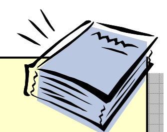
LITTLE CALFPASTURE RIVER BENTHIC TMDL

EXECUTIVE SUMMARY *(DRAFT)*

1.1. BACKGROUND

The Little Calfpasture River (Watershed ID VAV-I32R) is located in Augusta and Rockbridge Counties, Virginia. The Little Calfpasture River drains a land area of 53,395 acres (83 mi^2). This area (the Little Calfpasture River watershed) is mostly covered by forest (86%), with 12% covered by pasture or hay. The Little Calfpasture River flows south and joins with the Calfpasture River near Goshen, Virginia to form the Maury River. The Maury River flows into the James River, which empties into the Chesapeake Bay.



> **Definition:**
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> Watershed – All of the land area that drains to a particular point or water body.

1.2. THE PROBLEM

The Virginia Department of Environmental Quality (VADEQ) sets water quality standards or limits on the amount of pollution that is allowed in rivers and streams. A section of the Little Calfpasture River below the Goshen Dam fails to meet the general standard for aquatic life. This means that the river does not support a healthy and diverse community of bugs and fish. VADEQ conducted a study (called a stressor analysis) to figure out the reasons for this impairment. In general, the study found that the ultimate source of the impairment is the presence of Lake Merriweather and the Goshen Dam. The lake impacts the Little Calfpasture River in many ways, but the study found that the following three stressors were the most significant:

- Change in available food supply – This cause is to be expected when a river (such as the Little Calfpasture River) is dammed to form a lake. Food supplies in a lake are different than those in a stream, and directly below the dam, the available food supply resembles that of a lake more than a stream. This causes filter feeding organisms to dominate and outcompete those that would otherwise form a naturally diverse population. There is no way to correct this problem short of removing the dam, so VADEQ proposed to alter the water quality standard to allow for a zone of recovery below the dam.

- Low dissolved oxygen – During the late summer, low dissolved oxygen has been observed in the Little Calfpasture River below the dam. This condition occurred when very little surface water was coming over the dam spillway, and the majority of downstream flow was coming from an outlet pipe 10 ft deep in the lake. This deep discharge contains almost no oxygen and contributes to low dissolved oxygen downstream. To solve this problem, the Boy Scouts modified the outlet structure in 2009 to receive water from higher in the lake where there is more oxygen. Initial monitoring conducted by VADEQ in August 2009 suggests that this modification has solved the dissolved oxygen problem, but VADEQ will continue monitoring the Little Calfpasture River to ensure that dissolved oxygen standards are met.
- Sediment – High sediment loads from throughout the Little Calfpasture River watershed also contribute to the impairment below the dam. Sediment washed off of the land surface or eroded from the stream banks is transported into the lake during storm events. These high flow events also increase velocities through the lake, which can resuspend additional sediment that was previously deposited in the lake. Erosion of the lake shoreline can also contribute to sediment within the lake if lake levels are lowered prior to the storm event. All of these sources combine to increase suspended sediment concentrations in the lake following storm events. Some of the suspended sediment within the lake is re-deposited within the lake, but much (76% on average) is discharge from the lake through the spillway to the Little Calfpasture River below the dam. This discharge of sediment can persist for days to weeks following storm events. Since this discharge occurs as flows are receding from the event and velocities are decreasing, some of this sediment is deposited on the streambed below the dam. This excess sediment smothers certain bugs that live in the bottom of the stream and limits the diversity of aquatic life. To address this aspect of the impairment,

VADEQ has developed a Total Maximum Daily Load (TMDL) for sediment in the Little Calfpasture River.

1.3. CURRENT SOURCES OF SEDIMENT

Sediment that is accumulated in rivers can come from direct point sources (such as a sewage treatment plant) or from non-point sources, such as general erosion of the land surface. In the Little Calfpasture River watershed, there are very few point sources, so the vast majority of sediment comes from the land surface. This includes a variety of different land uses including pasture, cropland, residential, impervious, and forest areas. Sediment sources would also include stream bank erosion and Lake Merriweather itself. The amount of sediment that comes from each of these sources depends on many factors, such as the soil type, slope, land use, and patterns of precipitation.

> **Definition:**
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> Point Source – pollution that comes out of a pipe (like at a sewage treatment plant).
> Non-point Source – pollution that does not come out of a pipe but comes generally from the landscape (usually as runoff).

To account for these and many other important factors, VADEQ used two computer models (one called the Loading Simulation Program C++ model, or LSPC; and one called the Environmental Fluid Dynamics Computer Code, or EFDC) to track sediment from its source on the land, to the stream, and then downstream to the Maury River. To make sure that estimates from the model were accurate, the model was tested with real-world data. The model was used to predict sediment levels in the Little Calfpasture River from 2000 to 2006, and these predictions were compared to the results of suspended sediment samples collected from the Little Calfpasture River during that time period. Once the model passed this test, it could be used to make predictions about how sediment levels in the Little Calfpasture River might change if we better controlled the various sources of sediment and sediment management within Lake Merriweather.

> **Frequently Asked Question:**
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> *Why use a computer model?*
> Sampling and testing tells you a lot about the present and the past, but nothing about the future. A computer model is a tool that can help you make predictions about the future. This is necessary to figure out how much effort is needed to clean up a stream.

Based on model results, approximately 3395 tonnes of sediment enter Lake Merriweather each year. The majority of this sediment comes from degraded riparian pasture, which is pasture land that is located along the river and its tributaries where cattle have access and where active bank erosion is occurring. While these areas account for only 2% of the land area in the watershed, they account for 52% of the sediment. Measureable amounts also come from upland pasture, cropland, forest, residential, and impervious areas (Figure 0-1). Below Lake Merriweather, almost all of the sediment in the Little Calfpasture River comes from the lake. This makes the lake a secondary source of sediment, passing through and resuspending sediment that had earlier entered the lake. The study found that the load of sediment discharged following a storm event was dependent upon the magnitude of the storm, but on average 76% of incoming sediment was transported downstream. The study also found that sediment discharge periods below the lake were more extended than above the lake, lasting up to 8 days following storm events. This extended duration of high solids events below the dam explains the observed pattern of solids in the Little Calfpasture River and a majority of the aquatic life impairment.

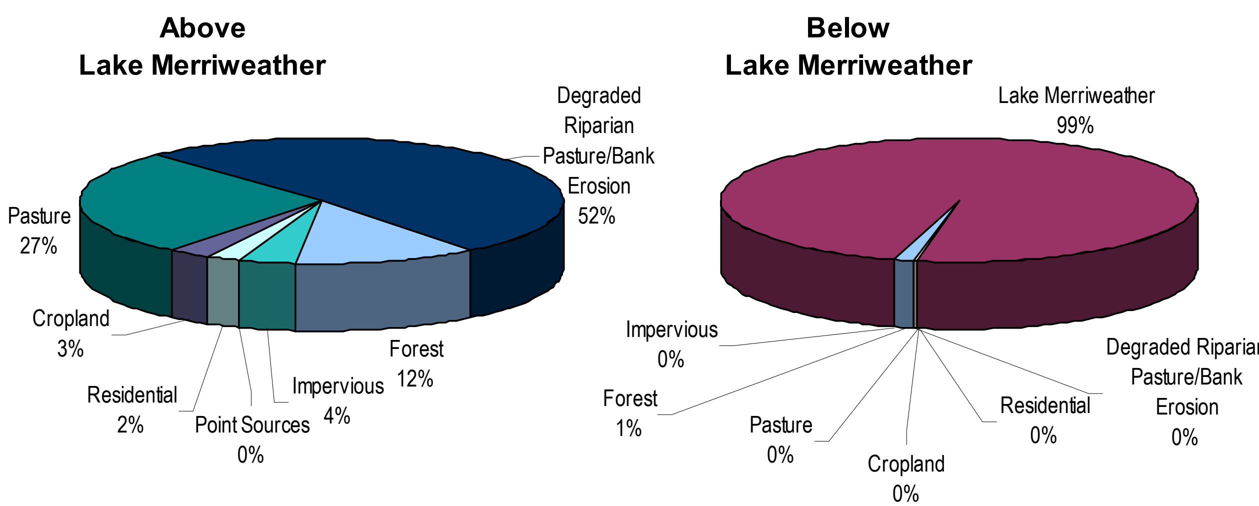

Figure 0-1. Sources of Sediment to the Little Calfpasture River.

1.4. FUTURE GOALS (THE TMDL)

After figuring out where the sediment in the Little Calfpasture River is currently coming from, the computer model was used to figure out how much sediment loads need to be reduced to clean up the Little Calfpasture River. The goal was to reduce sediment loads to 2001 levels, when downstream aquatic life met the state's standards. To do this, 40% reductions in sediment will be needed from cropland, pasture, residential, and urban lands; 66% reduction will be needed from degraded riparian pasture; and 34% reductions from improved lake sediment management will also be needed (Table 0-1). This report does not prescribe a single strategy for lake sediment management, but will allow various options to be investigated during implementation planning. This report does, however, emphasize the importance of a reduction strategy that includes both reductions in sediment sources throughout the watershed, and reductions coming from lake sediment management.

Definition:

TMDL – Total Maximum Daily Load. This is the amount of a pollutant that a stream can receive and still meet water quality standards. The term TMDL is also used more generally to describe the state's formal process for cleaning up polluted streams.

If the reductions specified in Table 0-1 are made, sediment loads will be reduced to below the 2001 levels (1198 tonnes/yr), and aquatic life should be restored. This reduced amount, known as the total maximum daily load (TMDL), is the maximum amount of sediment that can enter the Little Calfpasture River and still meet water quality standards. A small portion of this amount (30.4 tonnes /yr) is reserved for permitted discharges in the area (point sources), but most of the amount accounts for sediment from runoff and sources that do not come out of a pipe (nonpoint sources) (Table 0-2).

Table 0-1. Sediment Reductions Needed to Restore the Little Calfpasture River.

Source	Sediment Reductions Needed to Restore Water Quality
Forest	0%
Cropland	40%
Pasture	40%
Residential land	40%
Urban/Commercial/ Transportation	40%
Degraded Riparian Pasture	66%
Permitted Point Sources	0%
Lake Sediment Management	34%

Table 0-2. Total Maximum Daily Load of Sediment in the Little Calfpasture River that will Meet the Water Quality Standard.

Stream	Amount from Permitted Point Sources (WLA) (tonnes/yr)	Amount from Nonpoint Sources (LA) (tonnes/yr)	Margin of Safety (tonnes/yr)	Total Maximum Daily Load (tonnes/yr)
Little Calfpasture River (VAV-I32R)	30.4	1107.6	60	1198

1.5. WHAT HAPPENS NEXT

VADEQ will ask for public comment on this report and then submit it to the U.S. Environmental Protection Agency (USEPA) for approval. This report sets the clean-up goal for the Little Calfpasture River, leading to the next step a clean-up plan (or Implementation Plan) that lays out how that goal will be reached. The clean-up plan will set intermediate goals and describe actions that should be taken to clean up the Little Calfpasture River. Many of these actions are obvious and can be taken right now to reduce sediment and improve the health of the Little Calfpasture River. Some of these actions are listed below:

- Fence out cattle from streams and provide alternative water sources
- Leave a band of 35 – 100 ft along the stream in a natural condition so that it buffers or filters out sediment from farm or residential land (a riparian buffer)
- Practice conservation tillage practices
- Better manage sediment within Lake Merriweather
- Operate the dam in accordance with dam operation protocol and VADEQ consent order

These and other actions will be listed in the clean-up plan with associated costs and how much of each action it will take to meet the goals. The clean-up plan will also identify potential sources of money to help in the clean-up efforts. Most of this money will probably be available in the form of cost-share programs, which share the cost of improvements with the landowner. Please be aware that the state or federal government will not fix the problems in the Little Calfpasture River. It is primarily the responsibility of individual landowners and local governments to take the actions necessary to improve the river. The state agencies will help with developing the plan and finding money to support the plan, but actually making the improvements is up to those that live in the Little Calfpasture River watershed. By increasing education and awareness of the problem, and by working together to each do our part, we can make the changes necessary to improve the Little Calfpasture River.

> **Frequently Asked Question:**
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> *How will the TMDL be implemented?* For point sources, TMDL reductions will be implemented through discharge permits. For nonpoint sources, TMDL reductions will be implemented through best management practices (BMPs). Landowners will be asked to voluntarily participate in state and federal programs that help defer the cost of BMP installation.