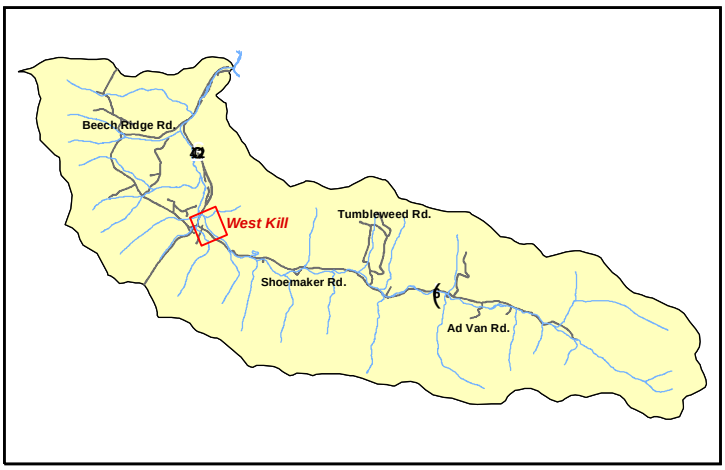


West Kill Management Unit 15

Stream Feature Statistics

34% of stream length is experiencing erosion
29% of stream length has been stabilized
14.0 acres of inadequate vegetation within the 300 ft. buffer
45 ft. of stream is within 50 ft. of the road
3 houses located within the 100-year floodplain boundary

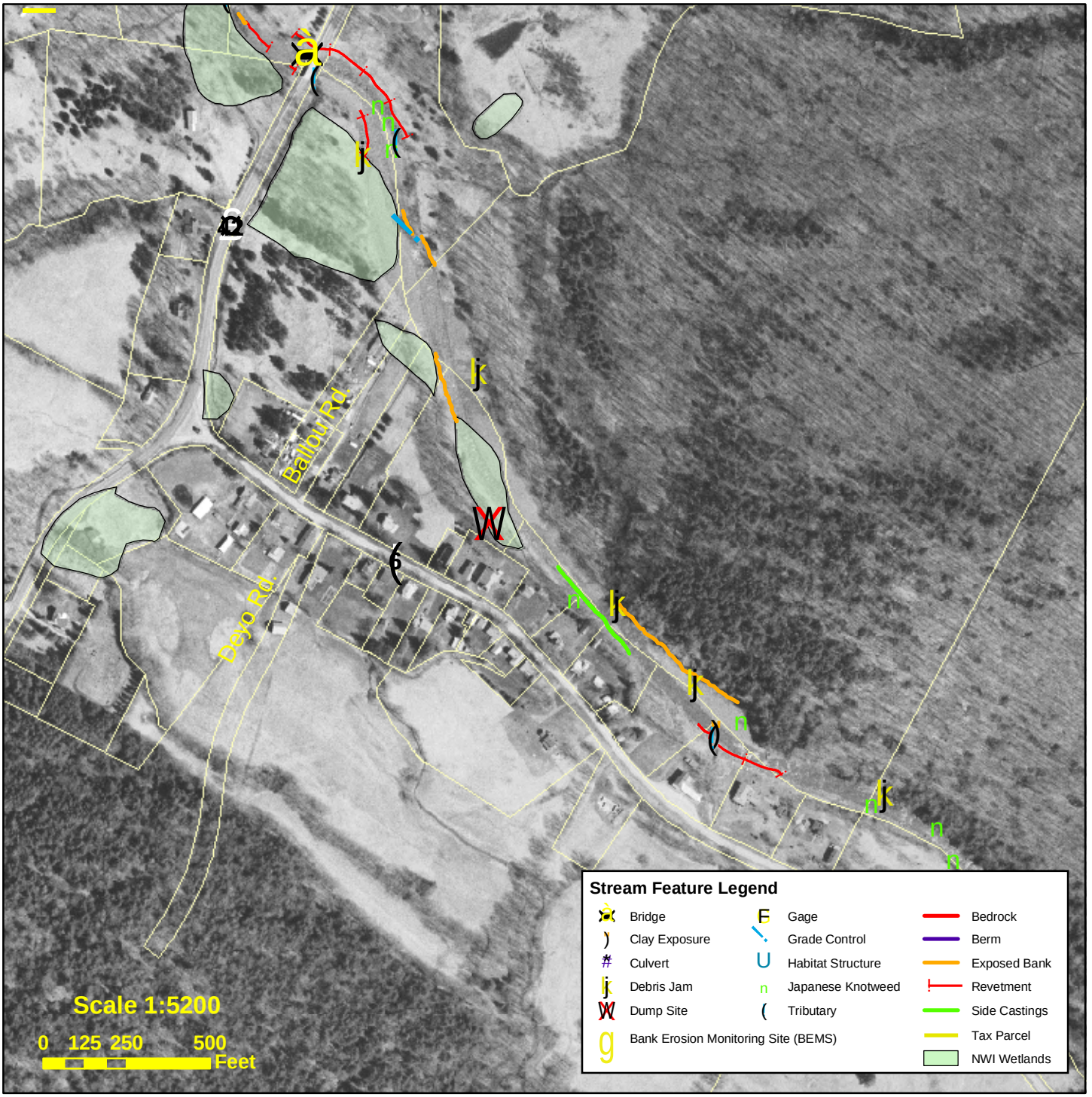


Figure 4.15.1 2004 aerial photography with stream feature inventory and tax parcels

Management Unit 15

Between Station 18646 and Station 16010

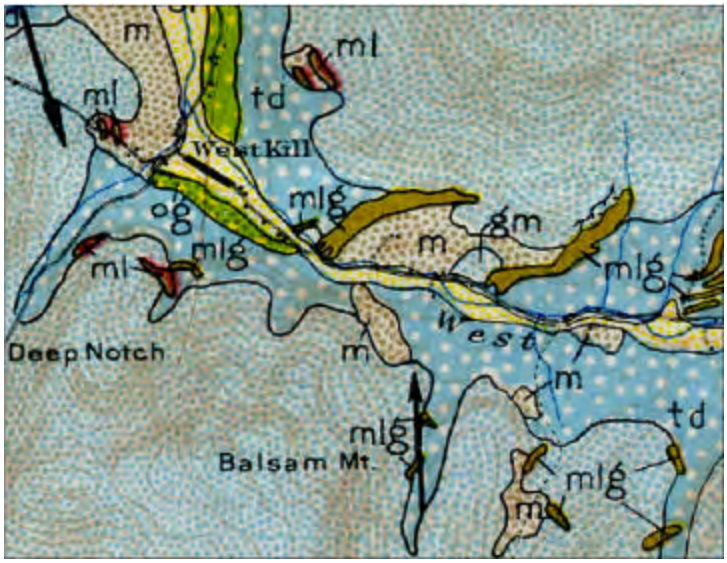
Management Unit Description

This management unit begins near the West Kill Community Center, continuing approximately 2636 ft. to the SR 42 Bridge. The drainage area ranges from 20.6 mi^2 at the top of the management unit to 22.8 mi^2 at the bottom of the unit. The valley slope is 1.65%.

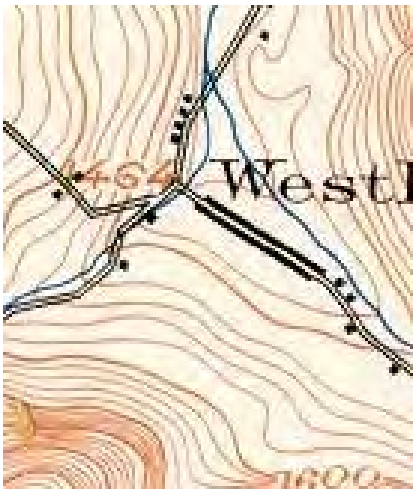
Summary of Recommendations Management Unit 15	
Intervention Level	Assisted Self-Recovery
Stream Morphology	Vegetative treatments in aggradational reaches to promote reduced width-depth ratios.
Riparian Vegetation	Interplanting of rip-rap, and enhancement of riparian buffer beyond rip-rap installations.
Infrastructure	Improved approach alignment and installation of flood plain drains at NYS Route 42 bridge.
Aquatic Habitat	Watershed wide study
Flood Related Threats	None
Water Quality	Removal of refuse from identified dump site in NWI Wetland.
Further Assessment	Establish a Bank Erosion Monitoring Site on erosion at Station 18300.

Historic Conditions

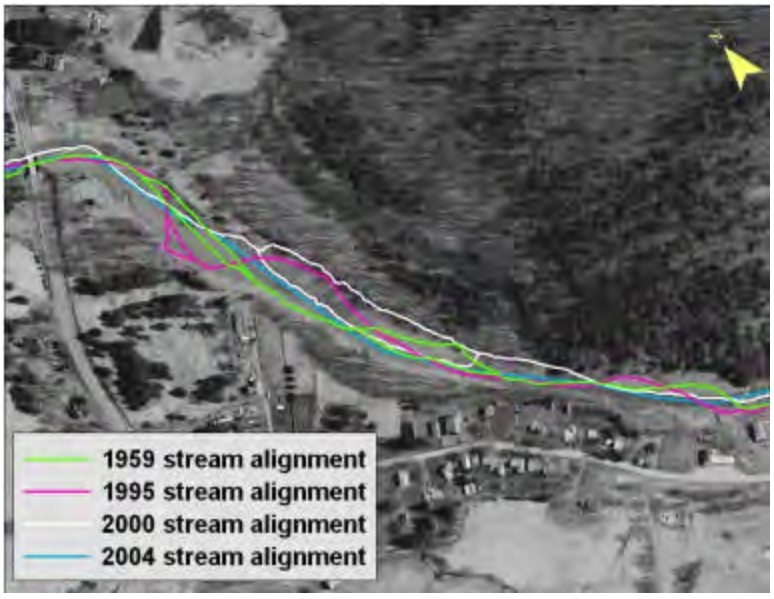
As the glaciers retreated about 12,000 years ago, they left their "tracks" in the Catskills. See Section 2.4 Geology of the West Kill Creek, for a description of these deposits.



Excerpt from Rich, 1935



USGS 1903 Topographic map, MU 15



Historic Stream Channel Alignments in MU15

As seen from the historical stream alignments, the channel alignment has changed somewhat over the years. Center bars, evident throughout the period of photographic record, indicate a history of aggradation and lateral migration in this unit.

Stream Channel and Floodplain Current Conditions

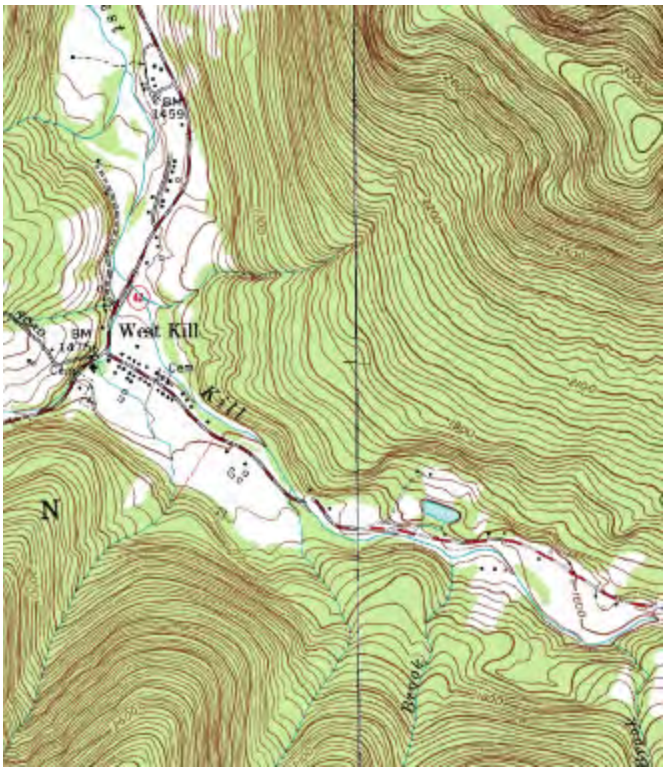
Revetment, Berms and Erosion

The 2004 stream feature inventory revealed that 34% (888 ft.) of the stream length exhibited signs of active erosion along 2636 ft. of total channel length (Fig. 4.15.1).

Revetment has been installed on a remarkably large 29% (757 ft.) of the stream length. No berms were identified in this management unit at the time of the stream feature inventory.

Stream Morphology

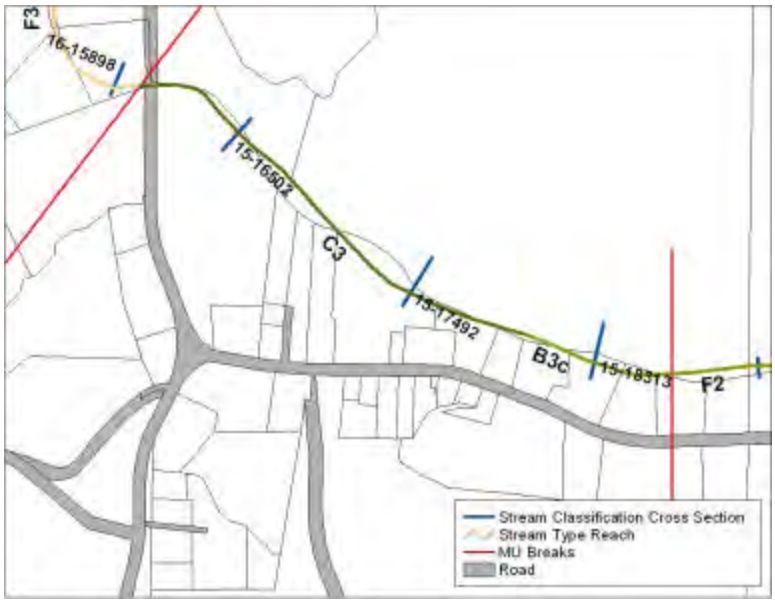
The following description of stream morphology references insets in the foldout Figure 4.15.2. "Left" and "right" references are oriented looking downstream, photos are also oriented looking downstream unless otherwise noted. Stationing references, however, proceed upstream, in feet, from an origin (Station 0) at the confluence with the Schoharie Creek at Lexington. Italicized terms are defined in the glossary. This characterization is the result of surveys conducted in 2004 and 2005.



Excerpt of 1980 USGS topographic map

The upstream portions of this unit are quite entrenched, with a sinuosity that is uncharacteristically low for the valley setting. The channel is confined between the valley wall to the north, and a high alluvial terrace to the south. The channel becomes increasingly connected to the alluvial terrace toward the downstream end of the unit. It appears that the channel in this unit may have been relocated to the north side of its former alluvial floodplain to facilitate agriculture and development. The relocation is likely to have straightened the channel. However, the downstream reaches of the unit appear to be recovering a more appropriate sinuosity for the valley setting as point-bars develop and belt width increases. Sediment supply to this unit appears to be quite high, potentially attributable to incisional processes active in Management Unit 14.

Stream morphology, or shape (i.e., slope, width and depth) changes several times in this unit (Fig. 5), creating small reaches with differing morphologic characteristics, which are classified as different *stream types* (See Section 3.2 for description of stream types)



Cross-sections and Rosgen stream types in MU 15

Management Unit #15 begins with a 646 ft. reach of B3cstream type documented by a monumented cross-section at Station 18313. The channel is moderately *entrenched*, or confined within the stream banks during high flood events. The channel slope is a very flat 0.6 % and the bed material is dominated by cobble.

Rip-rap, left

As Management Unit 15 begins, 214 ft. rip-rap is found on the left bank behind residential structures. The rip-rap continues from Management Unit 14. The riparian buffer beyond the rip rap installation is in poor condition, with mown grass to the edge of the bank. The risk to bank stability can be minimized by maintaining mature trees along the stream margin, including a critical buffer zone extending approximately 75 ft. from the centerline of the stream (Fig. 4.15.4). The risks and benefits associated with management of streamside vegetation will depend partly on the current channel conditions, and local channel surveys are recommended at each site. Recommendations for this area include interplanting of the rip rap, and enhancement of the riparian buffer with planting of ecologically appropriate tree and shrub species in the adjacent mown lawn.

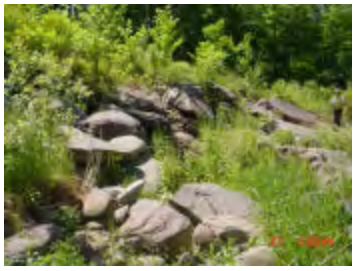
A tributary channel is evident on the left bank immediately downstream of the rip-rap. The channel is quite large, but conveyed no flow on the day it was observed. The channel appears over-sized for its catchment, and may convey West Kill flood water known to flank the Greene County Route 6 bridge at the head of Management unit 14 during extreme flows. The mouth of the tributary is perched and scour at the outfall is evident.

Tributary, left

Clay Exposure, till

Glacial till deposits (see Inset H, Fig. 4.15.2) are exposed near the mouth of the tributary in the left and right benches and in the bed. The *glacial till deposits* have a high silt and clay content, contributing sediment through both *wet and dry ravel* and yielding a significant suspended sediment load during high flows. Clay inputs into a stream are a serious water quality concern because they increase *turbidity*, degrade fish habitat, and can act as a carrier for other pollutants and pathogens.

Fifty-one feet of rip-rap are found on the left bank behind the West Kill Community Center. The installation has ample young vegetation growing through it and on the terrace beyond the rip-rap. A bench in front of the rip-rap is composed of glacial till, indicating that it is a glacial deposit exposed by bed degradation rather than an alluvial deposit formed by the stream. Recommendations for this site are to allow the existing vegetation to continue growing to maturity.



Rip-rap, left

Knotweed, right

Knotweed is observed on a gravel bar to the right of the stream. The stand is small and isolated. During the 2004 inventory, five stands of Japanese knotweed (Fallopia japonica), an invasive, exotic shrub species that can grow rapidly to crowd out more appropriate streamside vegetation, were observed throughout this management unit. In the 2005 inventory, the number observed had decreased to four. A program for eradication of Japanese knotweed throughout the West Kill valley is recommended.

Bank erosion, right

Debris jam, right

A large bank failure (see Inset D, Fig. 4.15.2) at the right has a large bar formed at its toe. The 482 ft. long failure appears active, with large debris sliding down its face, forming two debris jams at the toe. The first jam is set back on a bar, clear of low flow, but the second spans the low flow channel and causes a significant obstruction at higher flows. The bank is composed of clay rich till, posing a threat to water quality. The recovery potential of this failure is high due to the bar formation at the toe, reducing toe scour and

enhancing the overall stability of the bank. This failure was not monumented as a Bank Erosion Monitoring Site, but monitoring of this failure is recommended.

Debris Jam, right

Side castings, left

Evidence of side casting (see Inset G, Fig. 4.15.2) is observed along 338 ft. of the left bank. This is a likely relic of gravel removal in this aggradational setting.

Knotweed, left

A small stand of Knotweed is found on the terrace just beyond the side castings.

Aggradation

Aggradation becomes apparent near Station 17900, and is the prevailing stream process through the remainder of Management Unit 15. The channel becomes increasingly connected with the flood plain to the left of the channel as the stream flows behind the hamlet.

Flash Boards, left

Remnants of a flash board installation are found on the left terrace. The flash boards, intended to reduce flooding in the hamlet, are rotted or missing. The flood reduction measures are in poor condition, and are no longer effective.

A dumpsite is discovered on the terrace behind the flash boards. The dump site appears to still be active, with old and new metal, garbage and appliances. The dump site lies in one of the six wetlands within this management unit mapped in the National Wetland Inventory. Appliances, trash and other refuse often contain metals, lubricants and various chemicals that can be detrimental to water quality. The dumpsite also degrades the aesthetic quality of this reach. Removal of the trash and appliances is recommended in order to protect water quality and limit further soil contamination.

Dump Site

Two monumented cross-sections (Station 17492 and Station 16502) document 1990 ft. of C3 stream type in the reach between Stations 18000 and 16010. The slope in the reach increases from that of the upstream reach, and ranges between 1.1% and 1.6%, while cobble remains the dominant bed material.

Flash boards, left

More remnants of flash boards are found along 70 ft. of the left bank near Station 17350. Only the steel railroad track uprights remain bent over to the bed of the stream.

Bank erosion (Inset C, Fig. 4.15.2) is active along 231 ft. of the left bank, beginning near Station 17250. The bank has natural rocky toe protection, but is inadequate to prevent the aggradation-triggered erosion.

Bank erosion, left

Debris Jam, right

The bar opposite the erosion has accumulated several separate pieces of large woody debris.

Erosion is evident along 98 ft. of the right bank near Station 16750. The erosion has undermined trees that may become entrained in future flow events.

Bank Erosion, right

Grade control

The bank appears to have formerly been rip-rapped, as large angular rock lies in the stream bed along the erosion. The rock seems to have been pulled from the bank that it once armored. The rock does provide some measure of grade control (Inset B, Fig. 4.15.2) to the channel.

On the right, bank erosion continues for another 76 ft. downstream of the rock grade control. This erosion is less severe than the erosion upstream of the grade control, and has fair recovery potential. Neither of these two erosion sites were monumented as Bank Erosion Monitoring Sites.

Bank Erosion, looking upstream

Rip-rap, debris jam, left

A large debris jam is found at the upstream end of a 146 ft. long rip-rap installation on the left bank approaching the NYS Route 42 bridge. The debris forms a modest obstruction at high flows. The rip-rap appears new, and is in good condition.

Knotweed

Three small, isolated Knotweed stands are noted along rip-rap on the right bank between Stations 16400 and 16250.

Rip Rap, right

Rip-rap begins on the right bank near Station 16400, and extends 484 ft. The rip-rap armors the approach to the NYS Route 42 bridge, and continues into Management Unit 16. The rip-rap is fairly new and in good condition. The riparian buffer beyond the rip rap installation is in poor condition, with grass to the edge of the bank. Recommendations for this area include interplanting of the rip rap, and enhancement of the riparian buffer with planting of ecologically appropriate tree and shrub species in the adjacent grassed area.

Tributary, right

An unnamed tributary joins the West Kill near the upstream end of the rip-rap. The tributary drains a 0.5 mi^2 catchment, and is well vegetated and connected at its mouth.

Tributary, left

Another significant, but unnamed tributary, draining 1.6 mi^2, joins the West Kill from the left just upstream of the NYS Route 42 bridge. The tributary confluence is well connected with abundant vegetation. The reaches of this tributary between its mouth and its conveyance under Greene County Route 6 have recently been dredged to improve road drainage. Recommendations for this tributary include investigation of the feasibility of conveying stormwater runoff from NYS Route 42 and Greene County Route 6 in a dedicated drainage swale, to mitigate water quality impacts to the tributary.


NYS Route 42 bridge


Looking upstream


Looking downstream

NYS Route 42 bridge marks the downstream limit of Management Unit 15. The alignment of this bridge is poor, creating a sharp bend to the left as the channel approaches the bridge opening. The sharp bend in combination with poor floodplain drainage through the NYS route 42 road fill results in backwater and aggradation upstream. Recommendations at this site include modification of the stream approach to the bridge, and installation of flood plain drains under NYS Route 42.

Sediment Transport

Streams move sediment as well as water. Channel and floodplain conditions determine whether the reach aggrades, degrades, or remains in balance over time. If more sediment enters than leaves, the reach aggrades. If more leaves than enters, the stream degrades (See Section 3.1 for more details on Stream Processes).

Aggradation is the prevailing stream process observed in this unit. Excess sediment load delivered from Management Unit 14 in combination with backwater conditions at the NYS Route 42 bridge contribute to the sediment transport imbalance. Extensive grading of the active channel following the 1996 flood resulted in over-wide conditions and ineffective sediment transport conveyance. Sediment storage evident in this unit encourages lateral adjustment which may not be tolerable in this more developed portion of the valley. Bank cutting and lateral extension often confound the management objectives of streamside landowners.

Reduction of the sediment load resulting from incisional processes in Management Unit 14 is the first step necessary to achieve sediment transport balance in Management Unit 15. Improved approach alignment and installation of flood plain drainage at the NYS Route 42 bridge approach would likely reduce the backwater conditions and improve sediment transport continuity. Vegetative treatments may promote the development of more efficient channel dimensions for sediment transport. Aggradational reaches in this management unit should be evaluated to determine the feasibility of width-depth ratio reductions through in-stream plantings.

Riparian Vegetation

One of the most cost-effective methods for landowners to protect streamside property is to maintain or replant a healthy buffer of trees and shrubs along the bank, especially within the first 30 to 50 ft. of the stream. A dense mat of roots under trees and shrubs

bind the soil together, and makes it much less susceptible to erosion under flood flows. Mowed lawn does not provide adequate erosion protection on stream banks because it typically has a very shallow rooting system. Interplanting with native trees and shrubs can significantly increase the working life of existing rock rip-rap placed on streambanks for erosion protection. *Riparian*, or streamside, forest can buffer and filter contaminants coming from upland sources or overbank flows. Riparian plantings can include a great variety of flowering trees and shrubs, native to the Catskills, which are adapted to our regional climate and soil conditions and typically require less maintenance following planting and establishment.

Some plant species that are not native can create difficulties for stream management, particularly if they are invasive. Japanese knotweed (*Fallopia japonica*), for example, has become a widespread problem in recent years. Knotweed shades out other species with it's dense canopy structure (many large, overlapping leaves), but stands are sparse at ground level, with much bare space between narrow stems, and without adequate root structure to hold the soil of streambanks. The result can include rapid streambank erosion and increased surface runoff impacts.

An analysis of vegetation was conducted using aerial photography from 2005 and field inventories (Fig. 4.12.3). Japanese knotweed occurrences were documented as part of the stream feature inventory conducted during the summer of 2004, with additional occurrences identified in 2005.

In this management unit, the predominant vegetation type within the 300 ft. riparian buffer is Forest (41 %) followed by Herbaceous (27 %). *Impervious* area (5%) within this unit's buffer is primarily the Greene County Route 6, along with private residences and associated roads. Five occurrences of Japanese knotweed were documented in this management unit during the 2004 stream inventory, only four were document in 2005.

National Wetland Inventory wetlands in MU15

There are six wetlands within this management unit mapped in the National Wetland Inventory (see Section 2.5, Wetlands and Floodplains for more information on the

National Wetland Inventory and wetlands in the West Kill watershed). Wetlands are important features in the landscape that provide numerous beneficial functions including protecting and improving water quality, providing fish and wildlife habitats, storing floodwaters, and maintaining surface water flow during dry periods (See Section 2.6 for wetland type descriptions and regulations). The most upstream wetland, which is 0.8 acres in size, is classified as *riverine, lower perennial, unconsolidated shore, temporarily flooded* (R2USA). Moving downstream, there is a wetland measuring 1.4 acres in size, and is designated *palustrine, emergent, broadleaved deciduous seasonally flooded/saturated* (PEM1E), a wetland measuring 0.2 acres, and is designated *palustrine, emergent, broadleaved deciduous* (PEM1A), and a 0.4 acre wetland, designated *riverine, lower perennial, unconsolidated shore, temporarily flooded* (R2USA). Continuing downstream, the largest wetland measures 3.3 acres and is designated *palustrine, forested, broad-leaved deciduous, temporarily flooded* (PFO1A) and another small wetland measures 0.3 acres and is designated *palustrine, unconsolidated bottom, permanently flooded, diked/impounded* (PUBHh).

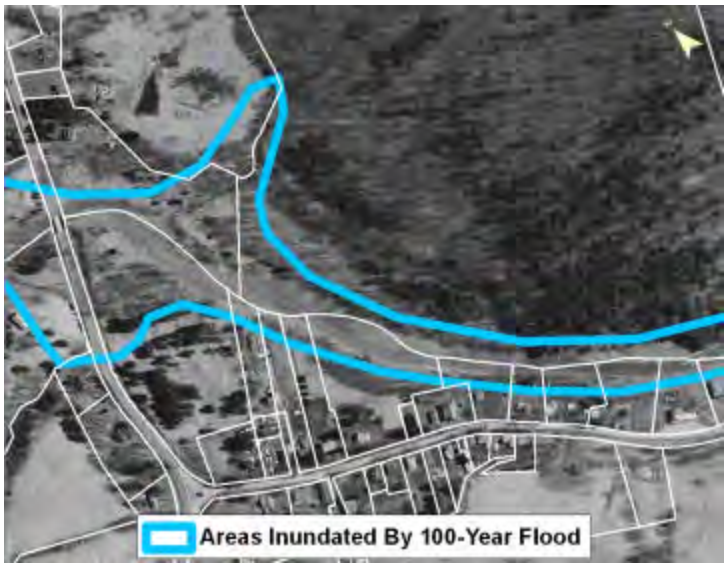
Areas of herbaceous (non-woody) cover present opportunities to improve the riparian buffer with tree plantings, to promote a more mature vegetation community along the streambank and in the floodplain. In November 2005, suitable riparian improvement planting sites were identified through a watershed-wide remote evaluation of current riparian buffer conditions and existing stream channel morphology. These locations indicate where plantings of trees and shrubs on and near stream banks can help reduce the threat of serious bank erosion, and can help improve aquatic habitat as well. In some cases, eligible locations include stream banks where rock rip-rap has already been placed, but where additional plantings could significantly improve long-term stream channel stability, as well as biological integrity of the stream and floodplain. Areas with serious erosion problems where the stream channel requires extensive reconstruction to restore long-term stability have been eliminated from this effort. In many cases, these sites can not be effectively treated with riparian enhancement alone, and full restoration efforts would include channel restoration components in addition to vegetative treatments.

Twenty-six potential planting sites were documented within this management unit (Fig. 4.15.4).

Recommendations for this site include planting native trees and shrubs along the edge of the stream bank and the upland area. Buffer width should be increased by the greatest amount agreeable to the landowners, but increasing the buffer width by at least 35 feet will increase the buffer functionality and improve stream bank stability while still allowing a significant lawn area.

Flood Threats

Inundation



100-year floodplain boundary in Management Unit 15

As part of its National Flood Insurance Program (NFIP), the Federal Emergency Management Agency (FEMA) performs hydrologic and hydraulic studies to produce Flood Insurance Rate Maps (FIRM), which identify areas prone to flooding. The NYS DEC Bureau of Flood Protection is currently developing new floodplain maps for the West Kill on the basis of recent surveys. These maps should be completed for the West Kill watershed in 2006.

According to this existing floodplain maps, there are 3 houses located within the 100-year floodplain boundary in this management. The 100-year floodplain is that area predicted to be inundated by floods of a magnitude that is expected to occur once in any 100 year period, on the basis of a statistical analysis of the local flood record. Most communities regulate the type of development that can occur in areas subject to these flood risks. The current NFIP maps are available for review at the Greene County Soil & Water Conservation District office.

Bank Erosion

Most of the stream banks within the management unit are considered stable, but 34% (888 ft.) of the stream length is experiencing some form of erosion. The notably high percentage of stream length that has been revetted indicates a history of instability.

There are no Bank Erosion Monitoring sites in MU15. It is recommended, however, that a Bank Erosion Monitoring Site be established for the erosion near Station 18300.

Infrastructure

Twenty-nine percent of the stream length in this management unit has been treated with some form of revetment. The bridge at NYS Route 42 appears to have detrimental effects on sediment transport continuity in the unit. Improvement of the approach alignment and flood plain drainage is recommended.

Aquatic Habitat

It is recommended that a habitat study be conducted on the West Kill Creek, with particular attention paid to possible temperature barriers in aggrading sections, to the frequency of disturbance of the bed due to incision at numerous points in the system, and to embeddedness resulting from excessive entrainment of fine sediment.

Habitat was compromised throughout this management unit, with inadequate canopy cover, possible temperature barriers, low diversity of bedform and introduction of fine sediment from eroding banks. However several reaches have abundant woody debris and shallow margins for rearing habitat.

Water Quality

Clay exposures and sediment from stream bank and channel erosion pose a potential threat to water quality in West Kill Creek. Clay and sediment inputs into a stream may increase *turbidity* and act as a carrier for other pollutants and pathogens. There was one significant clay exposure identified in the 2004 Inventory, and 3 clay exposures identified in 2005,

Stormwater runoff can also have a considerable impact on water quality. When it rains, water falls on roadways and flows untreated directly into West Kill Creek. The cumulative impact of oil, grease, sediment, salt, litter and other unseen pollutants found in road runoff can significantly degrade water quality. There are no stormwater culverts in this management unit,

Nutrient loading from failing septic systems is another potential source of water pollution. Leaking septic systems can contaminate water making it unhealthy for swimming or wading. There are numerous houses located in close proximity to the stream channel in this management unit. These homeowners should inspect their septic systems annually to make sure they are functioning properly. Each household should be on a regular septic service schedule to prevent over-accumulation of solids in their system. Servicing frequency varies per household and is determined by the following factors: household size, tank size, and presence of a garbage disposal. Pumping the septic system out every three to five years is recommended for a three-bedroom house with a 1,000-gallon tank; smaller tanks should be pumped more often.

The New York City Watershed Memorandum of Agreement (MOA) allocated 13.6 million dollars for residential septic system repair and replacement in the West-of-Hudson Watershed through 2002. Eligible systems included those that were less than 1,000-gallon capacity serving one- or two-family residences, or home and business combinations. Two homeowners in this management unit made use of this program to replace or repair a septic system.

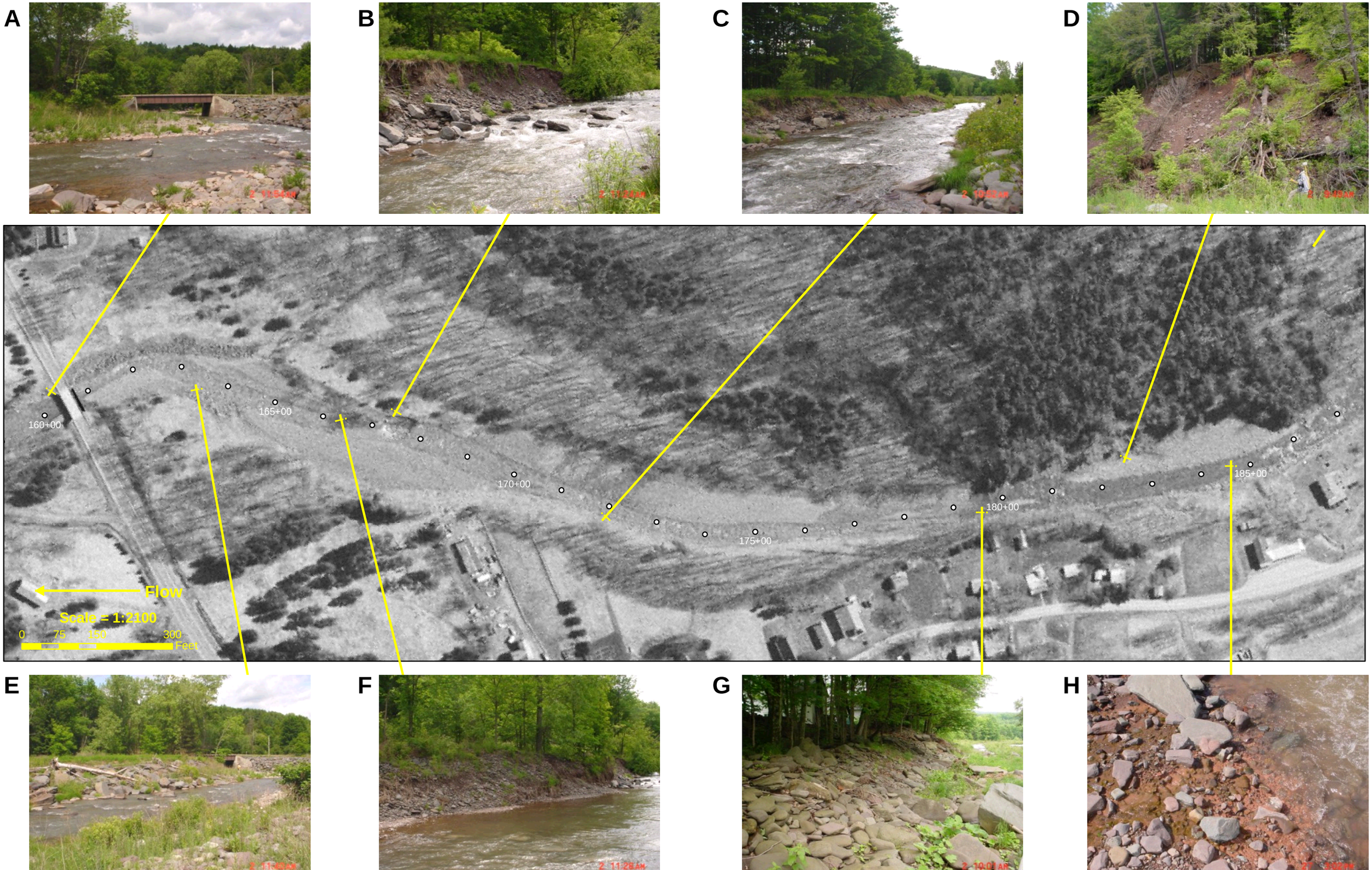


Figure 4.15.2 Management Unit 15 - 2004 aerial photography