

PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT TECHNICAL POLICY

POLICY NO.: Technical Policy, TECH-005

EFFECTIVE DATE: November 5, 2007

REVISED: November 2, 2015

POLICY TITLE: Construction Standards for Fences and Walls within Regulatory Floodplains

PURPOSE: To clarify 16.20.020.C.5 by establishing guidelines regarding the design and construction of fencing and walls that may be approvable without providing an engineering study demonstrating no adverse impact (i.e. encroachment criteria have been met).

BACKGROUND:

The Floodplain Management Ordinance provision 16.20.020.C states that an applicant proposing new development may be required to provide an engineering study, prepared by an Arizona-registered civil engineer, outlining the effects that the development will have on the flow of flood water through the area being developed and through surrounding areas. If an engineering study reasonably demonstrates that there is no adverse impact (i.e. meets encroachment criteria), a Floodplain Use Permit (FPUP) may be issued for the new development.

An FPUP is required for construction of any wall or fence within a regulatory floodplain. Depending on the nature of the flood hazard at the site, and the proposed characteristics of the wall or fence, the District may accept certain wall or fence configurations without requiring an engineering study. The allowed wall or fence configurations are summarized for each flood hazard area on the attached Table titled: *FLOODPLAIN MANAGEMENT PRACTICES FOR FENCES / WALLS*.

Because solid (masonry block) walls and certain types of fencing such as woven wire, wood or sheet steel (hereafter collectively described as walls/fences) have the potential to significantly obstruct or alter flow within floodprone areas and create hazardous conditions on surrounding properties, the Table indicates that these walls/fences may be allowed on a case-by case basis. Often an engineering study is required in these cases.

This policy establishes specific standards that may affect the acceptability of wall/fence designs including the proximity of the wall/fence to property boundaries, the alignment of the wall/fence relative to flow direction, the total amount of area enclosed or obstructed by the wall/fence, and the incorporation of flood openings in the wall/fence construction. This will result in consistent implementation of the construction standards and the requirement to obtain an engineering study when these standards have not been met.

POLICY:

Depending on the nature of the flood hazard at the site and the proposed characteristics of the wall/fence, the District may accept certain defined wall/fence configurations in lieu of requiring an engineering study. The allowed wall/fence configurations are summarized for each flood hazard area on the attached Table titled: *FLOODPLAIN MANAGEMENT PRACTICES FOR FENCES / WALLS*, effective January 13, 1994, and revised November 5, 2007. This Table specifies a case-by-case review for walls/fences constructed within the floodway fringe area. Designs that meet the standards outlined below may be approved by the District without an engineering study. Upon identification of unusual flood hazards, the District may still require an engineering study for designs in conformance with these standards.

A. All Walls/Fences

The requirements in this section apply to all walls and fences.

1. Accurate and Complete Site Plan - The FPUP application must be accompanied by a site plan of the property, to a measurable scale, which meets all of the requirements of 16.20.020 including showing all existing and proposed development, topography, and floodplain/erosion hazard setback delineations.
2. The site plan must also provide the proposed wall/fence alignment in relation to the property boundaries, as well as a dimensioned detail showing the flood openings or a reference to one of the standard details supplied by the District, if applicable. The site plan must indicate the location of any required flood openings, and demonstrate that these flood openings are aligned with similar flood openings on adjacent properties (if existing).
3. Covenant - Approval of the FPUP shall be conditioned on the signing of a covenant stipulating that all flood openings will be kept free of debris at all times and remain open for passage of floodwater and/or that fences will be elevated and kept free of debris, as applicable. The property owner must also acknowledge that if the wall/fence poses a flood hazard at any time in the future, the wall/fence shall be modified at the owner's expense to eliminate the hazard.
4. Walls or fences that are intended to contain livestock are not allowed in the channel of a regulatory wash.
5. The requirements of Technical Policy 026 shall be applied to walls and fences within Flow Corridors.

B. Open Fences

Open fences, which includes pipe rail fences and 3 or 4 strand barbed/barbless wire fences, are subject to District approval and are generally considered to be the preferred fencing type within a floodplain. To qualify as open fencing, the fencing occupies 10% or less of the flow area obstructed by the fence. Three or 4 strand wire fences are the only type of fence or wall allowed in a Floodway without an engineering analysis. With respect to open fences, the following standards must be met:

1. Fence posts or vertical wires or stays shall be placed no closer than 6 feet apart for stranded wire fence
2. Fence posts shall be placed no closer than 8 feet apart for pipe rail type fence
3. Fence posts may not be placed in the primary channel of a regulatory wash
4. Not allowed in the primary channel if the purpose of the fence is to contain livestock

C. Woven Wire Fences

Woven wire fence, which includes chain-link fence, field fence, and chicken wire fence, are subject to District approval and are deceptively hazardous in floodplains. While they are not solid obstructions to flow like a wall, they easily catch debris carried by floodwaters and divert and obstruct flow just like a wall. Hydrodynamic pressure on the trapped debris also applies forces that fences were not designed to withstand, causing them to fail. In order to construct a woven wire fence, the following standards must be met:

1. Woven wire fence aligned perpendicular to the direction of flow shall be set back a minimum of 50 feet from the upstream and 25 feet from the downstream property line unless the fence is elevated at or above the Base Flood Elevation.
2. Woven wire fence aligned parallel to the direction of flow shall be set back a minimum of 15 feet from the property line unless the fence is elevated at or above the Base Flood Elevation
3. Single strands of wire may be placed below the bottom of the woven wire fence at 6 inch intervals, except as noticed in item 5 below. If the fence is elevated 1 foot above grade, a single strand is allowed, and one additional strand is allowed for each additional 6 inches that the fence is elevated.
4. Woven wire fences shall not be placed within the channel of a regulatory wash. A woven wire fence across a regulatory wash must span the wash from bank to bank with the bottom of the fence elevated at or above the Base Flood Elevation. Nothing is allowed below the bottom of the fence where it

crosses a regulatory wash unless a report sealed by an Arizona registered civil engineer demonstrates that, when loaded with debris, the fence will not adversely impact an adjacent property.

D. Walls and Solid Fences Without Flood Openings (50 Feet or More from Property Boundaries)

Subject to District approval, with consideration for natural drainage, in order to construct a wall/fence without flood openings 50 feet or more from property boundaries without an engineering study, the following standards must be met:

1. The wall/fence shall be offset from all property boundaries by a minimum of 50 feet.
2. The total flow obstruction shall not exceed 50% of the extent of the floodplain impacting the property as measured perpendicular to the direction of flow, considered cumulatively with all other manmade obstructions to flow on the property (i.e. structures, elevated driveways, etc.).
3. For properties smaller than 1 acre, less than 50% of the total area of the property subject to flooding is enclosed or obstructed.
4. For properties larger than 1 acre, no more than 20,000 square feet of the subject property is enclosed.
5. The wall/fence is not placed across a defined wash or drainage swale (hereafter drainage path).

E. Walls and Solid Fences With Flood Openings (25-50 Feet from Property Boundaries)

Subject to District approval, with consideration for natural drainage, in order to construct a wall/fence within 25-50 feet of a property boundary without an engineering study, the following standards must be met (see also Exhibit D):

1. The wall/fence must be offset from all property boundaries by a minimum of 25 feet.
2. Walls/fences must contain flood openings that comprise at least 50% of the total wall/fence length. In this case, the flood openings shall be at grade, and the consist of any of the following: (See Exhibit D)
 - a. Alternating Panels of Solid Wall/Fence and flood openings provided by Wrought Iron Fence Panels: The bottom horizontal member of the wrought iron fence panel must be at least six inches above grade (or four inches above grade if the wall/fence provides pool enclosure), and the solid portions of the wrought iron fence located below flood level, shall occupy 20% or less of the flow area for an assumed 2 foot flow depth. (See Exhibit D, Sheet 1), or
 - b. Wall/Fence with flood openings provided by Bottom Holes: The height of the bottom holes shall be at least equal to the 1 percent annual chance flood depth. If pet containment within the wall/fence is desired, bottom holes may be fitted with horizontal bars (3/8 inch max dia.) spaced no closer than 6 inches vertically (4 inches vertical spacing if wall/fence provides pool enclosure). (See Exhibit D, Sheet 2)
 - i. Where 1 percent annual chance flood depths are six inches or less, bottom holes shall be a minimum of one full course of block high (a minimum of 8 inches) above natural grade and be a minimum of two blocks wide (a minimum of 32 inches).
 - ii. Where 1 percent annual chance flood depths are greater than six inches, bottom holes shall be a minimum of two courses of block high (a minimum of 16 inches) above natural grade, or to the base flood elevation, whichever is higher, and be a minimum of two blocks wide (a minimum of 32 inches).
3. Only Wrought iron fence panels may be placed across existing defined drainage paths. The bottom horizontal member of the wrought iron fence crossing the defined drainage path shall be elevated above the defined drainage path to the height of the bank of the defined drainage path or above the 100-year flood surface elevation within the defined drainage path, whichever is higher. There shall be no vertical posts within the defined drainage path.
4. For the purpose of facilitating passage of flood flow through adjacent lots, the flood openings on one property shall be generally aligned with the flood openings (if used) on adjacent properties.

The pertinent hydraulic features of this acceptable wall/fence are summarized on the attached Exhibit D, and are for hydraulic design purposes only; structural design of the wall/fence is the responsibility of the applicant.

F. Elevated Walls and Solid Fences (Within 25 Feet of Property Boundaries)

Subject to District approval, with consideration for natural drainage, in order to construct a wall/fence on the property boundaries without an engineering study, the following standards must be met:

1. The bottom of the wall/fence is elevated at or above the 1 percent annual chance flood depth along the entire length of the wall/fence;
2. Vertical posts supporting the wall/fence are spaced no closer than 8 feet apart;
3. The bottom of the wall/fence crossing the defined drainage path is elevated above the bank of the defined drainage path or above the 1 percent annual chance flood water surface elevation within the drainage path, whichever is higher;
4. If the wall/fence is elevated one foot or more above natural grade, a single strand of barbless wire may be placed below the solid fence with a minimum spacing of 6 inches between the strand of wire and the ground and/or the bottom of the wall/fence.

G. Walls and Solid Fences that Do Not Satisfy the Standards of this Policy

Proposed walls/fences that do not satisfy the standards above shall be supported by an engineering study that addresses the following (at a minimum):

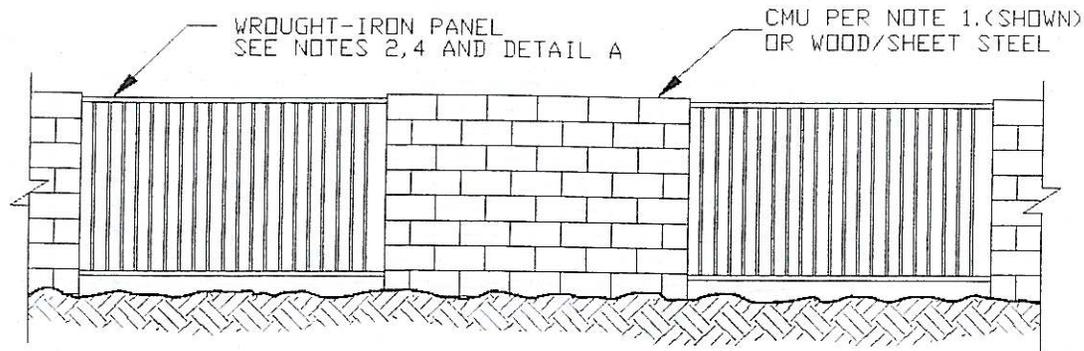
1. The study must demonstrate that the wall/fence does not adversely affect any adjacent property by showing that:
 - a. The wall/fence does not increase the 1 percent annual chance flood depth by more than 0.1 feet, as measured at property boundaries,
 - b. The wall/fence does not increase the 1 percent annual chance flood velocity by more than 1 foot per second or 10%, whichever is less, as measured at property boundaries,
 - c. The wall/fence does not increase the potential for erosion on any adjacent property, and
 - d. The wall/fence does not divert flow, meaning that flood water enters and exits the subject property in substantially the same location and under identical flow conditions after the wall/fence is present as it did before the wall/fence was constructed
2. The site plan must include a detail of the wall/fence design, and include a detail of any flood openings.
3. The site plan must be sealed by the engineer of record
4. The FPUP will be conditioned upon the requirement that a certification letter from an Arizona-registered civil engineer be provided to the District upon completion of the work, confirming that the wall/fence was constructed in accordance with the FPUP, the engineering study, and the site plan.

APPROVED BY:

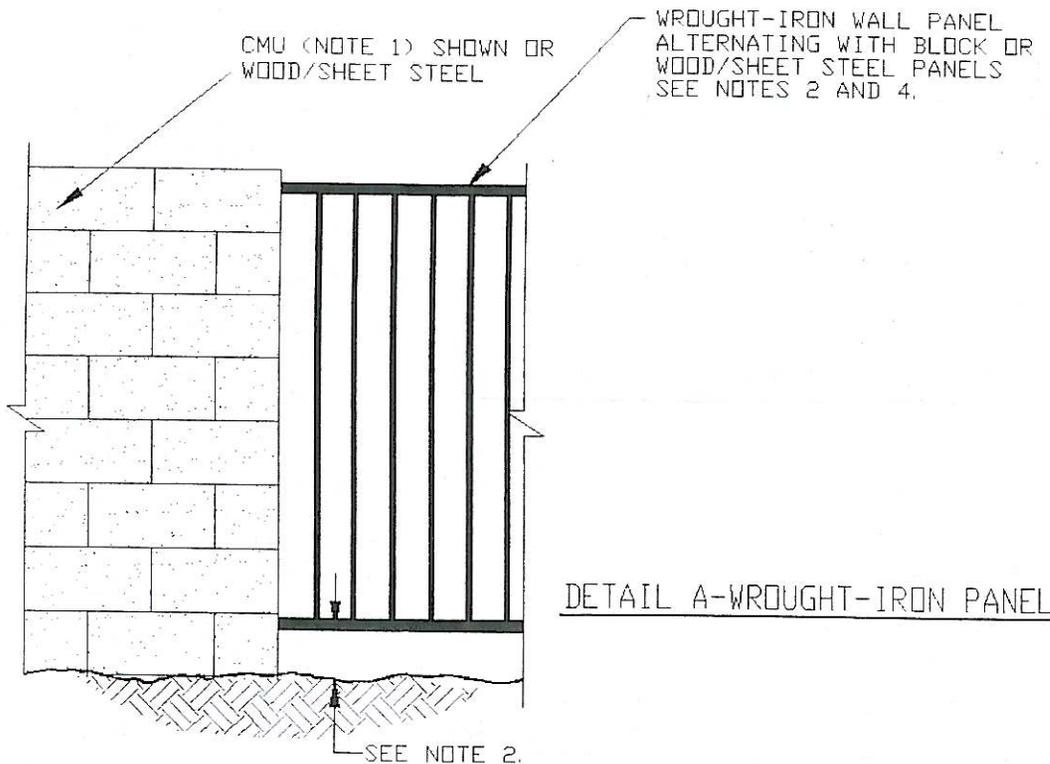
Suzanne Shields
Director

Date

Original Policy Approved:
Date(s) Revised:



50% LENGTH OF WALL/FENCE IS WROUGHT-IRON (NOTE 5)



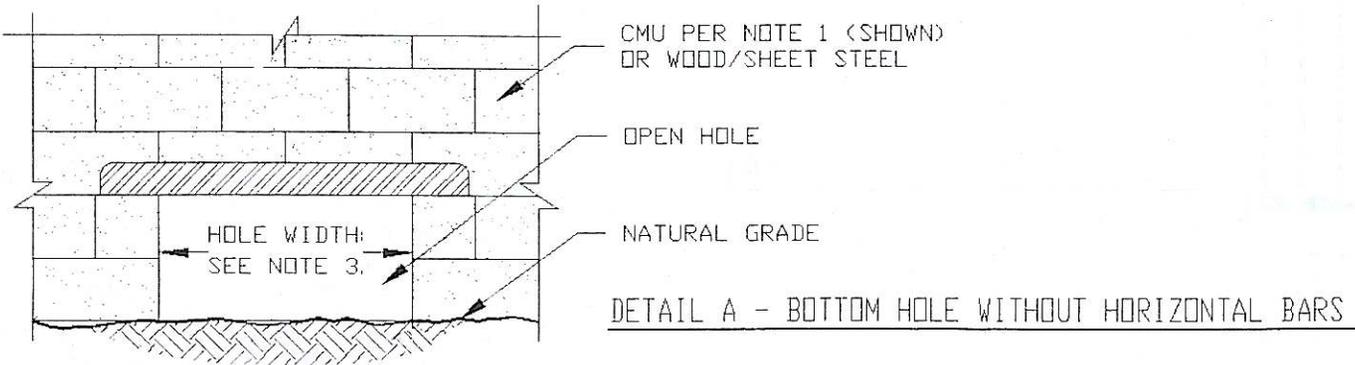
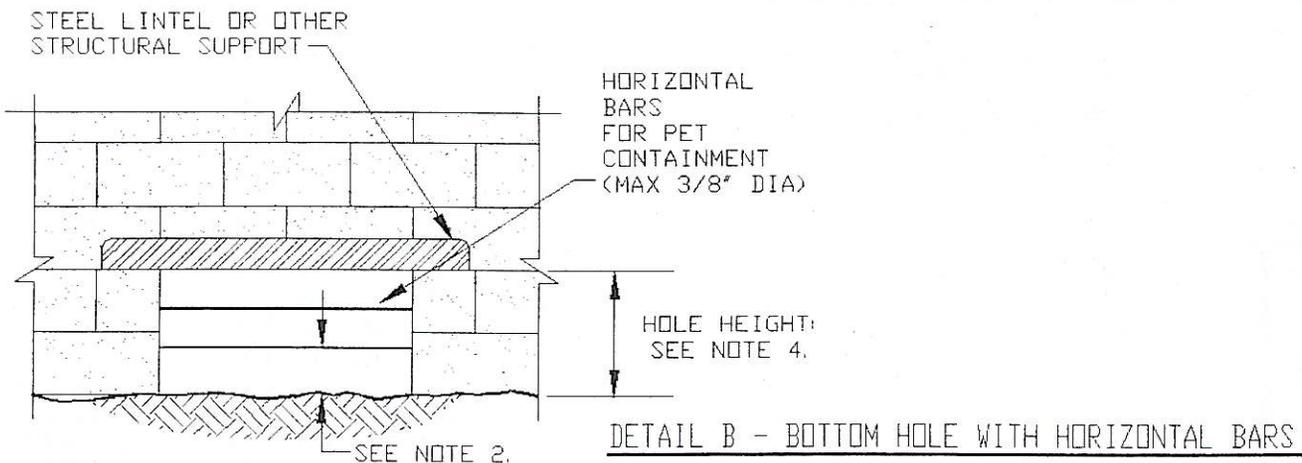
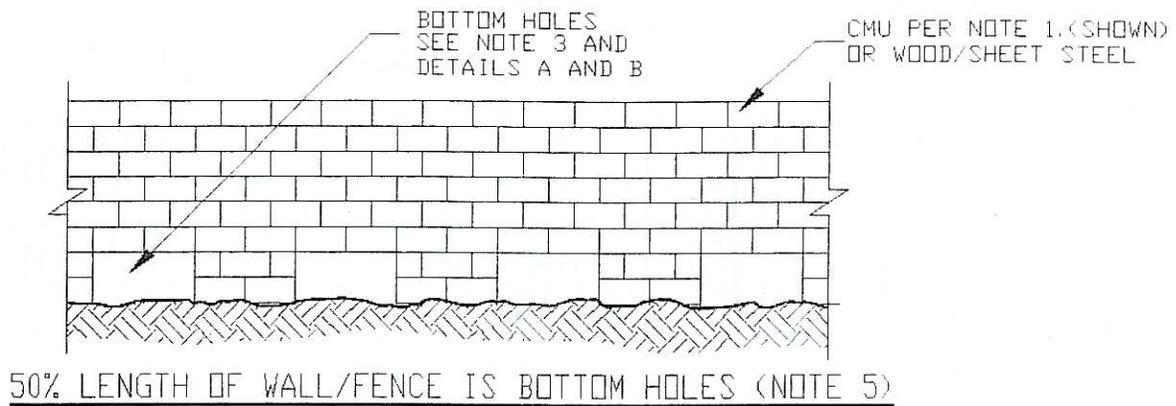
NOTES:

1. BASED ON STD 8"X8"X16" CMU BLOCK.
2. BOTTOM OF HORIZONTAL MEMBER IS MIN 6" ABOVE NATURAL GRADE, OR 4" MIN ABOVE NATURAL GRADE IF WALL/FENCE ENCLOSES A SWIMMING POOL.
3. NOTE NOT USED.
4. SOLID PORTIONS OF WROUGHT-IRON PANEL TO OBSTRUCT NO MORE THAN 20% OF 100-YR FLOOD FLOW AREA, ASSUMING A 2 FOOT FLOW DEPTH.
5. WALL/FENCE TO BE OFFSET A MIN OF 25 FT FROM PROPERTY BNDRY.
6. WALL/FENCE DETAILS ADDRESS HYDRAULIC REQUIREMENTS ONLY. ADDITIONAL ANALYSIS MUST BE PERFORMED BY APPLICANT TO DETERMINE DETAILS FOR STRUCTURAL STABILITY OF WALL/FENCE.
7. PROPERTY OWNER MUST COVENANT THAT WROUGHT IRON FENCE SHALL BE KEPT CLEAR OF DEBRIS OR BLOCKAGE AT ALL TIMES.
8. DETAILS PRESENTED DO NOT APPLY TO WALL/FENCE CROSSING WASHES.

EXHIBIT D SHEET 1 STANDARD DETAILS FOR WALLS/FENCES IN FLOODPLAINS

FLOOD OPENINGS COMPOSED OF WROUGHT IRON FENCE PANELS

NOT FOR CONSTRUCTION



NOTES:

1. BASED ON STD 8"X8"X16" CMU BLOCK.
2. BOTTOM HORIZONTAL BAR IS MIN 6" ABOVE GRADE, OR 4" MIN ABOVE GRADE IF WALL/FENCE ENCLOSES A SWIMMING POOL.
3. HOLES TO BE MIN 2 BLOCKS WIDE OR 32".
4. HOLE HEIGHT IS MIN 1 BLOCK HIGH OR 8" FOR SHEET FLOOD AREA, OR MINIMUM 2 BLOCKS HIGH OR 16", OR 100-YR FLOOD STAGE, WHICHEVER IS GREATER, IN FLOODWAY FRINGE AREAS.
5. WALL/FENCE TO BE OFFSET A MIN OF 25 FT FROM PROPERTY BNDRY.
6. WALL DETAILS ADDRESS HYDRAULIC REQUIREMENTS ONLY. ADDITIONAL ANALYSIS MUST BE PERFORMED BY APPLICANT TO DETERMINE DETAILS FOR STRUCTURAL STABILITY OF WALL/FENCE.
7. PROPERTY OWNER MUST COVENANT BOTTOM HOLES TO BE KEPT CLEAR OF DEBRIS OR BLOCKAGE AT ALL TIMES.
8. DETAILS PRESENTED DO NOT APPLY TO WALL/FENCE CROSSING WASHES.

EXHIBIT D SHEET 2 STANDARD DETAILS FOR WALLS/FENCES IN FLOODPLAINS

FLOOD OPENINGS COMPOSED OF BOTTOM HOLES

NOT FOR CONSTRUCTION

FLOODPLAIN MANAGEMENT PRACTICES FOR FENCES / WALLS IN REGULATORY FLOODPLAINS

TYPE OF FENCE, WALL (see below)	FLOOD HAZARD AREA IN WHICH FENCE / WALL IS CONSTRUCTED				
	FLOODWAY FRINGE (Ord. 2005 FC-2 16.08.370)	FLOODWAY (Ord. 2005 FC-2 16.08.360)	PRIMARY CHANNEL	SHALLOW SHEET FLOW (Ord. 2005 FC-2 16.08.640)	PONDING AREA (FEMA Zone AH, areas with Limited Velocity)
	Conditions for Permitting				
A	Allowed	Allowed	Allowed unless the purpose of the fencing is to contain livestock	Allowed	Allowed
B	Allowed	Allowed with limited cross fencing	No, this usually involves livestock	Allowed	Allowed
C	Case by case review of design required	Case by case review of design required	Case by case review of design required	Case by case review of design required	Case by case review of design required
D	Allowed if bottom of fence elevated to or above 100-year flood height	Case by case review of design required.	Not Allowed	Allowed if bottom of fence elevated to or above 100-year flood height	Allowed
E	Allowed if bottom of fence elevated to or above 100-year flood height	Not Allowed	Not Allowed	Allowed if bottom of fence elevated to or above 100-year flood height	Allowed
F	Case by case review of design required	Not Allowed	Not Allowed	Case by case review of design required	Allowed if bottom of fence elevated to or above 100-year flood height

TYPE OF FENCE, WALL

A	"Open" barbed or barbless wire. For floodplain management purposes barbed or barbless wire will be considered "open" if there is no more than one horizontal strand per foot of height and no more than one vertical wire, stay, or post per six feet of fence length.
B	"Open pipe or rail fencing (e.g., corrals). For floodplain management purposes pipe fencing will be considered "open" if the horizontal pipes or rails occupy <= ten percent (10%) of the flow area obstructed by the fence, and posts are spaced no closer than 8 feet.
C	Collapsible fencing.
D	Other wire, pipe, wrought iron, or rail type fencing (e.g., field fence) which does not meet the "open" requirements described above.
E	Chain link fencing.
F	Continuous wood or steel sheet fencing or masonry (block) walls.