1.5 Stream Setback

Description

A stream setback provides undeveloped area adjacent to a stream channel where over bank flooding, meander migration, and other stream processes that promote stormwater quantity and quality control freely occur. By providing adequate room for stream meandering and connectivity to a floodplain, a stream setback encourages stability of the stream channel and corridor. This benefits water quality by reducing streambank erosion at lower flows minimizing both the erosion induced sediment load and the need for costly armoring to protect structures and property. At higher flows, sediment is exported onto floodplain area where pollutants are assimilated from stormwater stored and safely conveyed above the banks. Setback area also filters pollutants from incoming surface runoff, promoting its infiltration to support stream baseflow. Setback vegetation fosters good stream ecology by contributing energy as organic carbon and shade that moderates water temperature and algal growth. In fact, streams with undeveloped, intact setbacks and floodplains have been found to have good aquatic biologic scores despite their urbanized watershed (Milter, 2004). Setback area also offers high quality habitat for terrestrial wildlife.

This chapter applies a stream setback at the development scale (individual parcels), however the sizing methodology discussed is also recommended when implementing stream setbacks throughout a watershed or community through local ordinance. Consult other resources for legal and procedural recommendations when establishing a setback ordinance.

Setback Methodology

A stream setback should be based on the most critical land area needed to sustain natural stream processes that are beneficial to water quality and overall stream integrity. These processes are responsible for the common lateral meandering pattern that a stream exhibits, for its channel form, and floodplain that develops vertically. These processes work to maintain a dynamic but stable stream channel.

A stream meanders in a sinuous, moving pattern of bends to manage and balance the energy of flowing water by increasing resistance and reducing the channel gradient. Over time, meanders migrate within a predictable corridor or streamway as illustrated in Figure 1.5.1 with sediment eroded from one bank to be deposited at another. This balanced, predictable channel movement and adjustment is referred to as dynamic stability.

Development near a stream can lock the channel's lateral position in place which works against this dynamic stability and will often require a significant investment in structural measures to limit bank erosion along the now unstable channel. Maintaining dynamic stability (or allowing degraded streams to regain dynamic stability) requires accounting for a stream's lateral movement. Therefore, this practice establishes a setback based on the predicted streamway width for streams in Ohio. As with the channel's size and form, the setback width is directly correlated to the drainage area. It is calculated at any point along the channel length using the stream's drainage area, the lowest elevation ground in the valley, and the channel location.

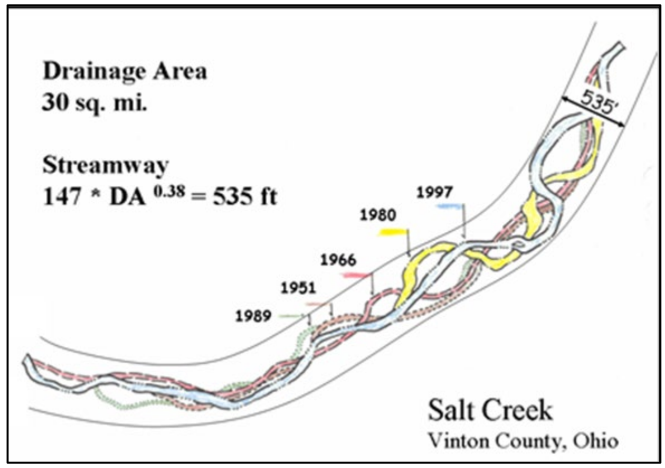

Figure 1.5.1 An illustration of stream meander migration within a streamway over time (Mecklenburg, D. Ohio Department of Natural Resources).

Many Ohio streams have been straightened or channelized either intentionally or in response to land use changes within the watershed. The existing meander pattern is often more narrow than it was historically. Erosion and deposition may be working to re-establish a dynamically stable channel form with a wider meander pattern and shallower flow. A stream setback establishes the area in which these restorative processes can continue to occur without jeopardizing development infrastructure.

Note that this methodology differs from the static distance approach that many stream buffer references recommend to treat agricultural runoff or to conserve the unique ecological characteristics of riparian area as well as FEMA delineated flood hazard areas which are based on large event flow predictions.

Planning and Feasibility

Setbacks are appropriate for all sizes of channels from ephemeral or intermittent streams up to large rivers, however streams with drainage areas less than 10 square miles are most in need of stream corridor protection and may provide the most benefit. Small channels can be easily modified for development and are less likely to have detailed floodplain mapping and protections.

Setbacks on straightened streams represent area where natural stream adjustments (meander migration and floodplain redevelopment) are predicted to occur. Providing space for these natural adjustments can return stability to the modified channel and may improve stream ecology. Rankin (1989) found Ohio streams with little or no sinuosity were associated with low biologic scores and cites Karr and Schlosser (1977) in suggesting streams with higher sinuosity often have less erosion and transport less suspended sediment at low to moderate flows.

Design Criteria

Setback Width

The setback width spans both sides of the channel. As illustrated in Figure 1.5.2, it is a combination of two overlapping areas: the streamway sized appropriate to accommodate the meander belt (approximately 10 channel widths) and a minimum distance from the channel bank (approximately one channel width). Both are calculated according to the drainage area to a given point along the stream through the following equations:

$$\text{Streamway Width (feet)} = 147(\text{DA})^{0.38}$$ Equation 1.5.1

and

$$\text{Minimum Distance From Channel (feet)} = 14.7(\text{DA})^{0.38}$$ Equation 1.5.2

where DA = drainage area in square miles.

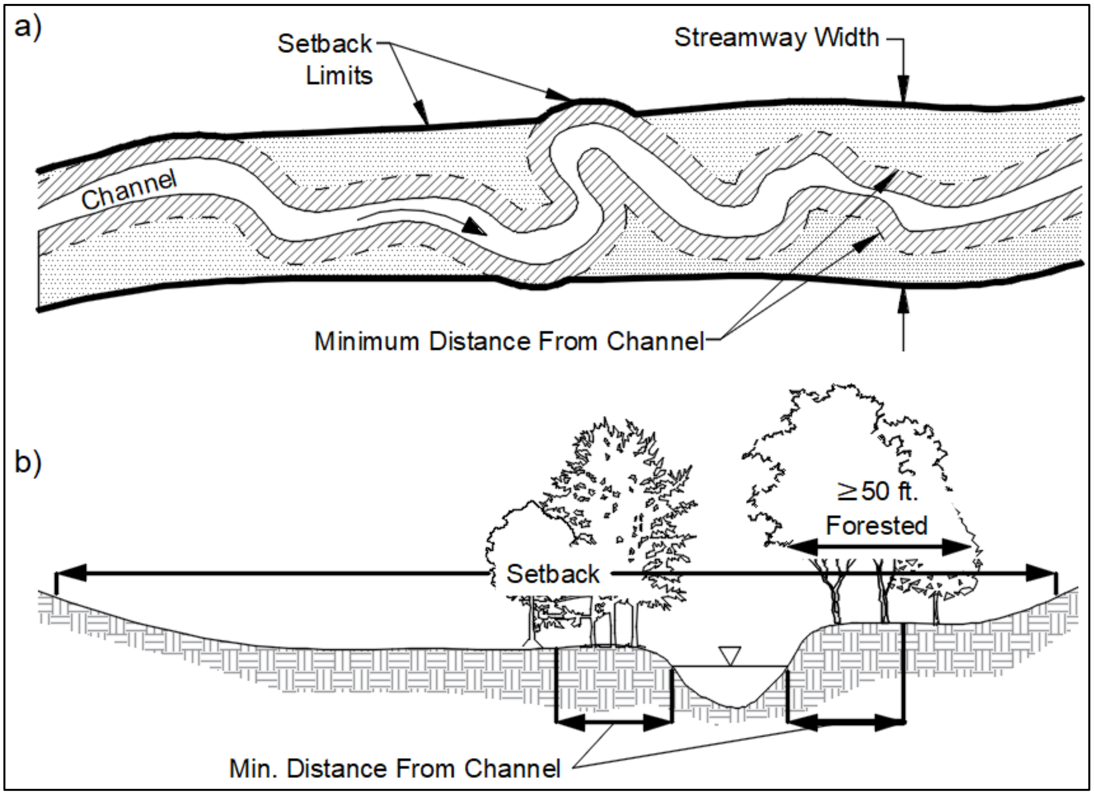

Figure 1.5.2 Illustration of a stream setback in a) plan view and b) section view (not to scale).

Lateral Positioning

A streamway is more a feature of the entire valley than any individual bend or the present location of a channel. It is more aptly visualized as a flood path or corridor. Fit the setback to the valley as illustrated in Figure 1.5.2b so the corresponding left and right boundary elevations match and the setback area incorporates the lowest elevations in the valley. The setback area will not always be exactly centered over the stream.

Setback Adjustments

Certain conditions justify altering the calculated width of the setback area. Physical constraints such as a narrow, confined valley smaller than the setback width, floodplain that extends beyond the area, wetlands contiguous to the area, or adjacent hillsides prone to slippage or being undercut because of stream flows may necessitate altering the setback area.

Reasonable adjustments may be necessary to ensure an existing parcel remains buildable and to maintain lot yields in new subdivisions to the extent possible.

Implement setbacks on sites with existing development within the setback to be expanded or redeveloped to minimize potential conflicts between current land uses and the stream setback. Limit the setback for that parcel to the line of the existing foundation/structure to ensure that development within the setback gets no closer to the stream.

Vegetation and Land Use

A healthy forest community provides the greatest benefit. Maintain riparian forest, preferably of native species, over at least the first 50 feet of the setback immediately adjacent to the channel on each bank. The remaining setback area may include vegetation compatible with the surrounding land uses such as grass or meadow provided that the setback characteristics are not impaired. For large rivers with extensive setback distances, further refinement of acceptable land uses within the area may be necessary after maintaining a forested riparian area.

Setback Identification

Clearly identify stream setback boundaries on the plat map, construction plans, stormwater pollution prevention plan (SWP3), and at the site. Prior to construction, install both temporary fencing to prevent encroachment and appropriate practices to minimize sediment from entering the setback. Following construction, provide a visual marker identifying any no-mow zones or permanently forested areas within the setback. Sections of split rail or similar unobtrusive fencing provide a visual marker distinguishing the setback from other land uses. In some cases, signage may suffice.

Avoid Concentrating Flow into the Setback Area

Encourage surface runoff to sheet flow into the setback area to maximize the treatment processes available. Convert concentrated flows from storm drains and swales to sheet flow as it enters the stream setback area by grading, constructing level spreaders, or other measures. Ensure tributary ditches and streams through the setback are not entrenched with limited access to active floodplain within the setback.

Restoration of Channelized or Degraded Streams

A setback should not deter stream rehabilitation. Many Ohio streams are channelized (straightened and/or deepened) or degraded by downcutting. Efforts to rehabilitate an entrenched stream by providing the channel with greater access to an active floodplain within the setback will ensure more natural stability and a higher functioning practice. Development construction may provide an opportune time to conduct restoration work.

Construction Considerations

Establish a stream setback prior to any soil disturbing activities. The setback area should not be disturbed except for planting or to remove invasive species. Use proper sediment and erosion controls to prevent construction sediment from fouling the setback area.

When planting, use a diverse selection of native species conducive to a transitional and upland landscape and appropriate to the regional climate.

Maintenance Considerations

A stream setback should be inspected regularly to ensure it is maintained in accordance with its planned land use, any no-mow zones are upheld, and that forested riparian areas remain in a natural state.

Do not treat setback area with herbicides except to control invasive species.

A stream setback should be placed in a conservation easement to protect these resources in perpetuity. Easements should be regularly monitored, addressing any easement agreement violations.

Passive uses such as foot trails and picnic areas may be maintained through the setback. Timber harvesting on privately held areas should not be done within 25 feet of either bank. Removal of invasive species is allowable and highly recommended for maintenance of the setback.

Local Implementation Tools

Zoning, conservation easements, and public ownership are options to ensure long-term protection of a stream setback. Local government may utilize zoning to set appropriate land uses within the setback area. Many local governments will accept ownership of such properties if deeded in fee simple to the community and may apply credit toward local open space or parkland set aside requirements. A conservation easement offers one of the best ways to protect stream setback area in perpetuity. It maintains private ownership while limiting detrimental uses and actions. Easements can be held by a legally qualified conservation organization (for example a land trust) or a government agency.

References

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