height of the PV array, and support structures may impact actual glare results. However, we have validated our models against several systems, including a PV array causing glare to the air-traffic control tower at Manchester-Boston Regional Airport and several sites in Albuquerque, and the tool accurately predicted the occurrence and intensity of glare at different times and days of the year.
Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare. This primarily affects V1 analyses of path receptors.
Random number computations are utilized by various steps of the annual hazard analysis algorithm. Predicted minutes of glare can vary between runs as a result. This limitation primarily affects analyses of Observation Point receptors, including ATCTs. Note that the SGHAT/ ForgeSolar methodology has always relied on an analytical, qualitative approach to accurately determine the overall hazard (i.e. green vs. yellow) of expected glare on an annual basis.
The analysis does not automatically consider obstacles (either man-made or natural) between the observation points and the prescribed solar installation that may obstruct observed glare, such as trees, hills, buildings, etc.
The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
The variable direct normal irradiance (DNI) feature (if selected) scales the user-prescribed peak DNI using a typical clear-day irradiance profile. This profile has a lower DNI in the mornings and evenings and a maximum at solar noon. The scaling uses a clear-day irradiance profile based on a normalized time relative to sunrise, solar noon, and sunset, which are prescribed by a sun-position algorithm and the latitude and longitude obtained from Google maps. The actual DNI on any given day can be affected by cloud cover, atmospheric attenuation, and other environmental factors.
The ocular hazard predicted by the tool depends on a number of environmental, optical, and human factors, which can be uncertain. We provide input fields and typical ranges of values for these factors so that the user can vary these parameters to see if they have an impact on the results. The speed of SGHAT allows expedited sensitivity and parametric analyses.
The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

Default glare analysis parameters and observer eye characteristics (for reference only):

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

ALBACORE, Portsmouth, NH

Albacore_10DegreeTilt_124Carports_ATCT_FAAReport

Client: Lonza

Created Feb 22, 2024
Updated Feb 22, 2024
Time-step 1 minute
Timezone offset UTC-5
Minimum sun altitude 0.0 deg
Site ID 112738.19298

Project type Advanced
Project status: active
Category 1 MW to 5 MW

Misc. Analysis Settings

DNI: **varies (1,000.0 W/m^2 peak)**
Ocular transmission coefficient: **0.5**
Pupil diameter: **0.002 m**
Eye focal length: **0.017 m**
Sun subtended angle: **9.3 mrad**

PV Analysis Methodology: **Version 2**
Enhanced subtended angle calculation: **On**

Summary of Results No glare predicted!

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
CRPRT1	0.0	124.0	0	0	-
CRPRT2	0.0	124.0	0	0	-
CRPRT3	0.0	124.0	0	0	-
CRPRT4	0.0	124.0	0	0	-
CRPRT5	0.0	214.0	0	0	-
LGBLDG	10.0	214.0	0	0	-
SMBLDG	10.0	214.0	0	0	-

Component Data

PV Array(s)

Total PV footprint area: 3.1 acres

Name: CRPRT1
Footprint area: 0.20 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085650	-70.803723	57.92	20.17	78.09
2	43.085595	-70.803619	57.81	14.00	71.81
3	43.085032	-70.804187	64.54	14.00	78.54
4	43.085084	-70.804291	66.68	20.17	86.85

Name: CRPRT2
Footprint area: 0.26 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085519	-70.803626	57.88	22.48	80.36
2	43.085431	-70.803461	56.75	14.00	70.75
3	43.084981	-70.803912	58.98	14.00	72.98
4	43.085070	-70.804083	59.73	22.48	82.20

Name: CRPRT3
Footprint area: 0.23 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085400	-70.803418	56.90	22.48	79.38
2	43.085325	-70.803271	56.23	14.00	70.23
3	43.084876	-70.803716	58.56	14.00	72.56
4	43.084953	-70.803866	59.01	22.48	81.49

Name: CRPRT4
Footprint area: 0.13 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085298	-70.803223	56.02	20.17	76.19
2	43.085253	-70.803139	56.21	14.00	70.21
3	43.084808	-70.803572	58.45	14.00	72.45
4	43.084851	-70.803658	58.35	20.17	78.52

Name: CRPRT5
Footprint area: 0.07 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 214.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085549	-70.803405	56.86	20.17	77.02
2	43.085404	-70.803116	55.16	20.17	75.32
3	43.085334	-70.803188	55.25	14.00	69.25
4	43.085478	-70.803470	57.01	14.00	71.01

Name: LGBLDG
Footprint area: 2.0 acres
Axis tracking: Fixed (no rotation)
Tilt: 10.0 deg
Orientation: 214.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.084344	-70.802133	51.60	93.83	145.44
2	43.084054	-70.801543	49.18	93.83	143.01
3	43.083901	-70.801690	49.39	93.83	143.22
4	43.083859	-70.801609	49.20	93.83	143.03
5	43.083897	-70.801574	49.27	93.83	143.10
6	43.083839	-70.801453	47.35	93.83	141.18
7	43.083345	-70.801919	51.93	93.83	145.76
8	43.083906	-70.803019	59.40	93.83	153.23
9	43.084395	-70.802537	54.24	93.83	148.07
10	43.084315	-70.802368	51.53	93.83	145.36
11	43.084337	-70.802347	51.04	93.83	144.87
12	43.084303	-70.802278	52.48	93.83	146.31
13	43.084336	-70.802245	52.51	93.83	146.34
14	43.084297	-70.802171	51.69	93.83	145.52

Name: SMBLDG
Footprint area: 0.22 acre
Axis tracking: Fixed (no rotation)
Tilt: 10.0 deg
Orientation: 214.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.084480	-70.803051	56.19	88.00	144.19
2	43.084450	-70.803081	56.31	88.00	144.31
3	43.084506	-70.803193	56.74	88.00	144.74
4	43.084466	-70.803232	56.81	88.00	144.81
5	43.084412	-70.803118	56.55	88.00	144.55
6	43.084252	-70.803275	58.91	88.00	146.91
7	43.084414	-70.803594	61.58	88.00	149.58
8	43.084643	-70.803375	58.79	88.00	146.79

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	ft	ft	ft
1-ATCT	43.084384	-70.818882	89.93	130.00	219.93
OP 2	43.082455	-70.800057	42.02	20.00	62.02
OP 3	43.082529	-70.799934	41.99	30.00	71.99
OP 4	43.083085	-70.799471	39.01	6.00	45.01
OP 5	43.083191	-70.799294	38.75	15.00	53.75
6-ATCT	43.084349	-70.818856	89.97	120.00	209.97

1-ATCT map image

6-ATCT map image

Obstruction Components

Name: BLDG1
Upper edge height: 12.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084600	-70.810084	76.71
2	43.084703	-70.809846	77.63
3	43.084534	-70.809702	77.38
4	43.084428	-70.809944	77.34
5	43.084600	-70.810084	76.71

Name: BLDG2
Upper edge height: 20.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084955	-70.806346	99.52
2	43.085031	-70.806408	98.08
3	43.084866	-70.806801	99.55
4	43.084555	-70.806565	99.98
5	43.084608	-70.806439	99.85
6	43.084444	-70.806325	99.64
7	43.084592	-70.806011	99.08
8	43.084965	-70.806346	99.43

Name: HighEdge1
Upper edge height: 22.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085534	-70.803609	57.89
2	43.085267	-70.803116	55.50

Name: HighEdge2
Upper edge height: 22.5 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085593	-70.803598	57.75
2	43.085019	-70.804161	63.07

Name: HighEdge3
Upper edge height: 22.5 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085424	-70.803445	56.71
2	43.084960	-70.803895	59.16

Name: HighEdge4
Upper edge height: 20.2 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085307	-70.803260	56.28
2	43.084860	-70.803684	58.42

Name: PRPT1
Upper edge height: 93.2 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084674	-70.803390	58.96
2	43.084478	-70.802983	56.11
3	43.084211	-70.803240	59.29
4	43.084415	-70.803648	62.46
5	43.084674	-70.803390	58.96

Name: PRPT2
Upper edge height: 99.3 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084580	-70.802457	53.31
2	43.083953	-70.801212	46.09
3	43.083224	-70.801856	52.36
4	43.083866	-70.803165	61.10
5	43.084580	-70.802457	53.31

Name: TREELINE
Upper edge height: 35.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085164	-70.808848	82.83
2	43.085454	-70.807942	81.22
3	43.085373	-70.807765	82.86
4	43.085040	-70.807564	86.97

Name: Trees
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.083891	-70.811509	72.86
2	43.084095	-70.811240	67.62

Name: Trees
Upper edge height: 17.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085036	-70.807176	92.20
2	43.084131	-70.806567	95.41

Name: Trees1
Upper edge height: 40.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085261	-70.816979	84.00
2	43.084955	-70.816877	84.48
3	43.084477	-70.817247	78.24

Name: Trees2
Upper edge height: 60.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084443	-70.818109	84.34
2	43.084602	-70.818167	84.74
3	43.084354	-70.818474	88.75

Name: Trees3
Upper edge height: 100.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084287	-70.810576	72.89
2	43.084550	-70.810195	75.28

Name: Trees4
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085793	-70.815175	77.90
2	43.085354	-70.814585	81.00
3	43.086098	-70.812858	77.64

Name: Trees5
Upper edge height: 45.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084411	-70.807233	89.30
2	43.084554	-70.807316	89.33
3	43.084677	-70.807358	89.54
4	43.084730	-70.807552	87.97

Name: Trees6
Upper edge height: 20.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085286	-70.814633	80.07
2	43.083793	-70.813418	79.96

Name: Trees7
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.083527	-70.812571	74.50
2	43.083829	-70.811932	72.49

Name: WRHSE1
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085129	-70.813496	81.26
2	43.085227	-70.813254	81.50
3	43.085137	-70.813085	81.35
4	43.084986	-70.813064	81.23
5	43.084886	-70.813292	81.62
6	43.085129	-70.813496	81.26

Name: WRHSE2
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084916	-70.813107	81.43
2	43.084740	-70.813499	81.62
3	43.084705	-70.813466	81.64
4	43.084630	-70.813662	81.71
5	43.084174	-70.813292	81.76
6	43.084399	-70.812785	81.68
7	43.084501	-70.812860	81.70
8	43.084540	-70.812758	81.66
9	43.084916	-70.813107	81.43

Summary of PV Glare Analysis

PV configuration and total predicted glare

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced	Data File
	deg	deg	min	min	kWh	
CRPRT1	0.0	124.0	0	0	-	-
CRPRT2	0.0	124.0	0	0	-	-
CRPRT3	0.0	124.0	0	0	-	-
CRPRT4	0.0	124.0	0	0	-	-
CRPRT5	0.0	214.0	0	0	-	-
LGBLDG	10.0	214.0	0	0	-	-
SMBLDG	10.0	214.0	0	0	-	-

PV & Receptor Analysis Results

Results for each PV array and receptor

CRPRT1 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0

No glare found

CRPRT2 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0

No glare found

CRPRT3 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0

No glare found

CRPRT4 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0

No glare found

CRPRT5 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0

No glare found

LGBLDG no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0

No glare found

SMBLDG no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0

No glare found

Assumptions

- Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
- Glare analyses do not automatically account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographi obstructions.
- Detailed system geometry is not rigorously simulated.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values and results may vary.
- The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
- Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for larg PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.
- The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
- Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, nc discrete, spectrum.
- Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
- Refer to the **Help page** for detailed assumptions and limitations not listed here.

ALBACORE, Portsmouth, NH

ALBCR_15Tilt_124Carports_NOObstrctns_2ATCT_AddOP

Client: Lonza

Created Feb 22, 2024
Updated Feb 22, 2024
Time-step 1 minute
Timezone offset UTC-5
Minimum sun altitude 0.0 deg
Site ID 112714.19298

Project type Advanced
Project status: active
Category 1 MW to 5 MW

Misc. Analysis Settings

DNI: **varies (1,000.0 W/m^2 peak)**
Ocular transmission coefficient: **0.5**
Pupil diameter: **0.002 m**
Eye focal length: **0.017 m**
Sun subtended angle: **9.3 mrad**

PV Analysis Methodology: **Version 2**
Enhanced subtended angle calculation: **On**

Summary of Results

Glare with low potential for temporary after-image predicted

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
CRPRT1	0.0	124.0	1,543	0	-
CRPRT2	0.0	124.0	0	0	-
CRPRT3	0.0	124.0	1,314	0	-
CRPRT4	0.0	124.0	1,617	0	-
CRPRT5	0.0	214.0	0	0	-
LGBLDG	15.0	214.0	0	0	-
SMBLDG	15.0	214.0	0	0	-

Component Data

PV Array(s)

Total PV footprint area: 3.1 acres

Name: CRPRT1
Footprint area: 0.20 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085650	-70.803723	57.92	20.17	78.09
2	43.085595	-70.803619	57.81	14.00	71.81
3	43.085032	-70.804187	64.54	14.00	78.54
4	43.085084	-70.804291	66.68	20.17	86.85

Name: CRPRT2
Footprint area: 0.26 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085519	-70.803626	57.88	22.48	80.36
2	43.085431	-70.803461	56.75	14.00	70.75
3	43.084981	-70.803912	58.98	14.00	72.98
4	43.085070	-70.804083	59.73	22.48	82.20

Name: CRPRT3
Footprint area: 0.23 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085400	-70.803418	56.90	22.48	79.38
2	43.085325	-70.803271	56.23	14.00	70.23
3	43.084876	-70.803716	58.56	14.00	72.56
4	43.084953	-70.803866	59.01	22.48	81.49

Name: CRPRT4
Footprint area: 0.13 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085298	-70.803223	56.02	20.17	76.19
2	43.085253	-70.803139	56.21	14.00	70.21
3	43.084808	-70.803572	58.45	14.00	72.45
4	43.084851	-70.803658	58.35	20.17	78.52

Name: CRPRT5
Footprint area: 0.07 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 214.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085549	-70.803405	56.86	20.17	77.02
2	43.085404	-70.803116	55.16	20.17	75.32
3	43.085334	-70.803188	55.25	14.00	69.25
4	43.085478	-70.803470	57.01	14.00	71.01

Name: LGBLDG
Footprint area: 2.0 acres
Axis tracking: Fixed (no rotation)
Tilt: 15.0 deg
Orientation: 214.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.084344	-70.802133	51.60	93.83	145.44
2	43.084054	-70.801543	49.18	93.83	143.01
3	43.083901	-70.801690	49.39	93.83	143.22
4	43.083859	-70.801609	49.20	93.83	143.03
5	43.083897	-70.801574	49.27	93.83	143.10
6	43.083839	-70.801453	47.35	93.83	141.18
7	43.083345	-70.801919	51.93	93.83	145.76
8	43.083906	-70.803019	59.40	93.83	153.23
9	43.084395	-70.802537	54.24	93.83	148.07
10	43.084315	-70.802368	51.53	93.83	145.36
11	43.084337	-70.802347	51.04	93.83	144.87
12	43.084303	-70.802278	52.48	93.83	146.31
13	43.084336	-70.802245	52.51	93.83	146.34
14	43.084297	-70.802171	51.69	93.83	145.52

Name: SMBLDG
Footprint area: 0.22 acre
Axis tracking: Fixed (no rotation)
Tilt: 15.0 deg
Orientation: 214.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.084480	-70.803051	56.19	88.00	144.19
2	43.084450	-70.803081	56.31	88.00	144.31
3	43.084506	-70.803193	56.74	88.00	144.74
4	43.084466	-70.803232	56.81	88.00	144.81
5	43.084412	-70.803118	56.55	88.00	144.55
6	43.084252	-70.803275	58.91	88.00	146.91
7	43.084414	-70.803594	61.58	88.00	149.58
8	43.084643	-70.803375	58.79	88.00	146.79

Route Receptor(s)

Name: Route 1
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.082607	-70.800659	43.16	4.50	47.66
2	43.082965	-70.800254	39.75	4.50	44.25
3	43.084118	-70.798835	40.69	4.50	45.19

Name: Route 2
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.084096	-70.798795	40.76	8.50	49.26
2	43.082949	-70.800223	39.72	8.50	48.22
3	43.082597	-70.800616	42.88	8.50	51.38

Name: Route 3
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085442	-70.804811	63.97	4.50	68.47
2	43.084962	-70.804519	67.50	4.50	72.00
3	43.084962	-70.804519	67.50	4.50	72.00
4	43.084630	-70.804302	69.07	4.50	73.57
5	43.084630	-70.804302	69.07	4.50	73.57
6	43.084394	-70.804068	68.75	4.50	73.25
7	43.083881	-70.803489	64.40	4.50	68.90
8	43.083614	-70.803103	60.85	4.50	65.35

Name: Route 4
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.083602	-70.803135	60.76	8.50	69.26
2	43.083841	-70.803542	64.38	8.50	72.88
3	43.084382	-70.804111	68.76	8.50	77.26
4	43.084618	-70.804339	69.09	8.50	77.59
5	43.084618	-70.804339	69.09	8.50	77.59
6	43.084888	-70.804519	67.86	8.50	76.36
7	43.084888	-70.804519	67.86	8.50	76.36
8	43.085416	-70.804830	64.17	8.50	72.67

Name: Route 5
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.082313	-70.799503	41.53	4.50	46.03
2	43.082995	-70.798326	37.86	4.50	42.36

Name: Route 6
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.082966	-70.798285	37.86	8.50	46.36
2	43.082274	-70.799457	41.51	8.50	50.01

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	ft	ft	ft
1-ATCT	43.084384	-70.818882	89.93	130.00	219.93
OP 2	43.082455	-70.800057	42.02	20.00	62.02
OP 3	43.082529	-70.799934	41.99	30.00	71.99
OP 4	43.083085	-70.799471	39.01	6.00	45.01
OP 5	43.083191	-70.799294	38.75	15.00	53.75
6-ATCT	43.084349	-70.818856	89.97	120.00	209.97
OP 7	43.083312	-70.803940	70.10	40.00	110.10

1-ATCT map image

6-ATCT map image

Obstruction Components

Name: HighEdge1
Upper edge height: 22.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085534	-70.803609	57.89
2	43.085267	-70.803116	55.50

Name: HighEdge2
Upper edge height: 22.5 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085593	-70.803598	57.75
2	43.085019	-70.804161	63.07

Name: HighEdge3
Upper edge height: 22.5 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085424	-70.803445	56.71
2	43.084960	-70.803895	59.16

Name: HighEdge4
Upper edge height: 20.2 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085307	-70.803260	56.28
2	43.084860	-70.803684	58.42

Name: PRPT1
Upper edge height: 93.2 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084674	-70.803390	58.96
2	43.084478	-70.802983	56.11
3	43.084211	-70.803240	59.29
4	43.084415	-70.803648	62.46
5	43.084674	-70.803390	58.96

Name: PRPT2
Upper edge height: 99.3 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084580	-70.802457	53.31
2	43.083953	-70.801212	46.09
3	43.083224	-70.801856	52.36
4	43.083866	-70.803165	61.10
5	43.084580	-70.802457	53.31

Summary of PV Glare Analysis

PV configuration and total predicted glare

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced	Data File
	deg	deg	min	min	kWh	
CRPRT1	0.0	124.0	1,543	0	-	-
CRPRT2	0.0	124.0	0	0	-	-
CRPRT3	0.0	124.0	1,314	0	-	-
CRPRT4	0.0	124.0	1,617	0	-	-
CRPRT5	0.0	214.0	0	0	-	-
LGBLDG	15.0	214.0	0	0	-	-
SMBLDG	15.0	214.0	0	0	-	-

Distinct glare per month

Excludes overlapping glare from PV array for multiple receptors at matching time(s)

PV	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
crprt1 (green)	0	0	105	292	0	0	0	81	319	0	0	0
crprt1 (yellow)	0	0	0	0	0	0	0	0	0	0	0	0
crprt3 (green)	0	88	142	137	0	0	0	1	281	86	0	0
crprt3 (yellow)	0	0	0	0	0	0	0	0	0	0	0	0
crprt4 (green)	0	139	219	103	0	0	0	0	273	187	0	0
crprt4 (yellow)	0	0	0	0	0	0	0	0	0	0	0	0

PV & Receptor Analysis Results

Results for each PV array and receptor

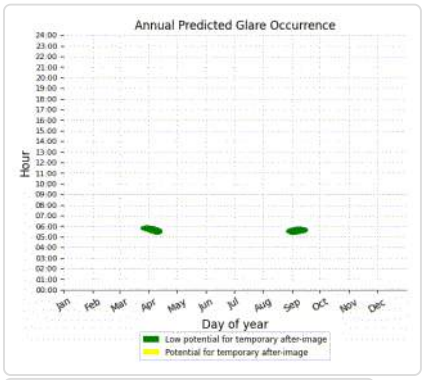
CRPRT1 low potential for temporary after-image

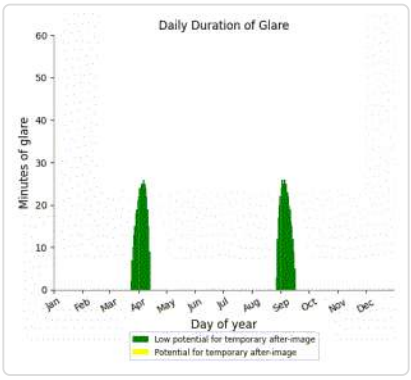
Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	783	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	760	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

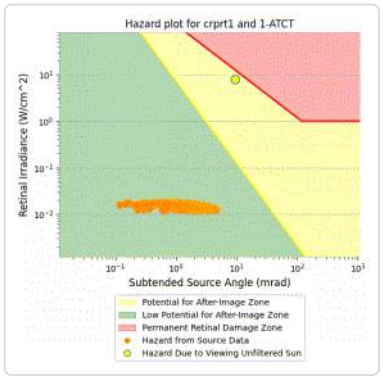
CRPRT1: 1-ATCT

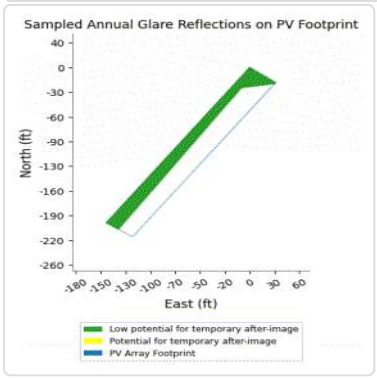
PV array is expected to produce the following glare for this receptor:

- 783 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.









CRPRT1: OP 2

No glare found

CRPRT1: OP 3

No glare found

CRPRT1: OP 4

No glare found

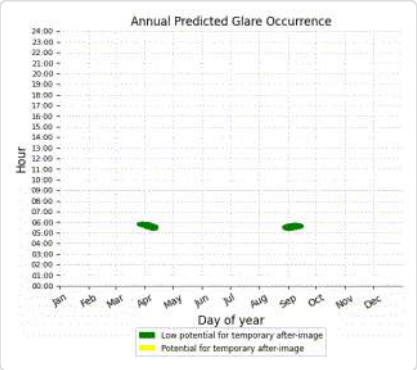
CRPRT1: OP 5

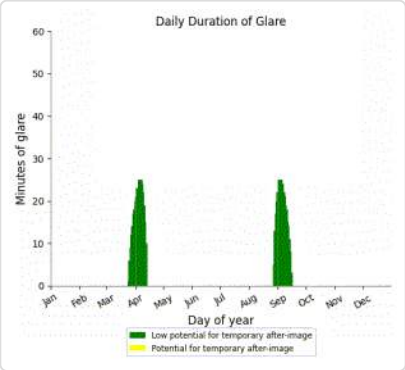
No glare found

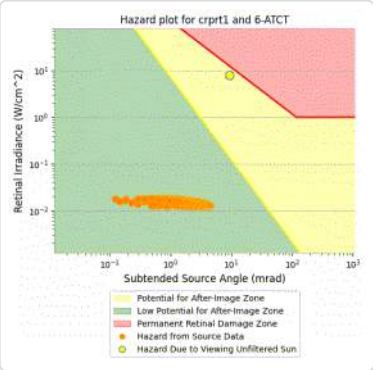
CRPRT1: 6-ATCT

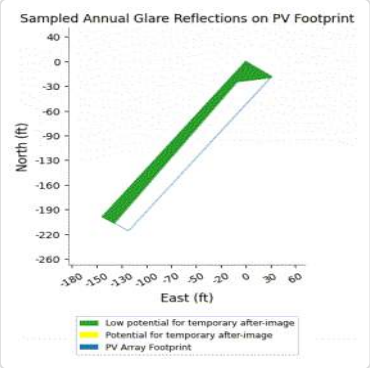
PV array is expected to produce the following glare for this receptor:

- 760 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.









CRPRT1: OP 7

No glare found

CRPRT1: Route 1

No glare found

CRPRT1: Route 2

No glare found

CRPRT1: Route 3

No glare found

CRPRT1: Route 4

No glare found

CRPRT1: Route 5

No glare found

CRPRT1: Route 6

No glare found

CRPRT2 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

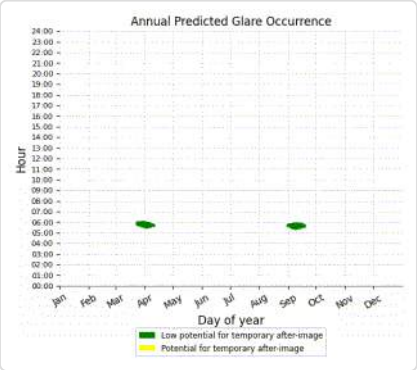
CRPRT3 low potential for temporary after-image

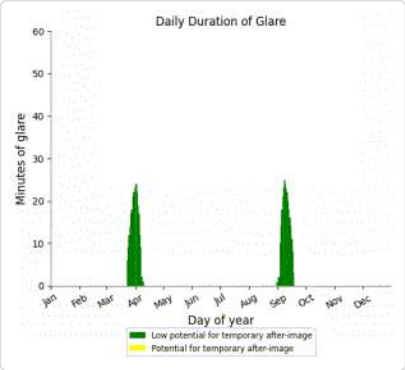
Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	548	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	530	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	78	0
Route: Route 4	158	0
Route: Route 5	0	0
Route: Route 6	0	0

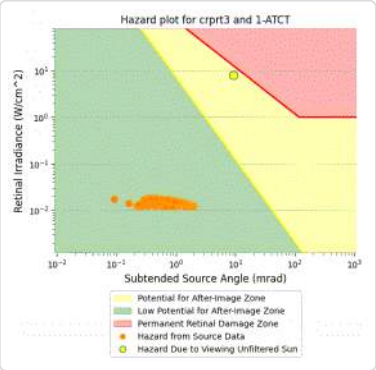
CRPRT3: 1-ATCT

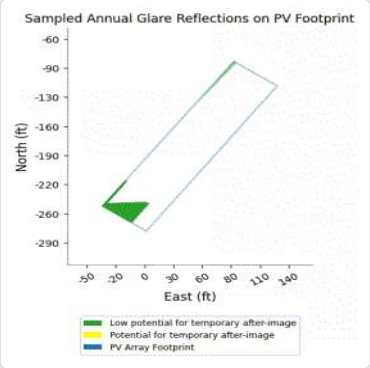
PV array is expected to produce the following glare for this receptor:

- 548 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.









CRPRT3: OP 2

No glare found

CRPRT3: OP 3

No glare found

CRPRT3: OP 4

No glare found

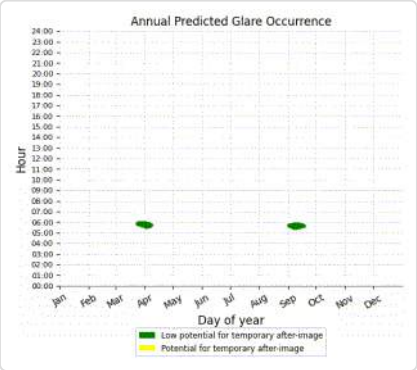
CRPRT3: OP 5

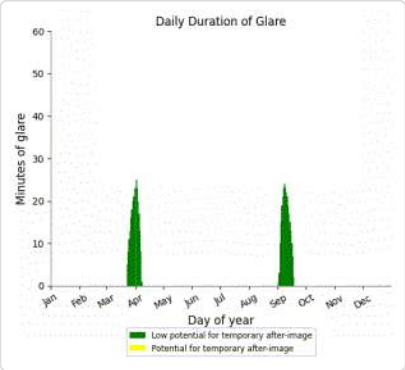
No glare found

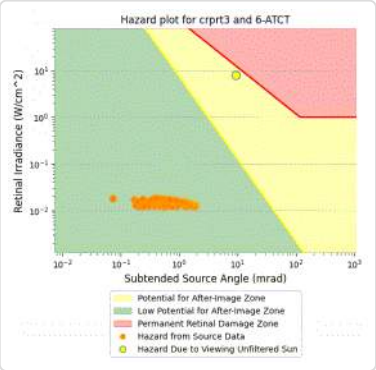
CRPRT3: 6-ATCT

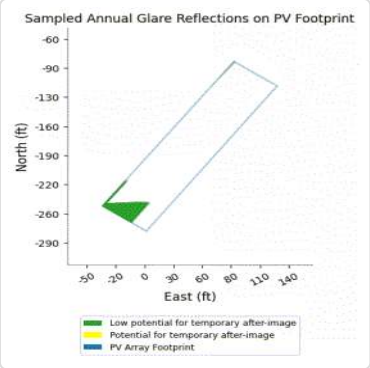
PV array is expected to produce the following glare for this receptor:

- 530 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.









CRPRT3: OP 7

No glare found

CRPRT3: Route 1

No glare found

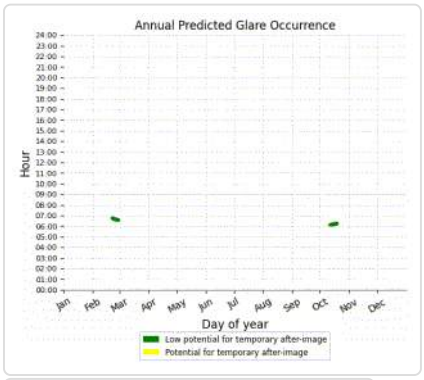
CRPRT3: Route 2

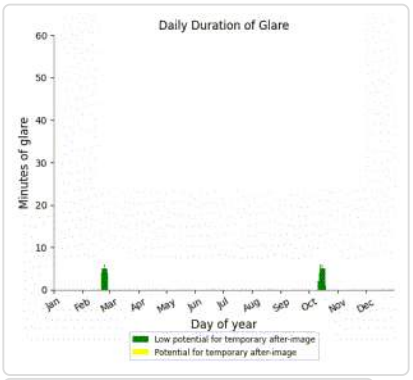
No glare found

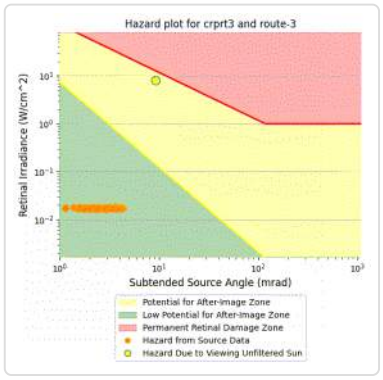
CRPRT3: Route 3

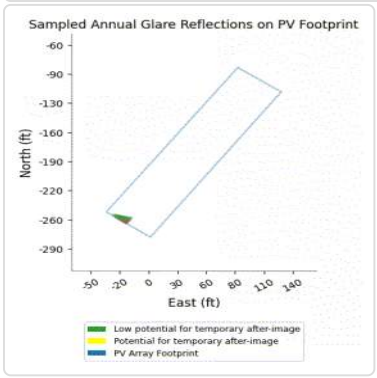
PV array is expected to produce the following glare for this receptor:

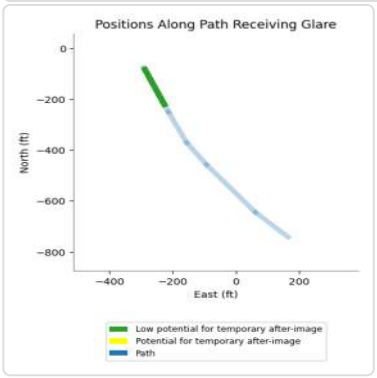
- 78 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.







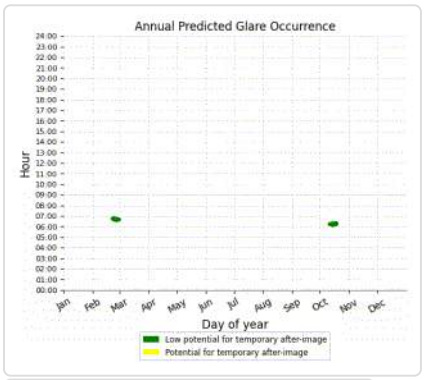


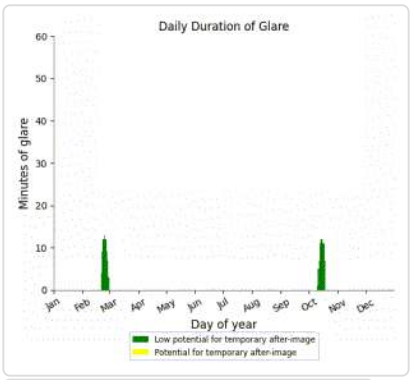


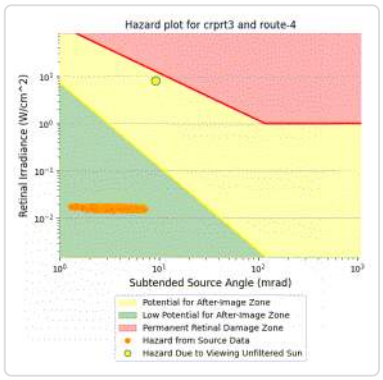
CRPRT3: Route 4

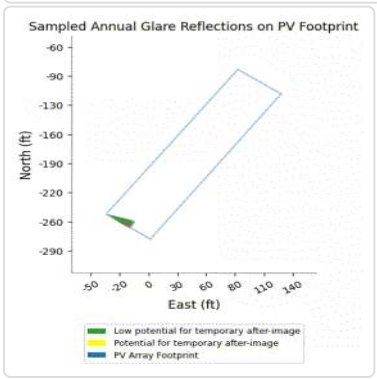
PV array is expected to produce the following glare for this receptor:

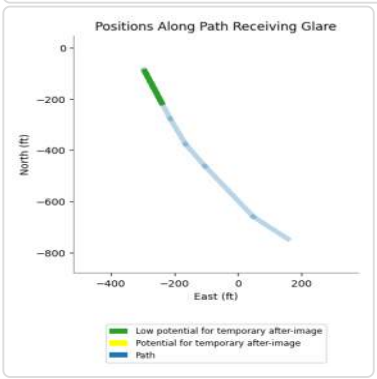
- 158 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.











CRPRT3: Route 5

No glare found

CRPRT3: Route 6

No glare found

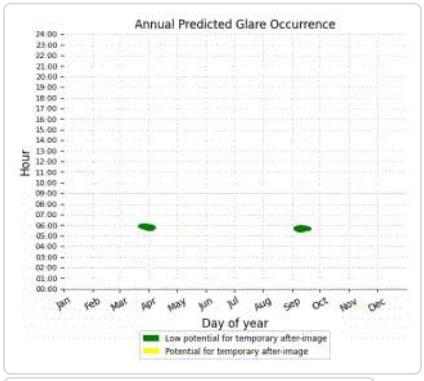
CRPRT4 low potential for temporary after-image

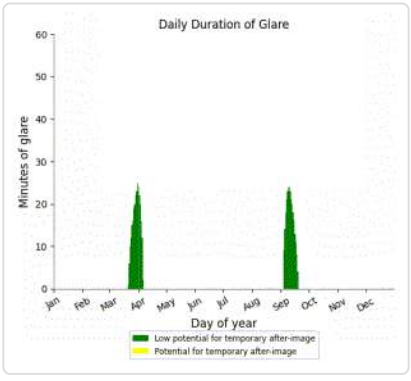
Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	532	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	514	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	314	0
Route: Route 4	257	0
Route: Route 5	0	0
Route: Route 6	0	0

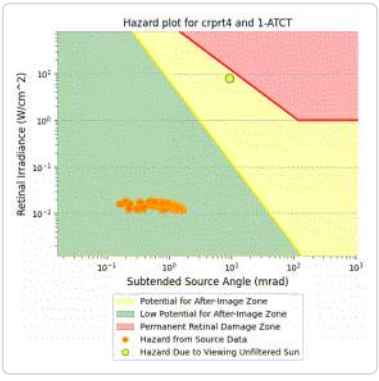
CRPRT4: 1-ATCT

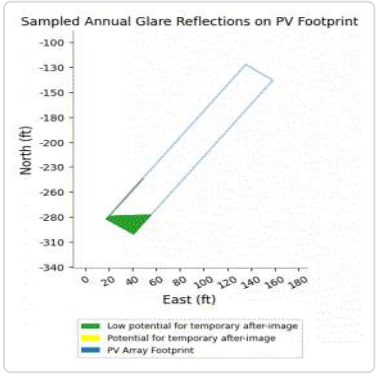
PV array is expected to produce the following glare for this receptor:

- 532 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.









CRPRT4: OP 2

No glare found

CRPRT4: OP 3

No glare found

CRPRT4: OP 4

No glare found

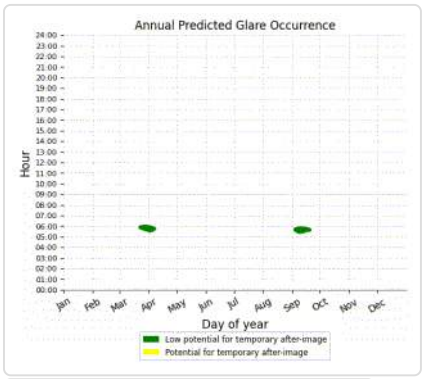
CRPRT4: OP 5

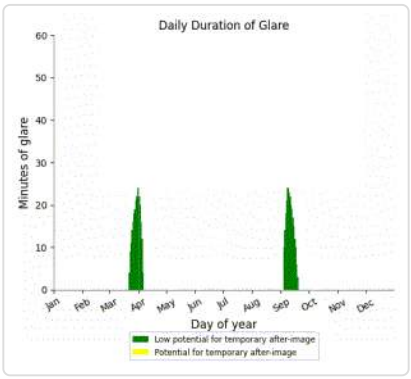
No glare found

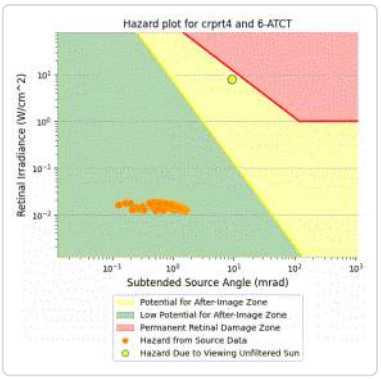
CRPRT4: 6-ATCT

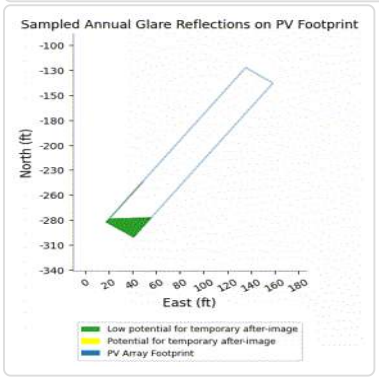
PV array is expected to produce the following glare for this receptor:

- 514 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.









CRPRT4: OP 7

No glare found

CRPRT4: Route 1

No glare found

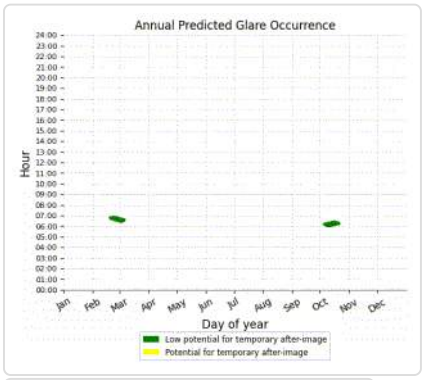
CRPRT4: Route 2

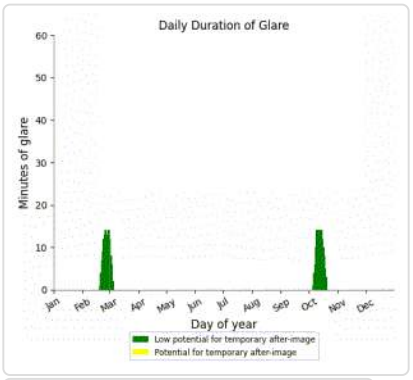
No glare found

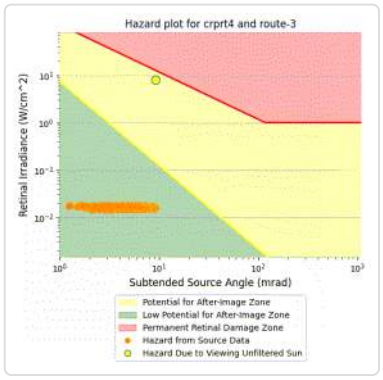
CRPRT4: Route 3

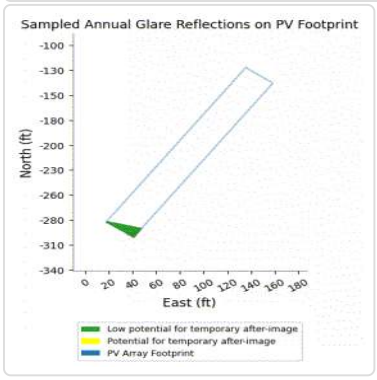
PV array is expected to produce the following glare for this receptor:

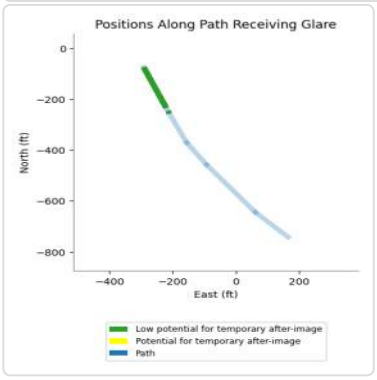
- 314 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.







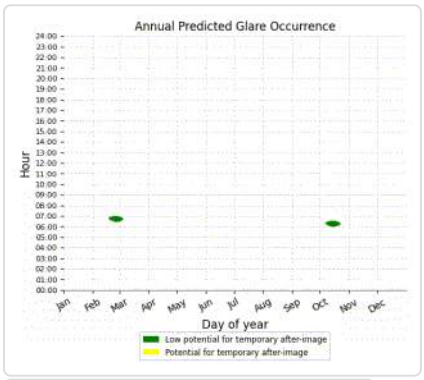


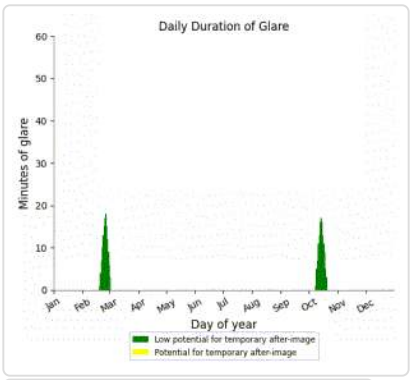


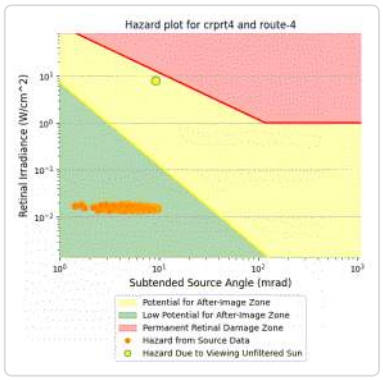
CRPRT4: Route 4

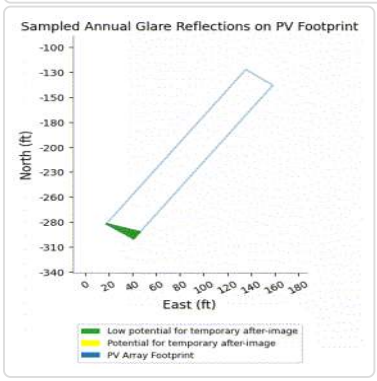
PV array is expected to produce the following glare for this receptor:

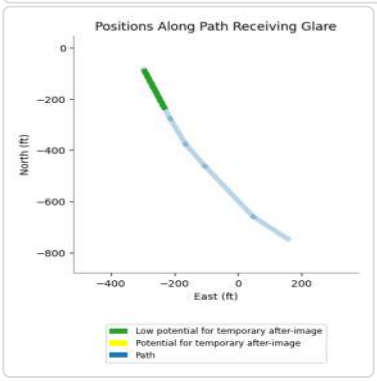
- 257 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.











CRPRT4: Route 5

No glare found

CRPRT4: Route 6

No glare found

CRPRT5 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

LGBLDG no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

SMBLDG no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

Assumptions

- Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
- Glare analyses do not automatically account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographi obstructions.
- Detailed system geometry is not rigorously simulated.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values and results may vary.
- The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
- Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for larg PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.
- The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
- Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, nc discrete, spectrum.
- Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
- Refer to the **Help page** for detailed assumptions and limitations not listed here.

ALBACORE, Portsmouth, NH

ALBCR_10Tilt_124Carports_Obstrctns_2ATCT_AddOP

Client: Lonza

Created Feb 22, 2024
Updated Feb 22, 2024
Time-step 1 minute
Timezone offset UTC-5
Minimum sun altitude 0.0 deg
Site ID 112715.19298

Project type Advanced
Project status: active
Category 1 MW to 5 MW

Misc. Analysis Settings

DNI: **varies (1,000.0 W/m^2 peak)**
Ocular transmission coefficient: **0.5**
Pupil diameter: **0.002 m**
Eye focal length: **0.017 m**
Sun subtended angle: **9.3 mrad**

PV Analysis Methodology: **Version 2**
Enhanced subtended angle calculation: **On**

Summary of Results No glare predicted!

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
CRPRT1	0.0	124.0	0	0	-
CRPRT2	0.0	124.0	0	0	-
CRPRT3	0.0	124.0	0	0	-
CRPRT4	0.0	124.0	0	0	-
CRPRT5	0.0	214.0	0	0	-
LGBLDG	10.0	214.0	0	0	-
SMBLDG	10.0	214.0	0	0	-

Component Data

PV Array(s)

Total PV footprint area: 3.1 acres

Name: CRPRT1
Footprint area: 0.20 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085650	-70.803723	57.92	20.17	78.09
2	43.085595	-70.803619	57.81	14.00	71.81
3	43.085032	-70.804187	64.54	14.00	78.54
4	43.085084	-70.804291	66.68	20.17	86.85

Name: CRPRT2
Footprint area: 0.26 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085519	-70.803626	57.88	22.48	80.36
2	43.085431	-70.803461	56.75	14.00	70.75
3	43.084981	-70.803912	58.98	14.00	72.98
4	43.085070	-70.804083	59.73	22.48	82.20

Name: CRPRT3
Footprint area: 0.23 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085400	-70.803418	56.90	22.48	79.38
2	43.085325	-70.803271	56.23	14.00	70.23
3	43.084876	-70.803716	58.56	14.00	72.56
4	43.084953	-70.803866	59.01	22.48	81.49

Name: CRPRT4
Footprint area: 0.13 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085298	-70.803223	56.02	20.17	76.19
2	43.085253	-70.803139	56.21	14.00	70.21
3	43.084808	-70.803572	58.45	14.00	72.45
4	43.084851	-70.803658	58.35	20.17	78.52

Name: CRPRT5
Footprint area: 0.07 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 214.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085549	-70.803405	56.86	20.17	77.02
2	43.085404	-70.803116	55.16	20.17	75.32
3	43.085334	-70.803188	55.25	14.00	69.25
4	43.085478	-70.803470	57.01	14.00	71.01

Name: LGBLDG
Footprint area: 2.0 acres
Axis tracking: Fixed (no rotation)
Tilt: 10.0 deg
Orientation: 214.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.084344	-70.802133	51.60	93.83	145.44
2	43.084054	-70.801543	49.18	93.83	143.01
3	43.083901	-70.801690	49.39	93.83	143.22
4	43.083859	-70.801609	49.20	93.83	143.03
5	43.083897	-70.801574	49.27	93.83	143.10
6	43.083839	-70.801453	47.35	93.83	141.18
7	43.083345	-70.801919	51.93	93.83	145.76
8	43.083906	-70.803019	59.40	93.83	153.23
9	43.084395	-70.802537	54.24	93.83	148.07
10	43.084315	-70.802368	51.53	93.83	145.36
11	43.084337	-70.802347	51.04	93.83	144.87
12	43.084303	-70.802278	52.48	93.83	146.31
13	43.084336	-70.802245	52.51	93.83	146.34
14	43.084297	-70.802171	51.69	93.83	145.52

Name: SMBLDG
Footprint area: 0.22 acre
Axis tracking: Fixed (no rotation)
Tilt: 10.0 deg
Orientation: 214.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.084480	-70.803051	56.19	88.00	144.19
2	43.084450	-70.803081	56.31	88.00	144.31
3	43.084506	-70.803193	56.74	88.00	144.74
4	43.084466	-70.803232	56.81	88.00	144.81
5	43.084412	-70.803118	56.55	88.00	144.55
6	43.084252	-70.803275	58.91	88.00	146.91
7	43.084414	-70.803594	61.58	88.00	149.58
8	43.084643	-70.803375	58.79	88.00	146.79

Route Receptor(s)

Name: Route 1
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.082607	-70.800659	43.16	4.50	47.66
2	43.082965	-70.800254	39.75	4.50	44.25
3	43.084118	-70.798835	40.69	4.50	45.19

Name: Route 2
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.084096	-70.798795	40.76	8.50	49.26
2	43.082949	-70.800223	39.72	8.50	48.22
3	43.082597	-70.800616	42.88	8.50	51.38

Name: Route 3
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085442	-70.804811	63.97	4.50	68.47
2	43.084962	-70.804519	67.50	4.50	72.00
3	43.084962	-70.804519	67.50	4.50	72.00
4	43.084630	-70.804302	69.07	4.50	73.57
5	43.084630	-70.804302	69.07	4.50	73.57
6	43.084394	-70.804068	68.75	4.50	73.25
7	43.083881	-70.803489	64.40	4.50	68.90
8	43.083614	-70.803103	60.85	4.50	65.35

Name: Route 4
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.083602	-70.803135	60.76	8.50	69.26
2	43.083841	-70.803542	64.38	8.50	72.88
3	43.084382	-70.804111	68.76	8.50	77.26
4	43.084618	-70.804339	69.09	8.50	77.59
5	43.084618	-70.804339	69.09	8.50	77.59
6	43.084888	-70.804519	67.86	8.50	76.36
7	43.084888	-70.804519	67.86	8.50	76.36
8	43.085416	-70.804830	64.17	8.50	72.67

Name: Route 5
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.082313	-70.799503	41.53	4.50	46.03
2	43.082995	-70.798326	37.86	4.50	42.36

Name: Route 6
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.082966	-70.798285	37.86	8.50	46.36
2	43.082274	-70.799457	41.51	8.50	50.01

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	ft	ft	ft
1-ATCT	43.084384	-70.818882	89.93	130.00	219.93
OP 2	43.082455	-70.800057	42.02	20.00	62.02
OP 3	43.082529	-70.799934	41.99	30.00	71.99
OP 4	43.083085	-70.799471	39.01	6.00	45.01
OP 5	43.083191	-70.799294	38.75	15.00	53.75
6-ATCT	43.084349	-70.818856	89.97	120.00	209.97
OP 7	43.083343	-70.803962	70.10	40.00	110.10

1-ATCT map image

6-ATCT map image

Obstruction Components

Name: BLDG2
Upper edge height: 20.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084955	-70.806346	99.52
2	43.085031	-70.806408	98.08
3	43.084866	-70.806801	99.55
4	43.084555	-70.806565	99.98
5	43.084608	-70.806439	99.85
6	43.084444	-70.806325	99.64
7	43.084592	-70.806011	99.08
8	43.084965	-70.806346	99.43

Name: HighEdge1
Upper edge height: 22.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085534	-70.803609	57.89
2	43.085267	-70.803116	55.50

Name: HighEdge2
Upper edge height: 22.5 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085593	-70.803598	57.75
2	43.085019	-70.804161	63.07

Name: HighEdge3
Upper edge height: 22.5 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085424	-70.803445	56.71
2	43.084960	-70.803895	59.16

Name: HighEdge4
Upper edge height: 20.2 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085307	-70.803260	56.28
2	43.084860	-70.803684	58.42

Name: PLANTING
Upper edge height: 9.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085446	-70.804721	64.24
2	43.084717	-70.804268	69.47
3	43.084592	-70.804158	69.46

Name: PRPT1
Upper edge height: 93.2 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084674	-70.803390	58.96
2	43.084478	-70.802983	56.11
3	43.084211	-70.803240	59.29
4	43.084415	-70.803648	62.46
5	43.084674	-70.803390	58.96

Name: PRPT2
Upper edge height: 99.3 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084580	-70.802457	53.31
2	43.083953	-70.801212	46.09
3	43.083224	-70.801856	52.36
4	43.083866	-70.803165	61.10
5	43.084580	-70.802457	53.31

Name: TREELINE
Upper edge height: 35.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085164	-70.808848	82.83
2	43.085454	-70.807942	81.22
3	43.085373	-70.807765	82.86
4	43.085040	-70.807564	86.97

Name: Trees
Upper edge height: 17.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085036	-70.807176	92.20
2	43.084131	-70.806567	95.41

Name: Trees
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.083891	-70.811509	72.86
2	43.084095	-70.811240	67.62

Name: Trees1
Upper edge height: 40.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085261	-70.816979	84.00
2	43.084955	-70.816877	84.48
3	43.084477	-70.817247	78.24

Name: Trees2
Upper edge height: 60.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084443	-70.818109	84.34
2	43.084602	-70.818167	84.74
3	43.084354	-70.818474	88.75

Name: Trees3
Upper edge height: 100.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084287	-70.810576	72.89
2	43.084550	-70.810195	75.28

Name: Trees4
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085793	-70.815175	77.90
2	43.085354	-70.814585	81.00
3	43.086098	-70.812858	77.64

Name: Trees5
Upper edge height: 45.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084411	-70.807233	89.30
2	43.084554	-70.807316	89.33
3	43.084677	-70.807358	89.54
4	43.084730	-70.807552	87.97

Name: Trees6
Upper edge height: 20.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085286	-70.814633	80.07
2	43.083793	-70.813418	79.96

Name: Trees7
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.083527	-70.812571	74.50
2	43.083829	-70.811932	72.49

Name: WRHSE1
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085129	-70.813496	81.26
2	43.085227	-70.813254	81.50
3	43.085137	-70.813085	81.35
4	43.084986	-70.813064	81.23
5	43.084886	-70.813292	81.62
6	43.085129	-70.813496	81.26

Name: WRHSE2
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084916	-70.813107	81.43
2	43.084740	-70.813499	81.62
3	43.084705	-70.813466	81.64
4	43.084630	-70.813662	81.71
5	43.084174	-70.813292	81.76
6	43.084399	-70.812785	81.68
7	43.084501	-70.812860	81.70
8	43.084540	-70.812758	81.66
9	43.084916	-70.813107	81.43

Summary of PV Glare Analysis

PV configuration and total predicted glare

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced	Data File
	deg	deg	min	min	kWh	
CRPRT1	0.0	124.0	0	0	-	-
CRPRT2	0.0	124.0	0	0	-	-
CRPRT3	0.0	124.0	0	0	-	-
CRPRT4	0.0	124.0	0	0	-	-
CRPRT5	0.0	214.0	0	0	-	-
LGBLDG	10.0	214.0	0	0	-	-
SMBLDG	10.0	214.0	0	0	-	-

PV & Receptor Analysis Results

Results for each PV array and receptor

CRPRT1 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

CRPRT2 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

CRPRT3 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

CRPRT4 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

CRPRT5 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

LGBLDG no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

SMBLDG no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

Assumptions

- Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
- Glare analyses do not automatically account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographi obstructions.
- Detailed system geometry is not rigorously simulated.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values and results may vary.

- The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
- Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for larg PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.
- The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
- Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, nc discrete, spectrum.
- Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
- Refer to the **Help page** for detailed assumptions and limitations not listed here.

ALBACORE, Portsmouth, NH

ALBCR_5Tilt_124Carports_Obstrctns_2ATCT_NoPlant

Client: Lonza

Created Feb 22, 2024
Updated Feb 22, 2024
Time-step 1 minute
Timezone offset UTC-5
Minimum sun altitude 0.0 deg
Site ID 112718.19298

Project type Advanced
Project status: active
Category 1 MW to 5 MW

Misc. Analysis Settings

DNI: **varies (1,000.0 W/m^2 peak)**
Ocular transmission coefficient: **0.5**
Pupil diameter: **0.002 m**
Eye focal length: **0.017 m**
Sun subtended angle: **9.3 mrad**

PV Analysis Methodology: **Version 2**
Enhanced subtended angle calculation: **On**

Summary of Results

Glare with low potential for temporary after-image predicted

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
CRPRT1	0.0	124.0	0	0	-
CRPRT2	0.0	124.0	0	0	-
CRPRT3	0.0	124.0	236	0	-
CRPRT4	0.0	124.0	566	0	-
CRPRT5	0.0	214.0	0	0	-
LGBLDG	5.0	214.0	0	0	-
SMBLDG	5.0	214.0	0	0	-

Component Data

PV Array(s)

Total PV footprint area: 3.1 acres

Name: CRPRT1
Footprint area: 0.20 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085650	-70.803723	57.92	20.17	78.09
2	43.085595	-70.803619	57.81	14.00	71.81
3	43.085032	-70.804187	64.54	14.00	78.54
4	43.085084	-70.804291	66.68	20.17	86.85

Name: CRPRT2
Footprint area: 0.26 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085519	-70.803626	57.88	22.48	80.36
2	43.085431	-70.803461	56.75	14.00	70.75
3	43.084981	-70.803912	58.98	14.00	72.98
4	43.085070	-70.804083	59.73	22.48	82.20

Name: CRPRT3
Footprint area: 0.23 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085400	-70.803418	56.90	22.48	79.38
2	43.085325	-70.803271	56.23	14.00	70.23
3	43.084876	-70.803716	58.56	14.00	72.56
4	43.084953	-70.803866	59.01	22.48	81.49

Name: CRPRT4
Footprint area: 0.13 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085298	-70.803223	56.02	20.17	76.19
2	43.085253	-70.803139	56.21	14.00	70.21
3	43.084808	-70.803572	58.45	14.00	72.45
4	43.084851	-70.803658	58.35	20.17	78.52

Name: CRPRT5
Footprint area: 0.07 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 214.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085549	-70.803405	56.86	20.17	77.02
2	43.085404	-70.803116	55.16	20.17	75.32
3	43.085334	-70.803188	55.25	14.00	69.25
4	43.085478	-70.803470	57.01	14.00	71.01

Name: LGBLDG
Footprint area: 2.0 acres
Axis tracking: Fixed (no rotation)
Tilt: 5.0 deg
Orientation: 214.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.084344	-70.802133	51.60	93.83	145.44
2	43.084054	-70.801543	49.18	93.83	143.01
3	43.083901	-70.801690	49.39	93.83	143.22
4	43.083859	-70.801609	49.20	93.83	143.03
5	43.083897	-70.801574	49.27	93.83	143.10
6	43.083839	-70.801453	47.35	93.83	141.18
7	43.083345	-70.801919	51.93	93.83	145.76
8	43.083906	-70.803019	59.40	93.83	153.23
9	43.084395	-70.802537	54.24	93.83	148.07
10	43.084315	-70.802368	51.53	93.83	145.36
11	43.084337	-70.802347	51.04	93.83	144.87
12	43.084303	-70.802278	52.48	93.83	146.31
13	43.084336	-70.802245	52.51	93.83	146.34
14	43.084297	-70.802171	51.69	93.83	145.52

Name: SMBLDG
Footprint area: 0.22 acre
Axis tracking: Fixed (no rotation)
Tilt: 5.0 deg
Orientation: 214.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.084480	-70.803051	56.19	88.00	144.19
2	43.084450	-70.803081	56.31	88.00	144.31
3	43.084506	-70.803193	56.74	88.00	144.74
4	43.084466	-70.803232	56.81	88.00	144.81
5	43.084412	-70.803118	56.55	88.00	144.55
6	43.084252	-70.803275	58.91	88.00	146.91
7	43.084414	-70.803594	61.58	88.00	149.58
8	43.084643	-70.803375	58.79	88.00	146.79

Route Receptor(s)

Name: Route 1
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.082607	-70.800659	43.16	4.50	47.66
2	43.082965	-70.800254	39.75	4.50	44.25
3	43.084118	-70.798835	40.69	4.50	45.19

Name: Route 2
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.084096	-70.798795	40.76	8.50	49.26
2	43.082949	-70.800223	39.72	8.50	48.22
3	43.082597	-70.800616	42.88	8.50	51.38

Name: Route 3
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085442	-70.804811	63.97	4.50	68.47
2	43.084962	-70.804519	67.50	4.50	72.00
3	43.084962	-70.804519	67.50	4.50	72.00
4	43.084630	-70.804302	69.07	4.50	73.57
5	43.084630	-70.804302	69.07	4.50	73.57
6	43.084394	-70.804068	68.75	4.50	73.25
7	43.083881	-70.803489	64.40	4.50	68.90
8	43.083614	-70.803103	60.85	4.50	65.35

Name: Route 4
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.083602	-70.803135	60.76	8.50	69.26
2	43.083841	-70.803542	64.38	8.50	72.88
3	43.084382	-70.804111	68.76	8.50	77.26
4	43.084618	-70.804339	69.09	8.50	77.59
5	43.084618	-70.804339	69.09	8.50	77.59
6	43.084888	-70.804519	67.86	8.50	76.36
7	43.084888	-70.804519	67.86	8.50	76.36
8	43.085416	-70.804830	64.17	8.50	72.67

Name: Route 5
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.082313	-70.799503	41.53	4.50	46.03
2	43.082995	-70.798326	37.86	4.50	42.36

Name: Route 6
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.082966	-70.798285	37.86	8.50	46.36
2	43.082274	-70.799457	41.51	8.50	50.01

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	ft	ft	ft
1-ATCT	43.084384	-70.818882	89.93	130.00	219.93
OP 2	43.082455	-70.800057	42.02	20.00	62.02
OP 3	43.082529	-70.799934	41.99	30.00	71.99
OP 4	43.083085	-70.799471	39.01	6.00	45.01
OP 5	43.083191	-70.799294	38.75	15.00	53.75
6-ATCT	43.084349	-70.818856	89.97	120.00	209.97
OP 7	43.083343	-70.803962	70.10	40.00	110.10

1-ATCT map image

6-ATCT map image

Obstruction Components

Name: BLDG2
Upper edge height: 20.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084955	-70.806346	99.52
2	43.085031	-70.806408	98.08
3	43.084866	-70.806801	99.55
4	43.084555	-70.806565	99.98
5	43.084608	-70.806439	99.85
6	43.084444	-70.806325	99.64
7	43.084592	-70.806011	99.08
8	43.084965	-70.806346	99.43

Name: HighEdge1
Upper edge height: 22.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085534	-70.803609	57.89
2	43.085267	-70.803116	55.50

Name: HighEdge2
Upper edge height: 22.5 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085593	-70.803598	57.75
2	43.085019	-70.804161	63.07

Name: HighEdge3
Upper edge height: 22.5 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085424	-70.803445	56.71
2	43.084960	-70.803895	59.16

Name: HighEdge4
Upper edge height: 20.2 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085307	-70.803260	56.28
2	43.084860	-70.803684	58.42

Name: PRPT1
Upper edge height: 93.2 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084674	-70.803390	58.96
2	43.084478	-70.802983	56.11
3	43.084211	-70.803240	59.29
4	43.084415	-70.803648	62.46
5	43.084674	-70.803390	58.96

Name: PRPT2
Upper edge height: 99.3 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084580	-70.802457	53.31
2	43.083953	-70.801212	46.09
3	43.083224	-70.801856	52.36
4	43.083866	-70.803165	61.10
5	43.084580	-70.802457	53.31

Name: TREELINE
Upper edge height: 35.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085164	-70.808848	82.83
2	43.085454	-70.807942	81.22
3	43.085373	-70.807765	82.86
4	43.085040	-70.807564	86.97

Name: Trees
Upper edge height: 17.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085036	-70.807176	92.20
2	43.084131	-70.806567	95.41

Name: Trees
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.083891	-70.811509	72.86
2	43.084095	-70.811240	67.62

Name: Trees1
Upper edge height: 40.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085261	-70.816979	84.00
2	43.084955	-70.816877	84.48
3	43.084477	-70.817247	78.24

Name: Trees2
Upper edge height: 60.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084443	-70.818109	84.34
2	43.084602	-70.818167	84.74
3	43.084354	-70.818474	88.75

Name: Trees3
Upper edge height: 100.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084287	-70.810576	72.89
2	43.084550	-70.810195	75.28

Name: Trees4
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085793	-70.815175	77.90
2	43.085354	-70.814585	81.00
3	43.086098	-70.812858	77.64

Name: Trees5
Upper edge height: 45.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084411	-70.807233	89.30
2	43.084554	-70.807316	89.33
3	43.084677	-70.807358	89.54
4	43.084730	-70.807552	87.97

Name: Trees6
Upper edge height: 20.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085286	-70.814633	80.07
2	43.083793	-70.813418	79.96

Name: Trees7
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.083527	-70.812571	74.50
2	43.083829	-70.811932	72.49

Name: WRHSE1
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085129	-70.813496	81.26
2	43.085227	-70.813254	81.50
3	43.085137	-70.813085	81.35
4	43.084986	-70.813064	81.23
5	43.084886	-70.813292	81.62
6	43.085129	-70.813496	81.26

Name: WRHSE2
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084916	-70.813107	81.43
2	43.084740	-70.813499	81.62
3	43.084705	-70.813466	81.64
4	43.084630	-70.813662	81.71
5	43.084174	-70.813292	81.76
6	43.084399	-70.812785	81.68
7	43.084501	-70.812860	81.70
8	43.084540	-70.812758	81.66
9	43.084916	-70.813107	81.43

Summary of PV Glare Analysis

PV configuration and total predicted glare

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced	Data File
	deg	deg	min	min	kWh	
CRPRT1	0.0	124.0	0	0	-	-
CRPRT2	0.0	124.0	0	0	-	-
CRPRT3	0.0	124.0	236	0	-	-
CRPRT4	0.0	124.0	566	0	-	-
CRPRT5	0.0	214.0	0	0	-	-
LGBLDG	5.0	214.0	0	0	-	-
SMBLDG	5.0	214.0	0	0	-	-

Distinct glare per month

Excludes overlapping glare from PV array for multiple receptors at matching time(s)

PV	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
crprt3 (green)	0	87	0	0	0	0	0	0	0	85	0	0
crprt3 (yellow)	0	0	0	0	0	0	0	0	0	0	0	0
crprt4 (green)	0	139	48	0	0	0	0	0	0	186	0	0
crprt4 (yellow)	0	0	0	0	0	0	0	0	0	0	0	0

PV & Receptor Analysis Results

Results for each PV array and receptor

CRPRT1 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

CRPRT2 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

CRPRT3 low potential for temporary after-image

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	79	0
Route: Route 4	157	0
Route: Route 5	0	0
Route: Route 6	0	0

CRPRT3: 1-ATCT

No glare found

CRPRT3: OP 2

No glare found

CRPRT3: OP 3

No glare found

CRPRT3: OP 4

No glare found

CRPRT3: OP 5

No glare found

CRPRT3: 6-ATCT

No glare found

CRPRT3: OP 7

No glare found

CRPRT3: Route 1

No glare found

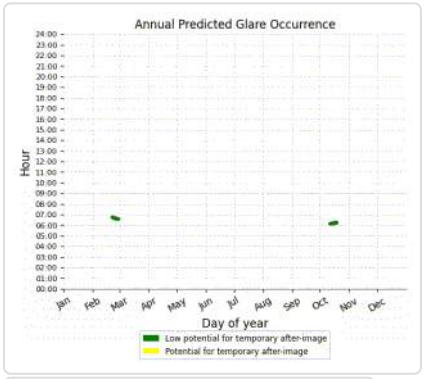
CRPRT3: Route 2

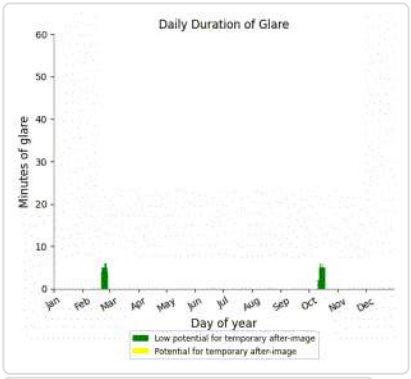
No glare found

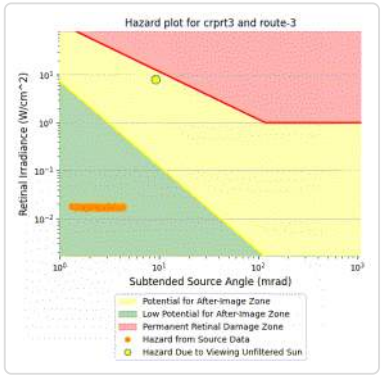
CRPRT3: Route 3

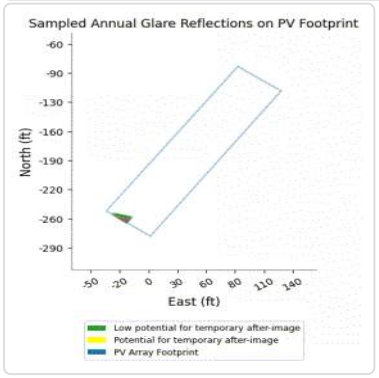
PV array is expected to produce the following glare for this receptor:

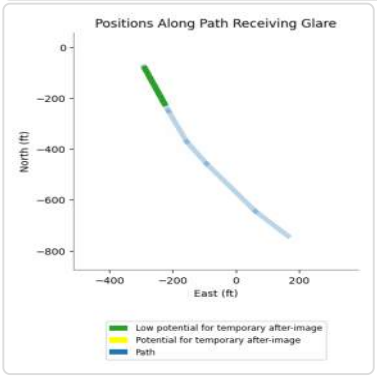
- 79 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.







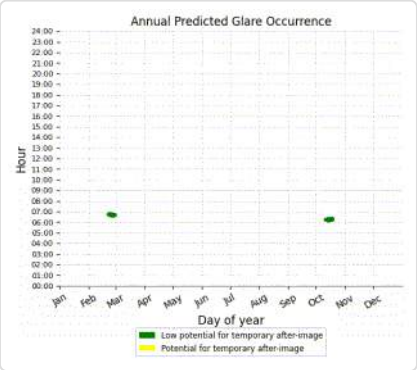


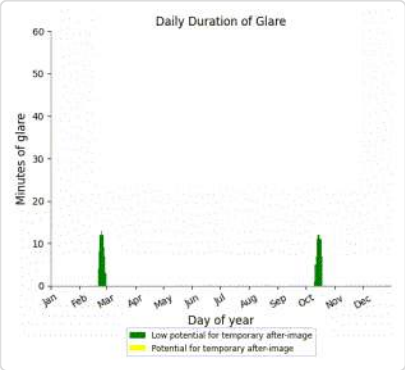


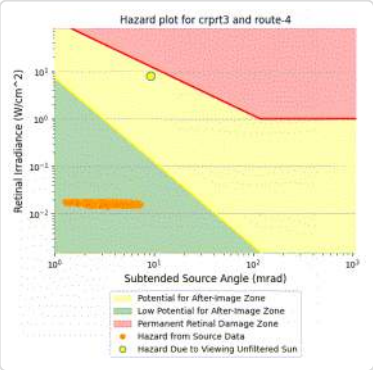
CRPRT3: Route 4

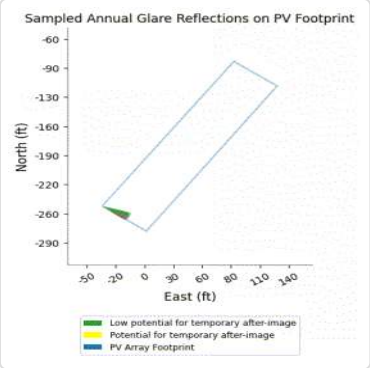
PV array is expected to produce the following glare for this receptor:

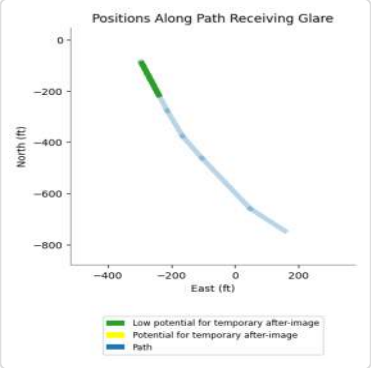
- 157 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.











CRPRT3: Route 5

No glare found

CRPRT3: Route 6

No glare found

CRPRT4 low potential for temporary after-image

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	311	0
Route: Route 4	255	0
Route: Route 5	0	0
Route: Route 6	0	0

CRPRT4: 1-ATCT

No glare found

CRPRT4: OP 2

No glare found

CRPRT4: OP 3

No glare found

CRPRT4: OP 4

No glare found

CRPRT4: OP 5

No glare found

CRPRT4: 6-ATCT

No glare found

CRPRT4: OP 7

No glare found

CRPRT4: Route 1

No glare found

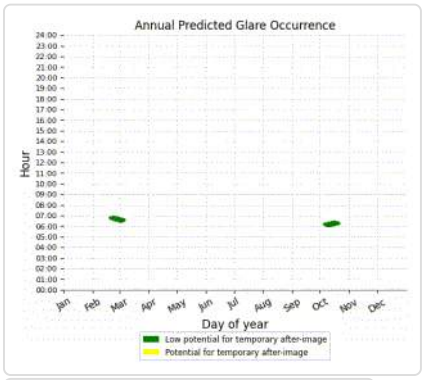
CRPRT4: Route 2

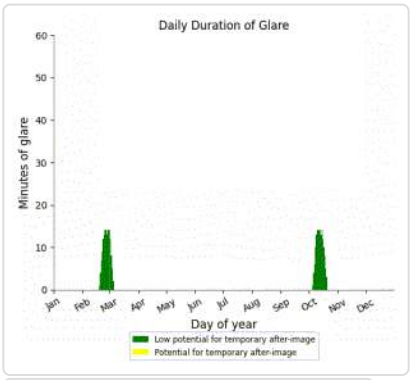
No glare found

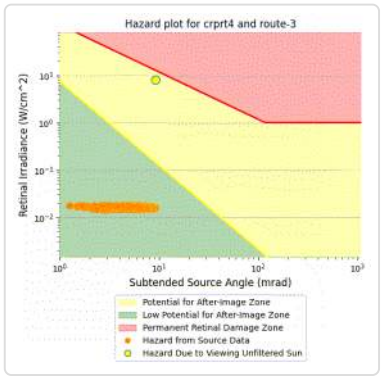
CRPRT4: Route 3

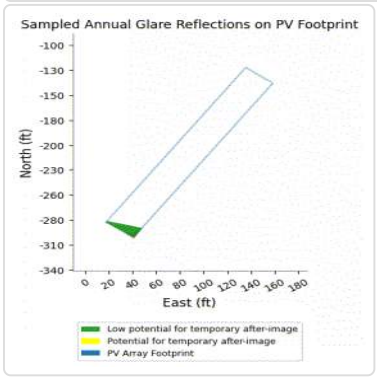
PV array is expected to produce the following glare for this receptor:

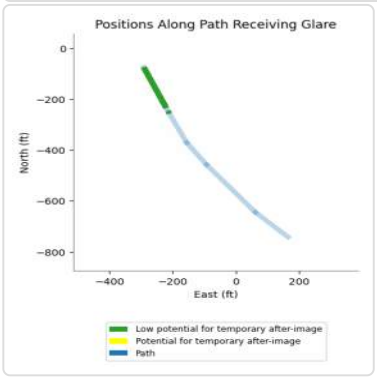
- 311 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.







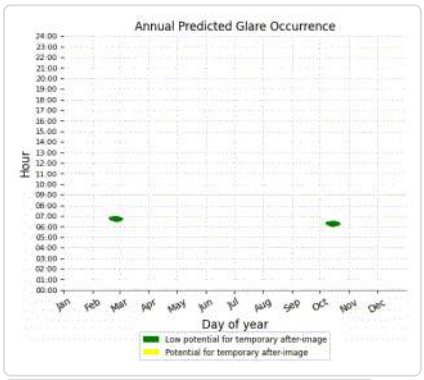


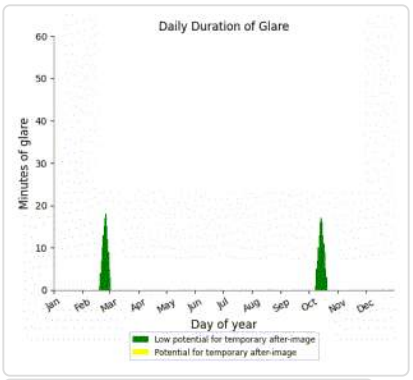


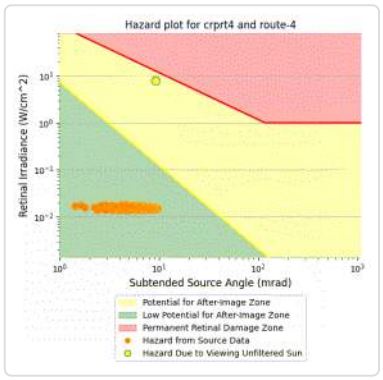
CRPRT4: Route 4

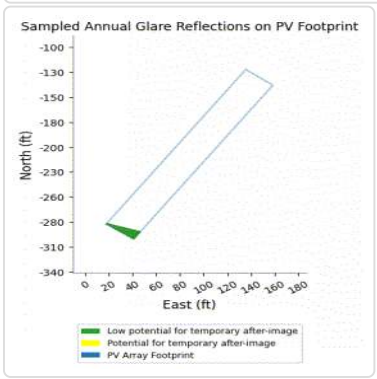
PV array is expected to produce the following glare for this receptor:

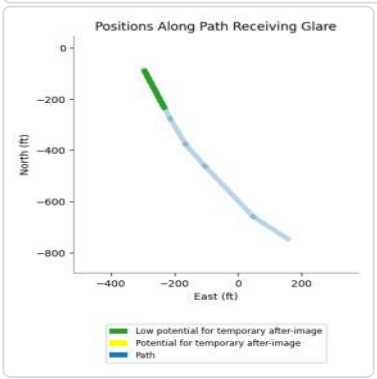
- 255 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.











CRPRT4: Route 5

No glare found

CRPRT4: Route 6

No glare found

CRPRT5 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

LGBLDG no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

SMBLDG no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

Assumptions

- Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
- Glare analyses do not automatically account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographi obstructions.
- Detailed system geometry is not rigorously simulated.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values and results may vary.
- The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
- Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for larg PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.
- The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
- Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, nc discrete, spectrum.
- Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
- Refer to the **Help page** for detailed assumptions and limitations not listed here.

ALBACORE, Portsmouth, NH

ALBCR_10Tilt_124Carports_Obstrctns_2ATCT_NoPlant

Client: Lonza

Created Feb 22, 2024
Updated Feb 22, 2024
Time-step 1 minute
Timezone offset UTC-5
Minimum sun altitude 0.0 deg
Site ID 112717.19298

Project type Advanced
Project status: active
Category 1 MW to 5 MW

Misc. Analysis Settings

DNI: **varies (1,000.0 W/m^2 peak)**
Ocular transmission coefficient: **0.5**
Pupil diameter: **0.002 m**
Eye focal length: **0.017 m**
Sun subtended angle: **9.3 mrad**

PV Analysis Methodology: **Version 2**
Enhanced subtended angle calculation: **On**

Summary of Results

Glare with low potential for temporary after-image predicted

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
CRPRT1	0.0	124.0	0	0	-
CRPRT2	0.0	124.0	0	0	-
CRPRT3	0.0	124.0	236	0	-
CRPRT4	0.0	124.0	566	0	-
CRPRT5	0.0	214.0	0	0	-
LGBLDG	10.0	214.0	0	0	-
SMBLDG	10.0	214.0	0	0	-

Component Data

PV Array(s)

Total PV footprint area: 3.1 acres

Name: CRPRT1
Footprint area: 0.20 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085650	-70.803723	57.92	20.17	78.09
2	43.085595	-70.803619	57.81	14.00	71.81
3	43.085032	-70.804187	64.54	14.00	78.54
4	43.085084	-70.804291	66.68	20.17	86.85

Name: CRPRT2
Footprint area: 0.26 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085519	-70.803626	57.88	22.48	80.36
2	43.085431	-70.803461	56.75	14.00	70.75
3	43.084981	-70.803912	58.98	14.00	72.98
4	43.085070	-70.804083	59.73	22.48	82.20

Name: CRPRT3
Footprint area: 0.23 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085400	-70.803418	56.90	22.48	79.38
2	43.085325	-70.803271	56.23	14.00	70.23
3	43.084876	-70.803716	58.56	14.00	72.56
4	43.084953	-70.803866	59.01	22.48	81.49

Name: CRPRT4
Footprint area: 0.13 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085298	-70.803223	56.02	20.17	76.19
2	43.085253	-70.803139	56.21	14.00	70.21
3	43.084808	-70.803572	58.45	14.00	72.45
4	43.084851	-70.803658	58.35	20.17	78.52

Name: CRPRT5
Footprint area: 0.07 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 214.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085549	-70.803405	56.86	20.17	77.02
2	43.085404	-70.803116	55.16	20.17	75.32
3	43.085334	-70.803188	55.25	14.00	69.25
4	43.085478	-70.803470	57.01	14.00	71.01

Name: LGBLDG
Footprint area: 2.0 acres
Axis tracking: Fixed (no rotation)
Tilt: 10.0 deg
Orientation: 214.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.084344	-70.802133	51.60	93.83	145.44
2	43.084054	-70.801543	49.18	93.83	143.01
3	43.083901	-70.801690	49.39	93.83	143.22
4	43.083859	-70.801609	49.20	93.83	143.03
5	43.083897	-70.801574	49.27	93.83	143.10
6	43.083839	-70.801453	47.35	93.83	141.18
7	43.083345	-70.801919	51.93	93.83	145.76
8	43.083906	-70.803019	59.40	93.83	153.23
9	43.084395	-70.802537	54.24	93.83	148.07
10	43.084315	-70.802368	51.53	93.83	145.36
11	43.084337	-70.802347	51.04	93.83	144.87
12	43.084303	-70.802278	52.48	93.83	146.31
13	43.084336	-70.802245	52.51	93.83	146.34
14	43.084297	-70.802171	51.69	93.83	145.52

Name: SMBLDG
Footprint area: 0.22 acre
Axis tracking: Fixed (no rotation)
Tilt: 10.0 deg
Orientation: 214.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.084480	-70.803051	56.19	88.00	144.19
2	43.084450	-70.803081	56.31	88.00	144.31
3	43.084506	-70.803193	56.74	88.00	144.74
4	43.084466	-70.803232	56.81	88.00	144.81
5	43.084412	-70.803118	56.55	88.00	144.55
6	43.084252	-70.803275	58.91	88.00	146.91
7	43.084414	-70.803594	61.58	88.00	149.58
8	43.084643	-70.803375	58.79	88.00	146.79

Route Receptor(s)

Name: Route 1
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.082607	-70.800659	43.16	4.50	47.66
2	43.082965	-70.800254	39.75	4.50	44.25
3	43.084118	-70.798835	40.69	4.50	45.19

Name: Route 2
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.084096	-70.798795	40.76	8.50	49.26
2	43.082949	-70.800223	39.72	8.50	48.22
3	43.082597	-70.800616	42.88	8.50	51.38

Name: Route 3
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085442	-70.804811	63.97	4.50	68.47
2	43.084962	-70.804519	67.50	4.50	72.00
3	43.084962	-70.804519	67.50	4.50	72.00
4	43.084630	-70.804302	69.07	4.50	73.57
5	43.084630	-70.804302	69.07	4.50	73.57
6	43.084394	-70.804068	68.75	4.50	73.25
7	43.083881	-70.803489	64.40	4.50	68.90
8	43.083614	-70.803103	60.85	4.50	65.35

Name: Route 4
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.083602	-70.803135	60.76	8.50	69.26
2	43.083841	-70.803542	64.38	8.50	72.88
3	43.084382	-70.804111	68.76	8.50	77.26
4	43.084618	-70.804339	69.09	8.50	77.59
5	43.084618	-70.804339	69.09	8.50	77.59
6	43.084888	-70.804519	67.86	8.50	76.36
7	43.084888	-70.804519	67.86	8.50	76.36
8	43.085416	-70.804830	64.17	8.50	72.67

Name: Route 5
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.082313	-70.799503	41.53	4.50	46.03
2	43.082995	-70.798326	37.86	4.50	42.36

Name: Route 6
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.082966	-70.798285	37.86	8.50	46.36
2	43.082274	-70.799457	41.51	8.50	50.01

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	ft	ft	ft
1-ATCT	43.084384	-70.818882	89.93	130.00	219.93
OP 2	43.082455	-70.800057	42.02	20.00	62.02
OP 3	43.082529	-70.799934	41.99	30.00	71.99
OP 4	43.083085	-70.799471	39.01	6.00	45.01
OP 5	43.083191	-70.799294	38.75	15.00	53.75
6-ATCT	43.084349	-70.818856	89.97	120.00	209.97
OP 7	43.083343	-70.803962	70.10	40.00	110.10

1-ATCT map image

6-ATCT map image

Obstruction Components

Name: BLDG2
Upper edge height: 20.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084955	-70.806346	99.52
2	43.085031	-70.806408	98.08
3	43.084866	-70.806801	99.55
4	43.084555	-70.806565	99.98
5	43.084608	-70.806439	99.85
6	43.084444	-70.806325	99.64
7	43.084592	-70.806011	99.08
8	43.084965	-70.806346	99.43

Name: HighEdge1
Upper edge height: 22.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085534	-70.803609	57.89
2	43.085267	-70.803116	55.50

Name: HighEdge2
Upper edge height: 22.5 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085593	-70.803598	57.75
2	43.085019	-70.804161	63.07

Name: HighEdge3
Upper edge height: 22.5 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085424	-70.803445	56.71
2	43.084960	-70.803895	59.16

Name: HighEdge4
Upper edge height: 20.2 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085307	-70.803260	56.28
2	43.084860	-70.803684	58.42

Name: PRPT1
Upper edge height: 93.2 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084674	-70.803390	58.96
2	43.084478	-70.802983	56.11
3	43.084211	-70.803240	59.29
4	43.084415	-70.803648	62.46
5	43.084674	-70.803390	58.96

Name: PRPT2
Upper edge height: 99.3 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084580	-70.802457	53.31
2	43.083953	-70.801212	46.09
3	43.083224	-70.801856	52.36
4	43.083866	-70.803165	61.10
5	43.084580	-70.802457	53.31

Name: TREELINE
Upper edge height: 35.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085164	-70.808848	82.83
2	43.085454	-70.807942	81.22
3	43.085373	-70.807765	82.86
4	43.085040	-70.807564	86.97

Name: Trees
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.083891	-70.811509	72.86
2	43.084095	-70.811240	67.62

Name: Trees
Upper edge height: 17.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085036	-70.807176	92.20
2	43.084131	-70.806567	95.41

Name: Trees1
Upper edge height: 40.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085261	-70.816979	84.00
2	43.084955	-70.816877	84.48
3	43.084477	-70.817247	78.24

Name: Trees2
Upper edge height: 60.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084443	-70.818109	84.34
2	43.084602	-70.818167	84.74
3	43.084354	-70.818474	88.75

Name: Trees3
Upper edge height: 100.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084287	-70.810576	72.89
2	43.084550	-70.810195	75.28

Name: Trees4
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085793	-70.815175	77.90
2	43.085354	-70.814585	81.00
3	43.086098	-70.812858	77.64

Name: Trees5
Upper edge height: 45.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084411	-70.807233	89.30
2	43.084554	-70.807316	89.33
3	43.084677	-70.807358	89.54
4	43.084730	-70.807552	87.97

Name: Trees6
Upper edge height: 20.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085286	-70.814633	80.07
2	43.083793	-70.813418	79.96

Name: Trees7
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.083527	-70.812571	74.50
2	43.083829	-70.811932	72.49

Name: WRHSE1
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085129	-70.813496	81.26
2	43.085227	-70.813254	81.50
3	43.085137	-70.813085	81.35
4	43.084986	-70.813064	81.23
5	43.084886	-70.813292	81.62
6	43.085129	-70.813496	81.26

Name: WRHSE2
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084916	-70.813107	81.43
2	43.084740	-70.813499	81.62
3	43.084705	-70.813466	81.64
4	43.084630	-70.813662	81.71
5	43.084174	-70.813292	81.76
6	43.084399	-70.812785	81.68
7	43.084501	-70.812860	81.70
8	43.084540	-70.812758	81.66
9	43.084916	-70.813107	81.43

Summary of PV Glare Analysis

PV configuration and total predicted glare

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced	Data File
	deg	deg	min	min	kWh	
CRPRT1	0.0	124.0	0	0	-	-
CRPRT2	0.0	124.0	0	0	-	-
CRPRT3	0.0	124.0	236	0	-	-
CRPRT4	0.0	124.0	566	0	-	-
CRPRT5	0.0	214.0	0	0	-	-
LGBLDG	10.0	214.0	0	0	-	-
SMBLDG	10.0	214.0	0	0	-	-

Distinct glare per month

Excludes overlapping glare from PV array for multiple receptors at matching time(s)

PV	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
crprt3 (green)	0	87	0	0	0	0	0	0	0	85	0	0
crprt3 (yellow)	0	0	0	0	0	0	0	0	0	0	0	0
crprt4 (green)	0	139	48	0	0	0	0	0	0	186	0	0
crprt4 (yellow)	0	0	0	0	0	0	0	0	0	0	0	0

PV & Receptor Analysis Results

Results for each PV array and receptor

CRPRT1 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

CRPRT2 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

CRPRT3 low potential for temporary after-image

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	79	0
Route: Route 4	157	0
Route: Route 5	0	0
Route: Route 6	0	0

CRPRT3: 1-ATCT

No glare found

CRPRT3: OP 2

No glare found

CRPRT3: OP 3

No glare found

CRPRT3: OP 4

No glare found

CRPRT3: OP 5

No glare found

CRPRT3: 6-ATCT

No glare found

CRPRT3: OP 7

No glare found

CRPRT3: Route 1

No glare found

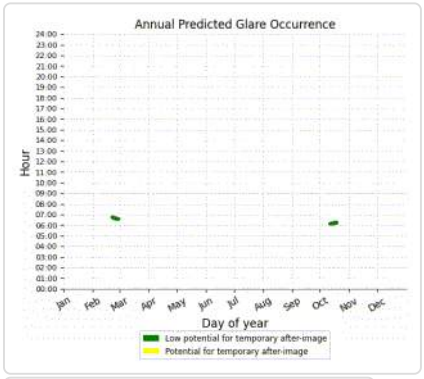
CRPRT3: Route 2

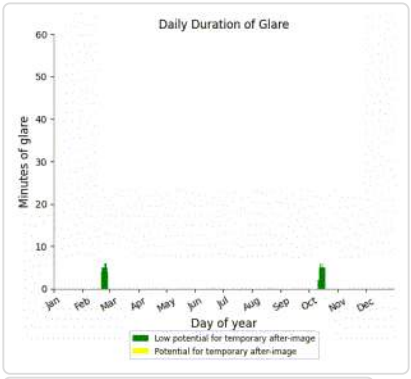
No glare found

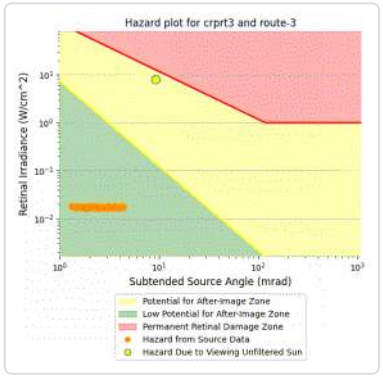
CRPRT3: Route 3

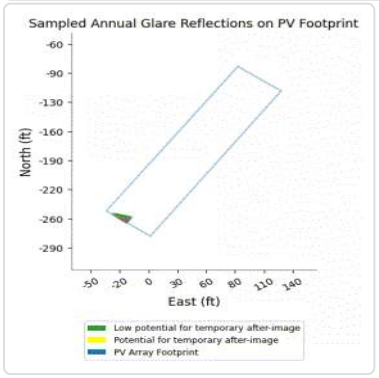
PV array is expected to produce the following glare for this receptor:

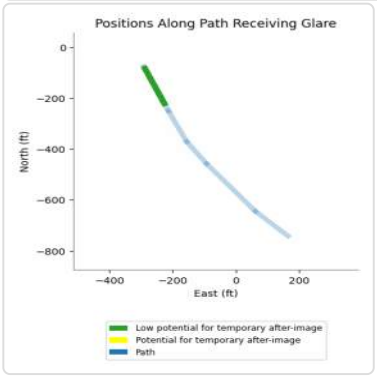
- 79 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.







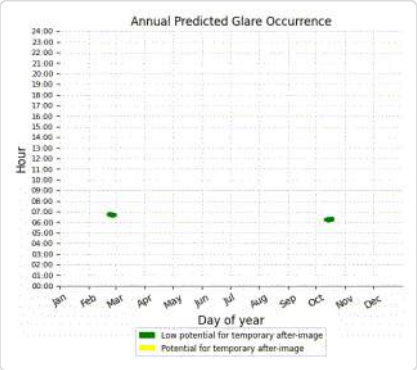


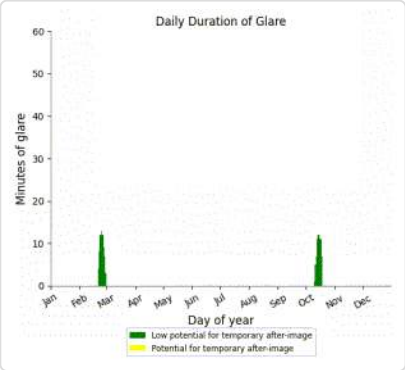


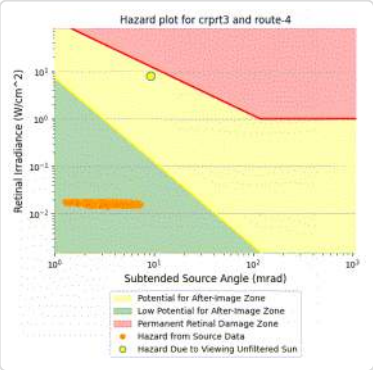
CRPRT3: Route 4

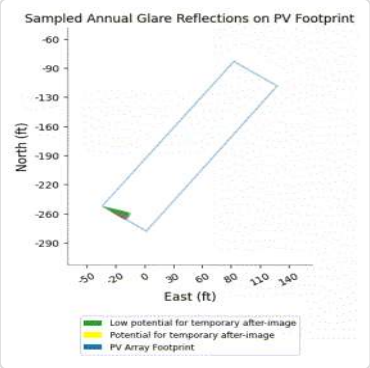
PV array is expected to produce the following glare for this receptor:

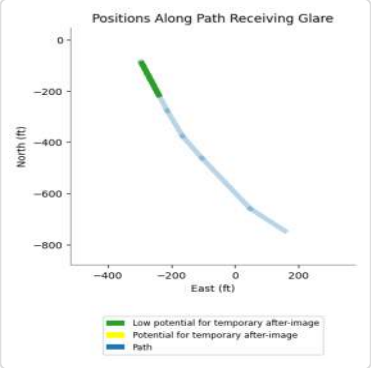
- 157 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.











CRPRT3: Route 5

No glare found

CRPRT3: Route 6

No glare found

CRPRT4 low potential for temporary after-image

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	311	0
Route: Route 4	255	0
Route: Route 5	0	0
Route: Route 6	0	0

CRPRT4: 1-ATCT

No glare found

CRPRT4: OP 2

No glare found

CRPRT4: OP 3

No glare found

CRPRT4: OP 4

No glare found

CRPRT4: OP 5

No glare found

CRPRT4: 6-ATCT

No glare found

CRPRT4: OP 7

No glare found

CRPRT4: Route 1

No glare found

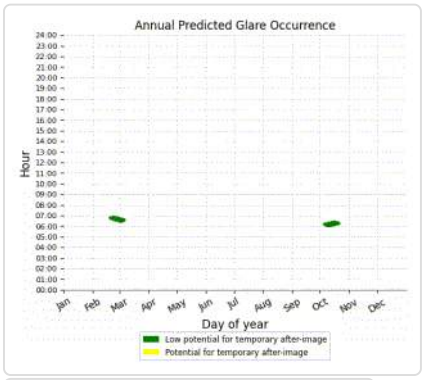
CRPRT4: Route 2

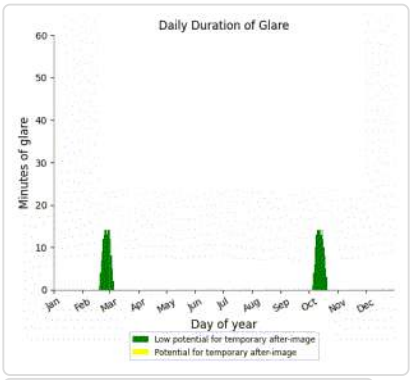
No glare found

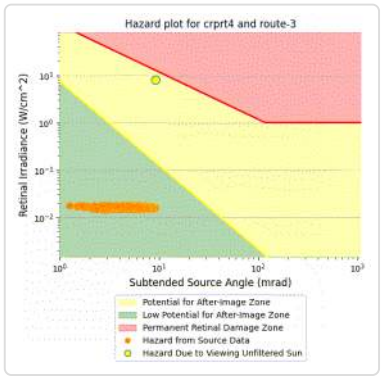
CRPRT4: Route 3

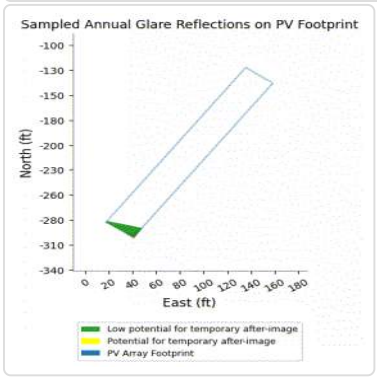
PV array is expected to produce the following glare for this receptor:

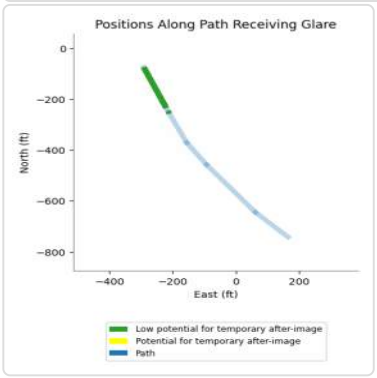
- 311 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.







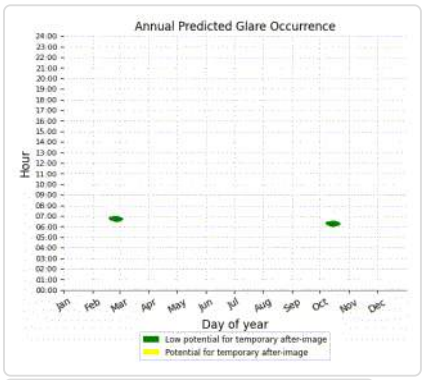


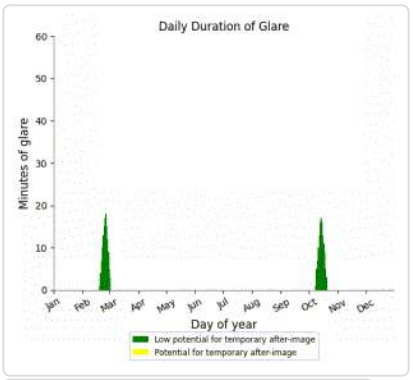


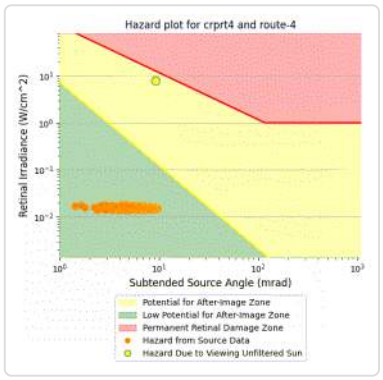
CRPRT4: Route 4

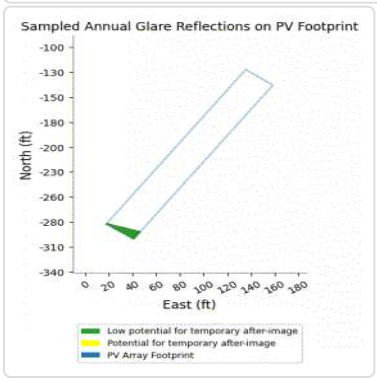
PV array is expected to produce the following glare for this receptor:

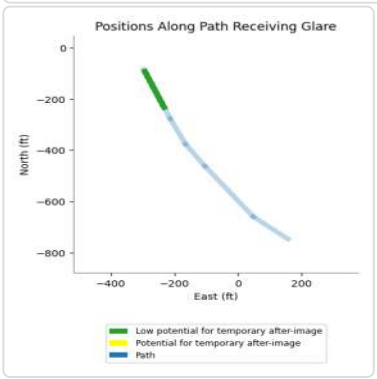
- 255 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.











CRPRT4: Route 5

No glare found

CRPRT4: Route 6

No glare found

CRPRT5 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

LGBLDG no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

SMBLDG no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

Assumptions

- Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
- Glare analyses do not automatically account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographi obstructions.
- Detailed system geometry is not rigorously simulated.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values and results may vary.
- The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
- Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for larg PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.
- The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
- Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, nc discrete, spectrum.
- Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
- Refer to the **Help page** for detailed assumptions and limitations not listed here.

ALBACORE, Portsmouth, NH

ALBCR_13Tilt_124Carports_Obstrctns_2ATCT_NoPlant

Client: Lonza

Created Feb 22, 2024
Updated Feb 22, 2024
Time-step 1 minute
Timezone offset UTC-5
Minimum sun altitude 0.0 deg
Site ID 112727.19298

Project type Advanced
Project status: active
Category 1 MW to 5 MW

Misc. Analysis Settings

DNI: **varies (1,000.0 W/m^2 peak)**
Ocular transmission coefficient: **0.5**
Pupil diameter: **0.002 m**
Eye focal length: **0.017 m**
Sun subtended angle: **9.3 mrad**

PV Analysis Methodology: **Version 2**
Enhanced subtended angle calculation: **On**

Summary of Results

Glare with low potential for temporary after-image predicted

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
CRPRT1	0.0	124.0	0	0	-
CRPRT2	0.0	124.0	0	0	-
CRPRT3	0.0	124.0	236	0	-
CRPRT4	0.0	124.0	566	0	-
CRPRT5	0.0	214.0	0	0	-
LGBLDG	13.0	214.0	0	0	-
SMBLDG	13.0	214.0	0	0	-

Component Data

PV Array(s)

Total PV footprint area: 3.1 acres

Name: CRPRT1
Footprint area: 0.20 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085650	-70.803723	57.92	20.17	78.09
2	43.085595	-70.803619	57.81	14.00	71.81
3	43.085032	-70.804187	64.54	14.00	78.54
4	43.085084	-70.804291	66.68	20.17	86.85

Name: CRPRT2
Footprint area: 0.26 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085519	-70.803626	57.88	22.48	80.36
2	43.085431	-70.803461	56.75	14.00	70.75
3	43.084981	-70.803912	58.98	14.00	72.98
4	43.085070	-70.804083	59.73	22.48	82.20

Name: CRPRT3
Footprint area: 0.23 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085400	-70.803418	56.90	22.48	79.38
2	43.085325	-70.803271	56.23	14.00	70.23
3	43.084876	-70.803716	58.56	14.00	72.56
4	43.084953	-70.803866	59.01	22.48	81.49

Name: CRPRT4
Footprint area: 0.13 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085298	-70.803223	56.02	20.17	76.19
2	43.085253	-70.803139	56.21	14.00	70.21
3	43.084808	-70.803572	58.45	14.00	72.45
4	43.084851	-70.803658	58.35	20.17	78.52

Name: CRPRT5
Footprint area: 0.07 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 214.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085549	-70.803405	56.86	20.17	77.02
2	43.085404	-70.803116	55.16	20.17	75.32
3	43.085334	-70.803188	55.25	14.00	69.25
4	43.085478	-70.803470	57.01	14.00	71.01

Name: LGBLDG
Footprint area: 2.0 acres
Axis tracking: Fixed (no rotation)
Tilt: 13.0 deg
Orientation: 214.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.084344	-70.802133	51.60	93.83	145.44
2	43.084054	-70.801543	49.18	93.83	143.01
3	43.083901	-70.801690	49.39	93.83	143.22
4	43.083859	-70.801609	49.20	93.83	143.03
5	43.083897	-70.801574	49.27	93.83	143.10
6	43.083839	-70.801453	47.35	93.83	141.18
7	43.083345	-70.801919	51.93	93.83	145.76
8	43.083906	-70.803019	59.40	93.83	153.23
9	43.084395	-70.802537	54.24	93.83	148.07
10	43.084315	-70.802368	51.53	93.83	145.36
11	43.084337	-70.802347	51.04	93.83	144.87
12	43.084303	-70.802278	52.48	93.83	146.31
13	43.084336	-70.802245	52.51	93.83	146.34
14	43.084297	-70.802171	51.69	93.83	145.52

Name: SMBLDG
Footprint area: 0.22 acre
Axis tracking: Fixed (no rotation)
Tilt: 13.0 deg
Orientation: 214.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.084480	-70.803051	56.19	88.00	144.19
2	43.084450	-70.803081	56.31	88.00	144.31
3	43.084506	-70.803193	56.74	88.00	144.74
4	43.084466	-70.803232	56.81	88.00	144.81
5	43.084412	-70.803118	56.55	88.00	144.55
6	43.084252	-70.803275	58.91	88.00	146.91
7	43.084414	-70.803594	61.58	88.00	149.58
8	43.084643	-70.803375	58.79	88.00	146.79

Route Receptor(s)

Name: Route 1
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.082607	-70.800659	43.16	4.50	47.66
2	43.082965	-70.800254	39.75	4.50	44.25
3	43.084118	-70.798835	40.69	4.50	45.19

Name: Route 2
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.084096	-70.798795	40.76	8.50	49.26
2	43.082949	-70.800223	39.72	8.50	48.22
3	43.082597	-70.800616	42.88	8.50	51.38

Name: Route 3
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085442	-70.804811	63.97	4.50	68.47
2	43.084962	-70.804519	67.50	4.50	72.00
3	43.084962	-70.804519	67.50	4.50	72.00
4	43.084630	-70.804302	69.07	4.50	73.57
5	43.084630	-70.804302	69.07	4.50	73.57
6	43.084394	-70.804068	68.75	4.50	73.25
7	43.083881	-70.803489	64.40	4.50	68.90
8	43.083614	-70.803103	60.85	4.50	65.35

Name: Route 4
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.083602	-70.803135	60.76	8.50	69.26
2	43.083841	-70.803542	64.38	8.50	72.88
3	43.084382	-70.804111	68.76	8.50	77.26
4	43.084618	-70.804339	69.09	8.50	77.59
5	43.084618	-70.804339	69.09	8.50	77.59
6	43.084888	-70.804519	67.86	8.50	76.36
7	43.084888	-70.804519	67.86	8.50	76.36
8	43.085416	-70.804830	64.17	8.50	72.67

Name: Route 5
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.082313	-70.799503	41.53	4.50	46.03
2	43.082995	-70.798326	37.86	4.50	42.36

Name: Route 6
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.082966	-70.798285	37.86	8.50	46.36
2	43.082274	-70.799457	41.51	8.50	50.01

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	ft	ft	ft
1-ATCT	43.084384	-70.818882	89.93	130.00	219.93
OP 2	43.082455	-70.800057	42.02	20.00	62.02
OP 3	43.082529	-70.799934	41.99	30.00	71.99
OP 4	43.083085	-70.799471	39.01	6.00	45.01
OP 5	43.083191	-70.799294	38.75	15.00	53.75
6-ATCT	43.084349	-70.818856	89.97	120.00	209.97
OP 7	43.083343	-70.803962	70.10	40.00	110.10

1-ATCT map image

6-ATCT map image

Obstruction Components

Name: BLDG2
Upper edge height: 20.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084955	-70.806346	99.52
2	43.085031	-70.806408	98.08
3	43.084866	-70.806801	99.55
4	43.084555	-70.806565	99.98
5	43.084608	-70.806439	99.85
6	43.084444	-70.806325	99.64
7	43.084592	-70.806011	99.08
8	43.084965	-70.806346	99.43

Name: HighEdge1
Upper edge height: 22.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085534	-70.803609	57.89
2	43.085267	-70.803116	55.50

Name: HighEdge2
Upper edge height: 22.5 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085593	-70.803598	57.75
2	43.085019	-70.804161	63.07

Name: HighEdge3
Upper edge height: 22.5 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085424	-70.803445	56.71
2	43.084960	-70.803895	59.16

Name: HighEdge4
Upper edge height: 20.2 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085307	-70.803260	56.28
2	43.084860	-70.803684	58.42

Name: PRPT1
Upper edge height: 93.2 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084674	-70.803390	58.96
2	43.084478	-70.802983	56.11
3	43.084211	-70.803240	59.29
4	43.084415	-70.803648	62.46
5	43.084674	-70.803390	58.96

Name: PRPT2
Upper edge height: 99.3 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084580	-70.802457	53.31
2	43.083953	-70.801212	46.09
3	43.083224	-70.801856	52.36
4	43.083866	-70.803165	61.10
5	43.084580	-70.802457	53.31

Name: TREELINE
Upper edge height: 35.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085164	-70.808848	82.83
2	43.085454	-70.807942	81.22
3	43.085373	-70.807765	82.86
4	43.085040	-70.807564	86.97

Name: Trees
Upper edge height: 17.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085036	-70.807176	92.20
2	43.084131	-70.806567	95.41

Name: Trees
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.083891	-70.811509	72.86
2	43.084095	-70.811240	67.62

Name: Trees1
Upper edge height: 40.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085261	-70.816979	84.00
2	43.084955	-70.816877	84.48
3	43.084477	-70.817247	78.24

Name: Trees2
Upper edge height: 60.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084443	-70.818109	84.34
2	43.084602	-70.818167	84.74
3	43.084354	-70.818474	88.75

Name: Trees3
Upper edge height: 100.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084287	-70.810576	72.89
2	43.084550	-70.810195	75.28

Name: Trees4
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085793	-70.815175	77.90
2	43.085354	-70.814585	81.00
3	43.086098	-70.812858	77.64

Name: Trees5
Upper edge height: 45.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084411	-70.807233	89.30
2	43.084554	-70.807316	89.33
3	43.084677	-70.807358	89.54
4	43.084730	-70.807552	87.97

Name: Trees6
Upper edge height: 20.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085286	-70.814633	80.07
2	43.083793	-70.813418	79.96

Name: Trees7
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.083527	-70.812571	74.50
2	43.083829	-70.811932	72.49

Name: WRHSE1
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085129	-70.813496	81.26
2	43.085227	-70.813254	81.50
3	43.085137	-70.813085	81.35
4	43.084986	-70.813064	81.23
5	43.084886	-70.813292	81.62
6	43.085129	-70.813496	81.26

Name: WRHSE2
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084916	-70.813107	81.43
2	43.084740	-70.813499	81.62
3	43.084705	-70.813466	81.64
4	43.084630	-70.813662	81.71
5	43.084174	-70.813292	81.76
6	43.084399	-70.812785	81.68
7	43.084501	-70.812860	81.70
8	43.084540	-70.812758	81.66
9	43.084916	-70.813107	81.43

Summary of PV Glare Analysis

PV configuration and total predicted glare

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced	Data File
	deg	deg	min	min	kWh	
CRPRT1	0.0	124.0	0	0	-	-
CRPRT2	0.0	124.0	0	0	-	-
CRPRT3	0.0	124.0	236	0	-	-
CRPRT4	0.0	124.0	566	0	-	-
CRPRT5	0.0	214.0	0	0	-	-
LGBLDG	13.0	214.0	0	0	-	-
SMBLDG	13.0	214.0	0	0	-	-

Distinct glare per month

Excludes overlapping glare from PV array for multiple receptors at matching time(s)

PV	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
crprt3 (green)	0	87	0	0	0	0	0	0	0	85	0	0
crprt3 (yellow)	0	0	0	0	0	0	0	0	0	0	0	0
crprt4 (green)	0	139	48	0	0	0	0	0	0	186	0	0
crprt4 (yellow)	0	0	0	0	0	0	0	0	0	0	0	0

PV & Receptor Analysis Results

Results for each PV array and receptor

CRPRT1 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

CRPRT2 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

CRPRT3 low potential for temporary after-image

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	79	0
Route: Route 4	157	0
Route: Route 5	0	0
Route: Route 6	0	0

CRPRT3: 1-ATCT

No glare found

CRPRT3: OP 2

No glare found

CRPRT3: OP 3

No glare found

CRPRT3: OP 4

No glare found

CRPRT3: OP 5

No glare found

CRPRT3: 6-ATCT

No glare found

CRPRT3: OP 7

No glare found

CRPRT3: Route 1

No glare found

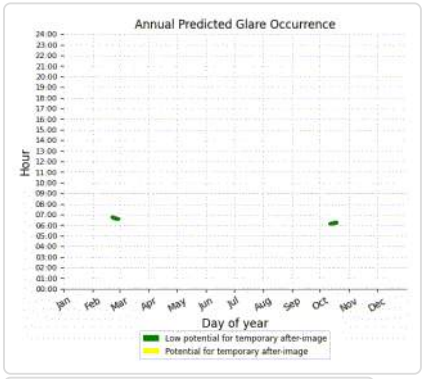
CRPRT3: Route 2

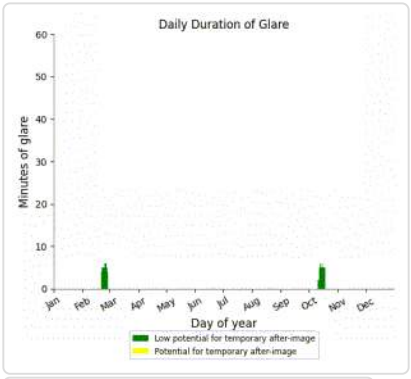
No glare found

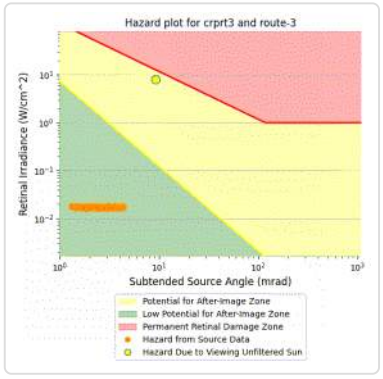
CRPRT3: Route 3

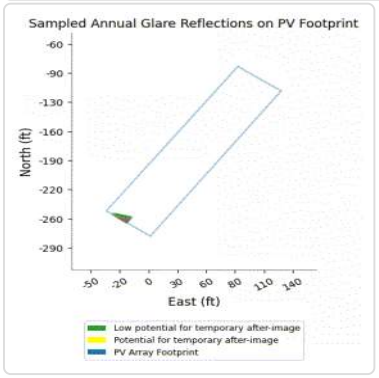
PV array is expected to produce the following glare for this receptor:

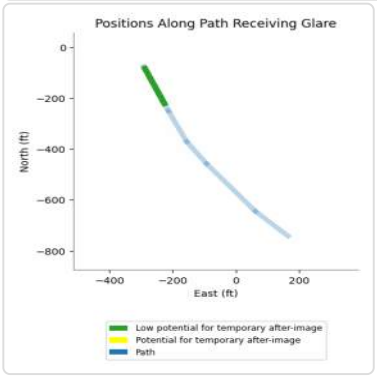
- 79 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.







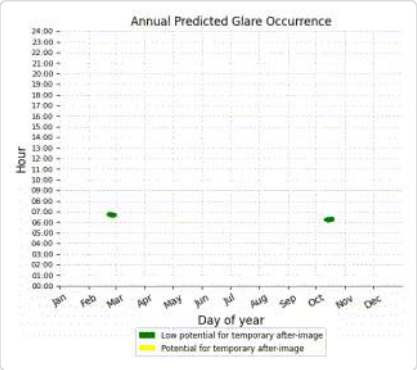


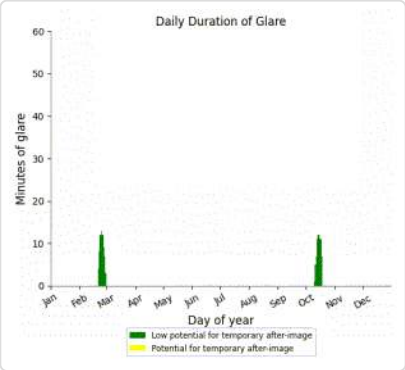


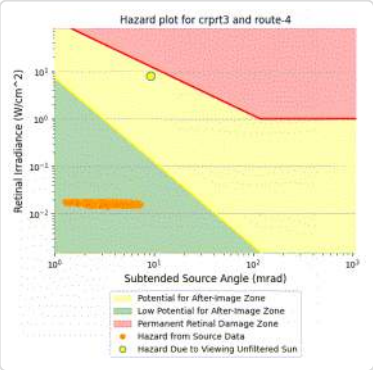
CRPRT3: Route 4

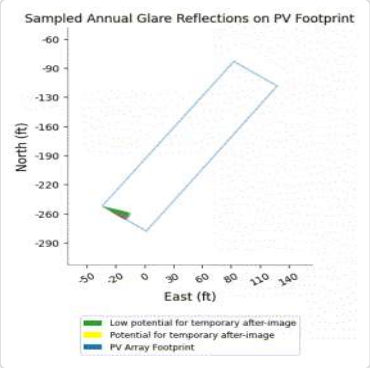
PV array is expected to produce the following glare for this receptor:

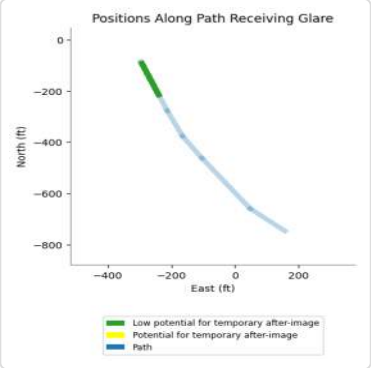
- 157 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.











CRPRT3: Route 5

No glare found

CRPRT3: Route 6

No glare found

CRPRT4 low potential for temporary after-image

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	311	0
Route: Route 4	255	0
Route: Route 5	0	0
Route: Route 6	0	0

CRPRT4: 1-ATCT

No glare found

CRPRT4: OP 2

No glare found

CRPRT4: OP 3

No glare found

CRPRT4: OP 4

No glare found

CRPRT4: OP 5

No glare found

CRPRT4: 6-ATCT

No glare found

CRPRT4: OP 7

No glare found

CRPRT4: Route 1

No glare found

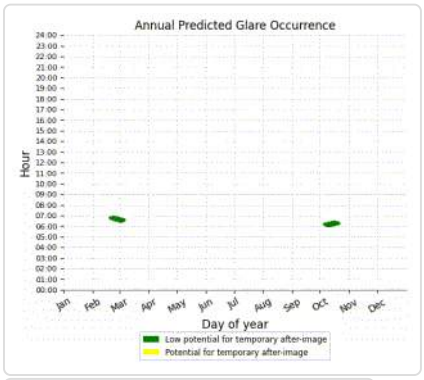
CRPRT4: Route 2

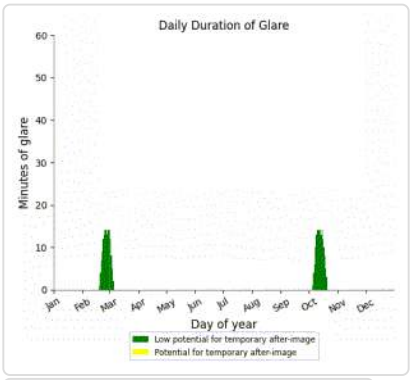
No glare found

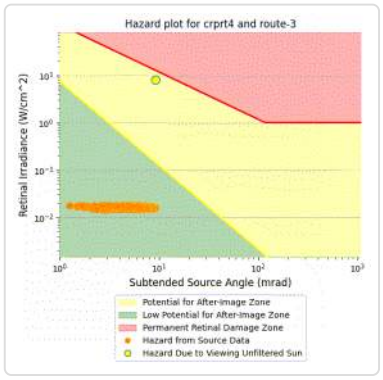
CRPRT4: Route 3

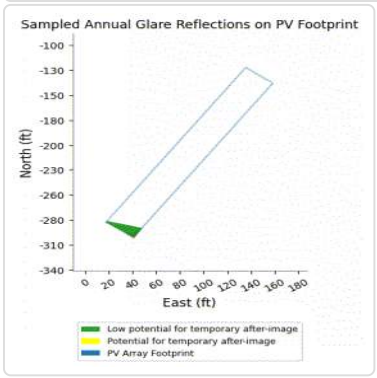
PV array is expected to produce the following glare for this receptor:

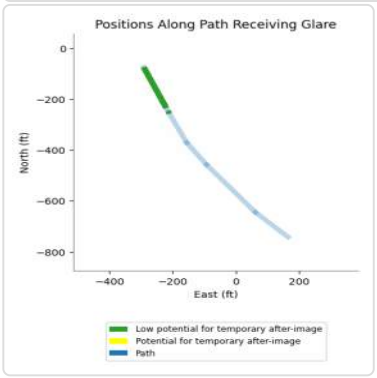
- 311 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.







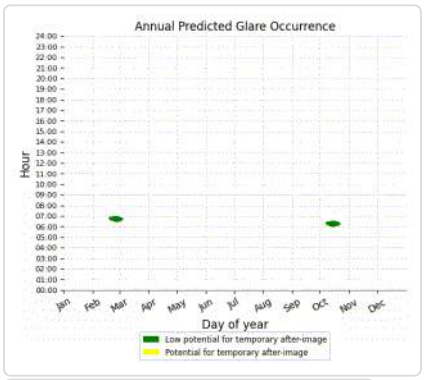


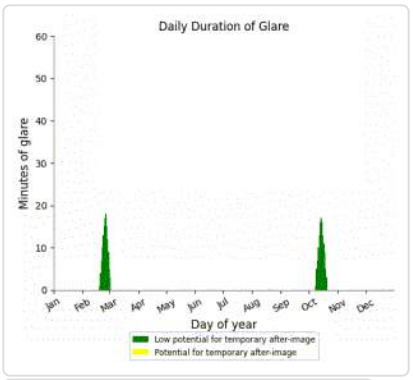


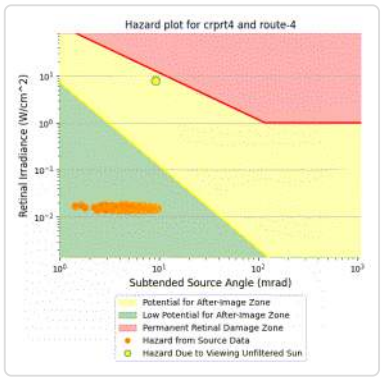
CRPRT4: Route 4

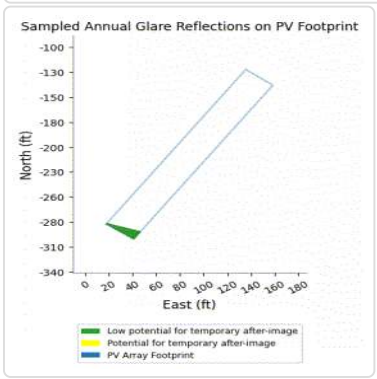
PV array is expected to produce the following glare for this receptor:

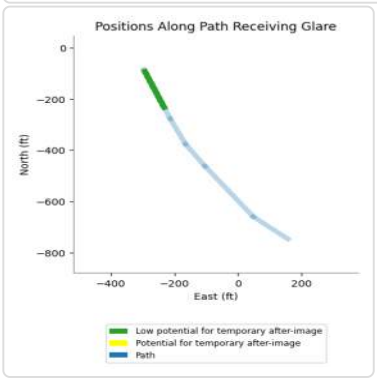
- 255 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.











CRPRT4: Route 5

No glare found

CRPRT4: Route 6

No glare found

CRPRT5 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

LGBLDG no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

SMBLDG no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

Assumptions

- Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
- Glare analyses do not automatically account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographi obstructions.
- Detailed system geometry is not rigorously simulated.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values and results may vary.
- The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
- Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for larg PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.
- The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
- Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, nc discrete, spectrum.
- Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
- Refer to the **Help page** for detailed assumptions and limitations not listed here.

ALBACORE, Portsmouth, NH

ALBCR_15Tilt_124Carports_Obstrctns_2ATCT_NoPlant

Client: Lonza

Created Feb 22, 2024
Updated Feb 22, 2024
Time-step 1 minute
Timezone offset UTC-5
Minimum sun altitude 0.0 deg
Site ID 112723.19298

Project type Advanced
Project status: active
Category 1 MW to 5 MW

Misc. Analysis Settings

DNI: **varies (1,000.0 W/m^2 peak)**
Ocular transmission coefficient: **0.5**
Pupil diameter: **0.002 m**
Eye focal length: **0.017 m**
Sun subtended angle: **9.3 mrad**

PV Analysis Methodology: **Version 2**
Enhanced subtended angle calculation: **On**

Summary of Results

Glare with low potential for temporary after-image predicted

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
CRPRT1	0.0	124.0	0	0	-
CRPRT2	0.0	124.0	0	0	-
CRPRT3	0.0	124.0	236	0	-
CRPRT4	0.0	124.0	566	0	-
CRPRT5	0.0	214.0	0	0	-
LGBLDG	15.0	214.0	0	0	-
SMBLDG	15.0	214.0	0	0	-

Component Data

PV Array(s)

Total PV footprint area: 3.1 acres

Name: CRPRT1
Footprint area: 0.20 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085650	-70.803723	57.92	20.17	78.09
2	43.085595	-70.803619	57.81	14.00	71.81
3	43.085032	-70.804187	64.54	14.00	78.54
4	43.085084	-70.804291	66.68	20.17	86.85

Name: CRPRT2
Footprint area: 0.26 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085519	-70.803626	57.88	22.48	80.36
2	43.085431	-70.803461	56.75	14.00	70.75
3	43.084981	-70.803912	58.98	14.00	72.98
4	43.085070	-70.804083	59.73	22.48	82.20

Name: CRPRT3
Footprint area: 0.23 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085400	-70.803418	56.90	22.48	79.38
2	43.085325	-70.803271	56.23	14.00	70.23
3	43.084876	-70.803716	58.56	14.00	72.56
4	43.084953	-70.803866	59.01	22.48	81.49

Name: CRPRT4
Footprint area: 0.13 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 124.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085298	-70.803223	56.02	20.17	76.19
2	43.085253	-70.803139	56.21	14.00	70.21
3	43.084808	-70.803572	58.45	14.00	72.45
4	43.084851	-70.803658	58.35	20.17	78.52

Name: CRPRT5
Footprint area: 0.07 acre
Axis tracking: Fixed (no rotation)
Tilt: 0.0 deg
Orientation: 214.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085549	-70.803405	56.86	20.17	77.02
2	43.085404	-70.803116	55.16	20.17	75.32
3	43.085334	-70.803188	55.25	14.00	69.25
4	43.085478	-70.803470	57.01	14.00	71.01

Name: LGBLDG
Footprint area: 2.0 acres
Axis tracking: Fixed (no rotation)
Tilt: 15.0 deg
Orientation: 214.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.084344	-70.802133	51.60	93.83	145.44
2	43.084054	-70.801543	49.18	93.83	143.01
3	43.083901	-70.801690	49.39	93.83	143.22
4	43.083859	-70.801609	49.20	93.83	143.03
5	43.083897	-70.801574	49.27	93.83	143.10
6	43.083839	-70.801453	47.35	93.83	141.18
7	43.083345	-70.801919	51.93	93.83	145.76
8	43.083906	-70.803019	59.40	93.83	153.23
9	43.084395	-70.802537	54.24	93.83	148.07
10	43.084315	-70.802368	51.53	93.83	145.36
11	43.084337	-70.802347	51.04	93.83	144.87
12	43.084303	-70.802278	52.48	93.83	146.31
13	43.084336	-70.802245	52.51	93.83	146.34
14	43.084297	-70.802171	51.69	93.83	145.52

Name: SMBLDG
Footprint area: 0.22 acre
Axis tracking: Fixed (no rotation)
Tilt: 15.0 deg
Orientation: 214.0 deg

Rated power: -
Panel material: Smooth glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 8.43 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.084480	-70.803051	56.19	88.00	144.19
2	43.084450	-70.803081	56.31	88.00	144.31
3	43.084506	-70.803193	56.74	88.00	144.74
4	43.084466	-70.803232	56.81	88.00	144.81
5	43.084412	-70.803118	56.55	88.00	144.55
6	43.084252	-70.803275	58.91	88.00	146.91
7	43.084414	-70.803594	61.58	88.00	149.58
8	43.084643	-70.803375	58.79	88.00	146.79

Route Receptor(s)

Name: Route 1
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.082607	-70.800659	43.16	4.50	47.66
2	43.082965	-70.800254	39.75	4.50	44.25
3	43.084118	-70.798835	40.69	4.50	45.19

Name: Route 2
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.084096	-70.798795	40.76	8.50	49.26
2	43.082949	-70.800223	39.72	8.50	48.22
3	43.082597	-70.800616	42.88	8.50	51.38

Name: Route 3
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.085442	-70.804811	63.97	4.50	68.47
2	43.084962	-70.804519	67.50	4.50	72.00
3	43.084962	-70.804519	67.50	4.50	72.00
4	43.084630	-70.804302	69.07	4.50	73.57
5	43.084630	-70.804302	69.07	4.50	73.57
6	43.084394	-70.804068	68.75	4.50	73.25
7	43.083881	-70.803489	64.40	4.50	68.90
8	43.083614	-70.803103	60.85	4.50	65.35

Name: Route 4
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.083602	-70.803135	60.76	8.50	69.26
2	43.083841	-70.803542	64.38	8.50	72.88
3	43.084382	-70.804111	68.76	8.50	77.26
4	43.084618	-70.804339	69.09	8.50	77.59
5	43.084618	-70.804339	69.09	8.50	77.59
6	43.084888	-70.804519	67.86	8.50	76.36
7	43.084888	-70.804519	67.86	8.50	76.36
8	43.085416	-70.804830	64.17	8.50	72.67

Name: Route 5
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.082313	-70.799503	41.53	4.50	46.03
2	43.082995	-70.798326	37.86	4.50	42.36

Name: Route 6
Route type Two-way
View angle: 50.0 deg

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	ft	ft	ft
1	43.082966	-70.798285	37.86	8.50	46.36
2	43.082274	-70.799457	41.51	8.50	50.01

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	ft	ft	ft
1-ATCT	43.084384	-70.818882	89.93	130.00	219.93
OP 2	43.082455	-70.800057	42.02	20.00	62.02
OP 3	43.082529	-70.799934	41.99	30.00	71.99
OP 4	43.083085	-70.799471	39.01	6.00	45.01
OP 5	43.083191	-70.799294	38.75	15.00	53.75
6-ATCT	43.084349	-70.818856	89.97	120.00	209.97
OP 7	43.083343	-70.803962	70.10	40.00	110.10

1-ATCT map image

6-ATCT map image

Obstruction Components

Name: BLDG2
Upper edge height: 20.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084955	-70.806346	99.52
2	43.085031	-70.806408	98.08
3	43.084866	-70.806801	99.55
4	43.084555	-70.806565	99.98
5	43.084608	-70.806439	99.85
6	43.084444	-70.806325	99.64
7	43.084592	-70.806011	99.08
8	43.084965	-70.806346	99.43

Name: HighEdge1
Upper edge height: 22.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085534	-70.803609	57.89
2	43.085267	-70.803116	55.50

Name: HighEdge2
Upper edge height: 22.5 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085593	-70.803598	57.75
2	43.085019	-70.804161	63.07

Name: HighEdge3
Upper edge height: 22.5 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085424	-70.803445	56.71
2	43.084960	-70.803895	59.16

Name: HighEdge4
Upper edge height: 20.2 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085307	-70.803260	56.28
2	43.084860	-70.803684	58.42

Name: PRPT1
Upper edge height: 93.2 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084674	-70.803390	58.96
2	43.084478	-70.802983	56.11
3	43.084211	-70.803240	59.29
4	43.084415	-70.803648	62.46
5	43.084674	-70.803390	58.96

Name: PRPT2
Upper edge height: 99.3 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084580	-70.802457	53.31
2	43.083953	-70.801212	46.09
3	43.083224	-70.801856	52.36
4	43.083866	-70.803165	61.10
5	43.084580	-70.802457	53.31

Name: TREELINE
Upper edge height: 35.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085164	-70.808848	82.83
2	43.085454	-70.807942	81.22
3	43.085373	-70.807765	82.86
4	43.085040	-70.807564	86.97

Name: Trees
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.083891	-70.811509	72.86
2	43.084095	-70.811240	67.62

Name: Trees
Upper edge height: 17.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085036	-70.807176	92.20
2	43.084131	-70.806567	95.41

Name: Trees1
Upper edge height: 40.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085261	-70.816979	84.00
2	43.084955	-70.816877	84.48
3	43.084477	-70.817247	78.24

Name: Trees2
Upper edge height: 60.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084443	-70.818109	84.34
2	43.084602	-70.818167	84.74
3	43.084354	-70.818474	88.75

Name: Trees3
Upper edge height: 100.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084287	-70.810576	72.89
2	43.084550	-70.810195	75.28

Name: Trees4
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085793	-70.815175	77.90
2	43.085354	-70.814585	81.00
3	43.086098	-70.812858	77.64

Name: Trees5
Upper edge height: 45.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084411	-70.807233	89.30
2	43.084554	-70.807316	89.33
3	43.084677	-70.807358	89.54
4	43.084730	-70.807552	87.97

Name: Trees6
Upper edge height: 20.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085286	-70.814633	80.07
2	43.083793	-70.813418	79.96

Name: Trees7
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.083527	-70.812571	74.50
2	43.083829	-70.811932	72.49

Name: WRHSE1
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.085129	-70.813496	81.26
2	43.085227	-70.813254	81.50
3	43.085137	-70.813085	81.35
4	43.084986	-70.813064	81.23
5	43.084886	-70.813292	81.62
6	43.085129	-70.813496	81.26

Name: WRHSE2
Upper edge height: 30.0 ft

Vertex	Latitude	Longitude	Ground elevation
	deg	deg	ft
1	43.084916	-70.813107	81.43
2	43.084740	-70.813499	81.62
3	43.084705	-70.813466	81.64
4	43.084630	-70.813662	81.71
5	43.084174	-70.813292	81.76
6	43.084399	-70.812785	81.68
7	43.084501	-70.812860	81.70
8	43.084540	-70.812758	81.66
9	43.084916	-70.813107	81.43

Summary of PV Glare Analysis

PV configuration and total predicted glare

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced	Data File
	deg	deg	min	min	kWh	
CRPRT1	0.0	124.0	0	0	-	-
CRPRT2	0.0	124.0	0	0	-	-
CRPRT3	0.0	124.0	236	0	-	-
CRPRT4	0.0	124.0	566	0	-	-
CRPRT5	0.0	214.0	0	0	-	-
LGBLDG	15.0	214.0	0	0	-	-
SMBLDG	15.0	214.0	0	0	-	-

Distinct glare per month

Excludes overlapping glare from PV array for multiple receptors at matching time(s)

PV	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
crprt3 (green)	0	87	0	0	0	0	0	0	0	85	0	0
crprt3 (yellow)	0	0	0	0	0	0	0	0	0	0	0	0
crprt4 (green)	0	139	48	0	0	0	0	0	0	186	0	0
crprt4 (yellow)	0	0	0	0	0	0	0	0	0	0	0	0

PV & Receptor Analysis Results

Results for each PV array and receptor

CRPRT1 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

CRPRT2 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

CRPRT3 low potential for temporary after-image

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	79	0
Route: Route 4	157	0
Route: Route 5	0	0
Route: Route 6	0	0

CRPRT3: 1-ATCT

No glare found

CRPRT3: OP 2

No glare found

CRPRT3: OP 3

No glare found

CRPRT3: OP 4

No glare found

CRPRT3: OP 5

No glare found

CRPRT3: 6-ATCT

No glare found

CRPRT3: OP 7

No glare found

CRPRT3: Route 1

No glare found

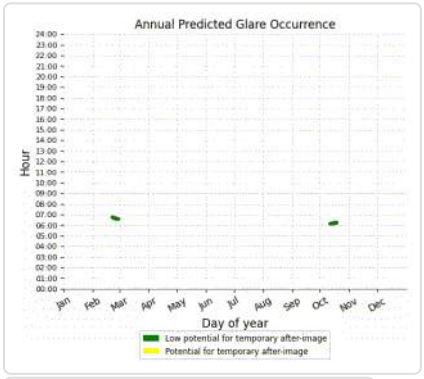
CRPRT3: Route 2

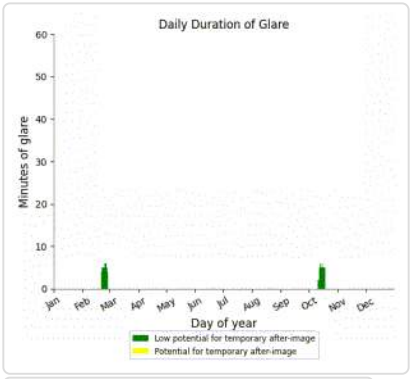
No glare found

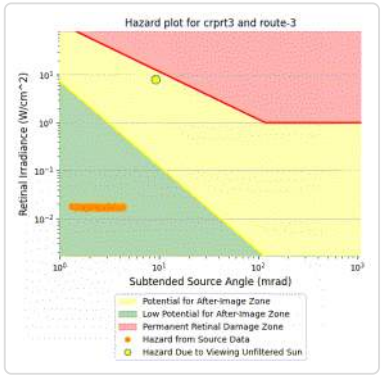
CRPRT3: Route 3

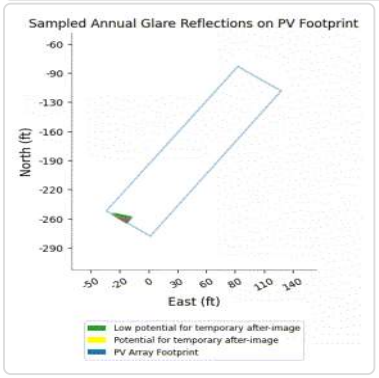
PV array is expected to produce the following glare for this receptor:

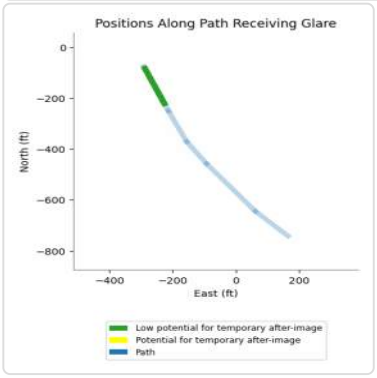
- 79 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.







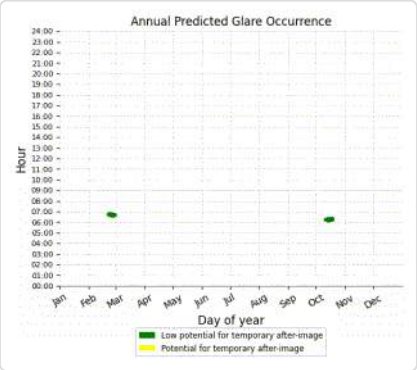


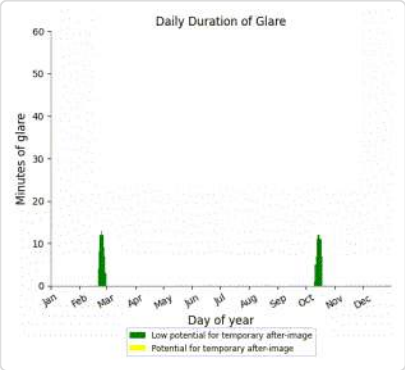


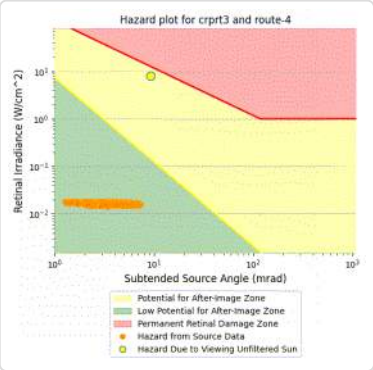
CRPRT3: Route 4

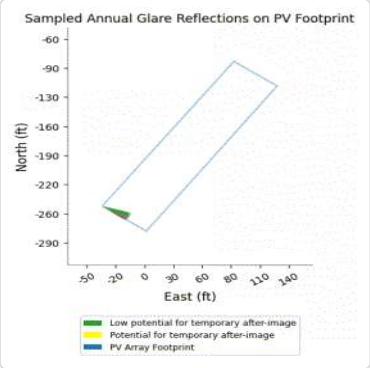
PV array is expected to produce the following glare for this receptor:

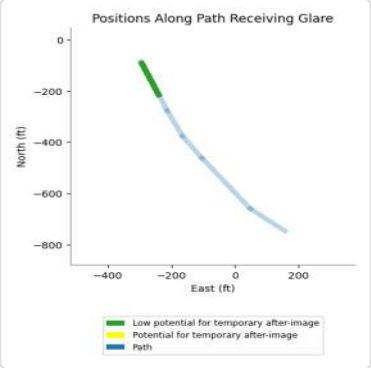
- 157 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.











CRPRT3: Route 5

No glare found

CRPRT3: Route 6

No glare found

CRPRT4 low potential for temporary after-image

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	311	0
Route: Route 4	255	0
Route: Route 5	0	0
Route: Route 6	0	0

CRPRT4: 1-ATCT

No glare found

CRPRT4: OP 2

No glare found

CRPRT4: OP 3

No glare found

CRPRT4: OP 4

No glare found

CRPRT4: OP 5

No glare found

CRPRT4: 6-ATCT

No glare found

CRPRT4: OP 7

No glare found

CRPRT4: Route 1

No glare found

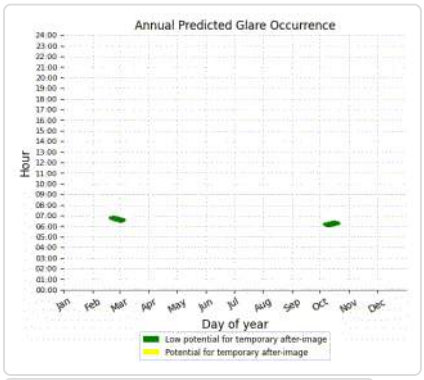
CRPRT4: Route 2

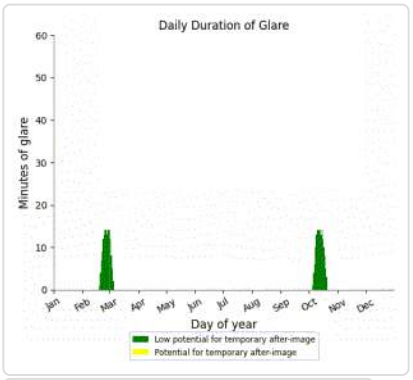
No glare found

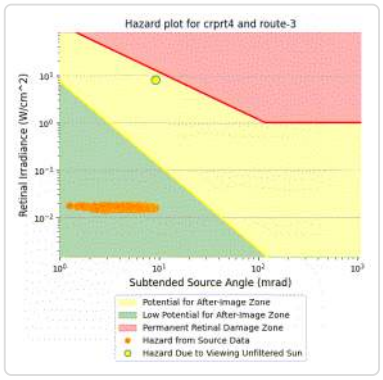
CRPRT4: Route 3

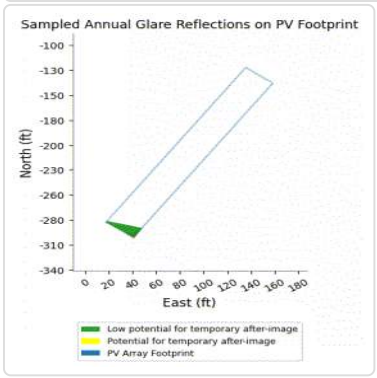
PV array is expected to produce the following glare for this receptor:

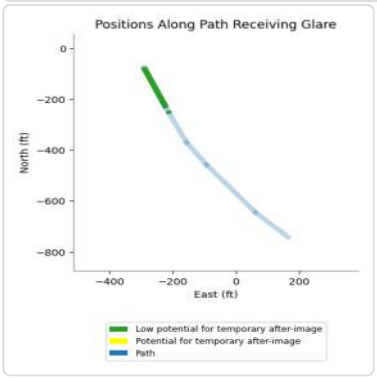
- 311 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.







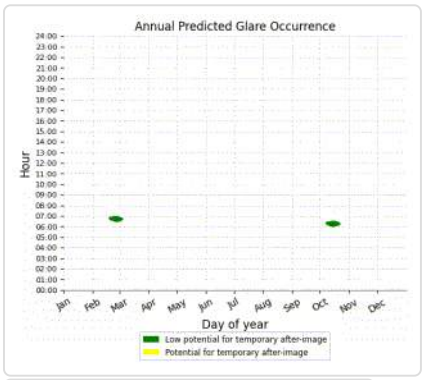


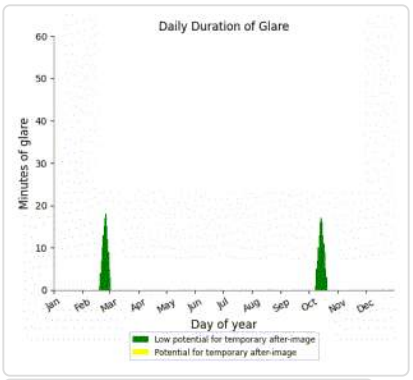


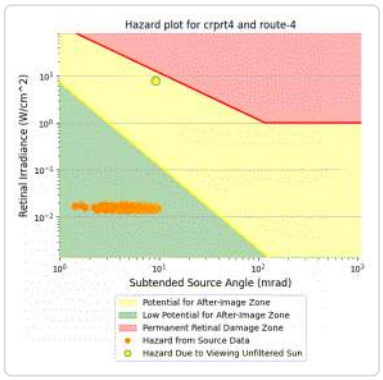
CRPRT4: Route 4

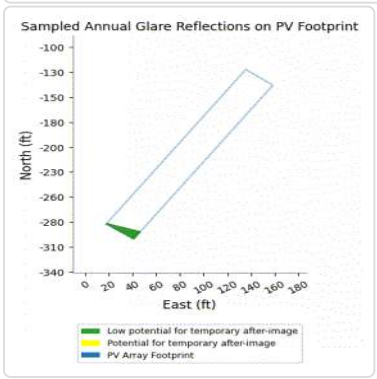
PV array is expected to produce the following glare for this receptor:

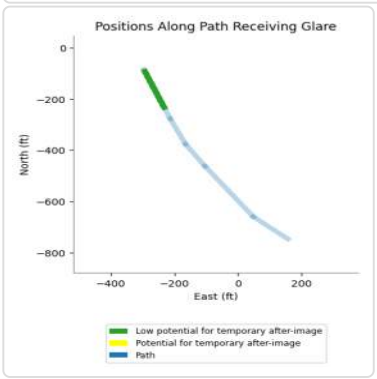
- 255 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.











CRPRT4: Route 5

No glare found

CRPRT4: Route 6

No glare found

CRPRT5 no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

LGBLDG no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

SMBLDG no glare found

Component	Green glare (min)	Yellow glare (min)
OP: 1-ATCT	0	0
OP: OP 2	0	0
OP: OP 3	0	0
OP: OP 4	0	0
OP: OP 5	0	0
OP: 6-ATCT	0	0
OP: OP 7	0	0
Route: Route 1	0	0
Route: Route 2	0	0
Route: Route 3	0	0
Route: Route 4	0	0
Route: Route 5	0	0
Route: Route 6	0	0

No glare found

Assumptions

- Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
- Glare analyses do not automatically account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographi obstructions.
- Detailed system geometry is not rigorously simulated.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values and results may vary.
- The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
- Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for larg PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.
- The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
- Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, nc discrete, spectrum.
- Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
- Refer to the **Help page** for detailed assumptions and limitations not listed here.

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