Town of Lyons
NON-RESIDENTIAL DRY FLOODPROOFING REQUIREMENTS (Jan. 2025)

This document is a reference for dry floodproofing projects located in the regulatory floodplain in the Town of Lyons. This document provides detailed information that is intended to ensure the success of dry floodproofing projects by meeting the documentation requirements for both regulatory and flood insurance purposes.

Any new or substantially improved (i.e. construction cost ≥ 50% market value of the existing building only) building is required to comply with FEMA and the Town of Lyons floodplain regulations. This compliance typically involves elevation of the lowest floor, together with attendant utilities and all associated machinery and equipment, to the minimum Flood Protection Elevation (FPE). The FPE is 2.0 feet above the Base Flood Elevation (BFE), or 2.0 feet plus depth of flooding above the existing Highest Adjacent Grade (HAG) in an AO Zone. When elevation is not feasible, the owner has the option of dry floodproofing the building. Dry floodproofing is only allowed for non- residential structures. *The Town of Lyons highly recommends elevation instead of dry floodproofing whenever possible due to complex design considerations, cost implications, construction and testing difficulties, long term maintenance responsibilities, and potential flood insurance ramifications.* Elevation of a structure is the preferred method of flood protection.

Floodproofed buildings are rated differently for flood insurance than elevated structures; therefore, the Town of Lyons recommends consulting a flood insurance agent prior to initiating floodproofing activities. The insurance agent can help determine if providing flood protection to a higher elevation than Lyons requires would be cost effective from a flood insurance standpoint. Typically, a dry floodproofed building must be protected one (1) foot higher compared to an elevated building to secure a similar flood insurance premium. Additional flood insurance information can be found at https://www.floodsmart.gov.

The purpose of dry floodproofing is to make a building watertight to floods of limited duration, velocity, depth, and debris. Dry floodproofing works best for slab-on-grade construction. A basement or crawlspace makes dry floodproofing more complex. Portions of the building exposed to floodwaters below the FPE must be constructed with materials resistant to flood damage. Flood Damage-Resistant Materials shall conform to FEMA's Technical Bulletin 2, "Flood Damage-Resistant Materials Requirements" (http://www.fema.gov/library/viewRecord.do?id=1580).

Dry floodproofing shall also be in compliance with the following documents:

1. **ASCE 24-14, "Flood Resistant Design and Construction":**
http://www.asce.org/templates/publications-book-detail.aspx?id=6963
2. **FEMA's P-936 "Floodproofing Non-Residential Buildings":**
http://www.fema.gov/media-library/assets/documents/34270
3. **FEMA's Technical Bulletin 3, "Non-Residential Floodproofing-Requirements and Certification":**
http://www.fema.gov/library/viewRecord.do?id=1716
4. **FEMA's P-348, "Protecting Building Utilities from Flood Damage":**
http://www.fema.gov/library/viewRecord.do?id=1750

To obtain a floodplain permit for dry floodproofing work in the Town of Lyons, the applicant shall satisfy the following requirements:

1. Due to flash flooding type events in this region, **ALL FLOODPROOFING MEASURES MUST BE EFFECTIVE WITHOUT HUMAN INTERVENTION**. These are often referred to as "passive" or "automatic" systems.

Exterior man doors are considered "passive" if these doors remain closed during business hours (other than for the entrance/exit of humans), have automatic closing mechanisms, and are closed and locked during non- business hours.

2. Dry floodproofing shall typically be limited to areas with flood velocities adjacent to the structure less than or equal to 5 ft/s in a 100-year flood event. Dry floodproofing **MAY** be considered in areas of higher velocities if it can be shown that the dry floodproofing measures can withstand the associated hydrostatic, hydrodynamic, buoyancy, and impact loading due to flood conditions and all safety concerns are addressed to the satisfaction of the Town.
3. At least one exit door or emergency escape/rescue opening capable of providing human ingress and egress must be provided above the Flood Protection Elevation (FPE). See ASCE 24-14, Section 6.2.2 for more information.
4. **Detailed plans** signed and sealed by a Colorado Professional Engineer or Architect must be provided. It is important to submit all construction drawings (civil, arch, MEPs, structural, etc…) for floodplain review. These plans must include:
    a. Base Flood Elevation (BFE), Flood Protection Elevation (FPE), and actual elevation of floodproofing measures.
    b. Design details and locations of floodproofing measures.
    c. Benchmark used. All elevations must be provided in NAVD 88 datum.
    d. Location and elevation of all exterior machinery and equipment servicing the building.
    e. Backwater prevention devices for storm and sanitary services.
    f. Direction and distance that all doors swing. Door closures typically use the force of water on the exterior side of the closure to make a tight seal. Floodproofing devices cannot block doors from opening when devices are in place.
    g. Standard dry floodproofing plan notes (see below).
5. **Detailed Grading Plan** with NAVD 1988 benchmark, signed and sealed by a Colorado Professional Engineer, must be submitted. The grading plan must show the regulatory floodplain and floodway boundaries with flood zones labeled. If the entire property is located in the floodplain, include a note stating such. The FEMA floodplain layers (taken from FEMA's National Flood Hazard Layer) can be downloaded from FEMA's Map Service Center (https://hazards.fema.gov/femaportal/NFHL/), free of charge. No fill or structures are allowed in the floodway.
6. **Structural Calculations:** Indicate how the structure will withstand hydrostatic, hydrodynamic, buoyancy, and impact loading due to flood conditions in addition to standard loading conditions. The calculations must assume flood loading to the design floodproofing elevation/depth. These calcs must be signed and sealed by a Colorado Professional Engineer.
7. **Seepage Considerations**: An explanation of how the structure will remain substantially impermeable to water must be provided by a Professional Engineer or Architect. Slight seepage may be allowed if the applicant can demonstrate that the resulting damages would be negligible, the seepage could be easily removed, and seepage rates for the entire structure would not exceed an amount which would result in an accumulation of more than 4 inches of water depth in the floodproofed space during a 24-hour period. *In addition, the seepage rate for a closure device (door, shield, gate, etc…) must not exceed 0.24 gallons per hour per linear foot of wetted perimeter (to FPE) in field tests.* This allowable seepage rate is 3 times the ANSI 2510 standard for closure devices. The architect and/or engineer must be very careful in selecting devices that can be installed to meet this standard.
8. **Internal Drainage:** Provide internal drainage to control seepage, per FEMA P-936. Generally this is sump pump which discharges above FPE, with backup power (automatic generator or battery). This must be shown on the plans and also included as a floodproofing component in the Floodproofing Report and Inspection and Maintenance Plan.
9. **Coordination with Building Department:** It is the owner's responsibility to verify that the proposed floodproofing improvements do not require additional permits/inspections from the Building Department and do not violate building codes.
10. **Manufacturer's Specification Sheets**: If using manufactured measures (i.e. sealants).
11. **Manufacturer Catalog Cuts:** If ordering measures from a catalog (i.e. doors, gates, shields, etc).
12. **DRAFT Inspection and Maintenance Plan** (per FEMA Technical Bulletin 3) for the floodproofing measures prepared by a Colorado Professional Engineer or Architect. This draft plan should be as complete as possible to avoid delays when trying to obtain Certificate of Occupancy (C.O.). The final version (required prior to C.O.) must be signed and sealed by the design professional and the owner. The plan must include, but is not

limited to:

a. Inspection and maintenance frequency for each floodproofing measure.
b. When maintenance is required, what actions must be taken and by whom.
c. Exterior envelope of structure.
d. All penetrations to the exterior of the structure.
e. All doors, shields, gates, barriers, closures, or components designed to provide flood protection to the structure.
f. All seals or gaskets for all doors, shields, gates, barriers, closures, or components.
g. Location of all doors, shields, gates, barriers, closures, or components as well as associated hardware, and any materials or specialized tools necessary to seal the structure.

13. **DRAFT Flood Emergency Action Plan (EAP)** (per FEMA Technical Bulletin 3) shall be prepared by a Colorado Professional Engineer or Architect. The final version (required prior to C.O.) must be signed and sealed by the design professional and signed by the owner. The plan must include, but is not limited to:
    a. What triggers the EAP.
    b. Clearly defined roles and responsibilities including contact info for who is responsible for enacting the EAP with backup contacts if the primary contact is not available.
    c. Procedures for notifying necessary parties when flooding is imminent.
    d. Evacuation or shelter in place plan, with all ingress and egress routes identified.
    e. Periodic training program. At a minimum the training must be performed annually and for all new employees.
14. **Floodproofing Notices:** Show on the plans where the required floodproofing notices will be posted within the building. These notices consist of a floodproofing map and inform the occupants of the structure that the building is floodproofed and show emergency procedures and evacuation routes. These will need to be posted in at least two (2) conspicuous locations in the building along with the EAP.
15. **ASCE 24-14 Design Certificate:** Written certification that the Engineer of Record's design and construction are in accordance with American Society of Civil Engineers ASCE 24-14 requirements to meet FEMA requirements in 44 CFR 60.3(c)(4). This certification must be signed and sealed by a Colorado Professional Engineer.
16. **FEMA Floodproofing Certificate for design**, which must be certified by a Colorado Professional Engineer or Architect.

<u>During construction and at the completion of a floodproofing project, the following items must be completed and approved by the floodplain manager prior to issuance of Certificate of Occupancy (C.O.):</u>

1. **Floodplain Foundation Inspection** as required per condition of the floodplain permit.
2. **Floodproofing Water Testing**: Field water testing up to the FPE will be required for all floodproofing measures. Additional thought must be given to how the contractor shall perform the water tests. Caution must be exercised and the tests must be performed in a manner to avoid damage to the interior and adjacent property in the event of failure or leakage. The contractor shall devise a methodology to perform the tests and capture and measure the seepage through all closure devices (or any other measures that must be tested) to prove that seepage rates for the entire structure would not exceed an amount which would result in an accumulation of more than 4 inches of water depth in the floodproofed space during a 24-hour period. *<u>In addition, the seepage rate for a closure device (door, shield, gate, etc…) must not exceed 0.24 gallons per hour per linear foot of wetted perimeter (to FPE) in field tests.</u>* This allowable seepage rate is 3 times the ANSI 2510 standard for closure devices. These tests must be observed by the Town's Floodplain Manager.
3. **Final Floodplain Inspection** as required per condition of the floodplain permit.
    a. Floodproofing Notice and EAP must be posted in two (2) conspicuous locations in the building.
4. **Floodproofing Report** to keep all of the of the floodplain/floodproofing info together in a format that is easy to follow and beneficial to the building owner for emergency, maintenance, and insurance purposes. The final report must be signed and sealed by a Colorado Professional Engineer or Architect. See below for a recommended report format. At a minimum, the report must contain the following:
    a. **FEMA Floodproofing Certificate for design**, which must be certified by a Colorado Professional Engineer or Architect. This was provided prior to permit issuance.
    b. **FEMA Floodproofing Certificate for construction**, which must be certified by a Colorado Professional Engineer or Architect.
    c. **Detailed Inspection and Maintenance Plan** (per FEMA Technical 3) for all floodproofing measures.

The final version must be prepared and signed and sealed by a Colorado Professional Engineer or Architect and signed by the owner.

d. **Flood Emergency Action Plan (EAP)** (per FEMA Technical Bulletin 3). The final version must be prepared and signed and sealed by a Colorado Professional Engineer or Architect and signed by the owner.
e. **ASCE 24-14 Design Certification:** Written certification stating that the design and construction meet ASCE 24-14 for meeting requirements in 44 CFR 60.3(c)(4). This certification must be signed and sealed by a Colorado Professional Engineer, and was required prior to permit issuance.
f. **ASCE 24-14 Construction Certification:** Written certification that says, when installed, all installed components and systems meet the requirements of ASCE 24-14 for meeting requirements in 44 CFR 60.3(c)(4). This certification must be signed and sealed by a Colorado Professional Engineer.
g. **Watertight Certification:** Written certification that the structure is watertight with walls substantially impermeable to water for meeting FEMA requirement under 44 CFR 60.3(c)(3). This certification must be signed and sealed by a Colorado Professional Engineer.
h. **Floodproofing Notice:** Copy of Floodproofing Notice to be posted in at least two (2) conspicuous locations in the building. See below for additional information.
i. **Field water testing results** including water depth for the test, measured seepage rates, and photographs of the water tests.
j. **As-built data** for all floodproofing measures including elevations and locations of all external machinery and equipment, elevations of floodproofing of building elements, etc…
k. **Photographs** of the completed structure and all of the floodproofing measures.

Standard Dry Floodproofing Plan Notes:

The following notes are required to be on the plans to aid the contractor in the dry floodproofing requirements and minimize unnecessary complication and non-compliance issues during construction. Other notes may be necessary for unique circumstances:

- Notes required on the Grading (aka Civil Engineering) Plan:
    1) PROPERTY IS LOCATED IN FLOOD ZONE __ FOR _____ RIVER/CREEK/GULCH.
    2) BASE FLOOD ELEVATION (BFE) = _____ (NAVD 1988)
    3) MINIMUM FLOOD PROTECTION ELEVATION (FPE) = _____ (NAVD 1988)
    4) ALL EXTERIOR MACHINERY AND EQUIPMENT MUST BE ELEVATED ABOVE THE FLOOD PROTECTION (FPE) TO PREVENT FLOOD DAMAGE. THIS INCLUDES, BUT IS NOT LIMITED TO: ALL ELECTRICAL EQUIPMENT (TRANSFORMERS, ELECTRIC METERS, ELECTRICAL PANELS, JUNCTION BOXES, RECEPTACLES, ETC...) MECHANICAL EQUIPMENT (HEAT PUMPS, AC UNITS, DUCTWORK, ETC...), GAS FACILITIES (GAS METER AND REGULATOR), AND COMMUNICATIONS EQUIPMENT (PANELS, PEDESTALS, ETC...).
    5) IT IS CRUCIAL THAT UTILITIY COMPANIES (XCEL, COMCAST, CENTURYLINK, ETC...) ARE NOTIFIED OF ELEVATION REQUIREMENTS WHEN CALLING IN SERVICE REQUESTS. EXTERIOR MACHINERY AND EQUIPMENT THAT IS INSTALLED BELOW THE REQUIRED ELEVATION WILL BE REQUIRED TO BE RELOCATED AT THE CONTRACTOR'S EXPENSE. CONTRACTORS SHALL MARK MINIMUM ELEVATIONS FOR UTILITY COMPANY INSTALLERS AND COORDINATE SAID INSTALLATIONS.
    6) THE CONTRACTOR SHALL SURVEY THE TOP OF ALL CONCRETE FORMS FOR FLOOD PROTECTION PRIOR TO INSTALLATION OF REINFORCING AND PLACEMENT OF CONCRETE TO VERIFY ELEVATIONS REQUIRED FOR FLOOD PROTECTION.
    7) EXTERIOR CONSTRUCTION BELOW THE FPE MUST BE CONSTRUCTED WITH MATERIALS RESISTANT TO FLOOD DAMAGES. FLOOD DAMAGE-RESISTANT MATERIALS MUST CONFORM TO FEMA'S TECHNICAL BULLETIN 2 "FLOOD DAMAGE-RESISTANT MATERIALS REQUIREMENTS."
    8) FIELD WATER TESTING TO THE FPE OF EACH FLOOD PROTECTION DEVICE WILL BE REQUIRED PRIOR TO ISSUANCE OF C.O. ADDITIONAL THOUGHT MUST BE GIVEN TO HOW THE CONTRACTOR SHALL PERFORM THE WATER TESTS. THESE TESTS MUST BE PERFORMED IN A MANNER THAT MINIMIZES RISK OF WATER DAMAGE TO THE INTERIOR AND ADJACENT PROPERTY IN THE EVENT OF FAILURE OR LEAKAGE. THE CONTRACTOR SHALL DEVISE A METHODOLOGY TO PERFORM THE TESTS AND CAPTURE AND MEASURE THE SEEPAGE THROUGH ALL CLOSURE DEVICES (OR ANY OTHER MEASURES THAT MUST BE TESTED) TO PROVE THAT SEEPAGE RATES FOR THE ENTIRE STRUCTURE WOULD NOT EXCEED AN AMOUNT WHICH WOULD RESULT IN AN ACCUMULATION OF MORE THAN 4 INCHES OF WATER DEPTH IN THE FLOODPROOFED SPACE DURING A 24-HOUR PERIOD. *IN ADDITION, THE SEEPAGE RATE FOR A CLOSURE DEVICE (DOOR, SHIELD, GATE, ETC…) MUST NOT EXCEED 0.24 GALLONS PER HOUR PER LINEAR FOOT OF WETTED PERIMETER (TO FPE).* THESE TESTS MUST BE OBSERVED BY THE TOWN'S FLOODPLAIN MANAGER. ALL REQUESTS FOR INSPECTIONS MUST BE CALLED TO SCHEDULE A MINIMUM OF 2 BUSINESS DAYS IN ADVANCE.
    9) A FLOODPLAIN FOUNDATION INSPECTION IS REQUIRED PRIOR TO VERTICAL CONSTRUCTION OF THE BUILDING. A BUILDING THAT IS NOT ELEVATED OR BACKFILLED PROPERLY MAY BE CONSIDERED NON-COMPLIANT AND CAN RESULT IN DENIAL OF C.O. AND/OR HIGH FLOOD INSURANCE PREMIUMS. FIXING NON-COMPLIANCE ISSUES AFTER

THE FACT CAN BE VERY COSTLY. THE REQUIRED FLOODPLAIN FOUNDATION INSPECTION WILL ONLY PROVIDE A VISUAL INSPECTION FOR CONFORMITY WITH PLANS, IT WILL NOT VERIFY ELEVATIONS. THE CONTRACTOR MUST CALL THE TOWN OF LYONS FLOODPLAIN MANAGER WITH PERMIT NUMBER TO SCHEDULE THE REQUIRED INSPECTION. ALL REQUESTS TO SCHEDULE INSPECTIONS MUST BE MADE AT LEAST 2 BUSINESS DAYS IN ADVANCE.

10) A FINAL FLOODPLAIN INSPECTION IS REQUIRED PRIOR TO ISSUANCE OF C.O. THE FINAL FLOODPLAIN INSPECTION CANNOT BE SCHEDULED UNTIL THE REQUIRED FLOODPROOFING REPORT AND ALL ASSOCIATED DOCUMENTS ARE APPROVED BY THE FLOODPLAIN MANAGER. THIS REQUIRES COORDINATION WITH THE ENGINEER AND OR ARCHITECT. THE CONTRACTOR MUST CALL THE TOWN OF LYONS FLOODPLAIN MANAGER WITH PERMIT NUMBER TO SCHEDULE THE REQUIRED INSPECTION. ALL REQUESTS FOR INSPECTIONS MUST BE MADE AT LEAST 2 BUSINESS DAYS IN ADVANCE.

- Notes required on the Architectural, Mechanical, Electrical & Plumbing Plans. Repeat these notes on each subset. This helps ensure that the subcontractors are informed about the floodplain and dry floodproofing requirements:
    1) SEE CIVIL SHEET ___ FOR ADDITIONAL FLOODPLAIN AND FLOODPROOFING REQUIREMENTS.
    2) ARCH ELEVATION 100'0" = _____ (NAVD 1988). REFER TO CIVIL ENGINEERING PLANS FOR ADDITIONAL INFORMATION.
    3) MINIMUM FLOOD PROTECTION ELEVATION (FPE) = _____ = _____ (NAVD 1988). REFER TO CIVIL ENGINEERING PLANS FOR ADDITIONAL INFORMATION.
    4) ALL EXTERIOR MACHINERY AND EQUIPMENT MUST BE ELEVATED ABOVE THE FLOOD PROTECTION (FPE) TO PREVENT FLOOD DAMAGE. THIS INCLUDES, BUT IS NOT LIMITED TO: ALL ELECTRICAL EQUIPMENT (TRANSFORMERS, ELECTRIC METERS, ELECTRICAL PANELS, JUNCTION BOXES, RECEPTACLES, ETC...) MECHANICAL EQUIPMENT (HEAT PUMPS, AC UNITS, DUCTWORK, ETC...), GAS FACILITIES (GAS METER AND REGULATOR), AND COMMUNICATIONS EQUIPMENT (PANELS, PEDESTALS, ETC...).
    5) IT IS CRUCIAL THAT UTILITIY COMPANIES (LYONS, XCEL, COMCAST, CENTURYLINK, ETC…) ARE NOTIFIED OF ELEVATION REQUIREMENTS WHEN CALLING IN SERVICE REQUESTS. EXTERIOR MACHINERY AND EQUIPMENT THAT IS INSTALLED BELOW THE REQUIRED ELEVATION WILL BE REQUIRED TO BE RELOCATED AT THE CONTRACTOR'S EXPENSE. CONTRACTORS SHALL MARK MINIMUM ELEVATIONS FOR UTILITY COMPANY INSTALLERS AND COORDINATE SAID INSTALLATIONS.

Recommended Floodproofing Report Format:

Main Report: Description of site and structure being floodproofed, proposed use, specific floodplain information and drainage patterns, detailed description of all floodproofing measures including an explanation of how the structure will remain substantially impermeable to water, and references.

Appendix A: Site Map, FIRM Panel, and other flood data
Appendix B: Flood Emergency Action Plan and Floodproofing Notice
Appendix C: Floodproofing Inspection and Maintenance Plan
Appendix D: Shop Drawings, Cut Sheets and Specifications
Appendix E: Structural Calculations
Appendix F: "Design" FEMA Floodproofing Certificate and ASCE 24-14 Certification
Appendix G: "Finished Construction" FEMA Floodproofing Certificate, ASCE 24-14 Certification, and Watertight Certification
Appendix H: Site Photographs
Appendix I: Floodproofing Field Testing Results and Photos of Floodproofing Tests
Appendix J: As-built data for floodproofing measures

Appendix K: Floodplain permit, floodproofing inspection records, and TCO/C.O. documentation

Appendix L: Inspection and Maintenance Logs [Placeholder section for future I&M documentation]

Required Floodproofing Notice contents:

- 11"x17" map of building showing all floodproofing measures. At a minimum, the notice must be laminated to protect against normal wear and tear. Metal or plastic signs are also acceptable.
- Show ingress and egress routes.
- Include the following note "NOTICE: THIS BUILDING IS IN THE FLOODPLAIN AND HAS BEEN DESIGNED AND CONSTRUCTED TO PREVENT FLOOD DAMAGE. TAMPERING WITH, OR REMOVING, FLOOD PROTECTION MEASURES IS A CODE VIOLATION AND CAN RESULT IN INCREASED FLOOD INSURANCE PREMIUMS. PLEASE FAMILIARIZE YOURSELF WITH THE FLOOD PROTECTION MEASURES AND THE FLOOD EMERGENCY ACTION PLAN. FOR YOUR SAFETY, NEVER ATTEMPT TO WALK OR DRIVE THROUGH FLOODWATERS."

Additional References:

- **FEMA Floodproofing Certificate:**

https://www.fema.gov/media-library/assets/documents/2748

- **FEMA Elevation Certificate:**

https://www.fema.gov/media-library/assets/documents/160

- **FEMA's Technical Bulletin 2, "Flood Damage-Resistant Materials Requirements":**

https://www.fema.gov/media-library/assets/documents/2655

- **FEMA's Technical Bulletin 3, "Non-Residential Floodproofing-Requirements and Certification":**

https://www.fema.gov/media-library/assets/documents/3473

- **FEMA's Technical Bulletin 4, "Elevator Installation":**

https://www.fema.gov/media-library/assets/documents/3478

- **FEMA's Technical Bulletin 6, "Below-Grade Parking Requirements":**

https://www.fema.gov/media-library/assets/documents/3498

- **National Flood Insurance Program (NFIP) Flood Insurance Manual:**

http://www.fema.gov/flood-insurance-manual

- **National Flood Barrier Testing and Certification Program:**

http://nationalfloodbarrier.org

Credits:

- **City and County of Denver Floodproofing Guidelines**