Clean Harbors Lone Mountain, LLC
40355 S. County Road 236
Waynoka, OK 78360-6302
(580) 697-3500

December 19, 2025

Ms. Hillary Young, P.E.
Chief Engineer
Land Protection Division
Oklahoma Department of Environmental Quality
707 North Robinson
P.O. Box 1677
Oklahoma City, OK 73101-1677

255723 CD___ #c___ c/o_____

RE: Response to Notice of Deficiency
Clean Harbors Lone Mountain, LLC; EPA ID No. OKD065438376

Dear Ms. Young:

Clean Harbors Lone Mountain, LLC ("CHLM" or the "Facility") received Notice of Deficiency (NOD) from the Oklahoma Department of Environmental Quality on November 20, 2025, requesting CHLM to submit drawings that are certified by a qualified Professional Engineer ("PE") in accordance with 40 C.F.R. § 264.14(a). and information clearly demonstrates that secondary containment for the proposed building will sufficiently contain 10% of the volume of the containers or the volume of the largest container, whichever is greater in accordance with 40 CFR §264.175(b)(3). for the Class 3, Tier III Permit Modification Request for Landfill Cell 16 Engineering Report submitted on August 27, 2025.

Please find the attached drawings for the Class 3, Tier III Permit Modification Request to expand CHLM's container management building required by 40 CFR § 270.14 (a) and 40 CFR § 264.175 (b)(3).

If you have any questions regarding this matter, or require any additional information, please feel free to contact me at (580) 697-3500 or meriwether.michael@cleanharbors.com or (580)-430-7219 or sawyer.christine@cleanharbors.com.

Sincerely,

Michael Meriwether
General Manager
Clean Harbors Lone Mountain, LLC

Attachments: Updated "PE" certified drawings

CC: Roarke Blackwell, ODEQ
Hilary Young, ODEQ
Michael Meriwether, Clean Harbors
Jared Torstenson, Clean Harbors
Jay Adair, Clean Harbors
Michael Crisenberry, Clean Harbors
Earthea Nance, EPA Region 6

CONTAINER MANAGEMENT BUILDING ADDITION
CLEAN HARBORS - LONE MOUNTAIN FACILITY

SECTION 33, TOWNSHIP 23 NORTH, RANGE 15 WEST I.M.

MAJOR COUNTY, OKLAHOMA

36°25'42.17"N, 98°48'20.62"W

36.428381°, -98.805728°

CleanHarbors®
ENVIRONMENTAL SERVICES, INC.

CONTACTS

CLEAN HARBORS - JOHN DINAPOLI - (781) 858-7412

CLEAN HARBORS - DOUG SCHRANTZ P.E. - (781) 556-9608

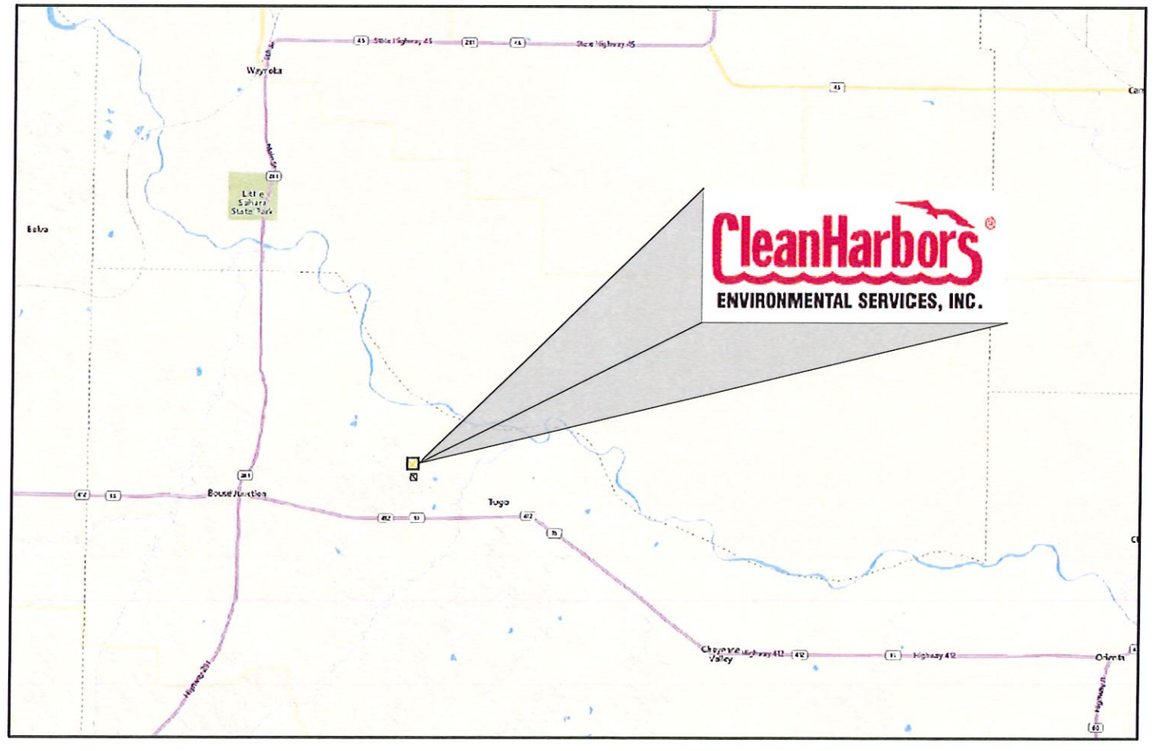
ENVIROTECH ENGINEERING & CONSULTING - ISAIAH IRBY, EIT (580)-234-8780 (DESIGN ENGINEER)

ENVIROTECH ENGINEERING & CONSULTING - TYLER WILLIAMS, PE (580)-234-8780 (SUPERVISING ENGINEER)

OKIE811
Know what's below Call before you dig.

UTILITY CAUTION

THE CONTRACTOR IS CAUTIONED THE LOCATION AND DEPTH OF EXISTING UTILITIES AS SHOWN ON THESE PLANS ARE BASED ON PUBLICLY AVAILABLE RECORDS OF THE VARIOUS UTILITY COMPANIES AND FIELD MEASUREMENTS. THE INFORMATION PROVIDED IS NOT TO BE RELIED ON AS BEING PRECISE OR COMPLETE. THE CONTRACTOR MUST CONTACT THE LOCAL UTILITY LOCATION CENTER AT LEAST 72 HOURS BEFORE ANY EXCAVATION TO REQUEST EXACT FIELD LOCATIONS OF THE UTILITIES.



INDEX TO DRAWINGS 11X17

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3.	SITE PLAN
4.	NOTES
5.	ADJOINING STRUCTURE DETAILS
6.	ARCHITECTURAL PROFILES
7.	ARCHITECTURAL PROFILES

LICENSED PROFESSIONAL ENGINEER
TYLER WILLIAMS
26476
OKLAHOMA
11/25/2025

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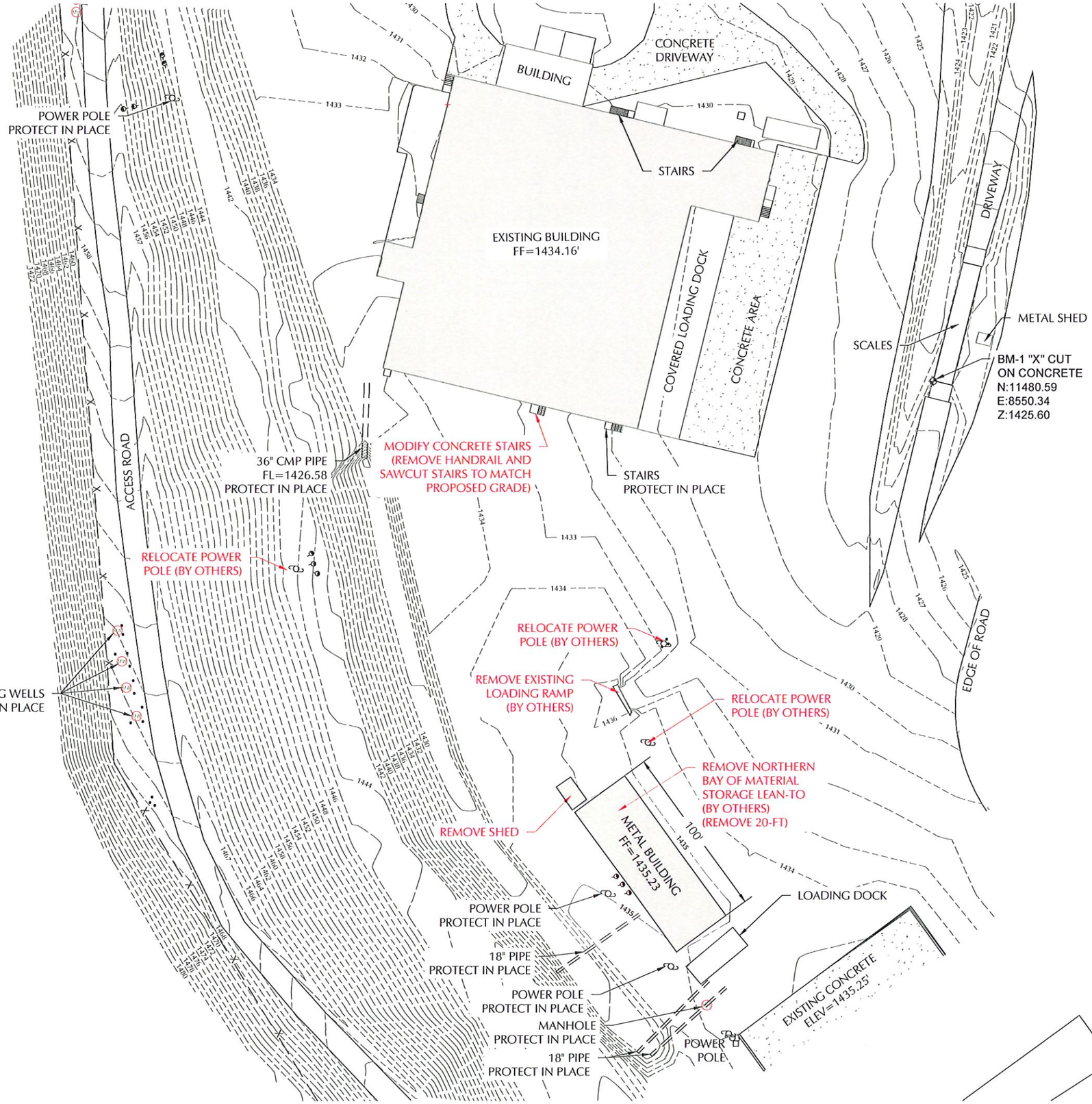

N
NORTH
0 30 60
Scale: 1"=60'
Bar Scale is intended for 11" x 17" (Full Size)

ENVIROTECH ENGINEERING
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NO.	DATE	DESCRIPTION

CleanHarbors
ENVIRONMENTAL SERVICES, INC.

EXISTING SITE AND DEMOLITION PLAN
CONTAINER MANAGEMENT BUILDING
LONE MOUNTAIN FACILITY
SECTION 33, TOWNSHIP 23 NORTH, RANGE 15 WEST, INDIAN MERIDIAN
MAJOR COUNTY, OKLAHOMA

LICENSED PROFESSIONAL ENGINEER
TYLER WILLIAMS
26476
OKLAHOMA
11/25/2025

DATE:	NOVEMBER 2025
SCALE:	1" = 60'
DESIGNED BY:	I. IRBY
DRAWN BY:	I. IRBY
CHECKED BY:	T. WILLIAMS
PROJECT NO.	024330-00
SHEET NO.	2 OF 7

11/25/2025 9:30:19 AM

EXISTING BUILDING
FF=1434.16'

MODIFY EXISTING STAIRCASE.
REMOVE HANDRAIL AND STEPS
TO MATCH PROPOSED GRADING.

36" CMP
FL=1426.58
(PROTECT IN PLACE)

CHANNEL AND PIPE INLET
LINED WITH 12"-18"
GROUTED RIP-RAP
APPROX. 160 CY RIP RAP

COVERED LOADING DOCK

EXISTING CONCRETE DRIVE

GRADE TO DRAIN

25'

45'

10.0'

1429.83'

1429.00'

1.3%

PROPOSED 15' WALKWAY
FF=1434.16'

150.0

PROPOSED 8" PVC DOWNSPOUT
CATCHMENT DRAIN PIPE @0.5%
END FL=1430.0'

PROPOSED COVERED LOADING DOCK

PROPOSED CONCRETE DRIVE
(EXTENDS UNDER COVERED
LOADING DOCK)

PROPOSED BUILDING
FF=1434.16'

172.0

STORMWATER DITCH @ 1.5%

ACCESS DRIVE

15.0' MIN

PROPOSED 8" PVC DOWNSPOUT
CATCHMENT DRAIN PIPE @0.5%
END FL=1432.0'

1429.83'

PROPOSED 6"
CONCRETE CURB 25-LF

1433.50'

PROPOSED LOCATION OF WALK DOOR
PLACE 4'x4' LEVEL CONCRETE PAD

GRADE TO DRAIN

PROPOSED 6" GRAVEL
APPROX. 390 CY

PROPOSED LOCATION OF WALK DOOR
PLACE CONCRETE STAIRCASE WITH HANDRAILS

MODIFIED SHED
EXISTING
FF=1435.23'

PROPOSED LOCATION OF OVERHEAD GARAGE DOOR
PLACE 4'x14' CONCRETE PAD FOR RAMP ACCESS
SLOPE AWAY FORM BUILDING AT 1%

ELECTRIC SERVICE LINE
(TIE INTO EXISTING
POWER POLE BY OTHERS)

MATCH EXISTING
STORMWATER DITCH

EXISTING CONCRETE
ELEV=1435.25'

GRADE TO DRAIN

-0.6%

45'

25'

1429.48'

EDGE OF ROAD

1450 1445 1440 1435 1430 1465 1460 1455 1450 1445 1435 1440 1435 1434 1433 1432 1434 1435 1434 1433 1432 1431 1430 1429 1428 1427 1426

3:1

EARTHWORK VOLUME
CUT: 4,596 CY
FILL: 1,632 CY
NET: 2,963 CY CUT
*CONCRETE VOLUME FOR PROPOSED BUILDING FOUNDATION INCLUDED IN FILL VOLUME

N
NORTH
0 20 40
Scale 1"=40'
Bar Scale is intended for 11" x 17" (Full Size)

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NO.	DATE	DESCRIPTION

CleanHarbors
ENVIRONMENTAL SERVICES, INC.

SITE PLAN
CONTAINER MANAGEMENT BUILDING
LONE MOUNTAIN FACILITY

SECTION 33, TOWNSHIP 23 NORTH, RANGE 15 WEST, INDIAN MERIDIAN
MAJOR COUNTY, OKLAHOMA

LICENSED PROFESSIONAL ENGINEER
TYLER WILLIAMS
26476
OKLAHOMA
11/25/2025

DATE:	NOVEMBER 2025
SCALE:	1" = 40'
DESIGNED BY:	I. IRBY
DRAWN BY:	I. IRBY
CHECKED BY:	T. WILLIAMS
PROJECT NO.	024330-00
SHEET NO.	3 OF 7

11/25/2025 9:27:28 AM

GENERAL NOTES:

1. ANY QUANTITIES SHOWN WITHIN THESE PLANS HAVE BEEN PROVIDED FOR PERMITTING PURPOSES ONLY AND ARE NOT INTENDED FOR USE IN PREPARATION OF CONTRACT DOCUMENTS. QUANTITIES INTENDED FOR, BUT NOT LIMITED TO, THE PREPARATION OF PROPOSALS AND BID DOCUMENTS SHALL BE INDEPENDENTLY EVALUATED BY THE ESTIMATING PARTY BASED UPON THE CONTENTS OF THESE PLANS.
2. RETURN ALL DISTURBED AREAS TO A CONDITION EQUAL TO OR BETTER THAN THE CONDITION PRIOR TO CONSTRUCTION.
3. THE SUBCONTRACTOR SHALL EMPLOY ALL NECESSARY BARRICADES, SIGNS, FENCES, FLASHING LIGHTS, FLAGMEN, ETC. FOR MAINTENANCE AND PROTECTION OF TRAFFIC AS REQUIRED BY CLEAN HARBORS REFER TO THE MANUALS ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD), LATEST EDITION, FOR DETAILS OF TRAFFIC CONTROL STANDARDS AND DEVICES.
4. THE SUBCONTRACTOR SHALL PROTECT ALL MONUMENTS, IRON PINS, AND PROPERTY CORNERS DURING CONSTRUCTION.
5. ALL SITE DIMENSIONS ARE REFERENCED TO THE FACE OF BACK OR EDGE OF PAVING UNLESS OTHERWISE NOTED. ALL BUILDING DIMENSIONS ARE REFERENCED TO THE OUTSIDE FACE OF THE STRUCTURE.
6. THE SUBCONTRACTOR SHALL VERIFY ALL DIMENSIONS IN THE FIELD PRIOR TO THE START OF CONSTRUCTION. THE SUBCONTRACTOR SHALL BE RESPONSIBLE FOR ALL FIELD DIMENSIONS AND SHALL REPORT ANY DISCREPANCIES BETWEEN THE PLANS AND ACTUAL FIELD CONDITION TO THE OWNER OR OWNER'S REPRESENTATIVE IMMEDIATELY. SUBCONTRACTOR SHALL WAIT FOR INSTRUCTION PRIOR TO PROCEEDING WITH WORK.
7. THE SUBCONTRACTOR SHALL PROVIDE SMOOTH TRANSITIONS FROM PROPOSED FEATURES TO EXISTING FEATURES AS NECESSARY.
8. THE SUBCONTRACTOR SHALL REPAIR, RESURFACE, RECONSTRUCT OR REFURBISH AT OWNERS DISCRETION ANY AREAS DAMAGED DURING CONSTRUCTION BY THE SUBCONTRACTOR, HIS SUBCONTRACTORS OR SUPPLIERS AT NO ADDITIONAL COST TO THE OWNER.
9. GRASSED AREAS DISTURBED BY CONSTRUCTION ACTIVITIES SHALL BE SEEDED OR SODDED AND ESTABLISHED AS PART OF THE PROJECT

SITE NOTES:

1. SUBCONTRACTOR SHALL REFER TO THE CONSTRUCTION DOCUMENTS, INCLUDING BUT NOT LIMITED TO THE WRITTEN SPECIFICATIONS, CONSTRUCTION DRAWINGS, STORMWATER POLLUTION PLAN, AND GEOTECHNICAL REPORT.
2. ALL CONSTRUCTION SHALL BE IN STRICT ACCORDANCE WITH THE OWNER'S DESIGN GUIDELINES AND SPECIFICATIONS, AND WHERE APPLICABLE, SHALL MEET THE REQUIREMENTS OF THE GOVERNING/PERMITTING AUTHORITY HAVING JURISDICTION.
3. SUBCONTRACTOR IS RESPONSIBLE FOR THEIR OWN HORIZONTAL AND VERTICAL CONTROL, REFERENCE POINTS, AND CONSTRUCTION STAKING AS INCIDENTAL TO THE PROJECT.
4. THE SUBCONTRACTOR SHALL FIELD VERIFY EXISTING ELEVATIONS/PROPERTY LINES/UTILITIES/DRAINAGE PRIOR TO CONSTRUCTION START.
5. ALL WORK NOT INCLUDED IN THE LUMP SUM SCOPE OF WORK SHALL BE CONSIDERED INCIDENTAL AND THE COST THEREOF SHALL BE INCLUDED IN LUMP SUM PRICING.
6. SUBCONTRACTOR SHALL REFER TO THE ARCHITECTURAL AND MEP PLANS AND SPECIFICATIONS BEING A PART OF THE CONSTRUCTION DOCUMENTS FOR THE EXACT LOCATIONS AND DIMENSIONS OF ENTRY, EXIT PORCHES, PRECISE BUILDING DIMENSIONS, EXACT BUILDING UTILITY ENTRANCE, AND DOWNSPOUT LOCATIONS/SPECIFICATIONS/DETAILS.
7. ALL DIMENSIONS SHOWN ARE TO THE EDGE OF CONCRETE UNLESS OTHERWISE NOTED.
8. BUILDING DIMENSIONS ARE TO OUTSIDE OF STEEL, UNLESS OTHERWISE SHOWN.
9. SUBCONTRACTOR SHALL REFER TO THE ARCHITECTURAL AND STRUCTURAL PLANS AND SPECIFICATIONS PREPARED BY OTHERS FOR ACTUAL LOCATION AND DETAILS OF ALL UTILITY ENTRANCES. SUBCONTRACTOR SHALL COORDINATE INSTALLATION OF UTILITIES IN SUCH AS MANNER AS TO AVOID CONFLICTS AND ASSURE PROPER DEPTHS ARE ACHIEVED, AS WELL AS COORDINATE WITH ANY UTILITY COMPANIES FOR APPROVED LOCATIONS AND SCHEDULING OF TIE-INS/CONNECTIONS TO THEIR FACILITIES.
10. REFER TO ARCHITECTURE PLANS FOR SITE LIGHTING AND ELECTRICAL CONDUIT PLANS. POLE LOCATIONS ARE SHOWN ON THIS SHEET FOR REFERENCE ONLY. IT IS THE SUBCONTRACTORS RESPONSIBILITY TO IDENTIFY AND ADJUST ANY CONSTRUCTED CONFLICTS WITH UNDERGROUND UTILITIES, SIDEWALKS, ETC.
11. CHECK ARCHITECTURAL PLANS FOR EXACT DOWNSPOUT LOCATIONS.

PAVING NOTES:

1. ALL PAVING MATERIALS AND CONSTRUCTION SHALL BE IN ACCORDANCE WITH THESE PLANS, THE FINAL GEOTECHNICAL REPORT, COMMONLY ACCEPTED CONSTRUCTION STANDARDS, OR AT THE SOLE DISCRETION OF THE OWNERS.
2. SUBCONTRACTOR IS RESPONSIBLE FOR ALL PAVING AND PAVING SUBGRADE TESTING AND CERTIFICATION, UNLESS SPECIFIED OTHERWISE BY OWNER. ALL PAVING AND PAVING SUBGRADE TESTING SHALL BE COORDINATED WITH ENVIROTECH.
3. SUBCONTRACTOR SHALL CONSTRUCT PROPOSED PAVEMENT TO MATCH EXISTING PAVEMENT AND BE PINNED WITH A SMOOTH, FLUSH, TRANSITION.
4. SUBCONTRACTOR SHALL FURNISH AND INSTALL ALL PAVEMENT MARKINGS AS DIRECTED BY OWNER.
5. ALL REINFORCING STEEL FOR CONCRETE PAVING SHALL CONFORM TO THE GEOTECHNICAL REPORT, CITY STANDARDS, AND ASTM A-615, GRADE 60, AND SHALL BE SUPPORTED PROPERLY BY REBAR CHAIRS.
6. SUBCONTRACTOR SHALL TAKE FIELD SLOPE MEASUREMENTS ON FINISHED SUBGRADE AND FORM BOARDS PRIOR TO PLACING PAVEMENT TO VERIFY THAT ALL ADA SLOPE REQUIREMENTS ARE PROVIDED. SUBCONTRACTOR SHALL CONTACT PROJECT ENGINEER PRIOR TO PAVING IF ANY EXCESSIVE SLOPES ARE ENCOUNTERED. NO SUBCONTRACTOR CHANGE ORDERS WILL BE ACCEPTED FOR ADA SLOPE COMPLIANCE ISSUES.

DEMOLITION NOTES:

1. THE SUBCONTRACTOR SHALL FIELD VERIFY AND LOCATE ALL EXISTING UTILITIES ON SITE PRIOR TO DEMOLITION.
2. THE SUBCONTRACTOR SHALL PERFORM DEMOLITION ACTIVITIES AS NOTED AND SHOWN ON THESE PLANS AND AS DIRECTED BY THE OWNER.
3. IT WILL BE THE SUBCONTRACTOR'S RESPONSIBILITY TO OBTAIN ANY PERMITS AND PAY FEES REQUIRED FOR DEMOLITION AND HAUL-OFF FROM THE APPROPRIATE AUTHORITIES.
4. THE SUBCONTRACTOR SHALL PREPARE ALL DOCUMENTS AND ACQUIRE APPROPRIATE PERMITS AS REQUIRED PRIOR TO THE COMMENCEMENT OF DEMOLITION.
5. THE DEMOLITION PLAN IS INTENDED TO DEPICT GENERAL DEMOLITION AND UTILITY WORK. IT IS NOT INTENDED TO IDENTIFY EACH ELEMENT OF DEMOLITION OR RELOCATION. SUBCONTRACTOR SHALL COORDINATE WITH THE OWNER AND APPROPRIATE UTILITY COMPANY PRIOR TO WORK.
6. SUBCONTRACTOR TO COMPLETELY DEMOLISH AND DISPOSE OF OFFSITE OR AS DIRECTED BY OWNER IN A LAWFUL MANNER EXISTING BUILDINGS, INCLUDING FOUNDATIONS AND ALL APPURTENANCES.
7. REMOVE AND DISPOSE OF ANY SIDEWALK, FENCES, STAIRS, WALLS, FOUNDATIONS, CONDUITS, LIGHT POLE BASES, DEBRIS AND RUBBISH REQUIRING REMOVAL FROM THE WORK AREA IN AN APPROVED LANDFILL.
8. REMOVE AND/OR PLUG EXISTING UTILITIES SUCH AS SANITARY SEWER, WATER, GAS, ELECTRIC, AND TELEPHONE AS SHOWN. THE SUBCONTRACTOR IS RESPONSIBLE FOR CONTACTING EACH UTILITY COMPANY TO COORDINATE REMOVAL OF ALL UTILITIES AND FOR DETERMINING HORIZONTAL AND VERTICAL LOCATIONS OF UTILITIES PRIOR TO COMMENCING WORK.
9. THE SUBCONTRACTOR SHALL ARRANGE FOR RESETTING OF CURB BOXES, VALVE BOXES AND REMOVAL AND/OR RELOCATION OF OVERHEAD UTILITIES AND POLES WITH THE APPROPRIATE UTILITY COMPANY.
10. INSTALL ALL EROSION AND SEDIMENT CONTROL DEVICE PROTECTION PRIOR TO BEGINNING DEMOLITION WORK.
11. THE SUBCONTRACTOR IS RESPONSIBLE FOR THE PROTECTION OF ALL UTILITIES TO REMAIN IN PLACE.
12. ALL EXISTING ITEMS TO REMAIN, WHICH ARE DAMAGED DURING CONSTRUCTION SHALL BE RESTORED TO ITS ORIGINAL CONDITION AT THE SOLE EXPENSE OF THE SUBCONTRACTOR.
13. DO NOT INTERRUPT EXISTING UTILITIES SERVICING FACILITIES OCCUPIED AND USED BY THE OWNER OR OTHERS DURING OCCUPIED HOURS EXCEPT WHEN SUCH INTERRUPTIONS HAVE BEEN AUTHORIZED IN WRITING BY THE OWNER AND THE LOCAL MUNICIPALITIES. INTERRUPTIONS SHALL ONLY OCCUR AFTER ACCEPTABLE TEMPORARY SERVICE HAS BEEN PROVIDED.
14. SHOULD ANY UNCHARTED OR INCORRECTLY CHARTED EXISTING PIPING OR OTHER UTILITY BE UNCOVERED DURING EXCAVATION, CONSULT THE ENGINEER AND OWNER IMMEDIATELY FOR DIRECTIONS BEFORE PROCEEDING FURTHER WITH WORK IN THIS AREA.

GRADING NOTES:

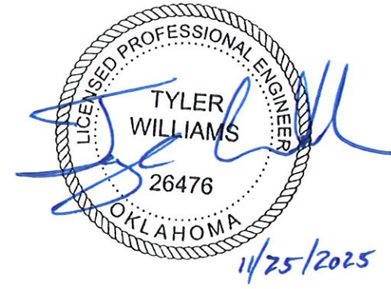
1. SUBCONTRACTOR SHALL REFER TO THE SITE-SPECIFIC GEOTECHNICAL REPORT FOR EXISTING SOIL CONDITIONS, CONSIDERATIONS, AND RECOMMENDATIONS.
2. SUBCONTRACTOR SHALL REFER TO THE CONSTRUCTION DOCUMENTS, INCLUDING BUT NOT LIMITED TO THE WRITTEN SPECIFICATIONS, CONSTRUCTION DRAWINGS, STORMWATER POLLUTION PLAN, AND GEOTECHNICAL REPORT.
3. SUBCONTRACTOR IS RESPONSIBLE FOR THEIR OWN HORIZONTAL AND VERTICAL CONTROL, REFERENCE POINTS, AND CONSTRUCTION STAKING AS INCIDENTAL TO THE PROJECT.
4. THE SUBCONTRACTOR SHALL FIELD VERIFY EXISTING ELEVATIONS/PROPERTY LINES/UTILITIES/DRAINAGE PRIOR TO CONSTRUCTION START.
5. ALL SITE EXCAVATION SHALL BE CONSIDERED UNCLASSIFIED EXCAVATION.
6. SUBCONTRACTOR SHALL PROVIDE FINAL GRADES THAT DO NOT OBSTRUCT ANY UTILITY ACCESS AND PROVIDE A SMOOTH TRANSITION TO MEET AND MATCH EXISTING GRADES ON ALL SIDES.
7. ALL NATURAL GROUND SLOPES SHALL NOT EXCEED 3:1. PAVING SLOPES SHALL NOT EXCEED 8%.
8. SUBCONTRACTOR SHALL ENSURE THAT ALL NECESSARY EARTH DISTURBING PERMITS HAVE BEEN ACQUIRED AND MEET THE CONDITIONS/REQUIREMENTS SET FORTH IN THE PERMITS PRIOR TO CONSTRUCTION.
9. SUBCONTRACTOR IS REQUIRED TO CALL ONE CALL AS WELL AS THE APPROPRIATE UTILITY COMPANY AT LEAST 48 HOURS BEFORE ANY EXCAVATION/CONSTRUCTION ACTIVITIES TAKE PLACE. IT SHALL BE THE RESPONSIBILITY OF THE SUBCONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH ARE IN CONFLICT WITH PROPOSED IMPROVEMENTS.
10. THE SUBCONTRACTOR SHALL GRADE THE SITE TO ENSURE ALL SURFACE WATER DRAINAGE IS AWAY FROM THE BUILDING AND PROVIDES POSITIVE DRAINAGE SO THAT NO STANDING/PONDING WATER TAKES PLACE ON SITE OR ON ADJACENT PROPERTIES.
11. THE BUILDING SUBGRADE SHALL BE CONSTRUCTED TO INCLUDE A MINIMUM OF 5-FT BEYOND THE BUILDING LIMITS AS SHOWN ON THE PLANS, OR AS DIRECTED BY THE OWNER.
12. REFERENCE ARCHITECTURAL AND STRUCTURAL DRAWINGS FOR BUILDING SPECIFICS.
13. THE BUILDING FOUNDATION SUBGRADE SHALL BE PREPARED IN STRICT ACCORDANCE WITH THE GEOTECHNICAL ENGINEERING STUDY AND THE CIVIL SPECIFICATIONS.
14. ESTABLISH FINAL SUBGRADE ELEVATIONS TO ALLOW FOR PAVEMENT/SLAB SECTIONS AS INDICATED ON THE PLANS.
15. IF CONFLICTS EXIST BETWEEN THE GEOTECHNICAL REPORT AND THE CONSTRUCTION DRAWINGS AND SPECIFICATIONS, THE MORE STRINGENT REQUIREMENTS SHALL APPLY.

UTILITY NOTES:

1. SUBCONTRACTOR SHALL REFER TO THE CONSTRUCTION DOCUMENTS, INCLUDING BUT NOT LIMITED TO THE WRITTEN SPECIFICATIONS, CONSTRUCTION DRAWINGS, AND GEOTECHNICAL REPORT.
2. ALL CONSTRUCTION SHALL BE IN STRICT ACCORDANCE WITH THE OWNER'S DESIGN GUIDELINES AND SPECIFICATIONS, AND WHERE APPLICABLE, SHALL MEET THE REQUIREMENTS OF THE GOVERNING/PERMITTING AUTHORITY HAVING JURISDICTION.
3. THE SUBCONTRACTOR SHALL FIELD VERIFY EXISTING ELEVATIONS/PROPERTY LINES/UTILITIES/DRAINAGE PRIOR TO CONSTRUCTION START.
4. SUBCONTRACTOR SHALL REFER TO THE ARCHITECTURAL AND MEP PLANS AND SPECIFICATIONS BEING A PART OF THE CONSTRUCTION DOCUMENTS FOR THE EXACT LOCATIONS AND DIMENSIONS OF ENTRY, EXIT PORCHES, PRECISE BUILDING DIMENSIONS, EXACT BUILDING UTILITY ENTRANCE, AND DOWNSPOUT LOCATIONS/SPECIFICATIONS/DETAILS.
5. SUBCONTRACTOR IS REQUIRED TO CALL ONE CALL AS WELL AS THE APPROPRIATE UTILITY COMPANY AT LEAST 48 HOURS BEFORE ANY EXCAVATION/CONSTRUCTION ACTIVITIES TAKE PLACE. IT SHALL BE THE RESPONSIBILITY OF THE SUBCONTRACTOR TO RELOCATE ALL EXISTING UTILITIES WHICH ARE IN CONFLICT WITH PROPOSED IMPROVEMENTS.
6. SUBCONTRACTOR SHALL ENSURE ALL CONSTRUCTED UTILITIES MEET THE MINIMUM SEPARATION AND COVER REQUIREMENTS SET FORTH BY THE PROVIDER, FEDERAL/STATE/LOCAL REGULATIONS, OR SPECIFICATIONS. IN THE EVENT THERE IS A CONFLICT, THE MOST STRINGENT SHALL APPLY.
7. DIMENSIONS SHOWN ARE TO CENTERLINE OF UTILITY
8. SUBCONTRACTOR SHALL COMPLY COMPLETELY WITH THE LATEST STANDARDS OF OSHA DIRECTIVES OR ANY OTHER AGENCY HAVING JURISDICTION FOR EXCAVATION AND TRENCHING PROCEDURES. THE SUBCONTRACTOR SHALL USE SUPPORT SYSTEMS, SLOPING, BENCHING, AND OTHER MEANS OF PROTECTION. THIS IS TO INCLUDE, BUT NOT LIMITED TO, ACCESS AND EGRESS FROM ALL EXCAVATION AND TRENCHING. SUBCONTRACTOR IS RESPONSIBLE FOR COMPLYING WITH PERFORMANCE CRITERIA AS REQUIRED BY OSHA.

EROSION CONTROL NOTES:

1. ALL SUBCONTRACTORS INVOLVED WITH STORMWATER POLLUTION PREVENTION SHALL OBTAIN A COPY OF THE STORMWATER POLLUTION PREVENTION PLAN
2. ALL TEMPORARY EROSION AND SEDIMENT CONTROLS MEASURES SHALL BE DISPOSED OF WITHIN 30 DAYS AFTER FINAL STABILIZATION. FINAL STABILIZATION HAS OCCURRED WHEN ALL SOIL DISTURBING ACTIVITIES ARE COMPLETED AND ESTABLISHED.
3. BEST MANAGEMENT PRACTICES (BMPS) AND CONTROLS SHALL CONFORM TO FEDERAL, STATE, OR LOCAL REQUIREMENTS OR MANUAL OF PRACTICES, AS APPLICABLE. SUBCONTRACTOR SHALL IMPLEMENT ADDITIONAL CONTROLS AS DIRECTED BY PERMITTING AGENCY OR OWNER.
4. SUBCONTRACTOR SHALL MINIMIZE CLEARING TO THE MAXIMUM EXTENT PRACTICAL.
5. ALL STORMWATER POLLUTION PREVENTION MEASURES PRESENTED ON THIS PLAN, AND IN THE STORMWATER POLLUTION PREVENTION PLAN, SHALL BE INITIATED AS SOON AS PRACTICABLE.
6. DISTURBED PORTIONS OF THE SITE WHERE CONSTRUCTION ACTIVITY HAS STOPPED FOR AT LEAST 14-DAYS SHALL BE TEMPORARILY SEEDED AND COVERED. THESE AREAS SHALL BE SEEDED AND COVERED NO LATER THAN 14-DAYS FROM THE LAST CONSTRUCTION ACTIVITY OCCURRING IN THESE AREAS.
7. DISTURBED PORTIONS OF THE SITE WHERE CONSTRUCTION ACTIVITY HAS PERMANENTLY STOPPED SHALL BE PERMANENTLY SEEDED AND COVERED. THESE AREAS SHALL BE SEEDED AND COVERED NO LATER THAN 14-DAYS AFTER THE LAST CONSTRUCTION ACTIVITY OCCURRING IN THESE AREAS. REFER TO THE GRADING PLAN AND/OR LANDSCAPE PLAN.
8. ALL MATERIALS SPILLED, DROPPED, WASHED, OR TRACKED FROM VEHICLES ONTO ROADWAYS OR INTO STORM DRAINS MUST BE REMOVED IMMEDIATELY.
9. SUBCONTRACTORS WILL BE RESPONSIBLE FOR REMOVING SEDIMENT THAT MAY HAVE COLLECTED IN THE STORM SEWER DRAINAGE SYSTEMS IN CONJUNCTION WITH THE STABILIZATION OF THE SITE.
10. ONSITE AND OFFSITE SOIL STOCKPILE AND BORROW AREAS SHALL BE PROTECTED FROM EROSION AND SEDIMENTATION THROUGH IMPLEMENTATION OF BEST MANAGEMENT PRACTICES. STOCKPILE AND BORROW AREA LOCATIONS SHALL BE NOTED ON THE SITE PLAN AND PERMITTED IN ACCORDANCE WITH GENERAL PERMIT REQUIREMENTS.
11. SILT FENCING SHALL BE INSTALLED DOWN GRADIENT OF ALL STOCKPILES TO PREVENT RUNOFF OF CONSTRUCTION MATERIAL.
12. SLOPES SHALL BE LEFT IN A ROUGHENED CONDITION DURING THE GRADING PHASE TO REDUCE RUNOFF VELOCITIES AND EROSION.
13. DUE TO THE GRADE CHANGES DURING THE DEVELOPMENT OF THE PROJECT, THE SUBCONTRACTOR SHALL BE RESPONSIBLE FOR ADJUSTING THE EROSION CONTROL MEASURES (SILT FENCES, ETC.) TO PREVENT EROSION AND RUNOFF.



ENVIROTECH ENGINEERING
2500 North Eleventh Street
Enid, Oklahoma
580.234.8780
envirotechconsulting.com
P.E. #24553 - Expiration Date: 1-31-2025

NO.	DATE	DESCRIPTION

CleanHarbors ENVIRONMENTAL SERVICES, INC.

NOTES
CONTAINER MANAGEMENT BUILDING
LONE MOUNTAIN FACILITY
SECTION 33, TOWNSHIP 23 NORTH, RANGE 15 WEST, INDIAN MERIDIAN
MAJOR COUNTY, OKLAHOMA

DATE:	NOVEMBER 2025
SCALE:	NOT TO SCALE
DESIGNED BY:	I. IRBY
DRAWN BY:	I. IRBY
CHECKED BY:	T. WILLIAMS
PROJECT NO.	024330-00
SHEET NO.	4 OF 7

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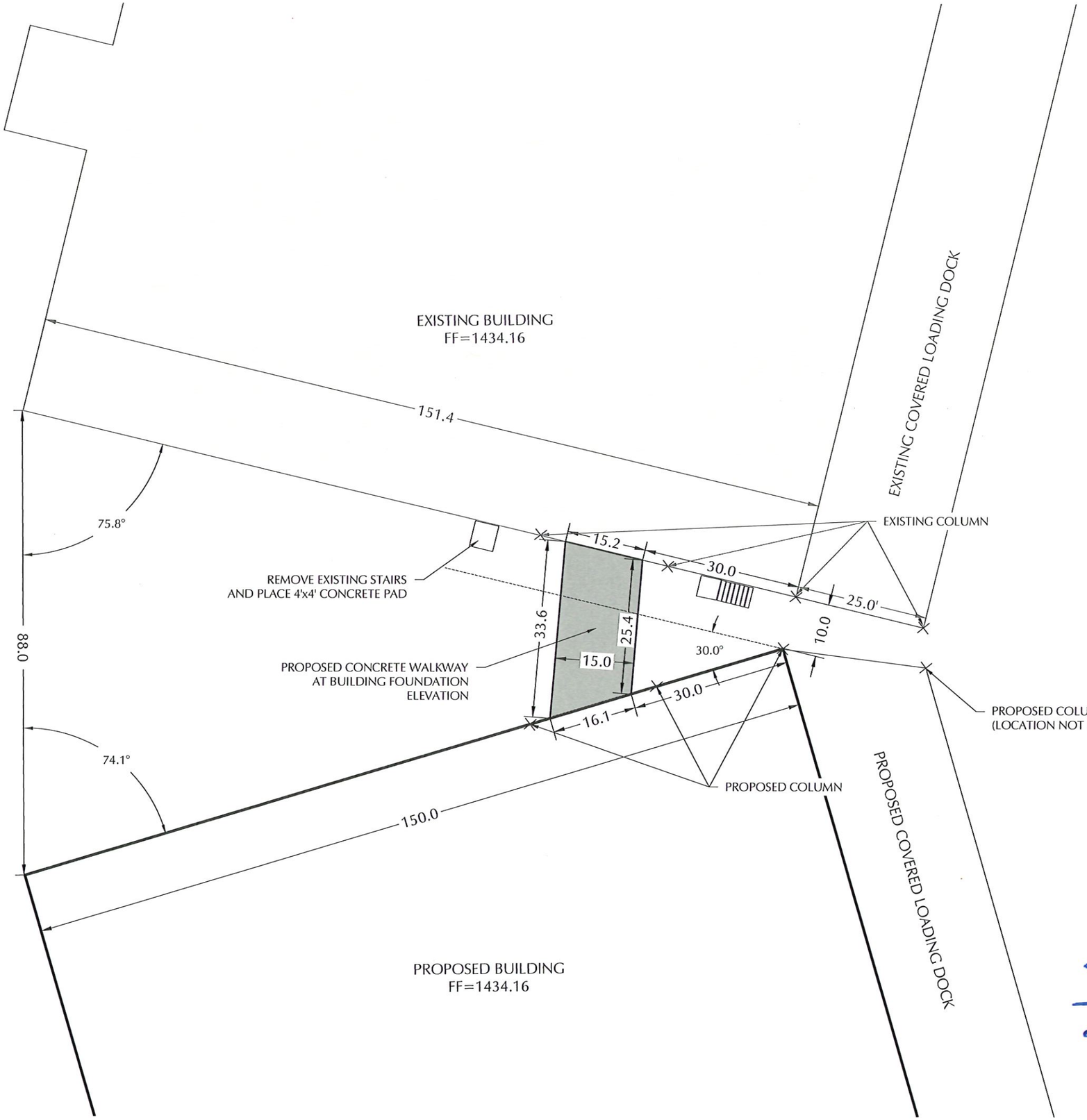

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TYLER WILLIAMS
26476
OKLAHOMA
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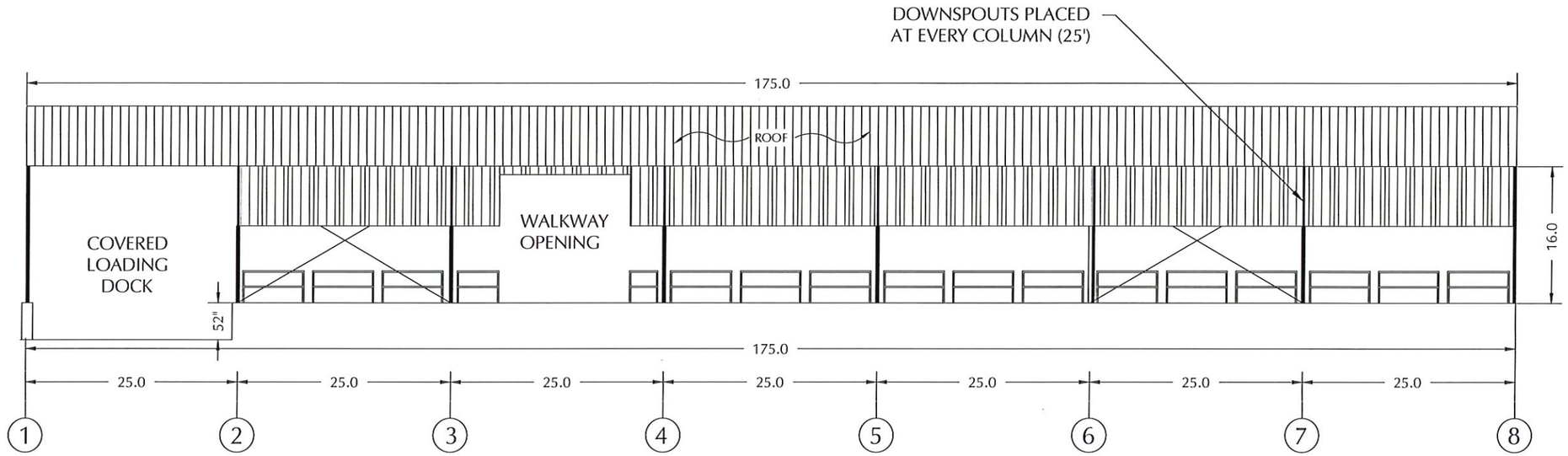

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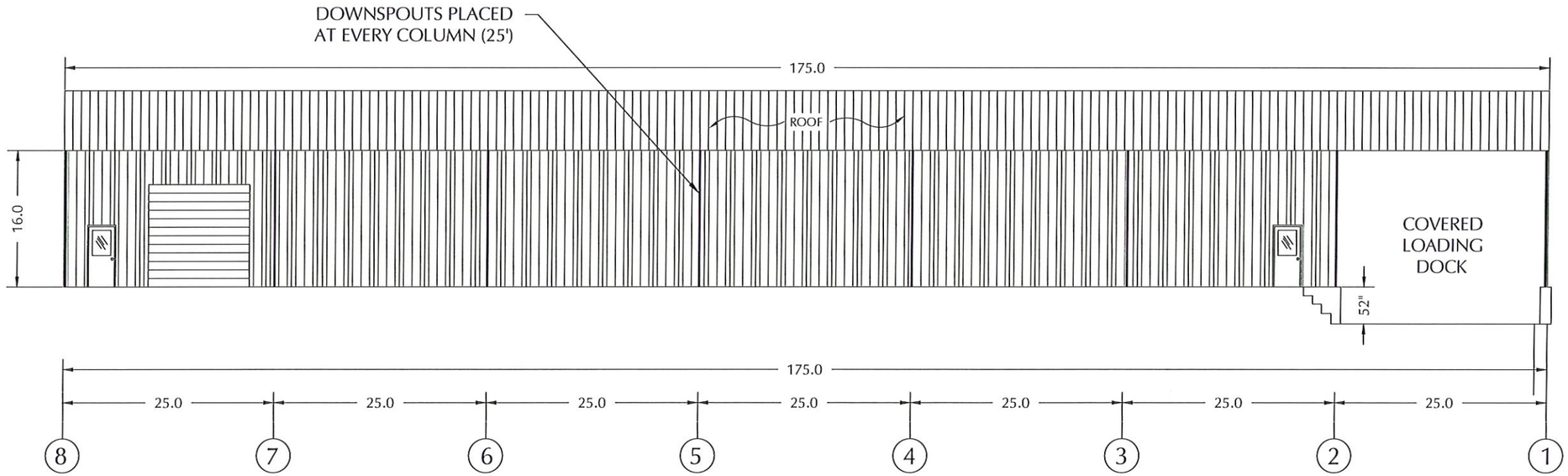

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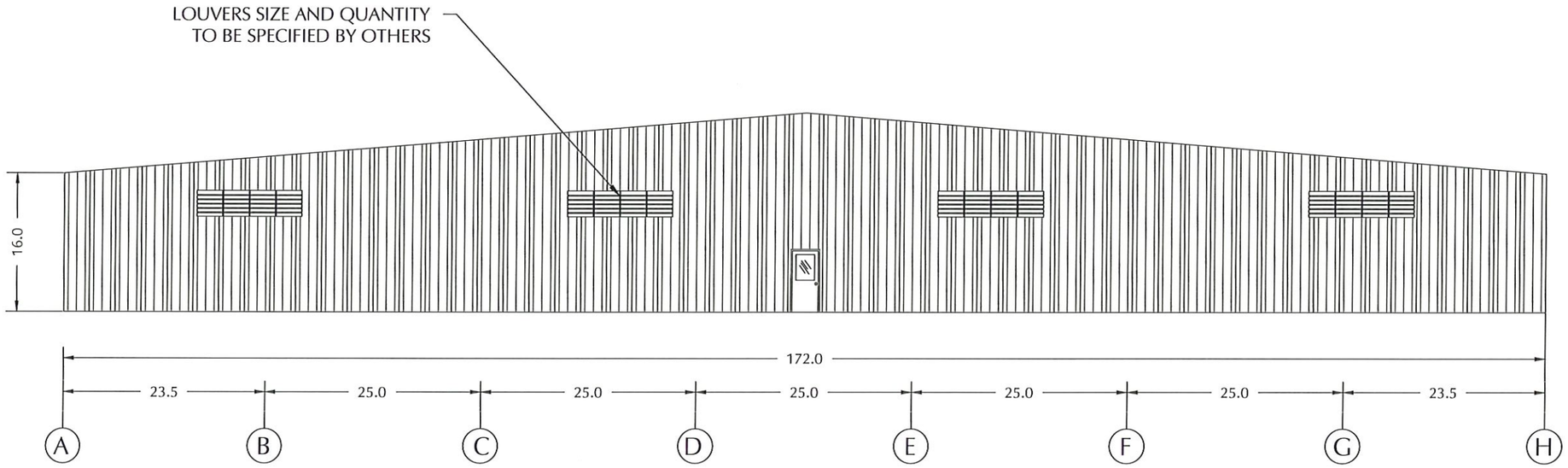

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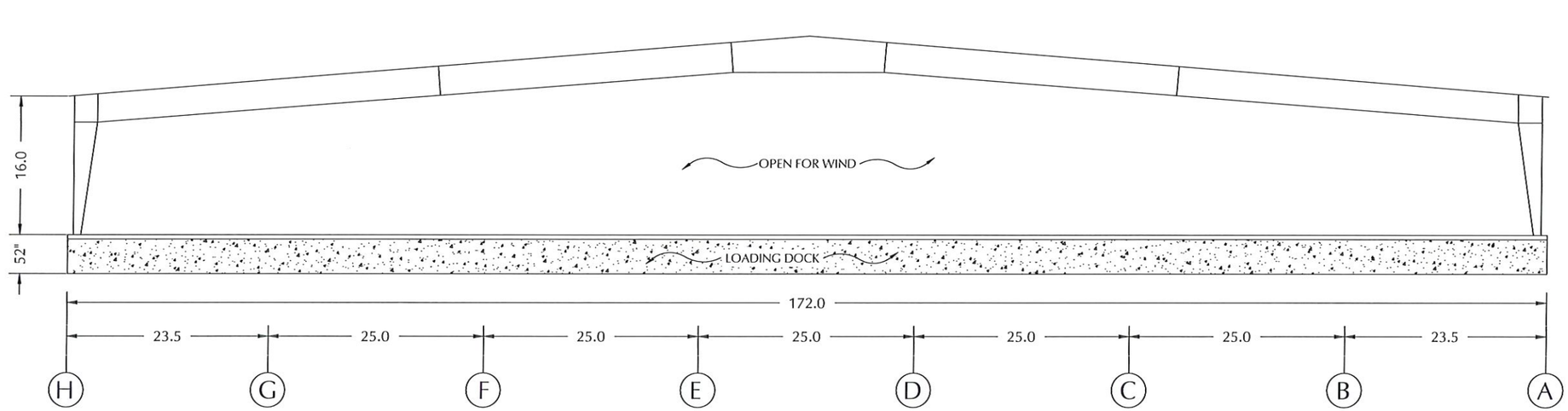

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Lone Mountain Facility
Waynoka, Oklahoma

Secondary Containment Design Report
for
Container Management Building Addition

December 15, 2025

REGISTERED PROFESSIONAL ENGINEER
FAIZUR R.
KHAN
21035
OKLAHOMA

12-15-2025

Table of Contents

List of Appendix

List of Figures

List of References

Reference 1: National Oceanic and Atmospheric Administration (NOAA) Atlas 14, Volume 8
Reference 2: Oklahoma Climatological Survey for Major County by Mesonet.
Reference 3: The speed of falling raindrop – The Physics Factbook.

1.0 Introduction

Clean Harbors Lone Mountain Facility, LLC (Clean Harbors) plans to permit Container Management Building Addition, which will be located immediately south of the existing Containment Management Building. The footprint and the storage capacity of the proposed Container Management Building Addition will be the same as that of the existing building. A Class 3, Tier 3 Permit Modification Request ("application") for Containment Management Building Addition was submitted to the Oklahoma Department of Environmental Quality (DEQ) on August 20, 2025.

Subsequently, on November 20, 2025, DEQ notified Clean Harbors that the Class 3 Permit application was found to be administratively complete and began conducting technical review of the application. As a part of the technical review, DEQ issued a Notice of Deficiency (NOD) and stated that a Secondary Containment capacity calculations for the proposed Container Management Building Addition must be submitted in accordance with 40 C.F.R. Part 264.175. This secondary containment design report contains the engineering analyses, detailed secondary containment capacity calculations, drawings, and supporting documentation (including references) for the Container Management Building addition.

It should be noted that the container storage management procedures (including off-loading, handling, transfer, inspection, sampling etc.) will be identical to that of the existing building. These procedures are described in detail in Volume 5 of the Lone Mountain Facility Permit Renewal document dated September, 2020.

2.0 Container Building Addition Capacity

The Container Management Building Addition can store a maximum capacity of 182,930 gallons of hazardous wastes, (equivalent to 3,326 55-gallon drums). This capacity is the same as that of the existing building capacity. A typical layout of the Container Management Building Addition is presented in Figure 2 (attached). Most of the containers in this proposed building are 55- gallon drums, 23 inches in diameter by 34 inches in height. The proposed building will handle approximately 1,000 containers of each flammable, solvent-based waste, acidic waste, and caustic waste. Approximately 300, 55-gallon drums may contain liquid reactive waste and lab packs.

These proportions may vary according to the daily fluctuations in the quantities received and stored at the facility. The Container Management Building includes a receiving dock, segregated storage areas, and storage/processing area. Assignment and transfer to the appropriate segregated storage or disposal area will occur in conjunction with waste characterization/analysis.

3.0 Requirement for the Base or Liner to Contain Liquids

The Container Management Building shall be constructed on a nominal eight (8) inch thick reinforced concrete pad over a compacted fill base. All concrete construction shall meet the design and construction standards specified in Americal Concrete Institute (ACI) Section ACI-318- 83, referred to as

"Reinforced Concrete Design" standards. The concrete compressive strength (after twenty-eight (28) days of curing) shall be three thousand (3000) psi or greater. The floor slab and containment walls shall be watertight, free of cracks or gaps[1]. All joints shall contain continuous water-stop to prevent any migration of liquid outside the containment. The containment system is designed to contain accumulated liquid resulting from leaks, spills, and wind-driven rain and shall be removed expeditiously. Liquids accumulated in the secondary containment areas, sumps, or low points because of spills or leaks will be removed within 24 hours of discovery, while liquids resulting from precipitation only will be removed within 48 hours of discovery or when the precipitation event has ended.

Concrete containment shall be provided by an eight (8) inch minimum thick, and a minimum of six (6) inch high curb around the building perimeter except for the loading dock (east) side. Containment is achieved at the loading dock side by abruptly sloping the floor 2-inches as shown in Figure 1A. In addition, internal curbs shall be constructed to segregate the storage areas from each other. Concrete sealant(s)/hardener(s), compatible with the waste types to which it may be exposed, shall be applied to all concrete surfaces in the containment system sumps prior to placing the new building in operation (see Figure 4).

4.0 Secondary Containment System Drainage

The floor of the container receiving and storage areas of the Container Management Building Addition is sloped at a grade of approximately one eighth (1/8) inch per foot from the front and rear of the slot towards a drainage trough along the slot centerline. The drainage trough is a minimum of twenty-four (24) inches deep and slopes at approximately one quarter (1/4) inch per foot from one side of the slot towards the other side of the slot. A plan view and cross section of the Container Management Building Addition is presented in Figures 2 and 3, respectively.

5.0 Secondary Containment System Capacity

A summary of the Secondary containment capacity calculations for the different areas of the Container Management Building Addition is presented in Appendix 1. The secondary containment capacity calculations show that the available containment capacity is substantially more than the capacity required per 40 CFR 264.175 (b)(3) and 40 CFR 264.175 (b)(4). The covered storage areas minimize infiltration of rain or dispersion of waste by wind. Rainwater from the roof is brought to ground level by a system of roof drains. Site grading around the building diverts water away from the building. Walls, curbs, and elevated floors prevent the run-on of storm water into containment areas.

6.0 Control of Run On

The covered storage areas minimize infiltration of rain or dispersion of waste by wind. The east side of the building has a 25-foot canopy (overhang) where the loading dock is located. The canopy(overhang) will prevent wind driven rain from entering the containment area. The west, north and south side of the building is protected from rain by metal siding. However, the north side of the building is partially open

[1] Cracks and gaps in the concrete surface will be corrected in a timely fashion. It is noted that superficial or insignificant cracks and gaps may occur in concrete surfaces which do not infringe upon secondary containment.

and subjected to wind driven rain. A very conservative estimate of the volume of rain entering the containment area from the north side is presented in Appendix 1. Rainwater from the roof is transported to ground level by a system of roof drains(downspouts). Positive site grading around the building diverts water away from the building. Walls, curbs, and elevated floors minimize run-on of storm water into the containment areas.

7.0 Removal of Liquids from Containment System

The slopes of the floors in the receiving and storage areas promote drainage toward troughs. Troughs will be inspected daily for the presence of liquids. Inspection schedules are discussed in detail in the facility permit Inspection Program. Liquids shall be removed by means of pumps or a vacuum tanker. The estimated volume of liquid removed, available analytical data, and disposal method shall be entered into the facilities Operating Record. The liquids shall be tested in accordance with the facilities Waste Analysis Plan.

APPENDIX 1

CONTAINER MANAGEMENT BUILDING ADDITION SECONDARY CONTAINMENT CAPACITY CALCULATIONS

PROBLEM: Calculate the secondary containment Capacity of Container Management Building Additions.

REGULATORY CRITERIA (40 CFR Part 264.175): Secondary containment must be able to store storm water resulting from a 25-year, 24-hour storm event plus the volume of the largest tank or 10% of the total volume, whichever is larger.

GIVEN: a) 25-year, 24-hour storm event = 5.85 inches (Per attached NOAA Atlas 14)
b) Building Size: 150.0 feet by 172.0 feet,
c) Height of Curb above Floor = 2.0 inches (minimum),
d) Trough width: 2.0', Depth =2.25'(average)
e) Volume of the Largest Container (Totes) = 350 Gallons
f) Total Permitted Capacity = 182,930 Gallons.
g) Prevailing wind direction is towards north in Major County, Oklahoma (Per OK Climatological Survey)

ASSUMPTIONS: a) All drums are placed on the floor. Maximum Number of Drum on the floor = 1480 (Conservative -worst case assumptions). Deduction for volume occupied by 1480 drums from gross secondary containment capacity will be considered.

FACTOR OF SAFETY AND BASIS: Net available capacity must exceed the required storage capacity in accordance with 40CFR Part 264.175 for container storage area.

SOLUTION:

The gross available secondary containment capacity is the summation of V1 + V2 + V3 where,

V1 = Volume of rectangular prism with a minimum 2-inch-high perimeter curb/slope.

V2 = Volume of triangular Prism due to sloping floor

V3 = Volume of square prism for trough/trench

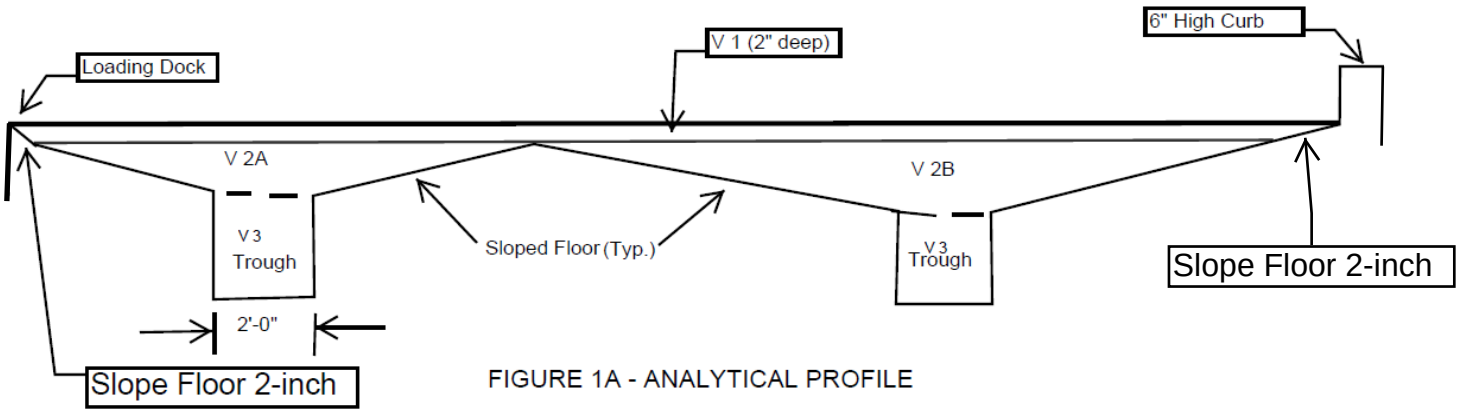


FIGURE 1A - ANALYTICAL PROFILE

Treatment Building Containment Calculations

Volume Calculations - See Figures 1A and 2

Notation	DETERMINE AVAILABLE VOLUME (ft^3)		
V1	**Volume 1 (V1) of Rect. Prism**	**Measurements**	**Unit**
	L (Length)=	170.67	ft
	W (Width)=	149.84	ft
	D (Depth)=	0.167	ft
	Volume =	4270.7	ft^3
V2A	**Volume 2 (V2A) - Triangular Prism(Receiving Area)**		
	L =	170.67	ft
	W =	49.17	ft
	D_1 =	0.33	ft
	Volume =	1397.2	ft^3
V2B	**Volume 2 (V2B) - Triangular Prism (Storage Area)**		
	L =	170.67	ft
	W =	88.00	ft
	D_1 =	0.50	ft
	Volume =	3754.7	ft^3
V3	**Volume 3 (V3) Square Prism (Trough/Trench)**		
	L (total length) =	335.3	ft
	W =	2.00	ft
	D_1 (Average Depth of Trough)	2.25	ft
	Volume =	1,509.0	ft^3
	Gross Volume of Containment =	10931.6	ft^3

Calculate Volume Displaced by Internal Curbs

C1	**Displaced Volume (East-West Curb)**		
	L(east-west) – Sum of 6 Curbs	528.0	ft
	W =	1.00	ft
	D (average depth)	0.33	ft
	Displaced Volume (East-West)	174.2	ft^3
C2	**Displaced Volume (N-S rollover Curb)**		
	L (North-South-sum of 2 curbs)	298.0	ft
	W =	2.00	ft
	D (average depth)	0.170	ft
	Displaced Volume (East-West)	101.3	ft^3
	Total Displaced Volume- Curb	275.5	ft^3

D1	**Calculate Volume Displaced by Drums**		
	Drum Diameter	1.92 feet	ft
	Area of Drum	2.89	ft^2
	Avg. Drum height below containment	0.40	ft
	Max. Number of Drums (bottom Row)	1480	
	Total Displaced Volume (Drum)	1,710.9	ft^3

Net Avalable Volume = V1+V2A+V2B+V3-C1-C2 -D1	**8945.2**	**ft^3**

Calculate Required Containment Storage Capacity Due to Added Containers

1) EPA 40CFR Part 264.175(b)(3) – **Capacity Increase**
The containment system must have sufficient capacity to contain 10% of
the volume of containers or the volume of the largest container, whichever is greater.
Container Management Building Addition Capacity = 182,930 Gallons
10% of total capacity = 18,293 gallons = 2,446 ft^3
Volume of the largest Container = 350 gallons

Required Containment System Capacity = 2,446 ft^3 (governs per 40CFR Part 265.175(b)(3).

Calculate Required Containment Storage Capacity Due to Run-On (40CFR Part 264.175(b)(4)

2) EPA 40 CFR Part 264.175(b)(4) - **Run-on into Containment System**
The proposed Container Management Building has the following enclosure/siding:
- East side of the building at Loading Dock: Protected from rain by a 25-feet Canopy/overhang
- West side of the building: Metal siding.
- South Side of the building: Metal siding; and
- North Side of the building: Partial metal siding.

Therefore, run-on into Containment System from wind driven rain is not possible **except for the partial opening on the North side of the building (see attached Figures 6 and 7).**

2a) Calculate the volume of run-on from the North side of the building

The prevailing wind for the Major County, Oklahoma generally comes from the south (see attached reference) where building is protected from wind driven rain by metal siding. The north side of the building is partially open as shown in Figure 6. The proximity of the **existing** container management building located on the north side will obstruct majority of wind driven rain falling into north-east side of the new building. A strong wind of 30 mph (sustaining for a duration of 24-hour) is assumed as a very conservative estimate for the purpose of calculating the volume of wind driven rain into the containment area.

Wind driven rain entering the containment from the north side will be dependent on the size, the speed of the raindrops, wind speed and wind directions. Terminal velocity of rain drop can be calculated using fluid mechanics formula given the diameter of the raindrops. A large raindrop has a diameter of 6 mm(see attached reference). The terminal velocity of a 6 mm diameter raindrop is between 9 to 10 meters per second (20 to 22 mph).

Design Rainfall Amount = 5.85 inches = 0.49 inches (Per attached NOAA Atlas 14)
Windspeed = 30 MPH
Terminal velocity of raindrops = 22 MPH
Determine the inclination angle(α) raindrops make with vertical direction during wind driven rain :

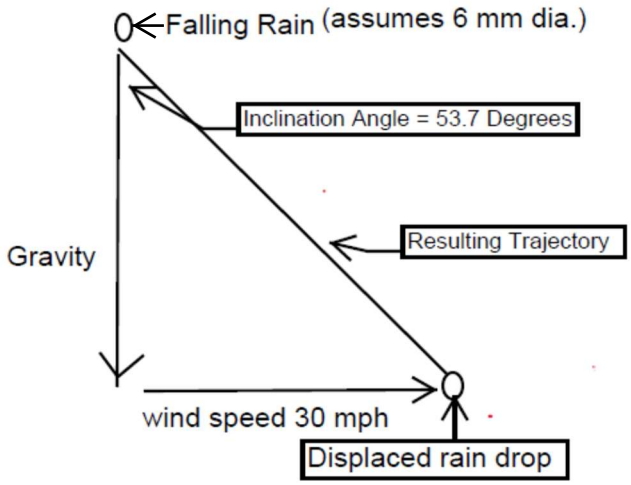


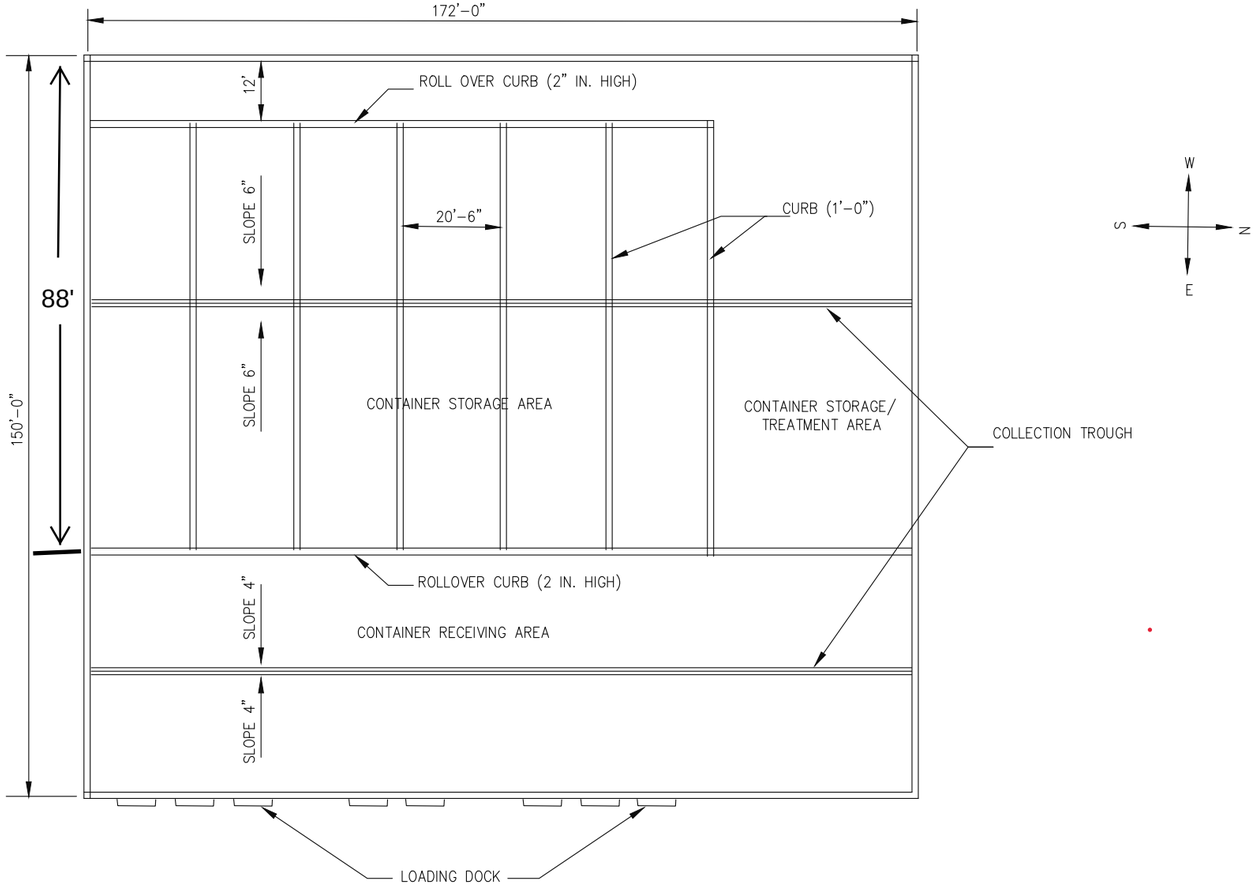
Figure 1B – Inclination Angle of Wind Driven Rain

Inclination Angle (α)= Arctan (30/22) = 53.7°.
Height of North Side Opening = 8 feet (given)
Wind Driven Run-on Distance inside the Building = 8' Tan 53.7° = 10.9 feet ≈ 11 feet
Tributary Area of Wind Driven Rain = 0.5 X150' X 11 feet = 825 ft^2 (assuming triangular distribution)

Volume of wind driven rain = 825 X0.49 X = 404.3 ft^3
Total Required Capacity = 10% of total container capacity + Wind Driven Rain Volume
Required Capacity = 2,446 + 404.3 = 2,850.3 ft^3
Total Available Capacity (8,945.2 ft^3) is greater than Required Capacity = 2,850.3 ft^3
Factor of Safety = Available Capacity/Required Capacity = 8945.2/2850.3 = 3.1 OK

Conclusion: A secondary containment for the proposed Container Building Addition as designed will provide sufficient containment capacity to store storm water resulting from a 25-year, 24-hour storm event plus the volume of the largest tank. Therefore, the proposed secondary containment system meets the requirement of 40 C.F.R. Part 264.175.

FIGURES



NOTE: THIS DRAWING IS PREPARED FOR SECONDARY CONTAINMENT CALCULATION ONLY

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Figure 2.

Plan View – Container Management Building Addition

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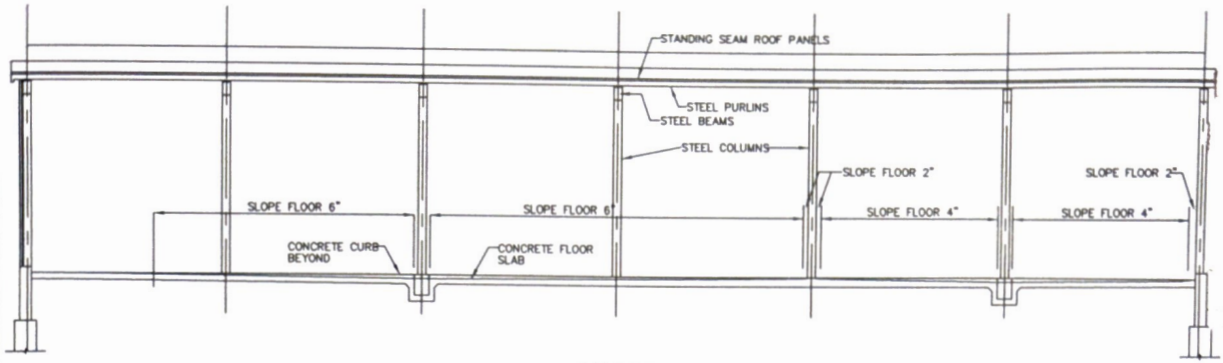

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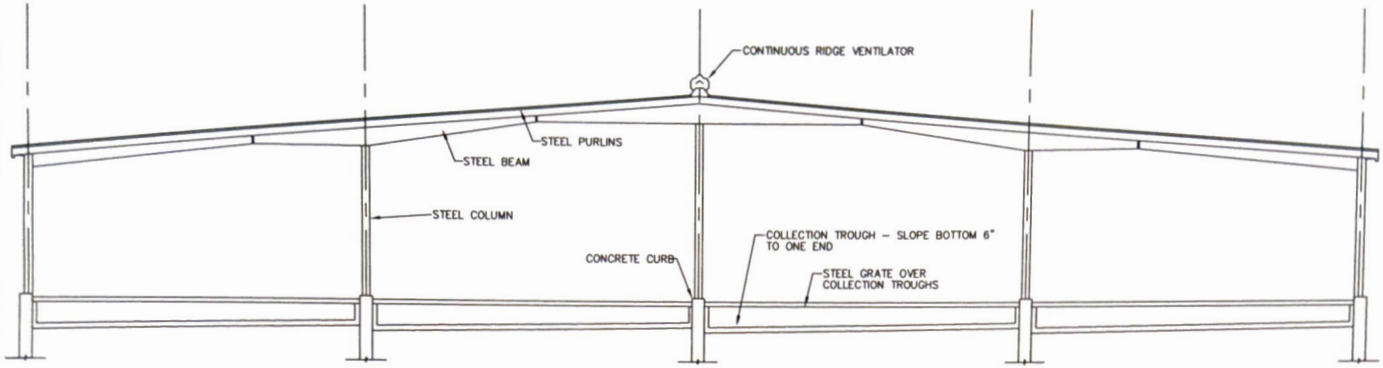

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Figure 3

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LONE MOUNTAIN FACILITY

FIGURE 3

CONTAINER MANAGEMENT BUILDING Addition

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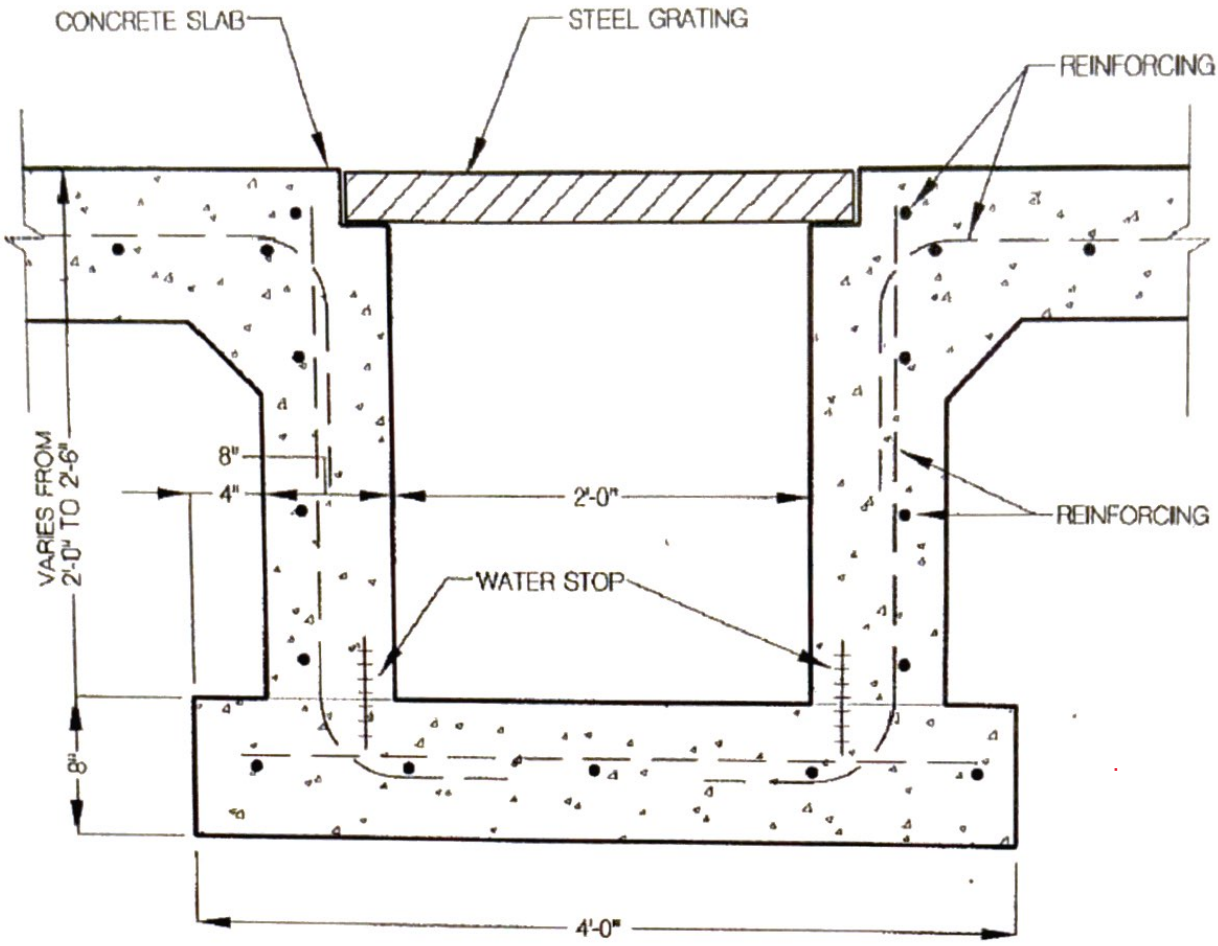

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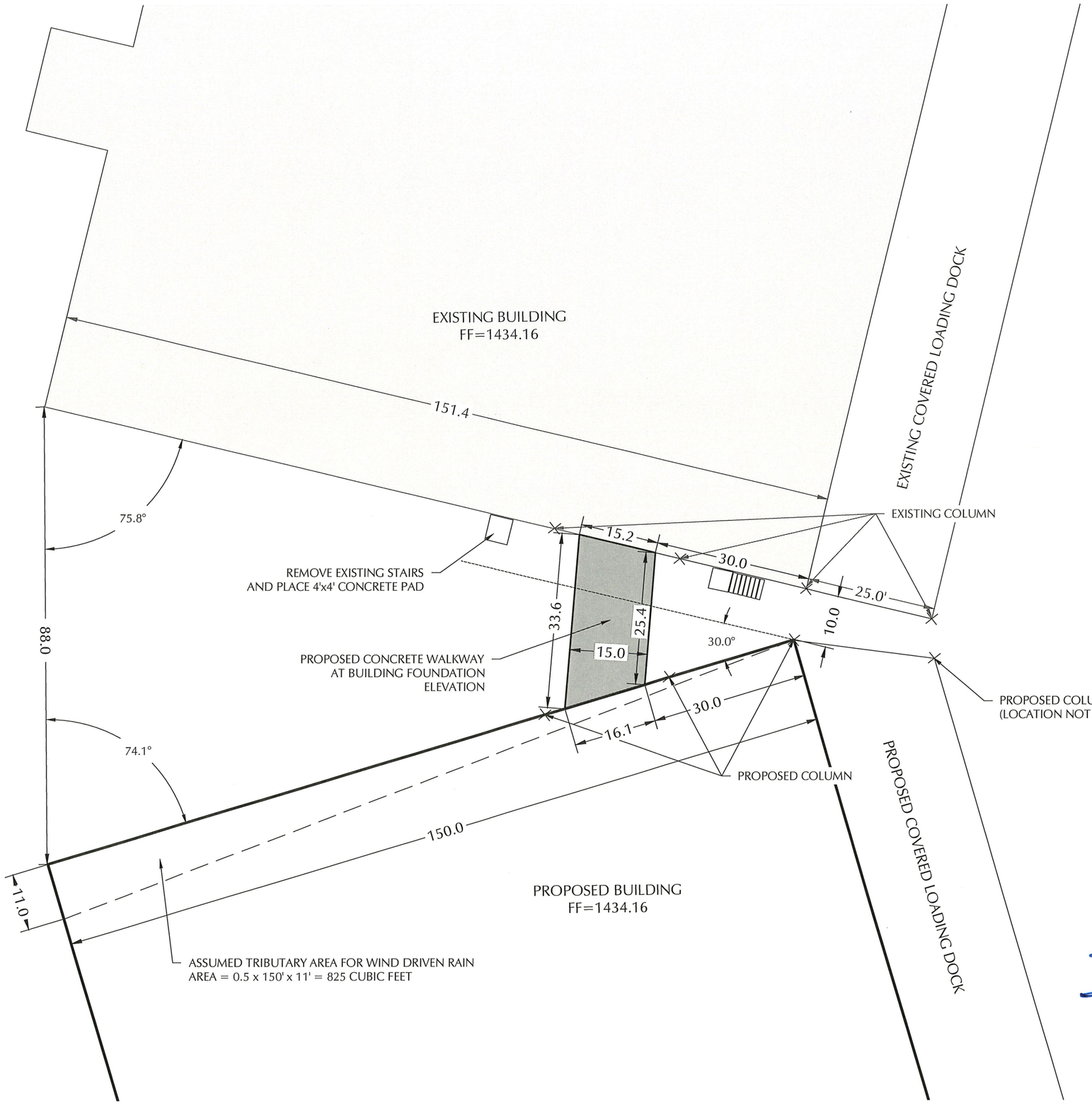
Figure 4

Proposed Container Management Building Addition
Collection Trough Cross-Section



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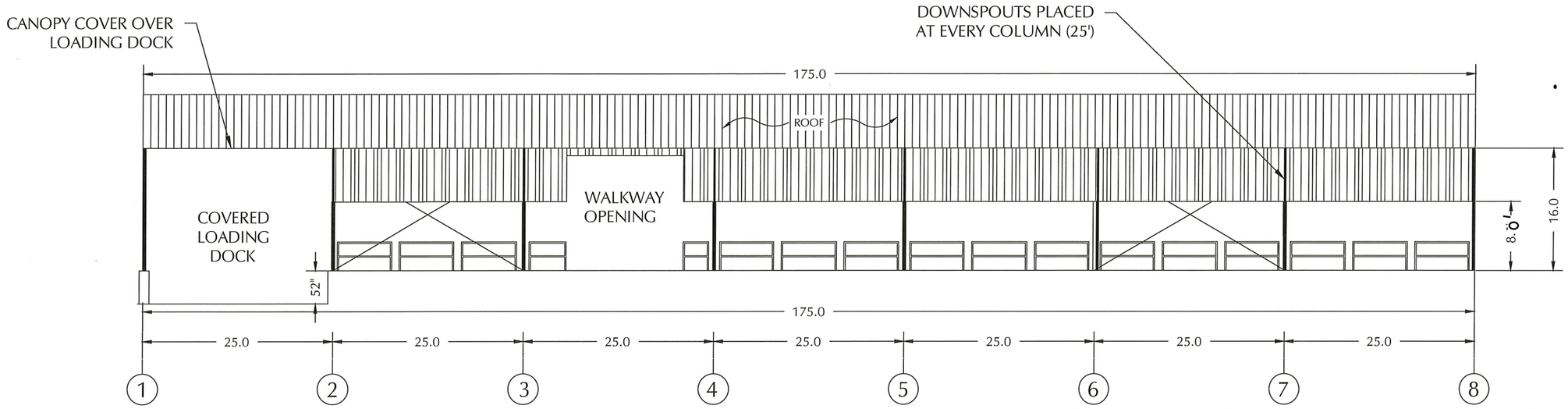

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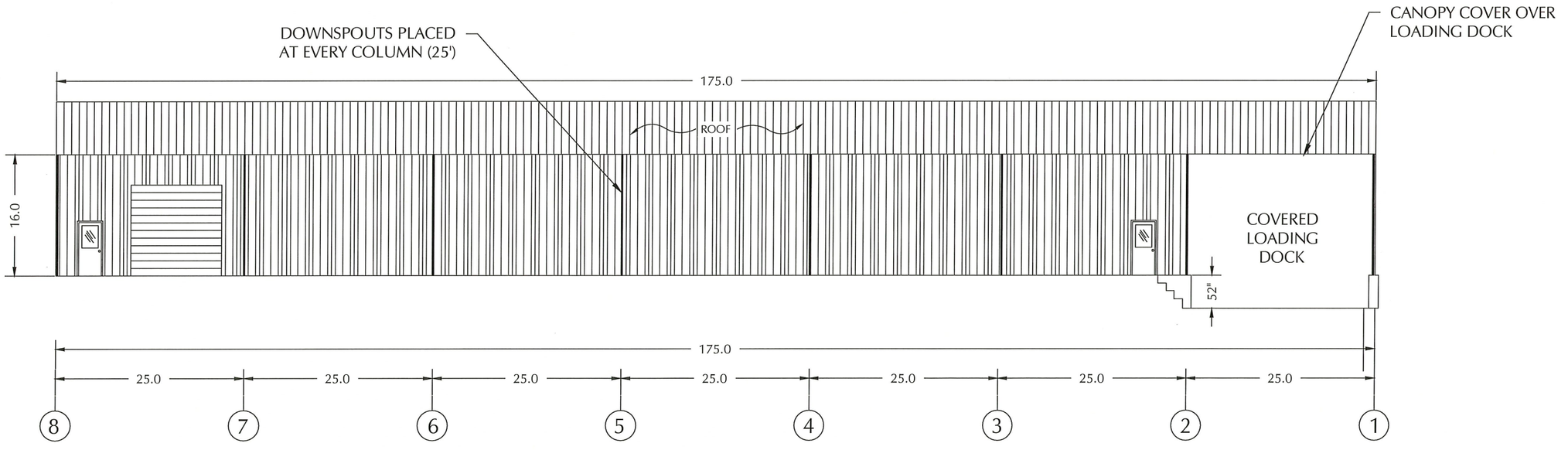

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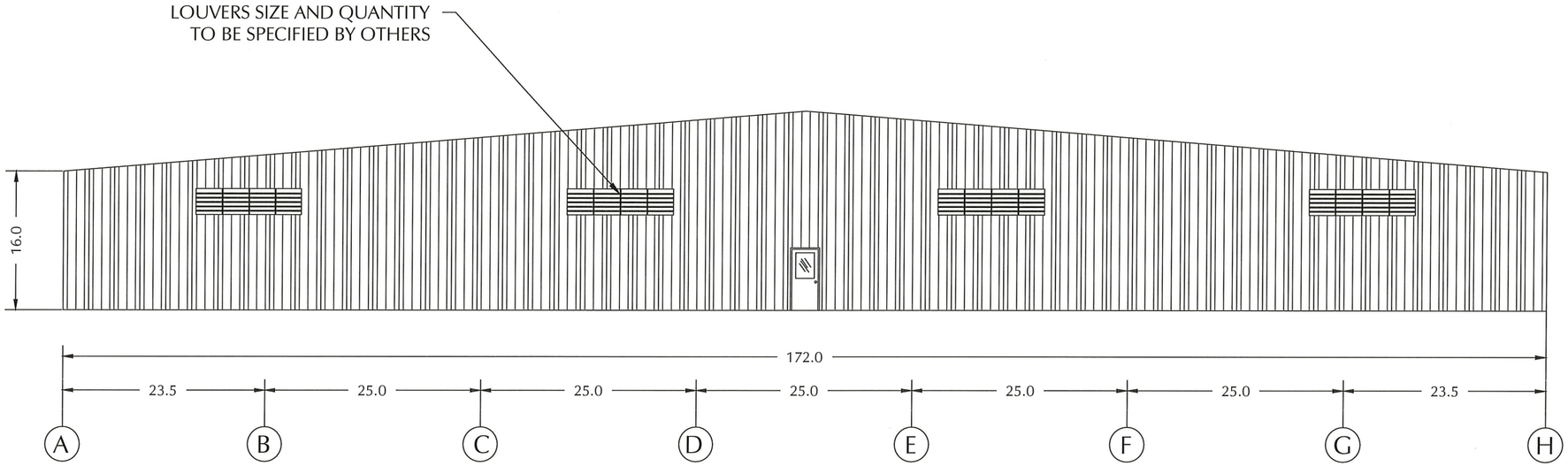

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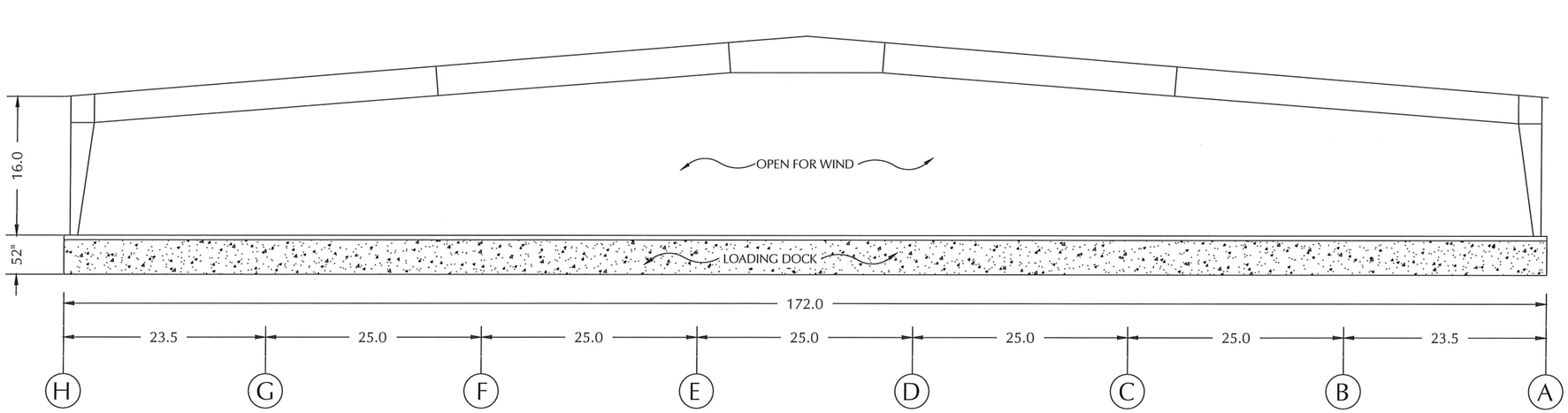

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SHEET NO.	7 OF 7

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X:\Projects\2024\024330-00-000 Clean Harbors Lone Mountain Container Management Building Geotech, Survey, & Design\CAD\SHEETS\Lone Mtn CMB Site Design CH Cordinates 12-19-24 MrI.dwg

References 1

NOAA Atlas 14, Volume 8, Version 2
Location name: Waynoka, Oklahoma, USA*
Latitude: 36.4286°, Longitude: -98.8042°
Elevation: 1418 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.379** (0.312-0.462)	**0.453** (0.373-0.552)	**0.574** (0.470-0.700)	**0.672** (0.547-0.824)	**0.805** (0.629-1.01)	**0.906** (0.691-1.16)	**1.00** (0.739-1.31)	**1.10** (0.777-1.48)	**1.23** (0.832-1.70)	**1.33** (0.874-1.86)
10-min	**0.555** (0.457-0.676)	**0.664** (0.546-0.809)	**0.840** (0.688-1.03)	**0.984** (0.800-1.21)	**1.18** (0.921-1.48)	**1.33** (1.01-1.69)	**1.47** (1.08-1.92)	**1.62** (1.14-2.17)	**1.81** (1.22-2.49)	**1.95** (1.28-2.73)
15-min	**0.677** (0.557-0.824)	**0.810** (0.666-0.987)	**1.02** (0.839-1.25)	**1.20** (0.976-1.47)	**1.44** (1.12-1.81)	**1.62** (1.23-2.06)	**1.80** (1.32-2.34)	**1.97** (1.39-2.64)	**2.20** (1.49-3.03)	**2.38** (1.56-3.33)
30-min	**0.967** (0.796-1.18)	**1.16** (0.953-1.41)	**1.47** (1.20-1.80)	**1.73** (1.40-2.12)	**2.07** (1.62-2.60)	**2.33** (1.78-2.97)	**2.59** (1.90-3.38)	**2.84** (2.00-3.81)	**3.18** (2.14-4.37)	**3.42** (2.25-4.79)
60-min	**1.25** (1.03-1.52)	**1.51** (1.24-1.84)	**1.92** (1.58-2.35)	**2.26** (1.84-2.78)	**2.73** (2.13-3.43)	**3.08** (2.35-3.92)	**3.42** (2.51-4.46)	**3.76** (2.64-5.04)	**4.21** (2.84-5.79)	**4.54** (2.98-6.35)
2-hr	**1.53** (1.27-1.85)	**1.85** (1.53-2.24)	**2.38** (1.96-2.88)	**2.80** (2.30-3.41)	**3.38** (2.66-4.22)	**3.82** (2.93-4.84)	**4.25** (3.15-5.51)	**4.68** (3.31-6.23)	**5.24** (3.56-7.16)	**5.65** (3.74-7.86)
3-hr	**1.69** (1.41-2.04)	**2.06** (1.71-2.47)	**2.64** (2.19-3.19)	**3.13** (2.57-3.79)	**3.78** (2.99-4.71)	**4.29** (3.31-5.41)	**4.79** (3.56-6.18)	**5.29** (3.76-7.01)	**5.94** (4.05-8.09)	**6.43** (4.28-8.91)
6-hr	**2.00** (1.68-2.39)	**2.41** (2.01-2.88)	**3.09** (2.57-3.70)	**3.66** (3.03-4.40)	**4.46** (3.56-5.55)	**5.10** (3.97-6.41)	**5.74** (4.31-7.40)	**6.41** (4.60-8.47)	**7.30** (5.03-9.91)	**8.00** (5.35-11.0)
12-hr	**2.35** (1.98-2.79)	**2.78** (2.34-3.29)	**3.52** (2.95-4.18)	**4.17** (3.48-4.98)	**5.13** (4.15-6.38)	**5.92** (4.66-7.44)	**6.75** (5.12-8.67)	**7.63** (5.53-10.1)	**8.86** (6.16-12.0)	**9.84** (6.64-13.4)
24-hr	**2.72** (2.31-3.20)	**3.18** (2.69-3.74)	**4.00** (3.37-4.71)	**4.74** (3.97-5.61)	**5.85** (4.78-7.25)	**6.79** (5.39-8.49)	**7.78** (5.95-9.96)	**8.86** (6.48-11.6)	**10.4** (7.29-14.0)	**11.6** (7.90-15.8)
2-day	**3.10** (2.64-3.61)	**3.62** (3.08-4.22)	**4.53** (3.85-5.30)	**5.36** (4.53-6.30)	**6.61** (5.43-8.11)	**7.65** (6.11-9.49)	**8.76** (6.74-11.1)	**9.95** (7.33-13.0)	**11.6** (8.22-15.6)	**13.0** (8.90-17.5)
3-day	**3.37** (2.88-3.91)	**3.90** (3.34-4.52)	**4.84** (4.13-5.63)	**5.69** (4.82-6.66)	**6.98** (5.76-8.53)	**8.05** (6.46-9.94)	**9.20** (7.11-11.6)	**10.4** (7.72-13.5)	**12.2** (8.66-16.2)	**13.6** (9.36-18.3)
4-day	**3.59** (3.08-4.15)	**4.13** (3.54-4.78)	**5.10** (4.36-5.91)	**5.97** (5.08-6.96)	**7.28** (6.02-8.86)	**8.38** (6.74-10.3)	**9.55** (7.40-12.0)	**10.8** (8.02-14.0)	**12.6** (8.96-16.7)	**14.0** (9.67-18.8)

7-day	**4.12** (3.56-4.74)	**4.75** (4.10-5.46)	**5.83** (5.02-6.72)	**6.79** (5.80-7.86)	**8.18** (6.78-9.84)	**9.32** (7.52-11.4)	**10.5** (8.18-13.1)	**11.8** (8.78-15.1)	**13.5** (9.68-17.8)	**15.0** (10.4-19.9)
10-day	**4.62** (4.01-5.29)	**5.32** (4.60-6.09)	**6.49** (5.60-7.45)	**7.50** (6.43-8.64)	**8.95** (7.43-10.7)	**10.1** (8.18-12.2)	**11.3** (8.83-14.0)	**12.6** (9.39-16.0)	**14.3** (10.3-18.7)	**15.7** (10.9-20.8)
20-day	**6.13** (5.35-6.95)	**6.94** (6.05-7.88)	**8.28** (7.20-9.43)	**9.41** (8.13-10.8)	**11.0** (9.16-12.9)	**12.2** (9.94-14.6)	**13.4** (10.6-16.5)	**14.7** (11.1-18.5)	**16.4** (11.8-21.2)	**17.7** (12.4-23.3)
30-day	**7.34** (6.43-8.28)	**8.28** (7.24-9.35)	**9.80** (8.55-11.1)	**11.1** (9.60-12.6)	**12.8** (10.7-15.0)	**14.1** (11.5-16.8)	**15.5** (12.2-18.8)	**16.8** (12.7-21.0)	**18.6** (13.4-23.9)	**19.9** (14.0-26.0)
45-day	**8.79** (7.74-9.88)	**9.94** (8.74-11.2)	**11.8** (10.3-13.3)	**13.3** (11.6-15.1)	**15.3** (12.8-17.8)	**16.9** (13.8-19.9)	**18.4** (14.5-22.2)	**19.9** (15.0-24.7)	**21.8** (15.8-27.9)	**23.2** (16.4-30.3)
60-day	**9.97** (8.80-11.2)	**11.3** (10.0-12.7)	**13.5** (11.9-15.2)	**15.3** (13.4-17.3)	**17.7** (14.8-20.4)	**19.4** (15.9-22.8)	**21.1** (16.7-25.4)	**22.8** (17.3-28.2)	**24.9** (18.1-31.8)	**26.5** (18.8-34.4)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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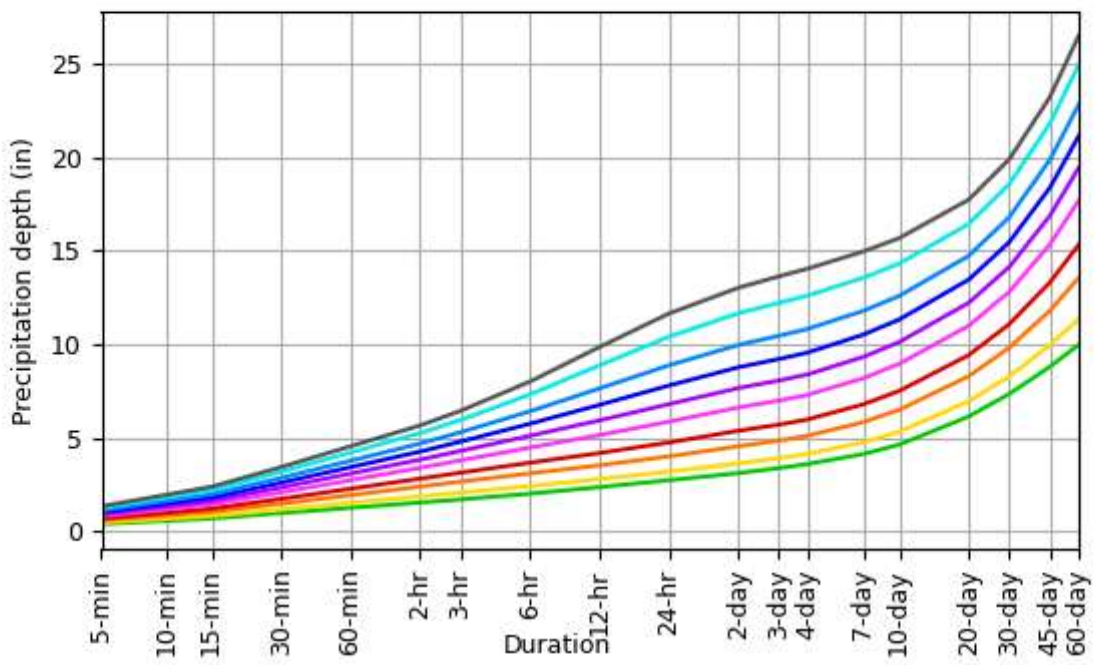
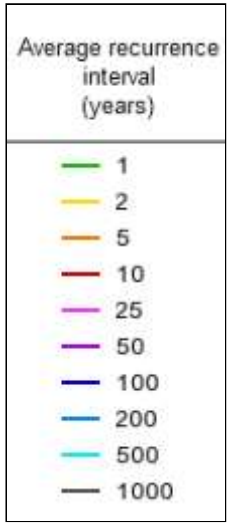
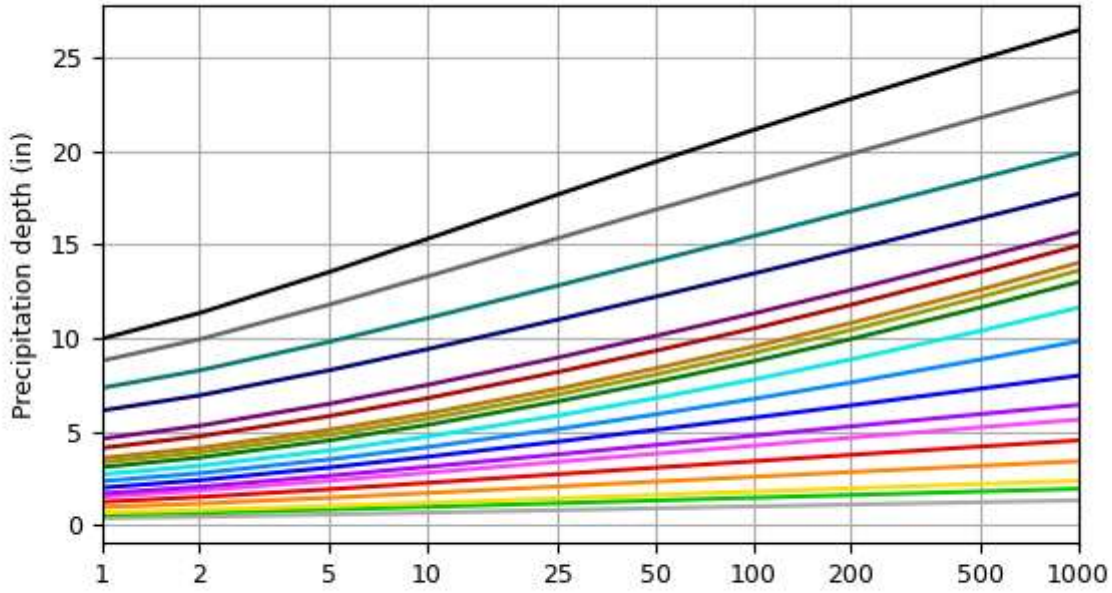
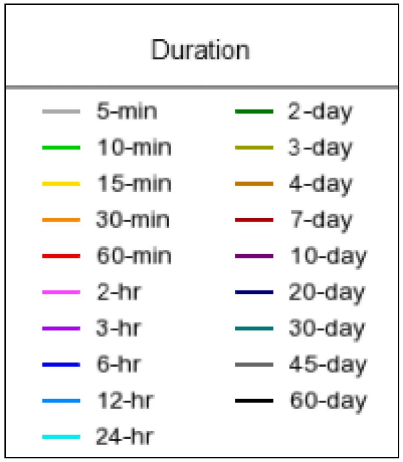
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 36.4286°, Longitude: -98.8042°









Average recurrence interval (years)

NOAA Atlas 14, Volume 8, Version 2

Created (GMT): Mon Dec 1 20:31:05 2025

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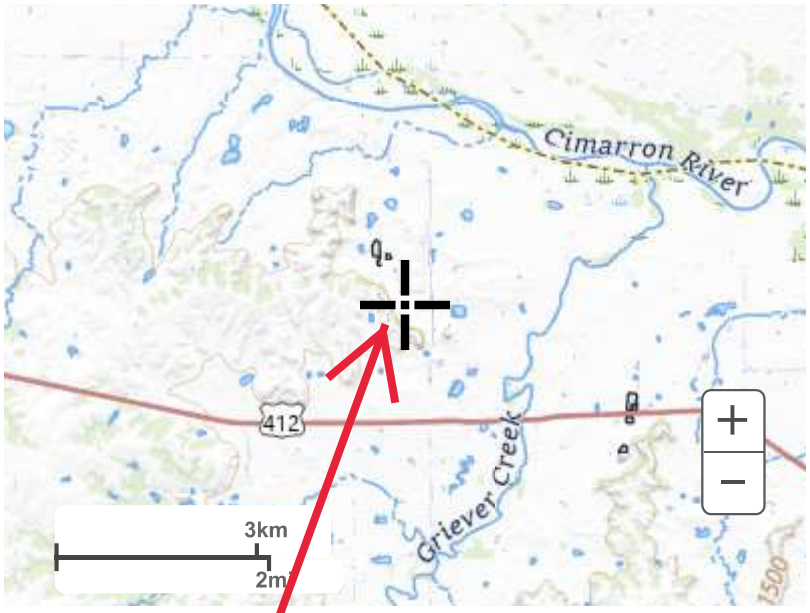
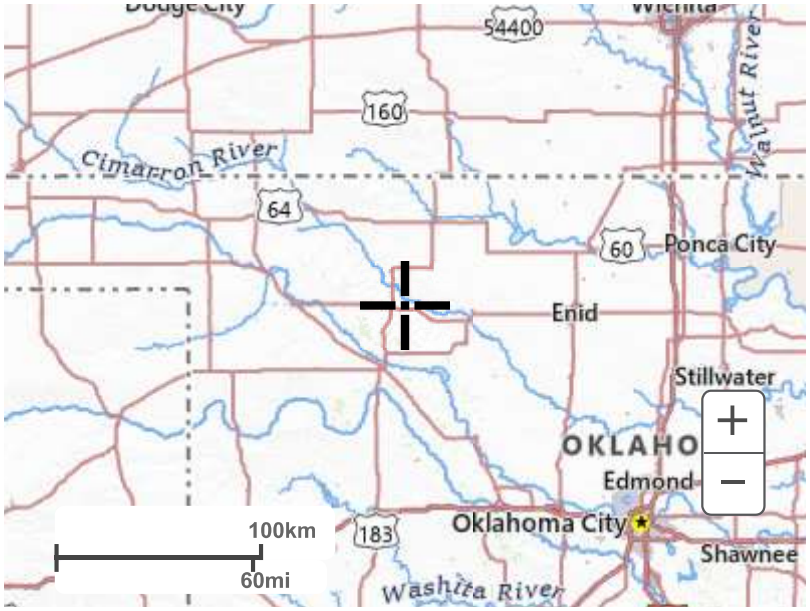
Maps & aerials

Small scale terrain



Large scale terrain

Lone Mountain Facility
40355 South County Road 236
Waynoka, OK 73860



Large scale map

Large scale aerial

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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Reference 2

MAJOR COUNTY

CLIMATE SUMMARY

AVERAGES

TEMPERATURE (°F)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
DAILY AVG	37.4	40.3	49.5	58.6	68.7	78.7	83.1	81.3	73.5	60.9	48.2	38.6	59.9
DAILY MIN	25.9	28.0	37.2	45.8	56.6	66.5	70.7	69.5	61.2	48.4	36.5	27.8	47.8
DAILY MAX	48.9	52.6	61.9	71.4	80.8	90.9	95.5	93.1	85.8	73.5	59.9	49.4	72.0

Annual number of days max temperature is greater than 90°F: 90
Annual number of days max temperature is greater than 100°F: 25
Annual number of days max temperature is less than 32°F: 11
Annual number of days min temperature is less than 32°F: 89
Annual number of heating degree days (HDD): 3868
Annual number of cooling degree days (CDD): 2049
Annual length of growing season: 208 days
Date of first fall freeze: November 1
Date of last spring freeze: April 5

PRECIPITATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
AMOUNT (in.)	1.03	1.22	2.19	3.56	4.33	4.72	4.47	3.17	2.89	2.88	1.58	1.50	33.54
NUMBER OF DAYS WITH RAIN	1.9	3.4	4.0	5.8	6.7	5.4	5.2	6.1	4.6	4.1	2.3	2.0	51.5

Annual snowfall: 8.2 in.
Annual percent sunshine (2006-2020): 69%
Annual number of thunderstorm days (1901-1995): 50
Annual number of hail (>1 in.) days (1986-2015): 5+
Annual number of tornadoes (1950-2021): 0.67
Total number of tornadoes (1950-2021): 48

Notes:
1.) Average first and last freeze dates are based on the 50th probability percentile.
2.) Unless noted, averages/normals are based on the 1991-2020 period.

OKLAHOMA CLIMATOLOGICAL SURVEY
Mesonet Oklahoma's Weather Network

RECORDS & EXTREMES

Record high temperature: 114°F (August 6, 1964)
Record low temperature: -15°F (February 10, 2011)
Earliest freeze date: October 19
Latest freeze date: April 20
Wettest year: 54.32 in. (1957)
Driest year: 17.55 in. (1968)
Greatest daily rainfall: 9.13 in. (September 12, 2008)
Greatest seasonal snowfall (Sep - Apr): 25.0 in. (1968-1969; 1987-1988; 1992-1993)
Greatest daily snowfall: 11.2 in. (February 26, 2013)

Note: Extreme earliest and latest freeze dates are based on the 10th probability percentile.

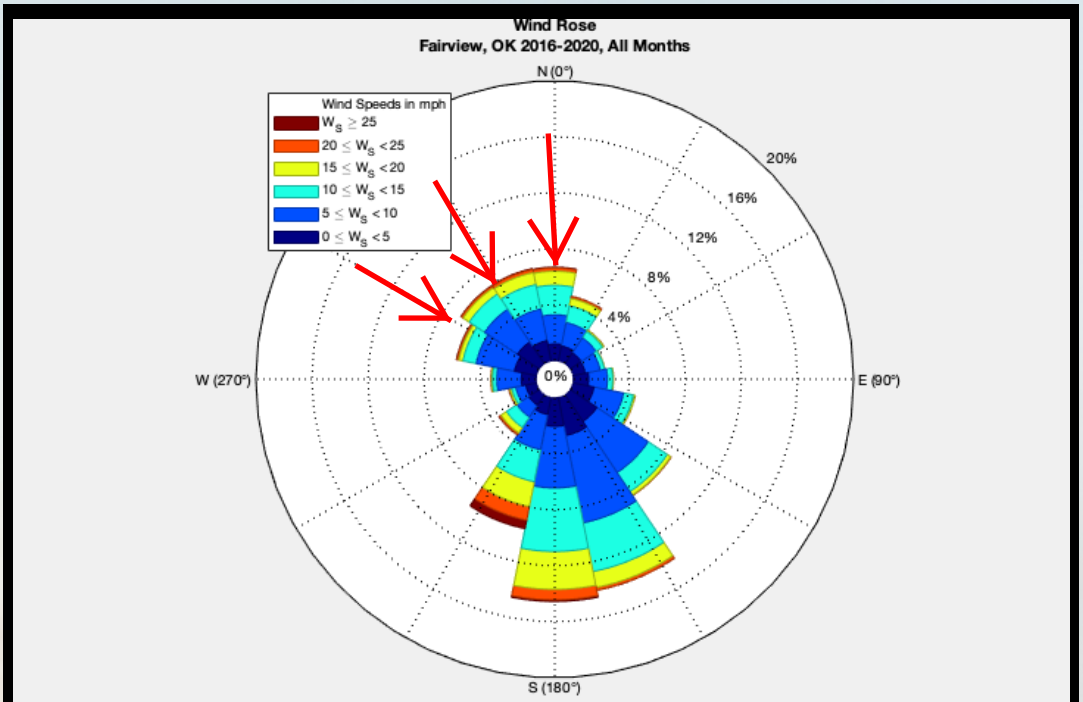
HOLIDAY STATS

	AVG MAX TEMP (°F)	AVG MIN TEMP (°F)	RECORD HIGH (°F)	RECORD LOW (°F)
NEW YEAR'S EVE, December 31	49	26	78 (1951)	0 (1968)
VALENTINE'S DAY, February 14	53	29	82 (1954)	12 (1949)
INDEPENDENCE DAY, July 4	94	68	105 (1954)	58 (1940)
HALLOWEEN, October 31	68	44	88 (1947)	28 (1949)
CHRISTMAS, December 25	51	29	78 (1955)	9 (1952)

WIND

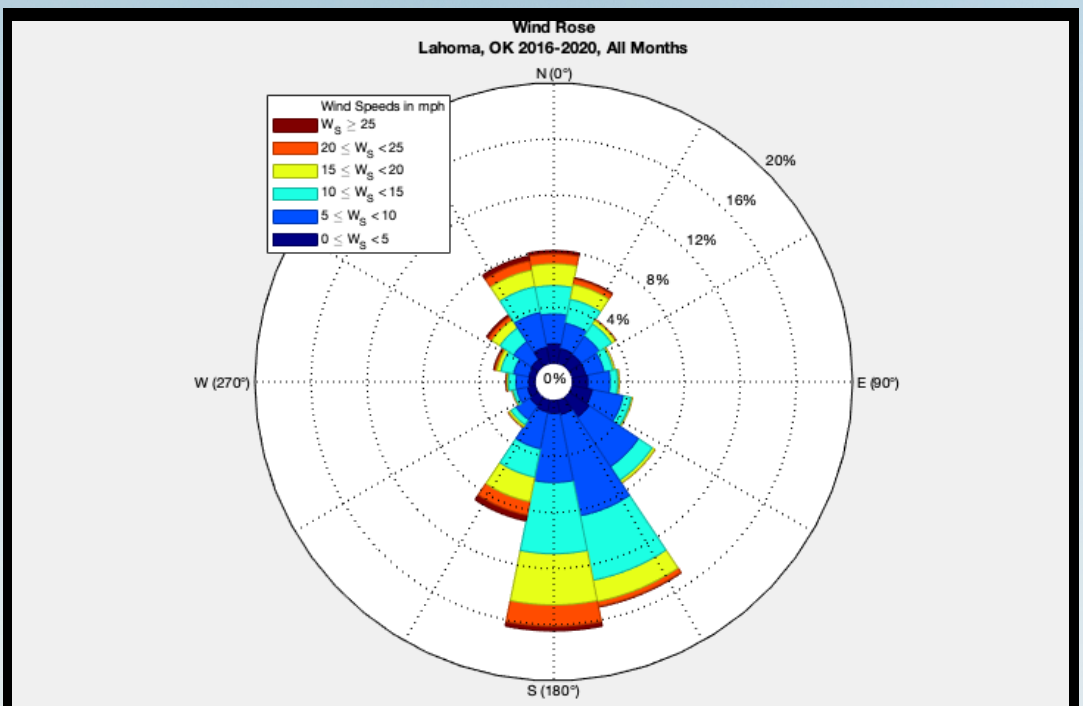
Average wind speed: 11 mph

Wind Roses: Wind roses show the prevailing direction from which the wind is blowing. North is up in the image. The circles show the percentage of time from which the wind is blowing in that direction, as well as the percentage of time for different wind speed ranges. The wind speed ranges are represented by different shades of color. For example, Fairview records a south wind about 15% of the time, with winds blowing between 10 and 15 mph about 5% (11%-6%=5%) of the time from that direction. The table below shows the percentage of time the wind is blowing from each of the 16-point compass headings, and the percent of time the prevailing wind is recorded in each speed bin.



Dir Range	Avg Dir	0-5 mph	5-10 mph	10-15 mph	15-20 mph	20-25 mph	25+ mph	Total
348.75 to 11.25	0	1.18	2.09	2.11	1.00	0.24	0.05	6.68
11.25 to 33.75	22.5	1.10	1.69	1.22	0.54	0.14	0.02	4.71
33.75 to 56.25	45	0.94	1.28	0.55	0.11	0.01	0.00	2.90
56.25 to 78.75	67.5	0.89	1.08	0.31	0.03	0.01	0.00	2.32
78.75 to 101.25	90	1.09	1.34	0.37	0.06	0.01	0.00	2.86
101.25 to 123.75	112.5	1.53	2.15	0.71	0.12	0.02	0.00	4.53
123.75 to 146.25	135	2.29	4.40	1.64	0.30	0.04	0.01	8.67
146.25 to 168.75	157.5	2.76	6.36	3.56	1.16	0.20	0.01	14.05
168.75 to 191.25	180	2.03	4.40	4.54	2.71	0.75	0.11	14.55
191.25 to 213.75	202.5	1.24	2.55	2.33	1.81	0.99	0.61	9.55
213.75 to 236.25	225	0.90	1.01	0.90	0.47	0.13	0.04	3.46
236.25 to 258.75	247.5	0.77	0.73	0.30	0.14	0.04	0.03	2.01
258.75 to 281.25	270	1.05	1.75	0.29	0.08	0.04	0.01	3.23
281.25 to 303.75	292.5	1.59	2.79	0.96	0.31	0.12	0.04	5.82
303.75 to 326.25	315	1.87	2.82	1.32	0.53	0.15	0.04	6.73
326.25 to 348.75	337.5	1.48	2.30	1.78	0.88	0.24	0.06	6.73
0 to 360	TOTAL	22.70	38.75	22.90	10.27	3.14	1.05	98.80
Calm	Wind = 0							1.20

Legend: → Estimated trajectory of wind driven rain towards south and south-east direction.



Dir Range	Avg Dir	0–5 mph	5–10 mph	10–15 mph	15–20 mph	20–25 mph	25+ mph	Total
348.75 to 11.25	0	1.38	2.12	2.02	1.55	0.71	0.24	8.03
11.25 to 33.75	22.5	1.07	1.85	1.74	1.08	0.39	0.10	6.24
33.75 to 56.25	45	1.01	1.57	1.05	0.31	0.07	0.01	4.02
56.25 to 78.75	67.5	0.99	1.33	0.64	0.13	0.02	0.01	3.11
78.75 to 101.25	90	1.10	1.59	0.53	0.11	0.02	0.01	3.35
101.25 to 123.75	112.5	1.47	2.25	0.57	0.10	0.01	0.00	4.40
123.75 to 146.25	135	1.69	4.25	1.18	0.22	0.03	0.00	7.37
146.25 to 168.75	157.5	1.03	7.38	4.69	1.55	0.36	0.06	15.06
168.75 to 191.25	180	0.92	4.93	5.08	3.65	1.53	0.33	16.44
191.25 to 213.75	202.5	0.85	2.68	2.07	1.79	0.97	0.42	8.78
213.75 to 236.25	225	0.71	1.19	0.44	0.18	0.05	0.02	2.60
236.25 to 258.75	247.5	0.58	0.79	0.25	0.05	0.02	0.01	1.70
258.75 to 281.25	270	0.44	0.92	0.54	0.08	0.06	0.05	2.09
281.25 to 303.75	292.5	0.45	1.12	0.94	0.29	0.14	0.09	3.04
303.75 to 326.25	315	0.57	1.54	1.18	0.69	0.29	0.18	4.44
326.25 to 348.75	337.5	1.18	2.51	1.89	1.20	0.67	0.36	7.82
0 to 360	TOTAL	15.45	38.01	24.80	13.00	5.34	1.89	98.48
Calm	Wind = 0							1.52

Oklahoma Climatological Survey:
climate.ok.gov
Oklahoma Mesonet:
mesonet.org

120 David L. Boren Blvd., Suite 2900
Norman, OK 73072
phone: 405.325.2541
fax: 405.325.7282

Reference 3

Speed of a Falling Raindrop

An educational, fair use website

Bibliographic Entry	Result (w/surrounding text)	Standardized Result
Corbert, John H. *Physical Geography Manual*. 1974. 5th ed. N.p.: Kendall/Hunt, 2003. 127.	"A large drop of about 5 mm (3/16 in.) diameter reaches a maximum speed of about 9 m/sec."	9 m/s
"Climate." *Encyclopedia Britannica*.2007, Encyclopedia Britannica Online. 25 May 2007.	"Large raindrops, up to six millimeters in diameter, have terminal velocities of about 10 metres per second and so may cause considerable compaction and erosion of the soil by their force of impact."	10 m/s ← 22 MPH
Beard, K.V. Terminal Velocity and Shape of Cloud and Precipitation Drops [pdf]. *Journal of the Atmospheric Sciences* (May 1976): 851-864.	[see graph 1 below]	9–13 m/s
Spilhaus, A.F. Raindrop Size, Shape, and Falling Speed [pdf]. *Journal of Meteorology*. 5 (June 1948): 108-110.	[see graph 2 below]	9.3 m/s
Holladay, April. Falling raindrops hit 5 to 20 mph speeds. Wonderquest. Albuquerque: 19 Dec 2001.	"At sea level, a large raindrop about 5 millimeters across (house-fly size) falls at the rate of 9 meters per second (20 miles per hour). Drizzle drops (less than 0.5 mm across, i.e., salt-grain size) fall at 2 meters per second (4.5 mph)."	9 m/s

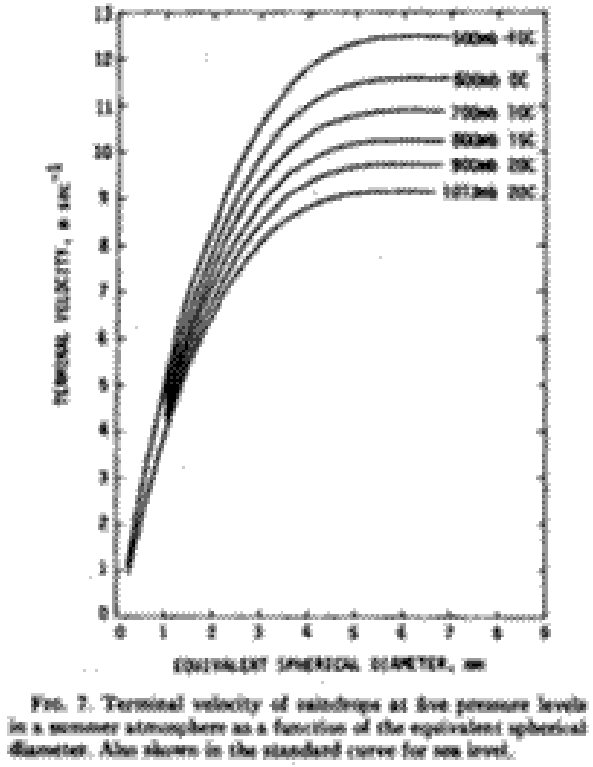


FIG. 7. Terminal velocity of raindrops at five pressure levels in a standard atmosphere as a function of the equivalent spherical diameter. Also shown is the standard curve for sea level.

Graph 1

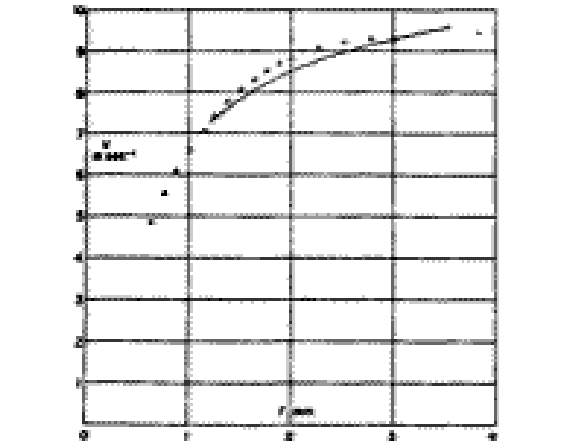


FIG. 4. Variation of the terminal fall speed, v, with radius of the raindrop, r. Experimental values shown by crosses, theory by full line.

Graph 2

Rain is the liquid form of precipitation on Earth. It is part of the hydrologic cycle that begins when water evaporates and forms clouds in the atmosphere. The water that forms these clouds is frozen and vaporized. Once enough water has evaporated, it is then released in the form of droplets of rain back to the surface of the Earth.

The average size of a raindrop is 6 millimeters in diameter, about the size of a housefly. Of course all raindrops vary in size due to the strength of a specific rainstorm, but this is considered a reasonable value of a typical raindrop. When a raindrop falls to the surface of the Earth, it is acted on by two main forces, gravity and drag. A stationary raindrop initially experiences an acceleration due to gravity of 9.8 m/s^2, as would any falling body. As gravity increases the speed of the raindrop in its descent, drag retards the downward acceleration of the raindrop. Usually,

air resistance that comes in contact with the water molecules as they fall causes the drag. The combination of these two forces causes a raindrop to reach a terminal velocity when the drag force is approximately equal to the weight of the raindrop. At this point, a raindrop experiences no further acceleration and therefore falls at a constant velocity.

The magnitude of the terminal velocity of an object is also affected by its orientation. A common misconception is the shape of the raindrop. It is often depicted as pointy and lopsided. However, research has found the shape of a raindrop to be rather spherical or slightly flattened on the bottom by airflow like a hamburger bun.

The terminal velocity of a 6-millimeter raindrop was found to be approximately 10 m/s. This value has been found to vary between 9 m/s and 13 m/s when measurements were taken on different days. The variance has been contributed to different air temperatures and pressures. In comparison, a human being falling to the surface of the Earth experiences a drastically larger terminal velocity of approximately 56 m/s.

Evan Kaplan -- 2007

External links to this page:

- How Fast Is Falling Rain? Rhett Allain. *Wired*. 29 August 2011.
- Estimating rainfall precipitation amounts by applying computer vision in cameras. Renato F. Cerqueira, Kiran Mantripragada, International Business Machines Corp. Patent US9436997 and US9582730 (2016, 2017).
- Important Parameters for the Characterization of Rain as an Energy Source. Nathan Dalton, Ben King, Chelsea Saucedo, Thomas M. Adams. *Proceedings of the 10th World Congress on Mechanical, Chemical, and Material Engineering* (MCM'24). Barcelona, Spain (22–24 August 2024).
- Simulation of the Rough Network Structure of Plant Leaves in Multiple Loading Cases. Liu Wang Yu, Liu Xi Feng. *Science Technology and Engineering*. Vol. 9 No. 23 (2009).

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