Because of the variable conditions that exist in Management Segment 3, further delineation of the segment was necessary to facilitate data collection and analysis. Based on general valley morphology, physical stream character, and the proximity of the business district, Segment 3 was broken into three stream reaches (3a, 3b, 3c) to further describe the area in more detail **(Map VI-4).**

Reach 3a (CR 65 Hensonville to Concrete Dam Above SR 296)

Reach 3a begins at County Route 65 in Hensonville, and continues approximately 2.1 miles to State Route 296 by the Thompson House. The drainage area ranges from 14 mi^2 at the top of the reach, to 24 mi^2 at State Route 296. The reach includes the 6.6 mi^2 sub-basin in East Windham (Silver Lake) as well as several smaller, unnamed ephemeral tributaries.

Stream Morphology/Stability

Based on information from the 1997 Phase I Inventory & Assessment, and Phase II monitoring, the GCSWCD has noted that reach 3a is experiencing several problems with channel morphology stability. While the very upper reach starts out fairly stable as it exits Hensonville, the Batavia Kill quickly becomes characterized by stream channel aggradation, and active streambank erosion as it reaches the confluence of the unnamed tributary that flows from East Windham (Silver Lake). Reach 3a is the first location in the watershed below CD Lane Park and the Peck Road bridge area, where extensive bedload deposition has been observed. The deposition has been attributed to a combination of factors including a transition in valley slope, the sediment supply from the Silver Lake tributary, and the presence of two concrete dams located within in the reach.

Reach 3a is influenced by a transition from a steeper valley slope (1.3%) above the reach, to a flatter slope (0.7%) in Valley Zone 3 **(Figure V-11)** where the reach is located. In addition to the change in valley slope, the introduction of excess sediment from the Silver Lake tributary may also be contributing to the aggradation noted during the assessment period. While the upper Batavia Kill has an altered sediment supply due to the C.D. Lane flood structure, the tributary from East Windham is impacted to a lesser extent by smaller impoundments such as Silver Lake, and extensive beaver dams.

The Phase I Inventory & Assessment conducted in 1997, indicated that the middle of the reach appeared to be in an unstable state with several areas of bank instability. Nearly 20% of the streambanks through reach 3a were experiencing active erosion at the time of the inventory and assessment. The reach was characterized as having an average of 1.14 ft^2 of exposed streambank per foot of streambank length. The principle failure mechanism was noted to be slumping due to hydraulic forces eroding the streambank toe, and is presumed to be the result of ongoing adjustments in planform **(Figure VI-32a, Photos C,G, Figure VI-32b photos F,G)**. Streambank height throughout most of the reach is fairly low, averaging around 5 feet, with a well defined floodplain throughout much of the reach

(Figure VI-32a photo C,D,E,G,H and Figure VI-32b photo F,G).

The Phase I Inventory and Assessment identified two concrete dam structures in Reach 3a. The first concrete dam structure is located at the confluence of a small unnamed tributary on the Police Anchor Camp property **(Figure VI-32a photo A, Figure VI-32b photo D)**. The structure measures approximately 100 feet long and is nearly nine feet high. The structure is characterized as being in poor condition, with extensive sedimentation. The tributary has eroded around the east wall of the structure. Currently, the structure impacts both the tributary, as well as the main stem of the Batavia Kill. Stream flow and sediment transport are being impacted, and the channel is migrating laterally.

The second concrete dam is located near the bottom of the reach, in the area behind the Thompson House **(Figure VI-32b photo E)**, with the structure located across the mainstem of the Batavia Kill. In general, this structure is in better condition than the first dam, and while some higher flows by-pass the structure, the stream has not breached the dam. The structure does impact stream slope by causing a localized slope reduction and modification of the streambed elevation above the structure. The structure is also believed to contribute to the stream bank erosion upstream through Reach 3a, due to the reduction in slope and transport capacity of the bedload being delivered from the Silver Lake tributary and ephemeral tributaries. Aggradation, followed by lateral streambank erosion, is typical of situations where check dams are created across a channel.

A detailed assessment of channel stability was initiated in 1998 with the installation of two monumented cross sections. The cross section was placed to monitor observed lateral migration of the channel. The cross section is positioned immediately downstream of the Batavia Kill's confluence with the Silver Lake tributary at a drainage area of 21.3mi^2. The stream at this cross section is classified as a C4 stream type, which is typical of the entire reach. During the monitoring between 1998 and 2000, the bankfull channel has widened by 4.5 feet, with aggradation of the streambed of approximately 0.8 feet **(Figure VI-29)**.

The second cross section is located at a drainage area of 23.7mi^2 and is located approximately 1,600 feet from the bottom of the reach. This section has experienced erosion along the left streambank. Erosion was thought to be partially caused by local flow divergence caused by large woody debris **(Figure VI-30)**. Classification of the channel at this cross section indicates a C4 stream type. Both cross sections in Reach 3a are

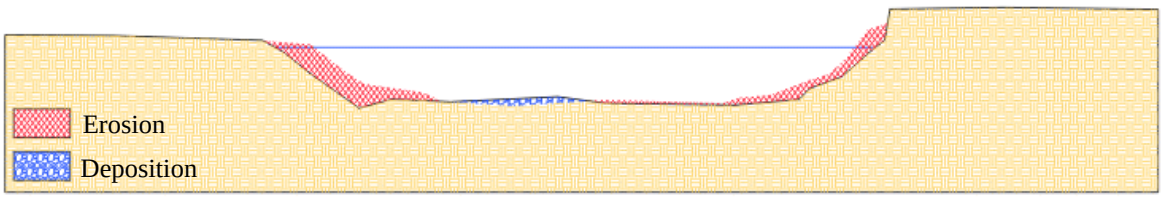


Figure VI-29: Overlay of 1998 and 2000 cross sections taken downstream of the confluence with Silver Lake tributary.

characterized as riffle features, with dominant sediment size bordering very large gravel and small cobble. During the monitoring period, the reach experienced a record flow during tropical storm Floyd (9/99).

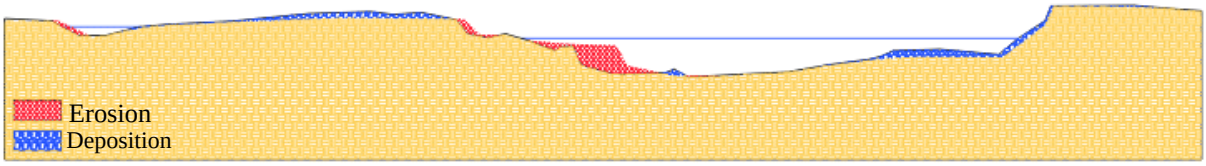


Figure VI-30: Overlay of 1998 and 2000 cross section from Reach 3a.

Aggradation and fluctuations in bed material size are considered to be the leading contributors to the reach's instabilities. The source and timing of the sediment is related to the Silver Lake tributary and storm events that mobilize the channel bed. The Silver Lake tributary presents the first appreciable bedload contribution to the stream below the CD Lane flood control structure. This is reflected in the inventoried delta and point bar formations below its confluence with the Batavia Kill. Storm events, such as those in 1996 and 1999, have left the reach in an unstable state with numerous raw banks and general disturbed physical characteristics. Recently, visual inspection has revealed that the reach is recovering naturally as evidenced by large areas of willow reestablishment and associated stabilizing of the stream banks. The presence of the concrete dam structure, frequent impacts by floods, and the lack of stronger riparian vegetation, however, make it unlikely that the reach will reach a stable form in the near future.

A review of aerial photographs from 1959, 1967 and 2000 **(Figure VI-31)** indicates that the reach has been experiencing relatively slow, but continual lateral adjustments in planform. There are several abandoned channels located within the reach presumably caused by channel migration and the rapid formation of chute cutoff during large flow events. The aerials show that the reach is characterized by significant sediment storage, starting at the point below the confluence with the Silver Lake tributary. A June 1980 aerial photograph shows evidence of active gravel mining through the floodplain in the upper extent of the reach.

In general, Reach 3a presents excellent conditions for restoration. The stream is positioned in the middle of the valley, with extensive floodplains located on both sides. The reach has suitable belt width available for meander development, and there is little to no anthropogenic constraints such as roads, bridges or homes. The overall stream alignment has a relatively low sinuosity of 1.12 considering the floodplain area available for meander development, and minimal hardening of the streambanks. Restoration would provide multiple benefits, including water quality protection and fisheries habitat enhancement. A restoration strategy that addressed fish passage at the lowest concrete dam would provide access to miles of streams.

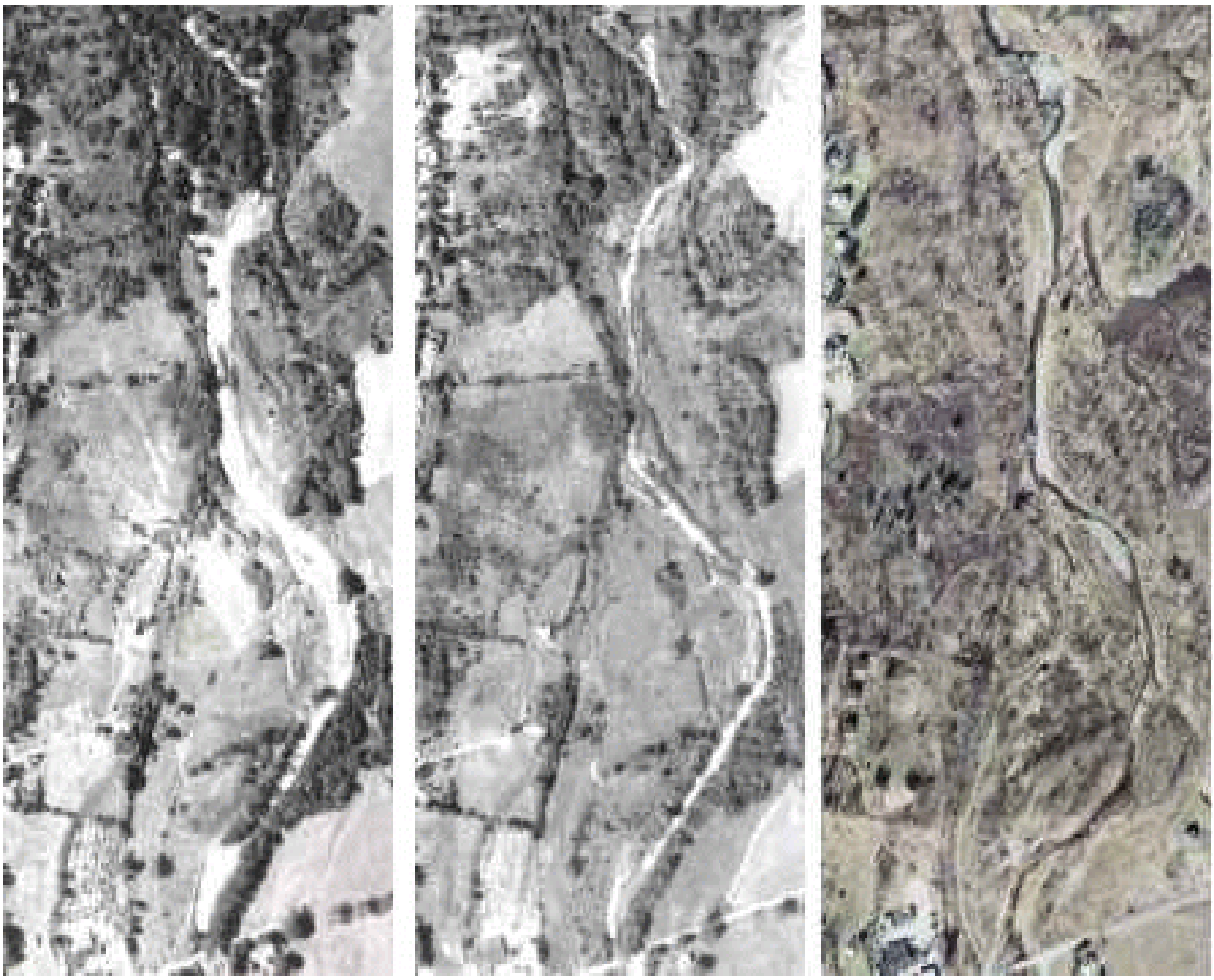


Figure VI-31: Aerial view of upper end of reach 3a from 1959 (left), 1967 (center) and 2000 (right). Bridge at County Route 65 in Hensonville is seen at bottom-center of each photo

Riparian Vegetation

Though the GCSWCD did not conduct a detailed riparian buffer assessment in Reach 3a, the Phase I inventory and assessment, recent inspections, and review of historical photographs has shown that most of the reach exhibits fair to poor riparian conditions. While some smaller sections of the reach have somewhat adequate forested buffers **(Figure VI-32a photo B,D & Figure VI-32b photo A,C,D)**, the majority of the reach has no riparian vegetation other than grasses and forbes that provide limited stability to the streambanks. In the areas of active erosion, often there is no woody vegetation present and the grasses do not provide adequate rooting depth to prevent bank failure **(Figure VI-32b photo F)**. The reach also contains a significant population of Japanese knotweed. As shown in **Figure VI-31**, the reach has exhibited poor riparian conditions as far back as 1959.

Water Quality

During the GCSWCD's observations of Reach 3a, no specific water quality concerns were noted. While the GCSWCD's assessment of the stream reach did not indicate any clay exposures in either the streambed or banks, the GCSWCD feels that the glacial clays are most likely only a few feet below the existing channel. The lack of clay exposures at this time may be attributed to the fact that the concrete structures have prevented degradation of the channel. While there is one trailer near the stream at the top of the reach, and the Thompson House facility is near the creek at the bottom, for the most part homes and other buildings in this reach are set back some distance from the stream. Any potential impacts to water quality from on-site waste water treatment will be adequately mitigated upon construction of the Windham wastewater treatment system in 2003.

Observations have indicated that there are no readily apparent impacts from stormwater systems in the area. Runoff from most of NYS Route 23, which runs along the reach, is treated to some extent by a complex of small tributaries passing through wetland. At the very bottom of the reach, near the State Route 296 intersection, road runoff does discharge directly to the stream from State Route 23. In addition to the stormwater drainage at the intersection of State Routes 23 and 296, the Thompson House may also present opportunities for stormwater rehabilitation through CWC grant programs..

Infrastructure

Infrastructure has little to no impact on reach 3a. At this time transportation infrastructure is limited to a county bridge at the very top of the bridge, and a state bridge at the bottom. In both cases, the bridges appear to be adequately sized for the stream and there are no observable signs of instability associated with either structure. The county bridge at the top of the reach does include a narrow steel I-beam center pier which does present a hazard for catching debris. Accumulation of debris during a flood event can result in localized flow divergence, causing the stream's energy to become directed against the streambank, ultimately resulting in bank failure. The bridge structure at State Route 296 spans the entire narrow floodplain, and appears to have no impact on the channel. The bridge is fairly old and the GCSWCD presumes that it will require replacement or rehabilitation in the near future. A well house for the Town of Windham is also located on the left floodplain, just below the County Route 65 bridge. The well house is several hundred feet from the actual creek and to date no problems have been reported by the Town of Windham.

Habitat

While the GCSWCD did not conduct a detailed habitat assessment, several observations can be made regarding reach 3a. In general, habitat appears to be fair at best, with little pool structure, little stream cover, and an actively shifting channel. One of the most important habitat issues in the reach involves the concrete structure at the bottom of the

reach. Although the dam structure is effective at providing local vertical stability in the Batavia Kill, the dam presents a barrier to fish migration. The presence of the structure prevents fish migration between the dam and the CD Lane Park flood control dam, effectively cutting off several miles of stream. The structure also cuts off fish access to a significant portion of the large tributary coming from East Windham (Silver Lake).

Flooding Issues

The GCSWCD is aware of limited flooding concerns in reach 3a. At the top of the reach, a trailer and one house appear to be located within the floodplain, but the presence of the C.D.Lane flood control structure has prevented any structural flooding in any of the recent flood events. The lower end of the tributary from East Windham does exhibit signs of accelerated erosion from recent floods in the area just above the confluence with the Batavia Kill. As noted earlier, all structures and roadways in the reach are located away from, and high above, the creek. The presence of a wide valley floor and available floodplain has reduced the occurrence of flooding problems.

Reach 3a Summary

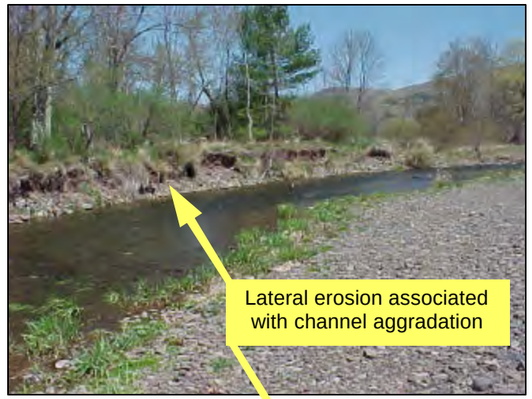
Reach 3a is characterized as a transitional zone, where the steeper upper watershed starts to hit the broader, flatter valley. The predominate stream type is C3/4, with the stream becoming more entrenched as it approaches State Route 296. The reach has been characterized as being relatively unstable, with aggradation and associated lateral channel adjustments occurring. The presence of a concrete dam near the bottom of the reach has impacted (reduced) the local channel slope, which has prevented channel incision and resulted in aggradation and associated lateral migration as evidenced by accelerated bank erosion. This erosion is exacerbated by the presence of Japanese knotweed and poor riparian vegetative cover on the banks.

Table VI-8: Management Recommendations Reach 3a.

Reach 3a: County Route 64 in Hensonville to State Route 296	
Intervention Level	Full/Assisted
Stream Morphology	Based on priorities, restore stream function within the reach. Natural channel stability through most of the reach should not be expected while the concrete structure is influencing the channel form and function. Restoration should restore sediment transport processes through the reach which may necessitate adjustments to or removal of the lower concrete dam.
Riparian Buffers	The reach does not contain adequate riparian buffers. While the upper reach near Hensonville may be appropriate for buffer establishment, the majority of the reach does not exhibit enough stability to advise new buffer establishment without associated channel adjustment. In the lower reach, buffer vegetation is critical to maintain stability of the high terrace where the Thompson House is located, and vegetation should be managed through replanting and selective pruning to increase buffer strength. The reach contains sizable areas of riparian wetland that may be protected by creation of a naturally stable stream channel. Any and all activities should be done to minimize impacts to these existing wetlands.
Water Quality	See general recommendations
Infrastructure	1. County Route 65 bridge - remove debris regularly, inspect bridge frequently for signs of local scour of center pier or streambanks. 2. State Route 296 bridge - any future replacement/retrofit should be done so as to maintain current span, with no center pier. 3. Construction of the Windham Wastewater system includes a sewer main in the floodplain corridor through the reach. Placement and construction should be done so as to reduce any impacts on the Batavia Kill.
Habitat	1. Removal or adjustments of the concrete dam at the lower end has the potential to substantially increase fish passage through the reach. 2. Construction of a stable channel form, with removal or adjustment of the dam, would provide a suitable riffle-pool complex, as well as involve establishment of riparian vegetation for shading, and restore fish passage.
Flooding	See General Recommendations
Further Assessment	1. Evaluate impact of the concrete dam on fish passage, as well as impacts upstream such as aggradation and loss of base flow. 2. Evaluate influence of East Windham (Silver Lake) tributary on sediment supply and transport through the reach. 3. Evaluate possibility of improvements to public access. Local resort businesses may benefit from development of fishing access or hiking trails along this reach.

A

B



C

D

E

F

Japanese knotweed

G

H

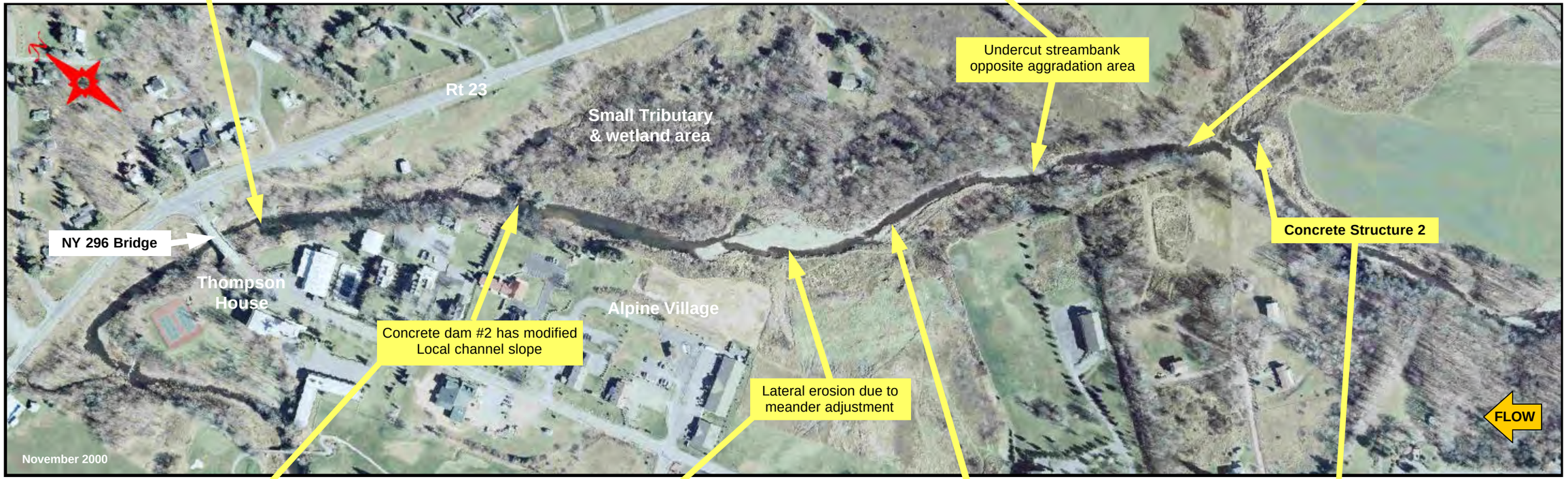
Batavia Kill Stream Management Plan

Figure VI-32a: Reach 3a-Upper


A


B


C




E


F


G


H

Batavia Kill Stream Management Plan

Figure VI-32b Reach 3a-Lower