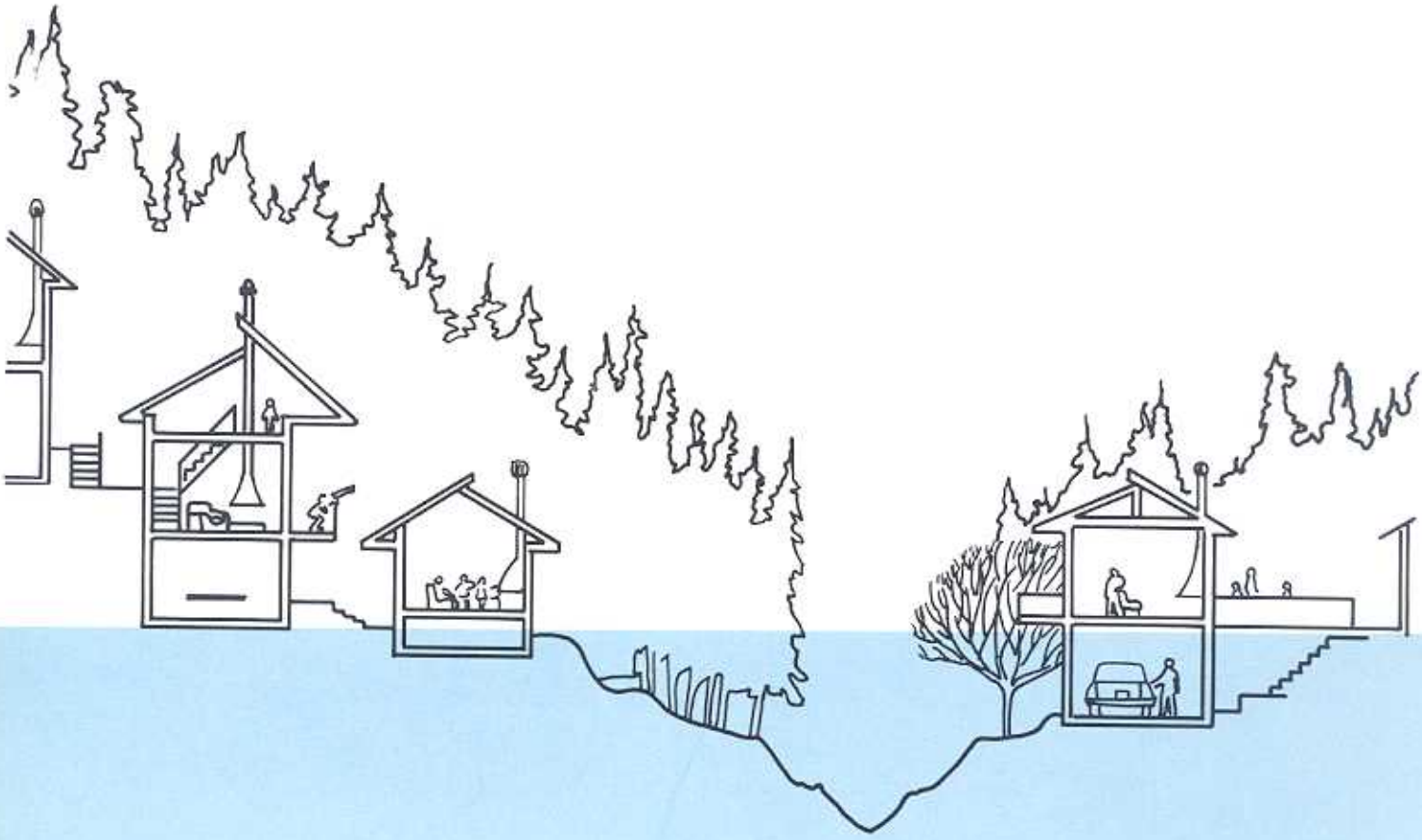

DESIGNING FLOODPROOFED HOMES IN ALASKA

State of Alaska
Steve Cowper Governor

DEPARTMENT OF COMMUNITY AND REGIONAL AFFAIRS
ASSISTING ALASKAN COMMUNITIES

Department of Community and Regional Affairs
David G. Hoffman, Commissioner

PURPOSE

This brochure provides general information on **floodproofing** as a flood protection measure for residential structures. Included in the brochure are eight INSERTS which offer a variety of information on floodproofing techniques and how they may be integrated into the design of the site and the structure. The information presented is advisory and not meant to be a complete interpretation of the requirements of federal law, State law, or local ordinances pertaining to floodplain development. More specific information about such requirements can be obtained from local municipal officials or the Department of Community and Regional Affairs, Municipal and Regional Assistance Division.

ALASKA'S FLOODING PROBLEM

Alaska's people have always been attracted to water. Rivers, inland lakes, and the coastal waters are not only a source of food, but also serve as highways for travel and commerce. The recreation and scenic qualities of waterfront properties make them even more attractive for development.

Development in areas subject to flooding, however, has been a mixed blessing. Overflowing streams and rivers and coastal storm flooding have caused extensive property damage, income loss, and sometimes loss of life. Millions of dollars of public funds have been spent in the payment of disaster relief and in the repair and rebuilding of community services. State funds expended between 1977-1988 for flooding related disaster assistance exceeded $29 million. Added to this cost is the disruption from floodwaters, the cost to communities, and the accompanying loss of personal belongings and income.

In spite of continued losses, improper development in Alaska's floodplains continues. Better floodplain management is needed.

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This publication was prepared by the Training and Technical Assistance Section in the Department of Community and Regional Affairs, Municipal and Regional Assistance Division, Anchorage, Alaska — Marty Rutherford, Director. The concept design was developed by the Ministry of Environment, British Columbia and the University of British Columbia, School of Architecture. The work that provided the basis for this publication was supported in part by funding under a cooperative agreement with the Federal Emergency Management Agency. June, 1986. Reprinted June 1989.

For further information and additional copies please contact: The Department of Community and Regional Affairs, Municipal and Regional Assistance Division, 949 E. 36th Avenue, Suite 400 Anchorage, Alaska 99508 (907) 563-1073 or P.O. Box BH Juneau, Alaska 99811 (907) 465-4750 Christy Miller, Project Manager.

REDUCING FLOOD DAMAGE

The nature of the flood threat and the measures which can be taken to counteract it are frequently misunderstood. Floodplain management involves a variety of interrelated flood protection activities which can be instituted by homeowners, developers, businesses, or local officials. Examples of floodplain management activities include the following:

Flood control projects

- such as reservoirs, levees, and channel improvements which attempt to control flooding by keeping the water in the floodway or established channel;

Flood insurance programs

- which provide reimbursement to homeowners, renters, and businesses for structures and contents damaged by flooding - flood insurance can be purchased in any community participating in the National Flood Insurance Program - to be eligible to participate a community must adopt by ordinance the minimum federal floodplain development regulations;

Flood alert systems

- and disaster preparedness plans which help reduce losses by permitting the evacuation of people and goods before flooding occurs;

Public awareness and education programs

- which provide information, educate buyers about hazardous property, and provide builders with information on techniques for lessening property damage;

Land use regulations

- which can be incorporated into building codes, subdivision regulations, or zoning ordinances to promote proper use of the floodplain; and

Floodproofing measures

- which make adjustments to structures and building contents in order to reduce flood damage.

A floodplain management program involves the use of some or all of these activities. Floodplain management programs in Alaska most commonly have adopted floodproofing as the primary flood protection activity. For development in or near the floodplain, an investment in floodproofing can minimize the risk, damage, and disruption each time a flood occurs. The information presented here will clarify what floodproofing measures are and how they affect the design and use of a structure.

WHEN IS FLOODPROOFING REQUIRED?

Floodproofing for residential construction or other development in the floodplain is required if:

1. the development is located in the floodplain **and** located in a city or borough participating in the National Flood Insurance Program, **or**
2. the development is being undertaken with federal or State financing.

To find out if a development is in the floodplain and if floodproofing measures are required, contact the local community permit official (for example, the planning department or city manager); federal or State funding agency; or the Department of Community and Regional Affairs, Municipal and Regional Assistance Division. The Municipal and Regional Assistance Division can also provide more information on the National Flood Insurance Program.

DEFINITIONS

Base Flood Elevation (B.F.E.):

- The water surface elevation which would result from a flood having a one percent chance of being equaled or exceeded in any given year. The 100-year-flood and Base Flood are terms for the same flooding event.

  To be eligible for flood insurance under the National Flood Insurance Program, a community must require residential structures to have the lowest habitable floor elevated to or above the Base Flood Elevation. If a Base Flood Elevation has not been calculated for a particular area, historical high water marks are generally recorded or are visible.

Coastal High Hazard Area:

- The area subject to high velocity waters, including but not limited to coastal storm surges or tsunamis. On Flood Insurance Rate Maps, coastal high hazard areas are shown as "V Zones" meaning velocity flood zones.

Floodplain or Flood Prone Area:

- Any area which may be submerged by floodwaters from any watercourse, lake, or other body of water, including the sea. These areas are shown as "A Zones" on Flood Insurance Rate Maps.

Floodway:

- The channel of the watercourse and the portion of the floodplain which is reasonably required to carry and discharge floodwaters of a designated magnitude. The floodway is intended to carry the deep and fast-moving water.

Flood Fringe:

- Land within the floodplain but not within the floodway.

Floodproofing:

- Any combination of structural changes and/or adjustments incorporated into the design and/or construction and alteration of buildings subject to flooding for the purpose of reducing or eliminating flood damage.

Freeboard:

- A factor of safety (to allow for waves and debris) above the Base Flood Elevation or a safety factor added to the historical high water mark.

  Generally, a freeboard of one foot elevation above the Base Flood Elevation is used to offer a margin of safety. The Base Flood Elevation, plus an allowance of one foot for freeboard, can be used to establish the elevation of the underside of the floor system for habitable buildings or the ground surface elevation upon which a manufactured home or structure rests. Freeboard may also be used in setting the top elevation of any dike or riverbank protection structure.

Habitable Floor:

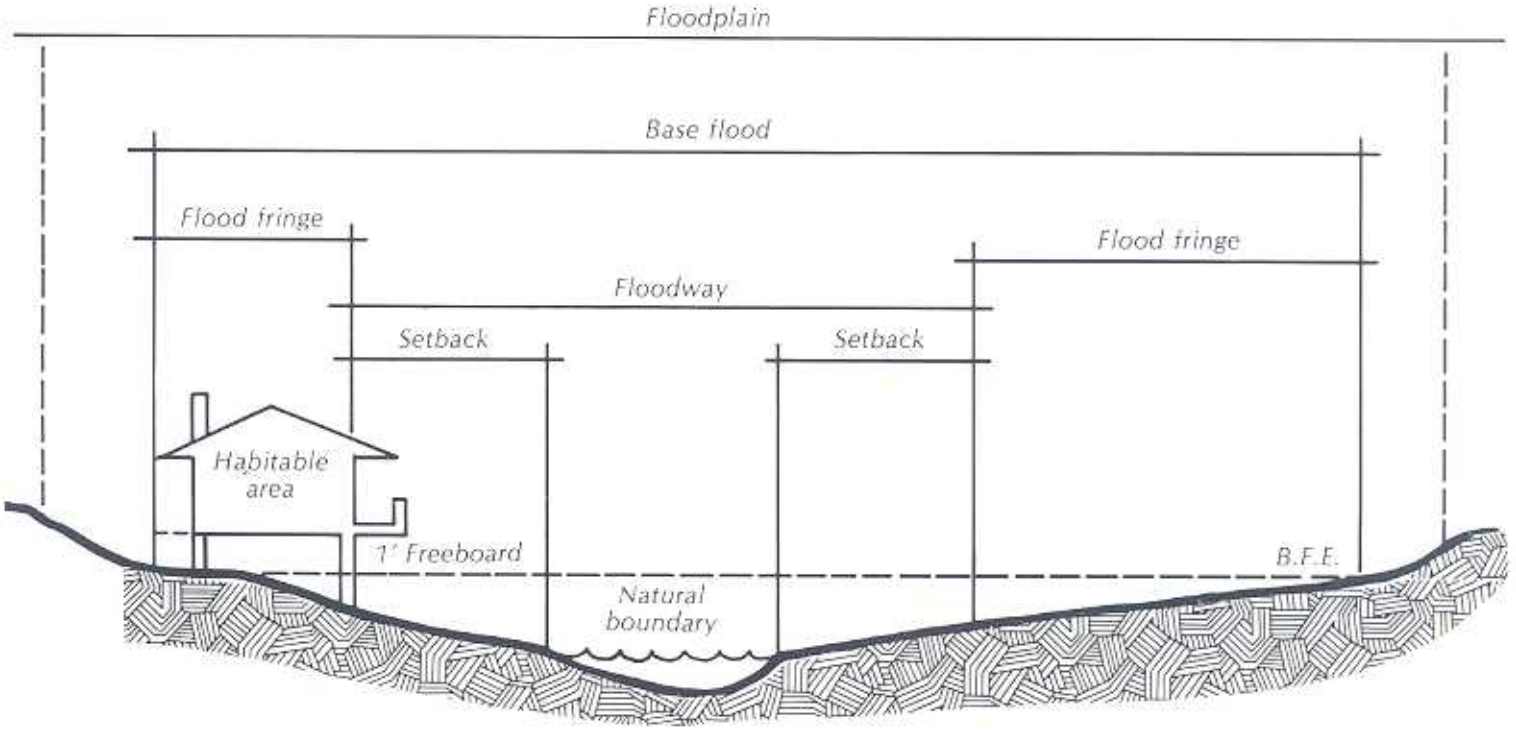
- Any room or space within a building or structure which is or can be used for human occupancy, which includes working, sleeping, eating, cooking, recreation, or a combination thereof. A floor used only for storage is not a habitable floor.

  The National Flood Insurance Program requires residential structures to have the "lowest habitable floor, including the basement" elevated to or above the Base Flood Elevation.

Setback:

- A safety buffer consisting of a natural vegetative or contour strip between the natural boundary of a waterbody and a structure.

Profile of a River Floodplain



ELEVATION CONSIDERATIONS FOR A FLOODPROOFED HOME

Elevating living spaces **above** the flood level is the primary factor in designing a floodproofed home. Elevating a home to provide flood protection affects the organization of the space **inside** and **outside** the home, particularly the location of storage areas and other nonhabitable spaces. Also, the location of entry ways and access to the living spaces required special attention. The first step is to choose a means of elevating the home above the flood level. This may be accomplished in a variety of ways including elevation on fill, elevation by structural means, or a combination of options.

Elevation on fill:

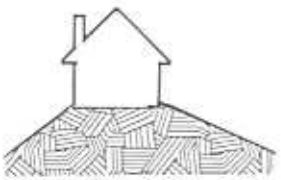
Placing residential structures on fill is one way of elevating a home and at the same time maximizing the space outside the home. Things to consider in the successful use of fill are selecting proper fill material, adequately compacting the fill, providing proper slopes, and using slope protective measures such as riprap, vegetation, or terracing.

Selecting Proper Fill Material:

The layout and design of the fill material will depend somewhat on the site conditions and types of construction materials which can be used economically. Gravel and rock are excellent choices, but in many areas of Alaska gravel and rock are not available. Fill material such as sand or silt may be the only choice, even though both can erode easily when exposed to flowing water. Slope or erosion protection, such as sand bagging, landscaping, and terracing, may be needed. A soils engineer should be consulted for design recommendations if river silt is the only available fill material.

Designing the Fill:

The following sketches illustrate various ways to obtain proper slopes when using fill material. When selecting a design, lot size, soil type, and location of the lot in relation to the floodway should be considered.



Sloped fill

Terraced fill

Combination

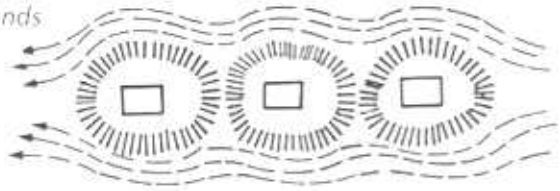
The following apply in all situations:

- Fill should not be located within the floodway.
- The shape of the fill should be streamlined as much as possible to minimize resistance to the flow of floodwater.

- If floodwaters are funnelled between two closely spaced mounds, the velocity of the water between the mounds and the potential for erosion are greatly increased. The channel should be shaped to minimize turbulence.

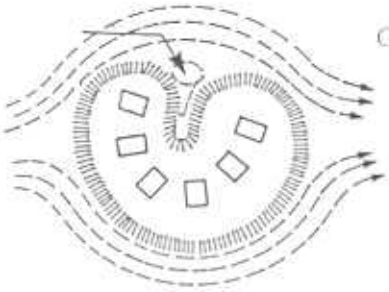
The following sketches illustrate ways to eliminate the problem of increased floodwater velocity due to the funnelling effect. This can be done by providing gentle curves and gradual slopes and reducing obstructions such as large trees, rocks, or fences. These measures also help to protect the dwellings from the impact of debris.

Individual mounds



INDIVIDUAL MOUNDS should be oriented in the direction of the floodwater flow.

Common mound



Slow moving water

A COMMON MOUND provides greater protection for individual structures. Shaping mounds to allow water movement to slow down, as is shown at the bottom of the mound in the sketch above, provides a protected area which can be used for access, boat storage, or to protect utilities, etc.

Cost:

The cost of elevating on fill will vary considerably depending on the availability of suitable fill, flood depths, soil types, and scour (erosion) protection requirements - all of which should be assessed by an engineer. For example, elevating a two story 2,500 square foot house in Southcentral Alaska on six feet of fill could increase the cost of the house by approximately 10 to 15%. In areas of Western Alaska where gravel fill may not be available and extensive scour protection may be required, the additional construction cost could increase by as much as 30%.

However, if a home is located in a community that is participating in the National Flood Insurance Program and the home is elevated on fill, the need for flood insurance may be waived (through a map revision process), thereby saving the homeowner the annual cost of flood insurance. The savings could off-set the increased construction costs.

Elevation by Structural Means:

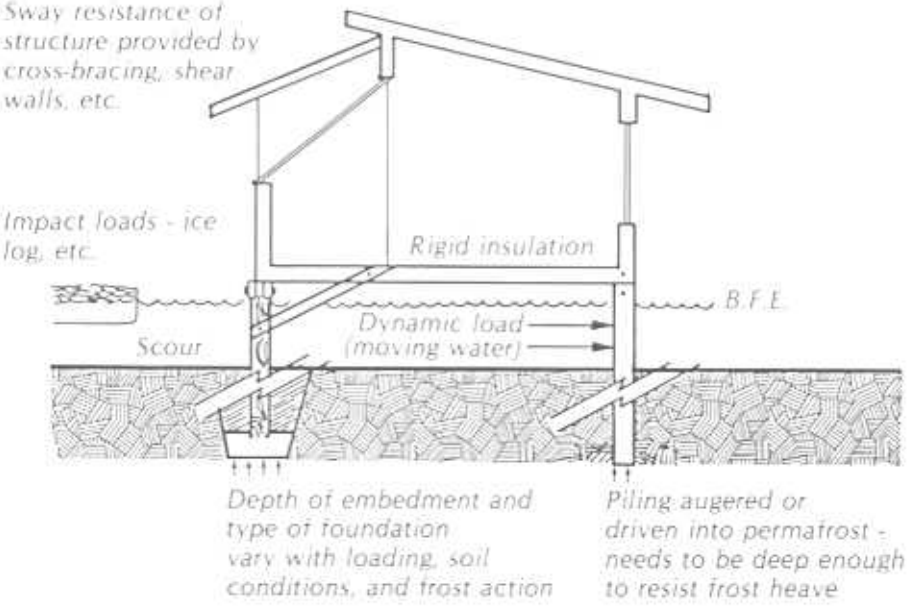
Another way to elevate a home is by using structural means (walls, posts, piers, or pilings). This method of elevating maximizes the space beneath the home. It also provides an alternative when adequate fill material is not available; when flood heights are extreme (therefore requiring large amounts of fill material); or when the building is being constructed in the floodway (fill should not be used in the floodway).

WALLS: masonry, concrete, or preserved wood *Post, piles, piers*

When elevating using structural means, the following should be considered:

- Orient the building lengthwise to the floodwater flow for least resistance.
- Use large spans between bracing to offer the least resistance to the flow of floodwater and debris.
- Locate shearing stress walls, diagonal bracing, and stairways parallel to the flow as much as possible in order to avoid obstructing the flow of floodwater and debris.
- Protect foundations from scouring (erosion) by compacting the soil around the foundation and deeply embedding the piers or pilings.
- In areas that have contact with water or saturated soils use rigid non-permeable insulation, treated timber only for structural supports, and galvanized frame connections.
- When using post, pier, or pile construction, consider local soil conditions for compactability, frost action, and/or permafrost.

The sketch below demonstrates these construction principles and details the water forces impacting the structure.

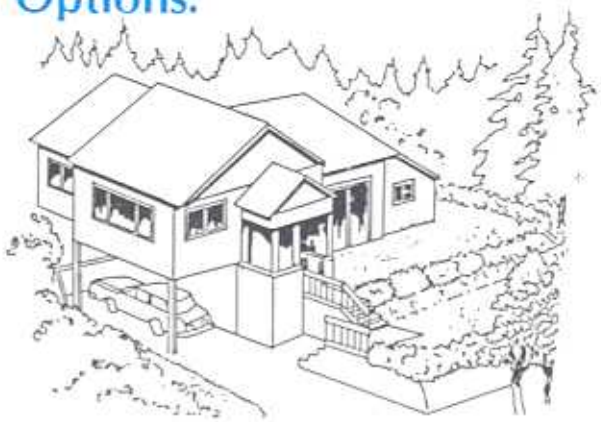


Cost:

The cost of elevating a home by structural means depends on the type of foundation used, the availability of construction materials, and other site specific conditions (such as permafrost). In some areas certain types of construction techniques may not be feasible because construction materials are not available locally or must be hauled in at great expense.

However, in many areas of the State, floodproofing by structural means may be accomplished with little additional cost. For example, in many communities in western Alaska, homes are routinely constructed on piling. By using slightly longer piling and adding cross bracing, flood protection could probably be achieved with only a 2% to 3% increase in construction cost.

Combination of Options:



Another elevation alternative involves the combining of options. The use of more than one structural option increases the opportunity for maximum use of space beneath the structure, as well as outdoor space. Because foundation requirements for combining flood protection options can be quite complex, an engineer should be consulted.

The following sketches illustrate combining elevation on fill and posts or piers to get the first floor living area above the Base Flood Elevation.

Elevating with fill and posts/piers

Cost:

Combining flood protection options can reduce construction costs by taking advantage of any special site conditions and combining construction techniques. This is especially true for the higher Base Flood Elevations where the cost advantage may be quite significant (for example, saving on the cost of fill by elevating part of the structure on posts/piers). Also, although combining structural options may increase the complexity of design and construction, the integration of methods can produce a unique structure which takes maximum advantage of the site.

Coastal High Hazard Areas:

Coastal high hazard areas are areas where the coastal floodplain is inundated by tidal surges with velocity waves (shown as V-zones or Coastal Velocity Flood Zones on Flood Insurance Rate Maps). Except for the use of fill, recommended construction practices mentioned above also apply to coastal high hazard areas. Additional recommendations for these hazard areas are listed below.

- Elevate structures on adequately anchored pilings, posts, or piers so the bottom of the structural supports which support the lowest floor (excluding the pilings or columns) is elevated to or above the Base Flood Elevation.
- Do not use fill for structural support in coastal high hazard areas.
- Construct non-structural walls below the Base Flood Elevation so that they are a breakaway or open lattice work type which will collapse under wind or water load without jeopardizing the structural support of the building.
- If saltwater contact is a problem, use epoxy coated rebar and galvanized frame connections to lessen corrosion.

The figure to the right illustrates the location of coastal high hazard zones (V-Zones on Flood Insurance Rate Maps) and the coastal floodplain (A-Zones on Flood Insurance Rate Maps).

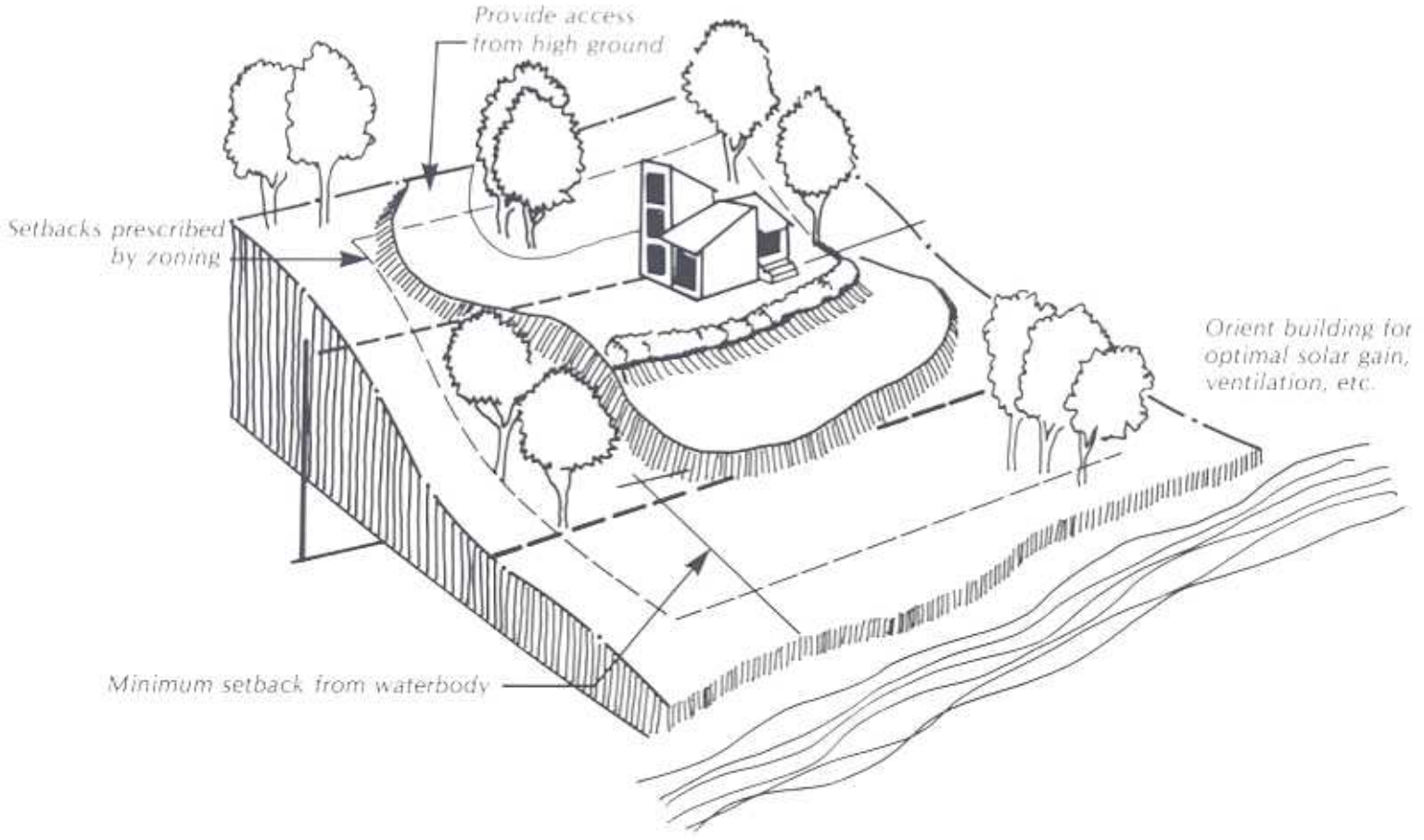
This information is advisory only and not meant to take the place of federal law, State law, or local ordinances governing floodplain development. For further information on applicable federal laws, State laws, and local ordinances, contact your local municipal official or the Department of Community and Regional Affairs, Municipal and Regional Assistance Division.

SITING AND LANDSCAPING CONSIDERATIONS FOR FLOODPROOFING

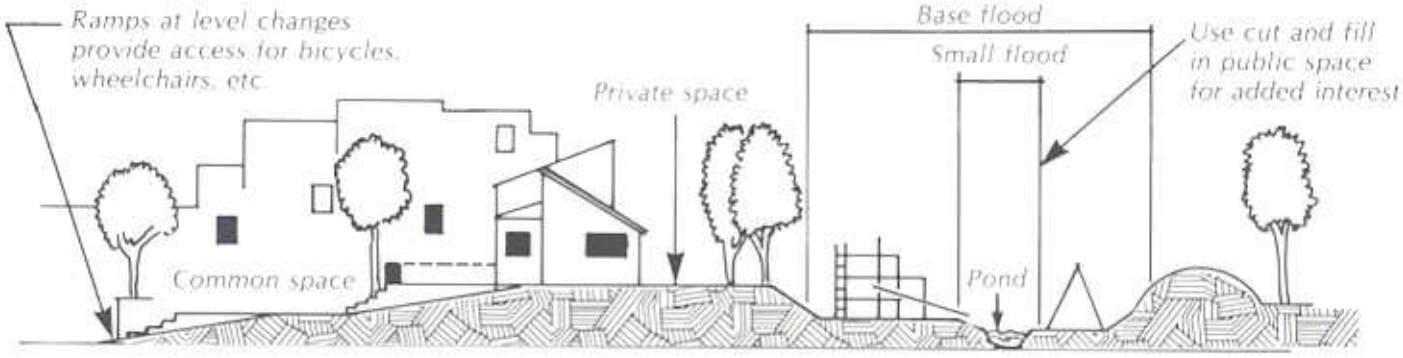
Siting:

In addition to considering sun angles, wind direction, views, and zoning regulations (for example, setbacks), the following should also be done when siting a building in the floodplain:

- Provide access and evacuation routes to higher ground.
- Locate the structure away from any waterbody so as to allow for erosion and wave action (to estimate a setback distance for erosion, multiply the average annual rate of erosion by the useful or mortgage life of the structure).
- Consider off-site drainage impacts (elevating on fill will increase the runoff on adjacent property).
- If possible, do not locate structures in the floodway.



Large scale earthmoving can provide required fill for elevating buildings while at the same time excavating areas for floodways or collection ponds. As illustrated in the following sketch, grade changes that result from elevating structures can be used to site activities (play yards, boat storage, gardens, parking, accessory structures), define private and common space, and create added interest.

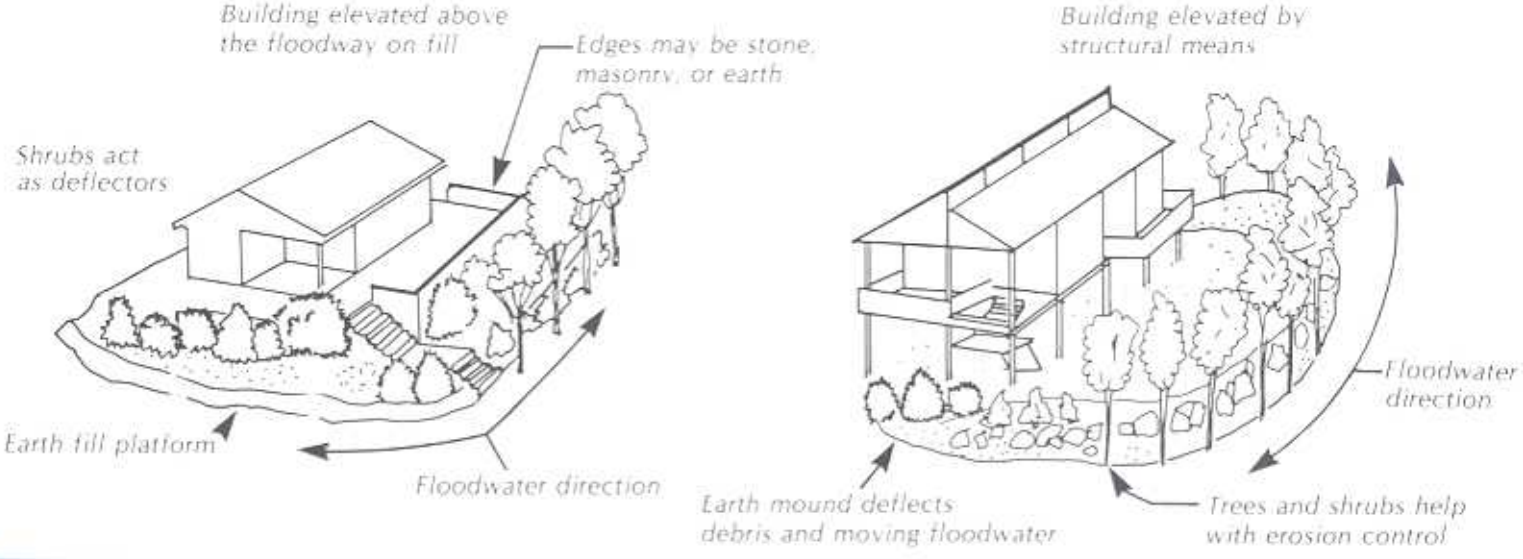


Landscaping:

The use of landscaping around a floodproofed home serves two purposes: it integrates the elevated portion of the buildings with the surroundings and it helps to control erosion and protect the dwelling from the impact of debris and moving water.

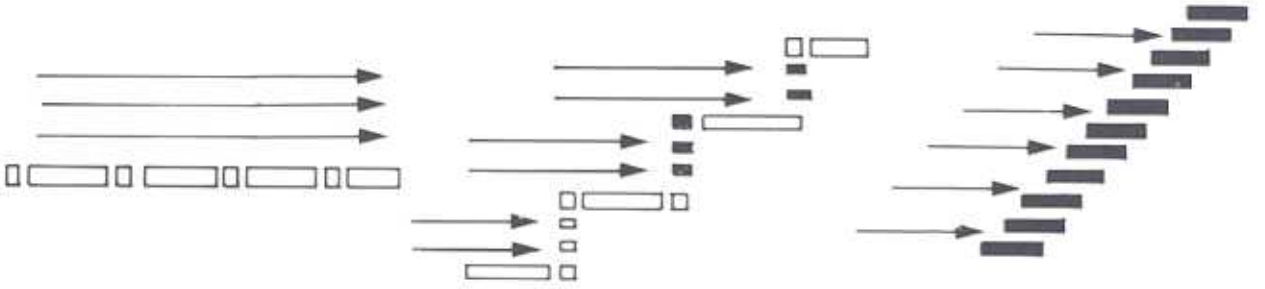
Planting grass, shrubs, and trees is one way to protect footings and fill from scouring and control erosion. Selection of grass and plant types will depend on the local climate and soil conditions. Also, some seed mixtures are better adapted to slopes in terms of maintenance, wear, and root development. Generally, the better the root system, the more able the plant is to withstand erosive forces. For example, willows have a good soil stabilization root system and are hearty in many of Alaska's floodplain soils.

The following illustrations show how landscaping can integrate buildings with surroundings, control erosion, and protect fill.



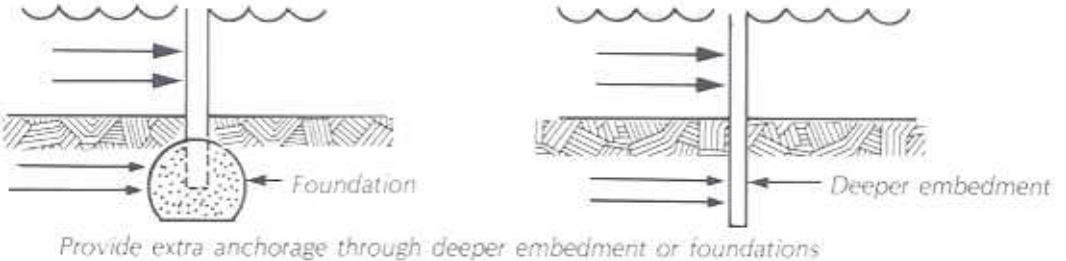
Another landscaping consideration is fencing. During flooding, fences can act as dams. This can be an advantage to keep ice and debris away from homes if fences are adequately anchored and properly constructed to withstand flood flows. Frequently, however, ice and debris pile up against fences inhibiting water flow and increasing the pressure against them until they are torn up or break apart.

The following sketches show how to orient fences to protect them from flood damage, or how to anchor and construct them to serve as debris barriers.



Orient fences parallel to floodwater flow

Allow larger openings for floodwater and small debris to pass through



Provide extra anchorage through deeper embedment or foundations

Wood boardwalks and logs used as traffic barriers should be anchored so that they do not become floating debris during floods.

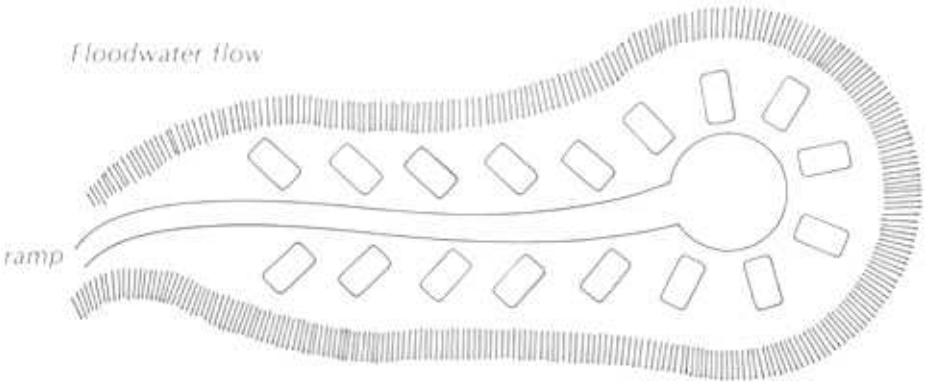
MANUFACTURED HOMES

A manufactured home is considered any transportable structure used with or without a permanent foundation (including mobile homes). The popularity of manufactured homes, coupled with their high vulnerability to the effects of flooding, require special techniques for elevating, providing services (utilities), and anchoring to protect manufactured homes in flood prone areas. A manufactured home that is elevated a few feet above the ground and anchored to resist wind forces will still be vulnerable to the additional forces produced by flooding. These homes should be elevated on a permanent foundation so that the lowest floor of the home is at or above the Base Flood Elevation. A manufactured home also should be anchored to an adequately anchored foundation system.

Elevating:

Removal to high ground, elevation on fill, or elevation on pilings are the siting options available for floodproofing a manufactured home.

In elevating single manufactured homes on fill, adequate surface drainage and access for a hauler should be provided. Earth fill should only be considered to elevate a manufactured home in areas where flood velocity is not greater than 10 feet per second due to the risk of scour, erosion, and subsequent foundation failure. In addition, fill should not be used where it will constrict the flow of floodwaters and cause increased flood elevations or water velocity. When locating several manufactured homes in a floodprone area (for example, in a mobile home park), it may be more feasible and cost effective to elevate several homes on a single mound with a single access ramp.



If a manufactured home is elevated on pilings, then the following should be considered:

- Lots need to be large enough to permit steps.
- Piling foundations should be placed in stable soil no more than 10 feet apart.
- Reinforcement is needed for pilings more than six feet above ground level.

Utilities:

To connect manufactured homes to any underground utilities (for example, water, sewer, gas, telephone, and electricity), utility pipes must be extended above grade to the floor of the home. This makes utility connections extremely susceptible to flood water infiltration and damage from floating debris. To minimize the damage to utility pipes, these service hook-ups must be located above the Base Flood Elevation. The following precautions are recommended:

- Place utility pipes in waterproof risers located adjacent to the elevated foundation members on the downstream side of the flood flow.
- Waterproof all electrical connections.
- Install backflow preventers on water and sewer lines.
- Locate propane and fuel oil tanks in a waterproof enclosure elevated above the anticipated flood level on the downstream side of the home.

Applicable codes and regulations should always be followed when designing and installing utility services.

Anchoring:

In order to floodproof a manufactured home, the top of the fill on which the home sits must be located at or above the Base Flood Elevation so the foundations and anchorage will not be affected by floodwater. Manufactured homes should be anchored to resist flotation, collapse, or lateral movement by providing over-the-top and frame ties to ground anchors. The following anchoring specifications should be considered:

- Locate over-the-top ties at each of the four corners and two additional ties per side at intermediate points (manufactured homes less than 60 feet long require only one additional tie per side).
- Locate frame ties at each corner of the mobile home and five additional ties per side at intermediate points (manufactured homes less than 50 feet long require four additional ties per side).
- Ensure that all components of the anchoring system are capable of carrying a force of 4,800 pounds.
- Use the same method to anchor any additions to the manufactured home.
- Ensure that any method of anchoring used involves a system designed to withstand a wind force of 90 miles per hour or greater.

Costs:

There are many costs associated with protecting a manufactured home from floods, including:

- developing the site;
- elevating the home; and
- properly securing the home on the foundation.

The cost of elevating a manufactured home on fill increases not only with the amount of fill required to raise the unit to a higher level, but also there is an additional cost for a longer ramp (more fill, additional paving, extra land area).

The cost of elevating a manufactured home on piers is variable. Piers can be cast-in-place, built-up concrete masonry units, or wood. The cost of the piers will vary due to local material and labor costs, the size of the pier, and the required depth of embedment. Of critical importance is the type of soil and ease with which the piers can be secured in the ground.

UTILITIES FOR A FLOODPROOFED HOME

Another consideration in floodproofing a home is the location and design of the utilities servicing the home. The destruction of or damage to utilities by floodwater can result in costly repairs or replacement. Further, the continued operation of utilities during flooding is a definite advantage, especially during floods of long duration.

For each type of service connection to the home (mechanical, electrical, plumbing, and on-site sewage), the following are recommended for protecting the utilities from flood damage.

Mechanical Systems:

- Furnaces, water heaters, and the like should be located above the Base Flood Elevation or placed in a waterproof enclosure.
- Fuel lines should be equipped with a float operated automatic shut-off valve as an extra precaution.
- Duct work and vents should be located above the Base Flood Elevation with at least one foot of freeboard.
- Fuel storage tanks should be buried or securely anchored and equipped with a water-tight cap. Tanks should not be buried under foundations and should be placed downstream of the home.

Electrical Systems:

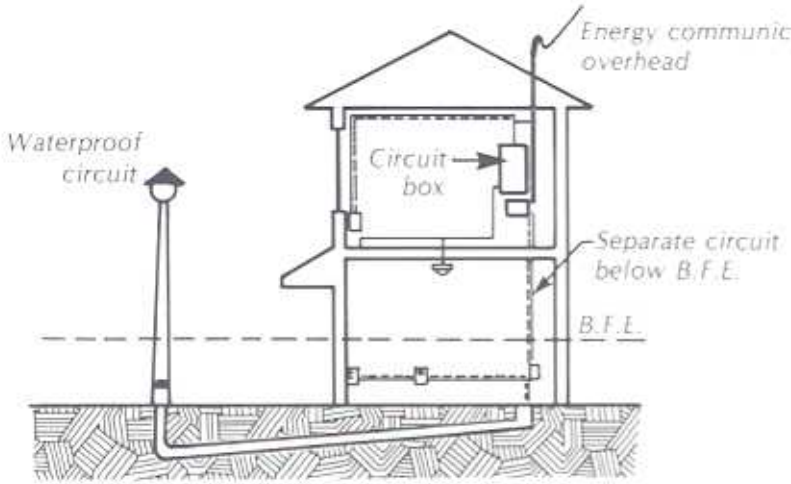
Power may be supplied from overhead wires or through an underground cable. If underground, the cable must be buried deep enough to avoid exposure from erosion or displacement by floodwater. In either instance:

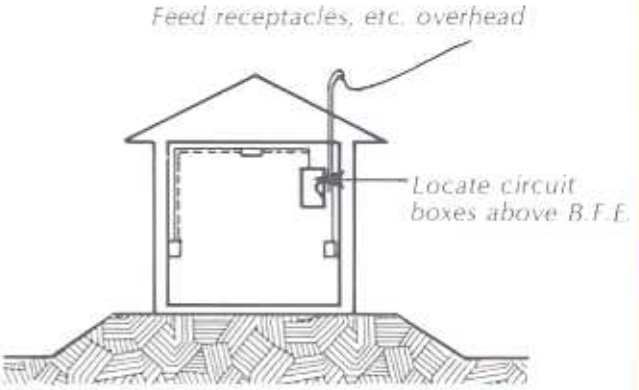
- Locate meters and panels above the Base Flood Elevation.
- Feed all receptacles, switches, etc. from above the Base Flood Elevation.
- Elevate generators above the Base Flood Elevation (if generators are portable they should be accessible).
- After flooding, inspect any circuitry or equipment which does flood.

If circuitry must be located below the Base Flood Elevation:

- Provide a separate circuit energized from a panel above the Base Flood Elevation.
- Use waterproof wiring.
- Limit circuits to 120 volts.
- Put emergency lighting on a separate circuit.
- Design electrical equipment below the Base Flood Elevation to be easily disconnected and portable.
- Provide a separate circuit for any sump pump.

Some of the techniques for safeguarding electrical systems in floodplains are shown below.





Plumbing:

Sewers and storm drains are the services most often affected during flooding. Floodwaters flow into the outlets increasing pressure on the lines and frequently causing backflow into the structure. To lessen this type of damage:

- Keep all plumbing fixtures above the Base Flood Elevation or equip those below with a backwater valve which stops reverse flow. This may be accomplished by locating a valve on the main line or by using separate valves on all fixtures below the Base Flood Elevation.
- An alternative to using backwater valves is to eliminate all gravity flow drains below the Base Flood Elevation - including floor drains, appliances (washers), and plumbing fixtures. The wastewater from these sources may be directed to a sump pump which lifts drainage above the flood elevation on a permanent basis. (This method uses electrical power.)
- Use cast iron or reinforced concrete pipes to withstand extra pressure.
- Locate water supply tanks, filters, and softeners above the Base Flood Elevation and install a back-water valve on the main water line to prevent contamination from floodwater.
- Individual wells should be located on slightly higher ground for drainage, and have a watertight casing extending at least 25 feet below the ground and upward to at least 6 inches (preferably 1 foot) above the Base Flood Elevation (or have the well casing sealed).

On-Site Sewage Disposal:

New and replacement septic systems should be designed to minimize or eliminate flood water infiltration into the system and also discharge from the septic system into flood waters.

The following recommendations are made with respect to septic tanks and holding tanks located in floodplains.

- If a septic system is required to operate during flooding, provisions should be made for sealing the septic tank.
- Both septic tanks and holding tanks should be watertight and not subject to excessive corrosion or decay. Metal or wooden tanks are not suitable.
- The outlet of the septic tank should be located at an elevation so effluent will flow by gravity into the distribution pipes of the soil absorption trenches. The bottom of the trenches should be at least as high as the elevation of the 10-year flood.
- The line to the septic tank should be fitted with a valve which will prevent the backflow of any liquid into the house.
- The inlet to a holding tank should be at least at the Base Flood Elevation, preferably one foot above.

The following wastewater disposal requirements apply to soil absorption units, such as drainfields, seepage pits, and seepage beds (these are specific requirements governed by the Alaska Department of Environmental Conservation, Title 18, Chapter 72, Alaska Administrative Code):

- It is prohibited to locate septic tanks, soil absorption units, or any privy within 100 feet of a natural or man-made waterbody.
- When area is limited and fill is needed to raise the elevation of the soil absorption unit, a sewage disposal mound may be considered. The fill soil should have a percolation rate between 5 and 30 minutes per inch. The vertical separation from the lowest part of the soil absorption system to the water table, as measured during the season of the year with maximum water table elevation, should be four feet or greater.

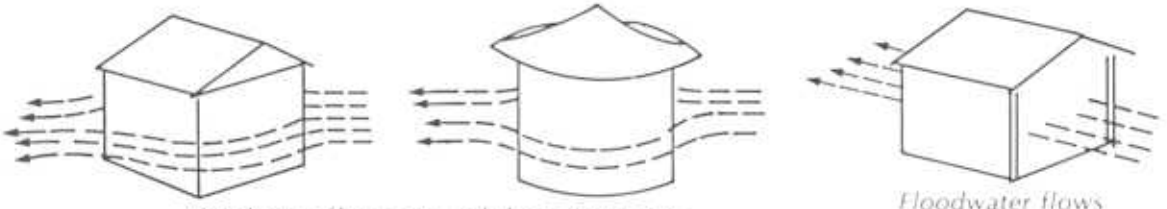
ACCESSORY STRUCTURES

Accessory structures are structures that people don't live in, such as smokehouses, food caches, and storage shelters. Floodproofing of accessory structures involves proper siting and designing to minimize damage from floodwater. For example, some accessory buildings may be constructed so that they can be moved to high ground in order to avoid flood damage, constructed to collapse rather than be destroyed by the flood forces, or designed to resist the flood forces.

Flood forces have a much greater impact on relatively small and less stable buildings than on larger structures such as dwellings. Flood forces acting on accessory structures tend to:

- topple the structure,
- break it up into parts,
- subject the structure to uplift forces, and/or,
- scour around the base or foundation of the structure.

As shown in these three figures, the floodproofing of small structures can be achieved by allowing water to flow through the structure or streamlining the structure to allow floodwaters to flow around.



Floodwater flows around these structures

Floodwater flows through this structure

Storage Tanks:

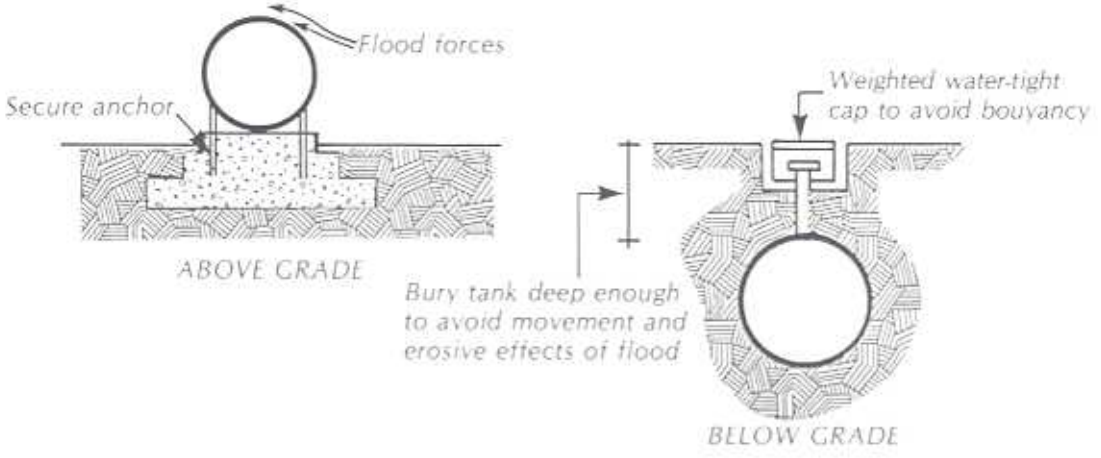
Fuel storage tanks are potentially dangerous during flooding - they are heavy yet often buoyant. If they are ripped from their stands, they may smash against structures or leak fuel. If possible, place these tanks above the Base Flood Elevation on a structure that is able to withstand flood and debris forces. Two ways of supporting fuel tanks above grade include:

- Locate the tanks on a separate elevated foundation system.
- Support tanks on a platform connected to the home foundation system.

Tanks and their supporting foundations should be located on the downstream side of the home and sufficiently anchored.

If it is not possible to elevate tanks above the Base Flood Elevation, they should be buried underground, weighted, and provided with water-tight caps.

Techniques for above and below grade flood protection of storage tanks are illustrated below.



Costs:

Leaking underground fuel storage tanks are a serious cause of groundwater contamination. The cost to clean up one underground drinking water supply contaminated by a leaking fuel tank may be incredibly high; between $2,000 and $2,000,000, or more.

For further information on laws, regulations and agency programs dealing with fuel storage tank installation and maintenance contact:

Department of Environmental Conservation
3601 C St., Suite 1334
Anchorage, AK 99503
563-6529

or

P.O. Box O
Juneau, AK 99811
465-2630

ECONOMICS OF ELEVATING

There are economic benefits to be gained by both a homeowner and the community if floodproofing methods are used. The risk of loss of life and property may also be reduced.

In communities that are participating in the National Flood Insurance Program, flood insurance is required on any federal or State mortgage loan for property in a designated flood hazard area. To be eligible to participate in the National Flood Insurance Program, a community must adopt and enforce minimum federal regulations governing floodplain development.

Floodproofing can result in savings in a variety of ways:

- Homeowners who elevate on fill and have proper documentation may request a Flood Insurance Map revision so that flood insurance purchase is no longer required.
- Homes elevated by post, pier, or pile must still purchase flood insurance, but at a savings (depending upon the elevation of the first floor above the Base Flood Elevation).

Flood insurance rates vary for each individual structure depending upon factors such as type of building construction, lowest floor elevation relative to the Base Flood Elevation, flood risk factors, and other factors. (Contents coverage is also available through the National Flood Insurance Program.)

Costs of reduced insurance should be compared to the costs of elevating a home, less the costs of flood damage which could occur. Items which should be considered in assessing flood damage include:

- costs of structural repairs,
- loss of personal property,
- cost of living elsewhere while the house is being cleaned or repaired, and
- loss in use of home and property.

The following sketch illustrates the savings or added costs in annual flood insurance premiums depending upon the elevation of the home relative to the Base Flood Elevation. A simple rule to remember is the higher a structure is elevated above the flood level, the lower the insurance. Structures built on the ground have the highest flood insurance rates.

EXAMPLE:

Flood Insurance Rate Map (FIRM) Zones A1-A30, AE Building.

Assumptions:

The annual insurance premiums are calculated for the above example assuming a one story home with no basement valued at $100,000. The insurance rates are based on a house built after the effective date of a Flood Insurance Rate Map (POST-FIRM) in a community participating in the National Flood Insurance Program.

Statistically, the 100-year-flood or Base Flood has a 26% chance of occurring during the term of a 30 year mortgage, a 1% chance of occurring annually.

Call your insurance agent for information on purchasing flood insurance for a building or its contents.

ELEVATION CERTIFICATION

For new or substantially improved residential structures in communities participating in the National Flood Insurance Program (NFIP), the lowest floor including the basement, must be elevated "at or above the Base Flood Elevation (BFE)."

The NFIP **Elevation Certificate,** or equivalent, is required for properties to obtain flood insurance. To obtain a "with certification" flood insurance rate, one of the following must be submitted with a National Flood Insurance Application:

1. the NFIP **Elevation Certificate** must show that the building's lowest floor is "at or above" the BFE; or

2. a certified letter from the appropriate local community official must state that the building was built in compliance with the community's Floodplain Management Ordinance.

If certified lowest floor elevations are not available from the community permit records, the property owner may have to hire a private engineer, architect, or land surveyor to complete and certify the required information.

PERMIT

Permit required to develop in any community participating in the NFIP.

ELEVATE

Building must have lowest floor elevation certified "at or above BFE."

INSURANCE PURCHASE

Flood Insurance required on any State or Federally guaranteed loan.

$LOAN$

Mortgage lender required to have proof of flood insurance purchase to close on loan.

COMMUNITY STATUS IN THE NATIONAL FLOOD INSURANCE PROGRAM

The following is a list of Alaska cities and boroughs where floodplain development permits must be obtained and floodplain requirements met for any development within the floodplain. Contact the local permit official for floodplain development regulations.

Alaska Communities Participating in the National Flood Insurance Program June 1989

- Anchorage
- Aniak
- Bethel
- Cordova
- Delta Junction
- Dillingham
- Fairbanks North Star Borough
- Galena
- Haines
- Hoonah
- Juneau, City and Borough
- Kenai Peninsula Borough
- Ketchikan Gateway Borough
- Kotzebue
- Matanuska-Susitna Borough
- Nenana
- Nome
- Petersburg
- Sitka, City & Borough
- Skagway
- Valdez

National Flood Insurance Program Non-Participating[1] Communities

[1]**Non-participating** communities have been notified that there are flood prone areas. A Flood Insurance Rate Map (FIRM) showing the areas subject to flooding has been prepared. Flood insurance is NOT available.

Sanctions apply to all suspended and **non-participating** communities. For these communities State and federally-related financial assistance such as grants, loans and some federal disaster assistance will be denied for development within flood hazard areas.

- City of Homer
- City of Kenai
- City of Soldotna
- City of Wrangell

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