Lake Churchill Mainstem Stream and Floodplain Restoration

Germantown, Maryland

Background

The Lake Churchill Mainstem is an unnamed, first-order, perennial stream that conveys flow to Lake Churchill in Germantown, Maryland. The stream drains 468 acres of highly developed urban area. Unmitigated runoff from 17 outfalls had severely eroded the stream, degrading the stream banks, exposing sewer lines, and undermining an existing pedestrian trail. The stream had also become the largest contributor of sediment to Lake Churchill, impacting the water quality in the lake.

In 2017, the Churchill Community Foundation, in partnership with the Potomac Conservancy, and with the help of grants from the Chesapeake Bay Trust and the Maryland Department of Natural Resources, initiated the Lake Churchill Mainstem Stream Restoration Project to mitigate stormdrain outfall runoff, reverse stream damage, improve stream hydraulic and geomorphic conditions, and address public safety concerns. The project was completed in 2021 at an approximate cost of $1.5 million. The Foundation will continue to monitor the condition of the stream and the performance of the infiltration and conveyance facilities installed.


Bank erosion due to channel migration


Trail encroached by rip-rap placed at outfall


Untreated stormdrain outfalls


Beaver dam

Stream Condition

Initial field observations revealed that the Lake Churchill Mainstem was a generally aggrading channel with increasing sinuosity; accelerated erosion of the stream in the upstream reaches was depositing sediment in the downstream reaches and raising the elevation of the stream bed. Areas of channel widening and down-cutting were also observed but considered a result of previous stabilization efforts, woody debris jams, changes to the channel resulting from beaver activity, and stormwater infrastructure that was concentrating and deflecting flows. Armored banks in some areas, prevented the stream from migrating and re-establishing a stable planform. The result in some locations was severe bank erosion opposite the armored bank.

Project Goals and Objectives

- Improve stream hydrology, hydraulics and geomorphic conditions
- Re-connect stream to the original floodplain
- Reduce nutrient and sediment loss from bank and channel erosion
- Stabilize stream banks to protect undercut trees and public trail
- Improve in-stream and floodplain habitat and enhance existing wetlands
- Improve riparian vegetation buffer

Quick Facts

Stream Length: 1,700 Linear Feet
Drainage Area: 468 Acres
Impervious: 39%
Stream Use Class: I-P

Restoration design by Charles P. Johnson & Associates, Inc., Greenbelt, Maryland
Construction by Bourn Environmental, Mitchellville, Maryland

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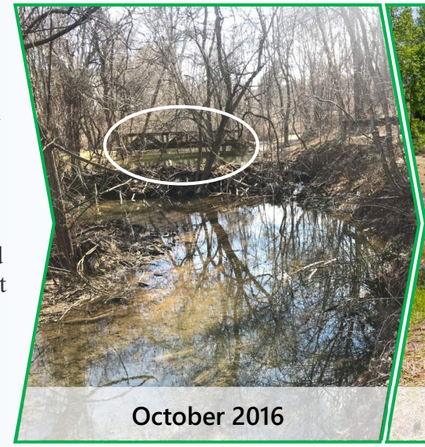
Stream Restoration

Stream Restoration Approach

A natural stream design approach was selected for this project. Grade control logs and constructed riffles were installed to reduce the risk of rilling and potential channel incision. Toe wood was placed on outer banks of meander bends to reduce bank erosion and lateral migration of the channel. Low benches and gentler bank slopes will allow the stream to access the floodplain during large storm events. The stream channel sinuosity was increased where feasible to reduce stream flow velocity and hence reduce erosive stress on stream banks. Overall, the project reused significant amount of woody debris, all stone and streambed material found on site and did not require import of additional fill material.



Stormwater Infiltration and Conveyance Facilities

To mitigate the impact of high energy flows from stormdrain outfalls, a total of four infiltration facilities were constructed along the left bank. The design incorporates vegetated infiltration, shallow wetland pools and sand-filter riffle to capture and dissipate runoff. These facilities are built with layers of filtering materials such as sand, planting media, riffle stone to absorb and filter stormwater runoff. In addition to filtering out pollutants, these facilities also promote the conversion of surface runoff to groundwater, which helps maintain base flow in the stream during dry spells and hence are beneficial to aquatic life.

Infiltration and Conveyance

Trail Improvements and Reforestation

Trail Improvements and Reforestation

Prior to restoration, the public trail was encroached in several locations by stream bank erosion and by riprap placed at stormdrain outfalls, creating concerns for accessibility and public safety. Hence, one of the goals of the project was to create a fully accessible and durable pedestrian trail that would promote recreational use of the stream valley. The proposed trail was relocated on higher ground and five concrete slabs were installed where the trail crosses the newly installed infiltration facilities along the stream. Moreover, 284 native trees and 172 native shrubs as well as 6125 native tubeling, forbs and graminoids were planted within the stream valley. As the trees and plants grow, they will provide shade, shelter and food for aquatic life as well as habitat for land animals. To further ensure public safety, trees at risk of falling were removed.

Project Benefits

- ✓ Pollutant load reductions achieved:
  - **61 tons/yr of sediment**
  - **480 lbs/yr of nitrogen**
  - **67 lbs/yr phosphorus**
- ✓ Dissipating in-stream storm velocities through installation of pool-riffle structures
- ✓ Use of toe wood to create aquatic habitat
- ✓ Reforestation and widening of the riparian corridor using native species.
- ✓ Reduction in sediment loads to Lake Churchill will improve the aquatic habitat and reduce maintenance costs
- ✓ Enhancement of the community recreational amenity that surrounds Lake Churchill and connects to an extensive trail system at Black Hill Regional Park.

CPJ Associates

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