SECTION 5.8

SEDIMENT CONTROL AND IN-CHANNEL FLOODWATER RETENTION

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Controlling in-channel sedimentation is best accomplished by employing good soil conservation practices in upland areas adjacent to streams and ditches. Installation of erosion control practices is the most effective. However, such effectiveness can significantly increase through utilization of vegetative buffer or filter strips. Vegetative filter strips are very effective in trapping sediment before it reaches the channel. Generally, the width of a filter strip should increase with the slope of the ground.

In-channel floodwater retention basins and in-channel sediment basins essentially employ the same concepts but at a different scale: the cross-sectional area of a channel is increased to reduce velocities, thereby allowing sediment deposition and increasing storage capacity. Sediment basins are generally smaller than retention basins, and place more emphasis on trapping sediment than providing additional storage. Floodwater retention basins are usually constructed to improve flood water storage capacity with the added benefit of some sediment control. However, it should be noted that off-line retention basins, when possible, are usually a more practical and economical choice than on-line retention basins.

The installation of in-channel floodwater retention and sedimentation basins (Practices 801 and 802) would often times involve excavation on both sides of a natural stream or a man-made ditch. While this is sometimes inevitable, it may be possible to limit the excavation activities to one side of a channel only. As indicated earlier in Section 5.6, one-sided modification of natural streams is always preferable to two-sided modification. The one-sided channel modification would involve fewer adverse impacts on terrestrial wildlife habitat and is, therefore, less likely to require extensive compensatory mitigation measures by the regulatory agencies.

Hydraulic dredging is used to remove in-channel sediment. This practice is most useful in channels large enough to accommodate dredging equipment, and with large-scale projects that justify such expensive measures.

Last Print/Revision Date: October 1999

PRACTICE 801
IN-CHANNEL SEDIMENT BASIN

DESCRIPTION

- Area within a channel designed to reduce flow velocities (thus allowing sediment deposition) by increasing the cross sectional area (width and depth) of a channel.

Exhibit 801a: In-Channel Sediment Basin (Source: NRCS Files)

PURPOSE

- To create a basin to trap and store sediment conveyed in stream flow or storm runoff.

WHERE APPLICABLE

- Where watercourse and gully erosion are a problem.
- Where the downstream environment may be significantly impacted by a large sediment influx.
- Where a stream or ditch is transporting heavy sediment loads.

ADVANTAGES

- Preserves the capacity of ditches and streams.
- Traps and stores sediment before it is borne downstream.
- Often provides additional runoff storage capacity which may reduce peak flows.
- May contribute to ground water recharge.
- Convenient access site for removing deposition in stream.

CONSTRAINTS

- Sediment basins do not trap all water-borne sediments.
- Should not be used in areas such as riffles where the creation of a basin would destroy valuable wildlife or aquatic habitat.
- May capture very little of water-borne sediments during major runoff events.
- Not as effective in preventing in-channel sediment loads as upland erosion control methods or watershed-based best management practices.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Excavation equipment.
- Seed for revegetation.
- Topsoil if necessary.

Installation

- Clear and grub (Practice 107) area to be improved.
- Basins should be placed at terraced intervals. The spacing should be set to prevent watercourse gully erosion.
- The basin should be large enough to control the runoff from a 10-year, 24-hour frequency storm without overtopping.
- The basin should have the capacity to store sediment accumulation for a period of 10 years.
- The basin should transition properly to existing or proposed channel and have the ends closed to the elevation needed for the design capacity.
- Seed as describe in Vegetative Stabilization (Practice 1102).
- Transition channel as described in Channel Tie-Ins (Practice 704).

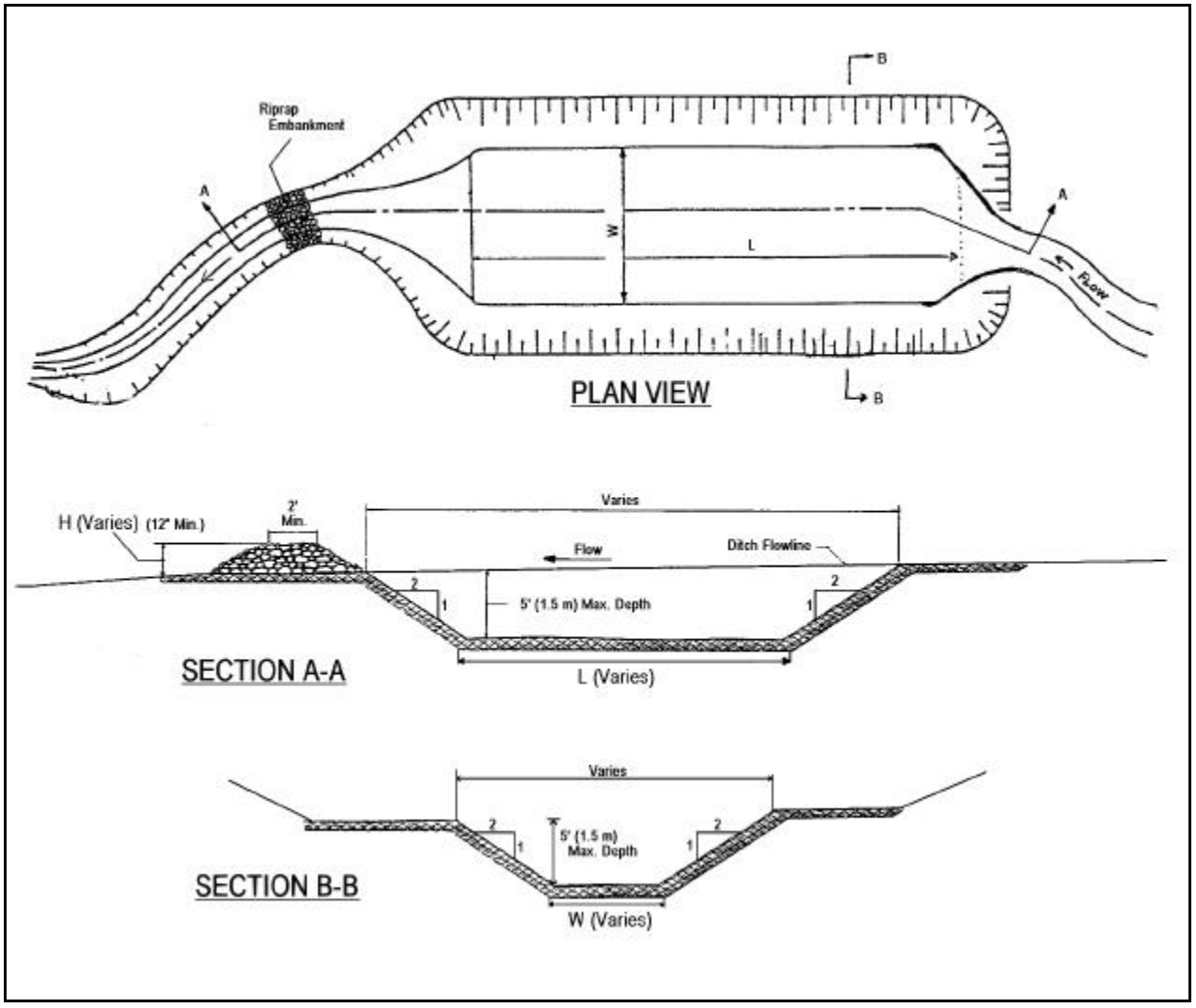

Exhibit 801b: Typical schematic of in-channel sediment basin (Source: CBBEL Files)

Special Considerations

- Channel cut-off or stabilization structures may be necessary at entrance and exit sections of basin to prevent unstable gully and channel erosion.

MAINTENANCE

- Inspect transition segments for erosion of banks or channel in order to maintain.
- Maintain sediment design capacity by routinely excavating the basin.
- Keep side slopes and transition areas free from brush in those areas needed for maintenance and sediment removal.
- Maintain transition areas in and out of sediment basin.
- Use soil conservation practices in surrounding watershed.

REFERENCES

Related Practices

- Practice 104 Temporary Diversion.
- Practice 107 Clearing and Grubbing.
- Practice 803 Hydraulic Dredge.
- Practice 1102 Vegetative Stabilization.
- Activity 5.3 Debrushing.
- Activity 5.11 Revegetation and Site Stabilization.

Other Sources of Information

- NRCS Standard Specifications.
- Indiana Erosion Control Manual.
- Illinois Stormwater Management BMPs

Last Print/Revision Date: October 13, 1996

PRACTICE 802
IN-CHANNEL FLOODWATER RETENTION BASIN

DESCRIPTION

- On-line retention area designed to decrease peak flow rates downstream from the retention facility.

Exhibit 802a: In-Channel Floodwater Retention Basin (Source: CBBEL Files)

PURPOSE

- Flood control.

WHERE APPLICABLE

- When off-site areas were developed without adequate detention controls.
- When off-site to on-site drainage area ratios are less than 5:1.

ADVANTAGES

- Reduces peak flow rates downstream.
- May improve water quality.
- Provides moderate flood control in certain situations.

CONSTRAINTS

- The larger the ratio of off-site to on-site runoff, the less effective on-line detention will be in achieving flood control and pollution removal.
- May negatively impact fish and wildlife if the existing stream or ditch provides good habitat.
- Regional detention (developed outside the main channel) is a better choice than in-channel detention in most situations.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Suitable fill.
- Seed for revegetation if necessary.
- Appropriate outlet.

Installation

- Select an outlet configuration that will maximize flood control as well as remove pollutants. The optimum configuration is also dependent upon the off-site area in terms of size, impervious percentage, and level of existing stormwater control.

- Regional Detention: The detention basin should be sized as if the entire area were on site. Land cover based on local zoning should be used for undeveloped off site areas. Release rates should be equal to the specified release rate (In most jurisdictions, the release rate is equivalent to 5 or 10-year undeveloped conditions. Staged (2-10-100) release rates are also becoming popular.) If there is some existing detention in the off site areas, it may be useful to model that detention (under both normal and overflow conditions) to reduce the storage needed in the regional basin.

- Off Site Area Developed with Inadequate Best Management Practices: A 2-year or 5-year (or the release rate designated in local ordinances or standards) should achieve reasonable pollutant removal. The overflow spillway should accommodate 100-year release rates for flood control benefits. The relatively low 2-year or 5-year release rate will improve capture of the first flush of larger storm events. The relatively high 100-year release rate will minimize the amount of detention storage that is filled prior to the peak of the event, reserving the storage to attenuate the peak flow.

- Off Site Area Developed with Detention and Other Best Management Practices: A 2-year or 5-year outlet (or the release rate designated in local ordinances or standards) should be sized. The high flow outlet should be sized based on the total drainage area (i.e. the 100-year release rate in developed condition).

- Off Site Area Undeveloped: On site detention should be based on the assumption that the area will be developed, and as described above.

Special Considerations

- See Exhibit 802b, for deciding whether an on-line detention (In-stream Floodwater Retention Basin) is appropriate for the specific site conditions.
- Locate In-Channel Flood Retention Basin where pool area can be contained within floodplain limits, when possible. Exhibit 802c shows plan view of an appropriately-designed retention pond.

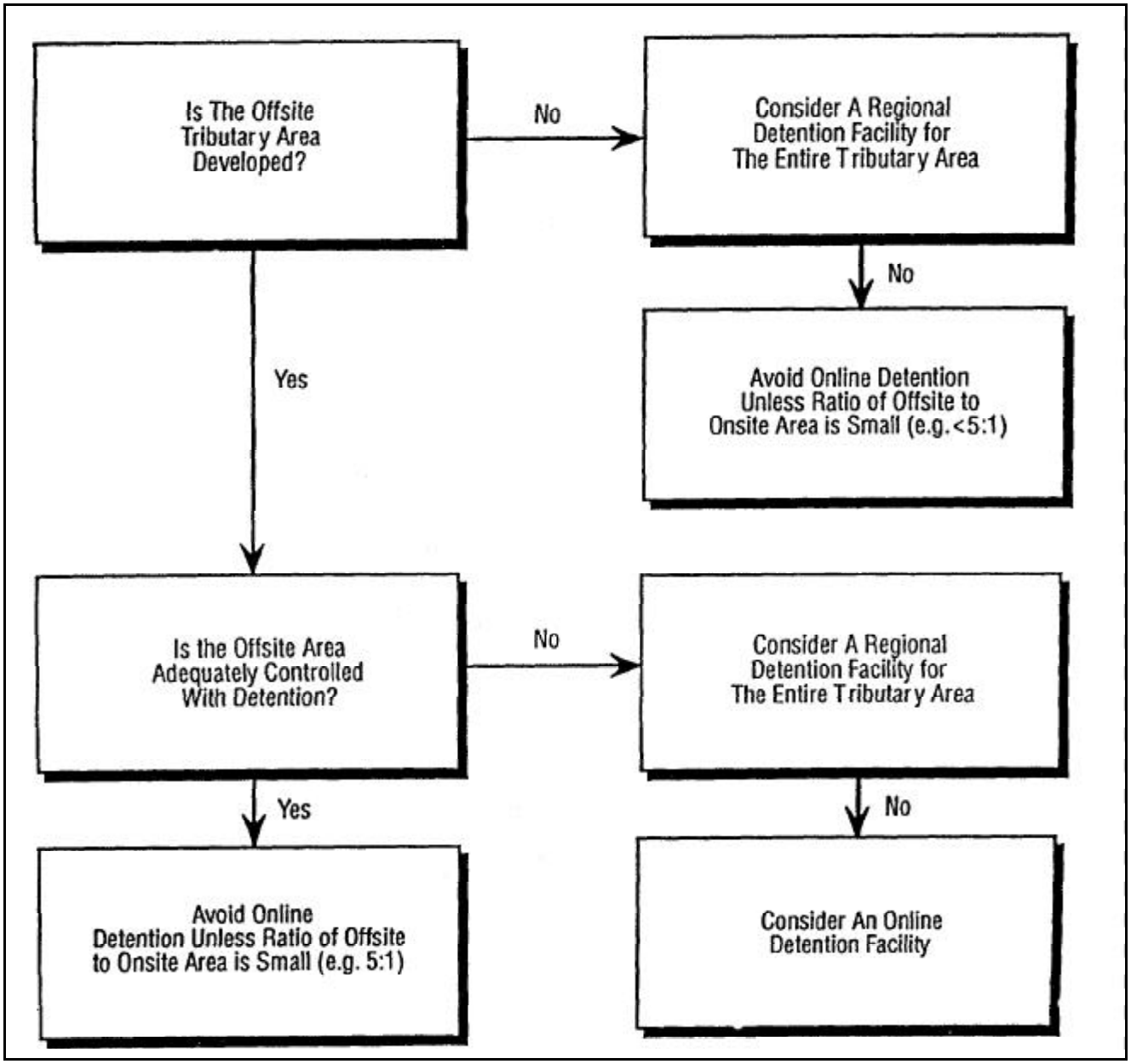

Exhibit 802b: Decision Process (Source: Illinois Stormwater Management BMPs)

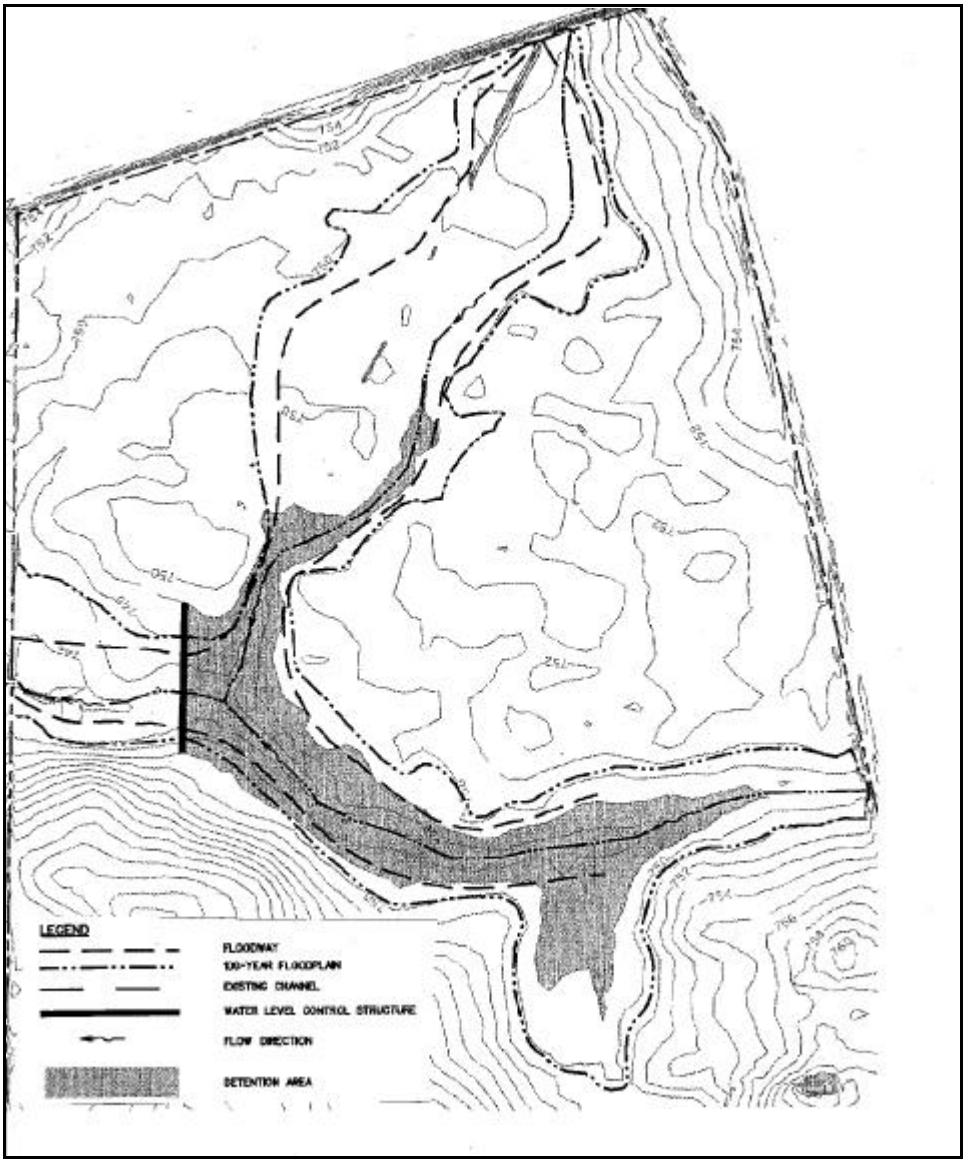

Exhibit 802c: Plan view of a properly-located In-Channel Retention Basin (Source: CBBEL Files)

MAINTENANCE

- Inspect inlets for blockages.
- Maintain sediment design capacity by clearing the basin or raising the embankment.
- Keep embankment area debrushed (Practices 301, 302, 303, 304).
- Use soil conservation practices in surrounding watershed.

REFERENCES

Related Practices

- Practice 706 In-Channel Sediment Basin.
- Practice 804 Grade Stabilization Structure.
- Practice 1102 Vegetative Stabilization.
- Activity 5.11 Revegetation and Site Stabilization.

Other Sources of Information

- Illinois Stormwater Management BMPs.

Last Print/Revision Date: October 1999

PRACTICE 803
HYDRAULIC DREDGING

DESCRIPTION

- Removing in-channel sediment using a hydraulic pump.

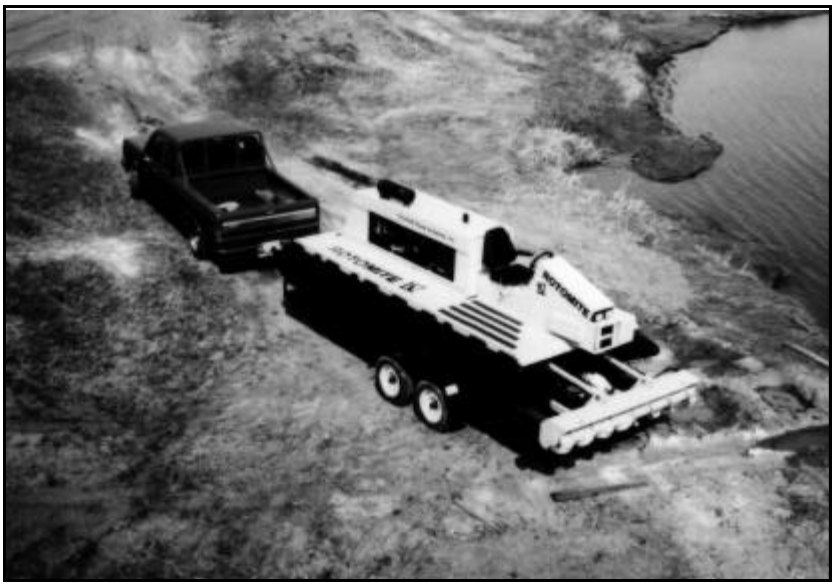

Exhibit 803a: Hydraulic Dredger being taken to the dredging site: (Source: Crisafulli Pump Company)

PURPOSE

- Removal of sediment from stream, lake, sediment basin, or similar facility.

WHERE APPLICABLE

- Wide channels or bodies of water capable of accommodating a hydraulic dredge.
- Removing accumulated sediments from In-Channel Sediment Basins/Traps
- In channels where sediment removal using standard earth moving equipment would cause an unacceptable amount of sediment resuspension.
- In streams or ponds where access by land is limited for removing the accumulated sediment.

ADVANTAGES

- Removes sediment with minimal resuspension of sediment.
- Restores channel conveyance and capacity.
- Allows sediment disposal to occur away from channel area.
- Allows vegetation to remain on banks.

CONSTRAINTS

- Usually requires wide, deep channels or larger bodies of water.
- Proximity to piers, docks or other structures may preclude the use of hydraulic dredges.
- Require appropriate disposal site to pump dredged material and allow it to dewater.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Cutterhead, dustpan, or hopper dredge.

Installation

- For most streams in Indiana, the hydraulic dredge will be utilized in association with an In-Channel Sediment Basin/Trap. The construction of the In-Channel Sediment Basin/Trap is explained in Practice 801. Exhibit 803b shows the typical section of a sediment trap within the area subject to hydraulic dredging highlighted.

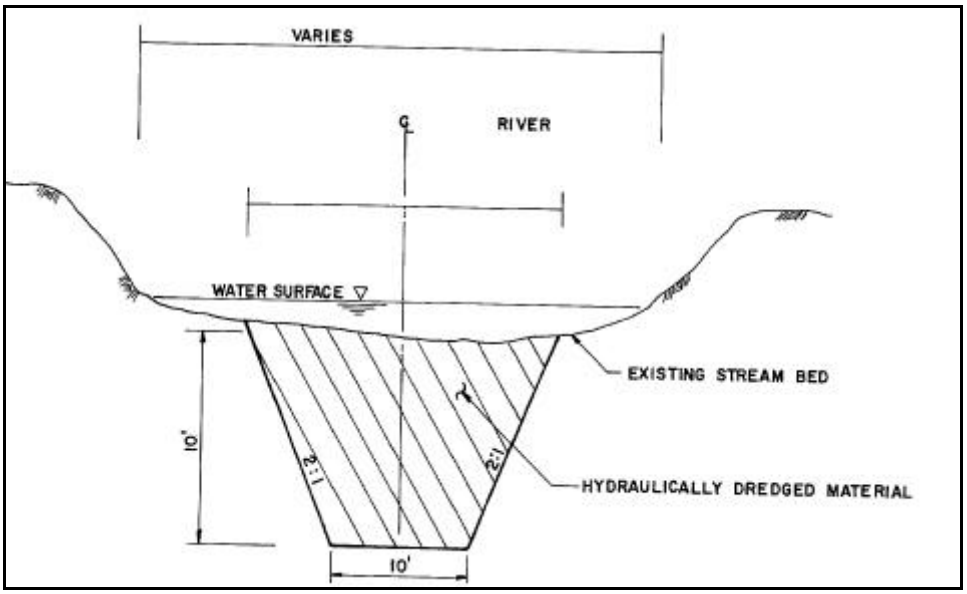

Exhibit 803b: A sediment trap typical section showing areas subject to hydraulic dredging (Source: CBBEL Files)

- Cutterhead Dredges: This type of dredge employs a suction device with high-energy cutting and sweeping action. Turbidity can be kept to a minimal through proper selection of cutter rotation speed, ladder swing speeds, and depth of cut. Generally, the optimum selection of these parameters correspond to the selection for attaining the highest production. Cutterhead dredges are not recommended for the removal of more than 10' of material.

- Dustpan Dredges: The dustpan dredge is a hydraulic suction dredge that uses a widely flared dredgehead along which water jets are mounted. The jets loosen and agitate sediment particles which are then captured in the dustpan. This type of dredge works best in free-flowing granular material, and is not recommended to dredge fine-grained (clay) sediment.

- Hopper Dredges: These dredges remove sediment by dragging a large, flat draghead and using a hydraulic suction to remove the disturbed material. Resuspension of sediment using hopper dredges may be less than or comparable to that for cutterhead dredges.

- Disposal Site: A disposal site needs to be prepared in order to contain the dredged material while allowing proper dewatering of removed sediment. This basin may require extensive sediment control measures and runoff control structures.

Special Considerations

- In most cases, maneuverability requirements, hydrodynamic conditions, location of the disposal site, and other factors dictate the type of dredge to be used.
- Special purpose dredges may be necessary if conventional dredges are deemed inappropriate.
- Limited number of contractors with necessary equipment are located in Indiana. This may increase costs associated with this practice.
- Concerns for use of this practice near permanent structures such as bridges, road embankments, etc., must be addressed.
- Channel cutoff or stabilization structures may be necessary at entrance and exit sections to prevent unstable channel erosion.

MAINTENANCE

- Redredge as necessary to maintain acceptable flow conveyance and capacity.

REFERENCES

Related Practices

- Practice 801 In-Channel Sediment Basin.
- Practice 802 In-Channel Floodwater Retention Basin.

Other Sources of Information

- COE Dredging Technical note

Last Print/Revision Date: October 13, 1996

PRACTICE 804
VEGETATIVE FILTER STRIP

DESCRIPTION

- Vegetated buffer strip between a sediment-producing site and a watercourse that should be protected from sedimentation. (Note: a variation of this practice is also included in the Indiana Erosion Control Handbook.)

Exhibit 804a: Vegetative Filter Strip (Source: NRCS Files)

PURPOSE

- To remove sediment and other pollutants from runoff water by filtration, deposition, infiltration, absorption, and vegetative uptake.

WHERE APPLICABLE

- Along construction sites to reduce sediment born in sheetflow.
- Above or adjacent to wetlands, streams or ditches when conditions allow and a buffer is required.

ADVANTAGES

- Slows the flow of and removes sediment from surface runoff.
- Reduces damage associated with sedimentation.
- Improve water quality.

CONSTRAINTS

- Sometimes requires regular maintenance such as mowing, debrushing, burning, etc.
- Maximum concentrated flow depth should not exceed 2.5".
- May impact fish migration at normal and low flows.

DESIGN AND CONSTRUCTION GUIDELINES

Materials

- Appropriate seed mix. (Exhibit 1102b, Buffer Zones/Filter Strips)

Installation

- Clear and grub area (Practice 107).
- Slope should be $\leq$ 15%.
- Maximum contributing area should be 5 acres.
- Minimum filter strip width should be determined using Table 804b. Larger widths, beyond those shown in the table, may improve sediment removal efficiency, especially for a larger than average

contributing area.

Ground Slope	Minimum Width (feet)
Less than 1%	10
1 - 5%	20
5 - 6%	30
6 - 9%	40
9 - 13%	50
13 - 18%	60

Exhibit 804b: Minimum filter strip width for various percent slopes.

- Filter strip length should be at least 50'-75' long.
- Seed according to Vegetative Stabilization (Practice 1102, Exhibit 1102b - Buffer Zone/Filter Strips). Vegetation should be planted during optimum seeding times on firm, moist seed beds. Lime and fertilize as necessary.
- Multi-species Riparian Buffer Strips may also be utilized, when appropriate. A model taken from an Ecological Restoration Symposium (see reference) is shown as Exhibit 804c.

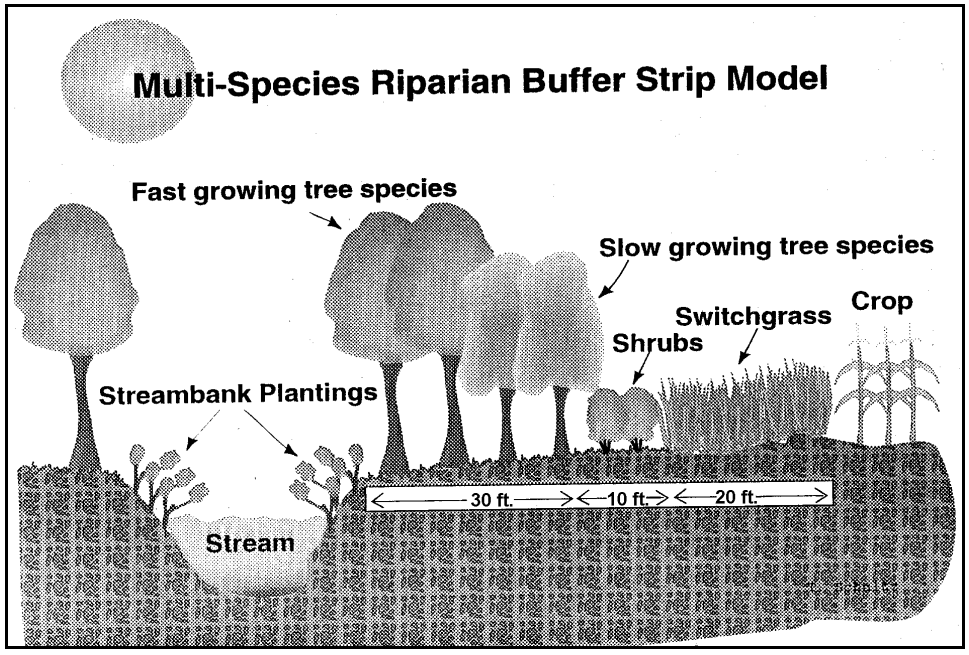

Exhibit 804c: Multi-Species Riparian Buffer Strip Model (Source: Ecological Restoration Symposium)

Special Considerations

- Avoid compacting soils underlying the filter strip during construction.
- Uniform sheet flow is necessary throughout.
- Establish filter strip as early as possible.
- Maintain vegetation at the most dense stand possible, especially at ground level.
- Flow depth should not exceed the height of the grass.

- Shrubs do not appreciably improve water quality in filter strips.
- Filter strip limits should be marked in order to keep farming activities off.

MAINTENANCE

- Mow as necessary (preferably after August), or utilize an appropriate management technique for species used. Burning is also possible with proper permits, if required.
- Use caution if using herbicide.
- Vegetated filter strips should not be used as roadways.
- Inspect regularly for erosion and repair as necessary.
- Filter strips that have accumulated so much sediment that they are above design grade should be disked, graded and replanted as necessary to reestablish sheet flow conditions.

REFERENCES

Related Practices

- Practice 107 Clearing and Grubbing.
- Practice 1101 Mulching.
- Practice 1102 Vegetative Stabilization.

Other Sources of Information

- NRCS Engineering Field Handbook.
- Indiana Erosion Control Handbook.

Last Print/Revision Date: October 1999