BIRD RIVER WATERSHED WATER QUALITY MANAGEMENT PLAN

Executive Summary

Prepared for:

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EXECUTIVE SUMMARY

The Bird River is located in southeastern Baltimore County, Maryland (see Figure 1-1). The Bird River, and Gunpowder Falls to the north, are the two main tributaries to the Gunpowder River. Surface water flow to the Bird River is primarily provided by Whitemarsh Run and its tributaries: North Fork, South Fork, and Honeygo Run. Another significant Bird River tributary is Windlass Run. The total watershed area is approximately 26 square miles (16,500 acres). For the purposes of this study, the watershed was divided into eleven subareas (see Figure ES-1). The western-most headwaters are located near the intersection of Harford Road and Interstate 695. Historically, the Bird River and its tributaries have been substantially impacted by sand and gravel mining and land development. These impacts have included loss of natural habitat, stream channel erosion, flooding, increased sediment and nutrient pollutant loads, and sedimentation of the Bird River estuary. Recognizing the environmental and economic significance of these impacts, Baltimore County has initiated a multi-faceted program to correct these problems in the Bird River watershed and similar problems in other watersheds in the County.

The objective of this plan is to assist the Baltimore County Department of Environmental Protection and Resource Management (DEPRM) in the identification and evaluation of water quality problems in the Bird River watershed, and the designation of appropriate control measures to prevent, eliminate or reduce these problems in the watershed.

Five major tasks were undertaken in the development of the Bird River Watershed Water Quality Management Plan:

1. Characterization of the watershed;
2. Identification, assessment, and ranking of water quality problems through field surveys;

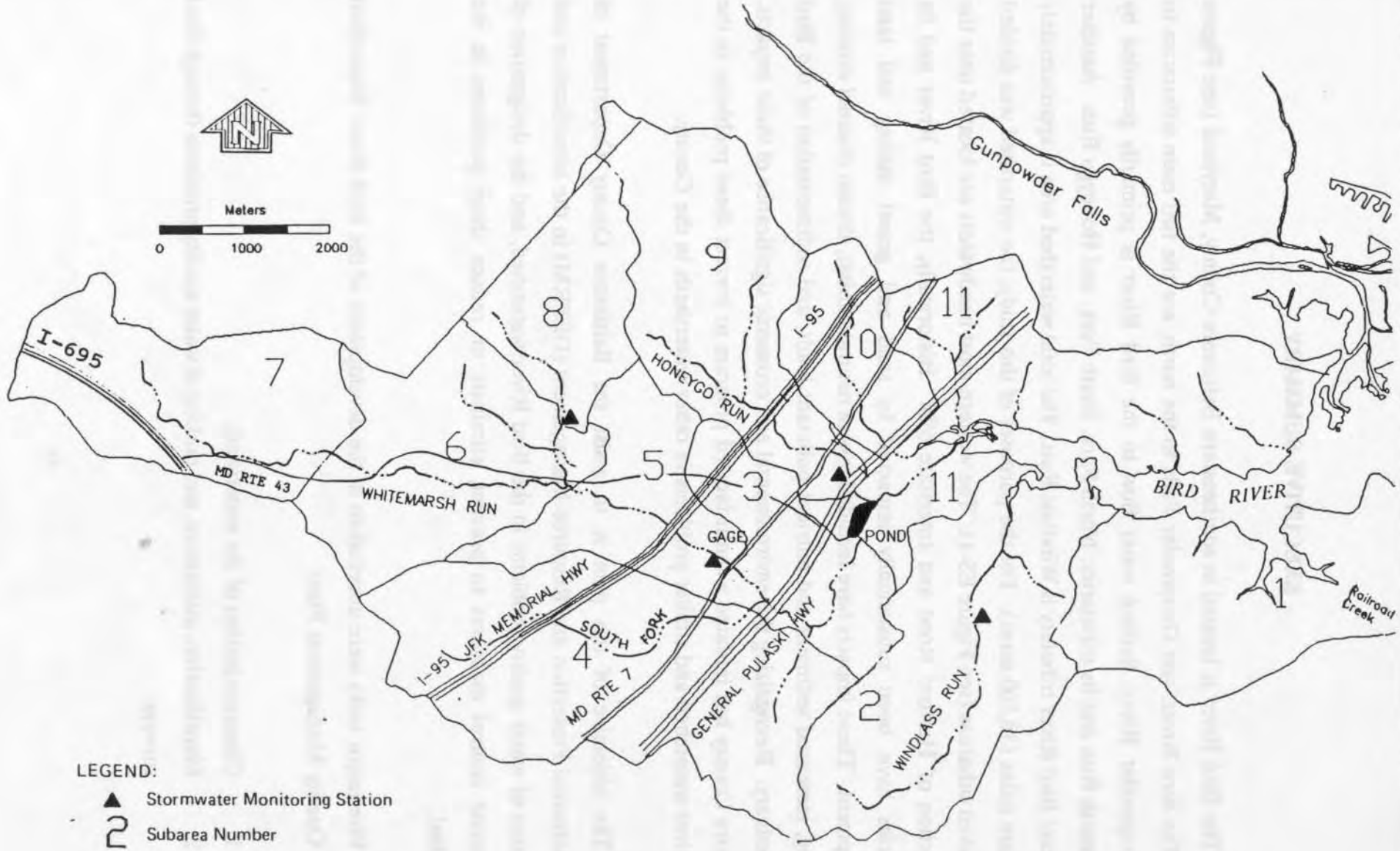

FIGURE ES-1
MAP OF THE BIRD RIVER WATERSHED
AND SUBAREAS

Dames & Moore

3. Water quality monitoring at four automatic sampling stations located on the tributary streams and at four stations located on the Bird River estuary, as well as water quality modeling;
4. Identification and evaluation of potential water quality control measures; and
5. Prioritization or ranking of control measures and development of an implementation strategy.

The most widespread land uses (1989) in the watershed are forested land and agriculture measuring 5,571 acres (34 percent) and 3,078 acres (19 percent), respectively. Residential ¼-acre lots, exposed soil and undeveloped open space are also prevalent in the watershed with acreages ranging from 1,342 to 1,564 acres (8 to 9 percent). The least common land uses include paved surfaces and 1-acre residential lots at 171 and 661 acres (1 and 4 percent), respectively. Development under the County's 1989-2000 Master Plan will result in significant shifts in land use. The dominant land uses will shift from forested land and agriculture to ¼-acre residential lots and commercial/industrial. The ¼-acre residential lot category will increase from 1,564 acres to 5,045 acres (9 to 31 percent) and commercial and industrial will increase from 865 acres to 4,070 acres (5 to 25 percent). Correspondingly large decreases in agriculture and forested land will occur as a result of this development. Agriculture will decrease from 3,078 to 637 acres (19 to 4 percent) and forested land will decrease from 5,571 acres to 1,573 acres (34 to 10 percent). Overall, the watershed was approximately 40 percent developed in 1989 and will increase to 80 percent developed under the 1989-2000 Master Plan. (This analysis does not consider the Master Plan amendments made to the Honeygo area in 1994.) Nevertheless, these can be considered significant changes that have the potential to cause serious deleterious effects if substantial stormwater controls are not implemented.

Additionally, this shift in land use under the Master Plan will dramatically increase nutrient loads to the Bird River Estuary, subsequently leading to worsening water quality conditions. Stormwater and estuary monitoring was conducted during 1991 to determine existing water quality conditions and to provide baseline data for future evaluations during

and following implementation of water quality control measures. Stormwater monitoring equipment was installed to collect water samples and measure flow rates at the following locations in the watershed:

North Fork at Beaconsfield Drive;
Whitemarsh Run at Route 7;
Honeygo Run at Route 40; and
Windlass Run at Bird River Road.

Average storm pollutant loads and average unit pollutant loads (lb/mi^2) were calculated and demonstrate that the highest contributors of pollutants on a lb/mi^2 basis are Honeygo Run and North Fork, while the lowest contributors are Windlass Run and Whitemarsh Run. Unit pollutant loads from North Fork are 3.2 to 9.1 times higher than unit pollutant loads from Windlass Run.

Chlorophyll a, a measure of algal growth in water, was monitored at four locations in the Bird River estuary. The chlorophyll a concentrations in the estuary range from 140 micrograms per liter (ug/l) at E-4 to 72.6 ug/l at E-1. Chlorophyll a concentrations should be below 15 ug/L to be indicative of healthy conditions. High concentrations of chlorophyll a result in low transparency, which limits the habitat for submerged aquatic vegetation (SAV) which is important to the survival of a wide range of aquatic organisms.

The modeling efforts for this study consisted of watershed modeling using SWMM and estuary modeling using WASP for both existing and future land use conditions. The SWMM model projects that stormflows and the pollutant loads for nutrients, biochemical oxygen demand, bacteria and zinc will increase substantially under future conditions. Total suspended solids will decrease, however, because of decreases in agricultural, construction and mining activity. The WASP model also projects that nutrient concentrations will increase in the Bird River estuary under future land use conditions. Dissolved oxygen may also become slightly depressed in the upstream reaches of the estuary.

The stream surveys, and the watershed and estuary monitoring and modeling data, strongly support the need for a nutrient and sediment reduction strategy for the Bird River watershed. Continued monitoring is recommended at two of the four tributary monitoring stations for one to two years to provide an adequate long-term description of existing conditions. After this data set is collected, the monitoring program could be modified to monitor the effectiveness of best management practices installed in the watershed.

Based on the activities that were completed for this study, the general ranking of problems in the entire watershed from highest to lowest is:

1. Stream channel instability,
2. High percent watershed imperviousness,
3. Elevated pollutant loads,
4. Unforested riparian buffer,
5. Mining impacts,
6. Agricultural impacts,
7. Man-made fish migration barriers, and
8. Unauthorized wastewater discharges.

These problems are discussed below.

1. Stream channel instability is the most significant problem in the Bird River watershed. On a watershed-wide basis, approximately 67 percent of the surveyed channels characterized have been identified as unstable[1]. Approximately 85,000 feet of surveyed channel have been classified under the Rosgen stream classification system as "F" class, and approximately 2,800 feet have been so disturbed and cannot

[1] These summaries of stream channel conditions only apply to the sections of stream channel that were surveyed during the execution of this watershed study. Although the inventory of surveyed stream channels is extensive, certain channels, particularly those of first order streams, were not surveyed due to resource constraints. These data summaries, therefore, may not be representative of first order and other stream channels that were not surveyed.

be classified. In addition, approximately 8,600 feet of moderate and severe streambank erosion are present in the watershed. Debris blockages and streambank disturbances are also high in several subareas. From a stream channel stability perspective, the subareas may be ranked from worst to best as follows: Subareas 4, 9, 6, 7, 3, 8, 5, 10, 11, 2, and 1.

2. The high percentage of imperviousness in the watershed is the next most significant problem in the Bird River watershed. Approximately 14 percent of the watershed is currently impervious. This factor will increase to 40 percent under future land use conditions. From a percent imperviousness perspective, the subareas may be ranked from worst to best under existing land use as follows: Subareas 7, 8, 5, 4, 6, 3, 11, 10, 9, 1, and 2. Under future land use, the rankings would be: Subareas 5, 3, 4, 10, 6, 7, 8, 2, 9, 11, and 1.

3. Elevated pollutant loading as predicted by the SWMM model is the next most significant problem on a watershed-wide basis. Using total phosphorus (TP) as an indicator parameter, the existing TP load is 1.88 pounds per acre per year (lbs/ac/yr). Under future land use conditions, this factor will increase substantially to 3.60 lbs/ac/yr. From a pollutant loading perspective, the subareas may be ranked from worst to best under existing land use as follows: Subareas 7, 5, 8, 4, 6, 3, 11, 10, 1, 9, and 2. Under future land use, the rankings would be: Subareas 5, 4, 3, 10, 6, 7, 8, 9, 2, 11, and 1.

Nutrient and sediment loads from the agricultural and urbanized subareas of the Bird River watershed are having a detrimental effect upon water quality in the streams and estuarine waters of the Bird River.

Development of the Bird River watershed according to the Master Plan without stormwater management controls would result in a doubling of nutrient loads to the Bird River estuary. With stormwater controls complying with existing stormwater

management regulations, a 37 percent increase in Total Phosphorus (TP) loads to the estuary will result.

Water quality in the estuary is negatively affected by non-point source pollutant loads from the Bird River watershed. The average chlorophyll a concentration from four estuary monitoring stations ranged from 73 to 140 ug/l. Healthy conditions in estuaries are typically observed when chlorophyll a concentrations are below 15 ug/L. Because estuary water quality is negatively affected by existing nutrient loads, and future development will increase nutrient loads to the estuary, water quality conditions in the estuary can be expected to worsen with additional development without additional stormwater controls.

4. The next most significant problem in the Bird River watershed is unforested riparian buffers. Currently, approximately 41,350 feet of riparian buffer is unforested. This represents 16 percent of all streambank. The subareas may be ranked from worst to best from an unforested buffer perspective as follows: Subareas 6, 5, 4, 9, 8, 3, 2, 10, 7, 1, and 11. This ranking has been based on feet of unforested buffer rather than percent of a subarea's buffer that is unforested.

5. Although mining has had a significant impact on a few sub-watersheds in the past, mining has had moderate impacts on the Bird River watershed as a whole and is considered to be the next most serious problem in the watershed. These impacts have included increased sediment loads and channel erosion, channel destruction, and loss of riparian buffer. The subareas may be qualitatively ranked from worst to best from a mining impact perspective as follows: Subareas 5, 3, 4, 6, 9, 10, and 8. Subareas 1, 2, 7, and 11 have been minimally affected by surface mining activities.

6. Agricultural activities have also had moderate impacts on the Bird River watershed and are considered the next most serious problem in the watershed. These impacts have included increased sediment and nutrient loads and channel erosion. The

subareas may be qualitatively ranked from worst to best from an agricultural impact perspective as follows: Subareas 9, 10, 6, 4, 11, 1, 2, 3, 5, 7, and 8. Subareas 7 and 8 have been largely developed and are no longer affected by agricultural activities.

7. Man-made fish migration barriers are common throughout the watershed and are a concern if river herring are to return to large portions of the Bird River watershed. The subareas may be qualitatively ranked from worst to best from a fish barrier perspective as follows: Subareas 3, 5, 6, 10, 9, and 8. This ranking is based on a downstream to upstream progression beginning with the mainstem of Whitemarsh Run, and then with the tributary streams. The barriers must be removed in a downstream to upstream progression to facilitate fish movements up the watershed.

8. The final water quality and habitat problem that has been ranked in the watershed is unauthorized wastewater discharges. These unauthorized discharges are not a significant problem from a watershed-wide perspective, but need to be addressed in several isolated locations of a few subareas. These subareas include 9, 6, and 2.

Watershed and stream restoration measures were evaluated after the water quality and habitat problems had been defined, summarized and ranked. This evaluation was based on three primary goals:

1. Restore stream stability, reduce stream erosion and improve fish and wildlife habitat in the non-tidal portions of the Bird River watershed;

2. Reduce nutrient inputs to the tidal river and to the Chesapeake Bay for the purpose of increasing the quality of habitat for submerged aquatic vegetation (SAV) and other aquatic life; and

3. Reduce sediment inputs to the tidal river to minimize the need for periodic dredging of the recreational boat channel and to increase the quality of habitat for SAV and other aquatic life.

Initially, five case study areas in the watershed were evaluated as part of the study. The case study areas were selected by Baltimore County DEPRM as being generally representative of water quality and habitat problems in the watershed. The case study areas included:

1. Whitemarsh Run upstream of Harford Road
2. Whitemarsh Run from Route 1 to Perry Hall Boulevard
3. Whitemarsh Run from Perry Hall Boulevard to I-95
4. South Fork of Whitemarsh Run between Route 7 and Route 40
5. Honeygo Run from I-95 to Route 7

Since these case study areas encompass the majority of the problems in the watershed, the restoration options that were developed for them were used to prepare integrated restoration plans for each of the eleven subareas in the watershed. The options that were considered included stream- and source-based controls.

Stream-based controls can facilitate a self-maintaining system that is neither aggrading or degrading, has adequate bedload, builds and maintains point bars, and provides aquatic habitat and water quality enhancement. These controls were selected on the basis of Rosgen's evolutionary approach to stream restoration, and include reestablished sinuosity, stable channel geometry, overbank floodplain, and bank armoring.

Source-based water quality control measures (stormwater management facilities such as end-of-pipe BMPs and ponds) can significantly reduce pollutant loads. Total phosphorus loads can be reduced by 24 percent if end-of-pipe and headwater regional

ponds are constructed. Empirical relationships between phosphorus loading and estuary water quality suggest that phosphorus loads should be reduced by 82 percent to achieve acceptable water quality in the Bird River. The end-of-pipe BMPs and headwater regional ponds can also result in achievement of the 40 percent nutrient reduction goal of the Chesapeake Bay Agreement. The 40 percent goal is for the controllable load, which is the difference between the total load and the base load that would be present if the entire watershed was forested.

Recommended controls for the eleven subareas include:

Restoration of Rosgen "F" class channels to "C" and "B" class channels, and certain "D" class channels to "C" class channels.

Reforestation of existing riparian buffers.

Removal of man-made fish migration barriers.

Construction of small BMPs at the outfalls of storm drains where suitable space is available. These are referred to as end-of-pipe BMPs.

Retrofits of existing dry ponds that currently do not have significant pollutant removal capability. The retrofit will increase pollutant trap efficiency through modifications of the outlet riser and/or wetlands plantings.

Repair or expansion of existing regional BMPs.

Implementation of agricultural BMPs.

Elimination of unauthorized residential and industrial point discharges, and the repair of failing septic systems.

Increased public involvement in activities such as streambank restoration and protection, and decreased use of lawn and garden pesticides and fertilizers.

These controls will reduce the existing total phosphorus load by 7,367 lbs/yr, which is very close to the 40 percent pollutant reduction goal of the Chesapeake Bay Agreement. The estimated construction costs for the eleven subareas are summarized in Table ES-1.

Table ES–1
Summary of Estimated Costs for Source– and Stream–based Controls

Subarea	Construction Cost of Source–based Controls	Construction Cost of Stream–based Controls (a)	Total Construction Costs
1	$0	$4,000	$4,000
2	$0	$7,000	$7,000
3(b)	$194,000	$1,227,000	$1,421,000
4	$1,089,000	$2,770,000	$3,859,000
5	$485,000	$768,000	$1,253,000
6	$170,000	$1,899,000	$2,069,000
7	$1,542,000	$1,737,000	$3,279,000
8	$614,000	$1,687,000	$2,301,000
9	$229,000	$2,285,000	$2,514,000
10	$86,000	$392,000	$478,000
11	$156,000	$3,000	$159,000
Totals:	$4,565,000	$12,779,000	$17,344,000

(a) Includes cost to re–establish forested stream buffers.
(b) Add $800,000 if regional pond at Ebenezer Road is included.

Additional controls will also be required under future land use conditions to achieve the 40 percent goal. Three options are presented to achieve the 40 percent reduction goal. These options are:

1. Construction of additional regional BMPs in the lower portion of the Whitemarsh Run watershed.

2. Requirement for more effective stormwater management measures for existing development. These requirements could include the use of two-cell ponds, or revising the return period requirement.

3. Downzoning of planned land use so that pollutant loads from future development are not as high as anticipated.

The recommended source-based control for future development is a flexible approach that would allow either more effective stormwater management controls for future development or payment of a fee to Baltimore County for construction of more regional controls. The stormwater management design methods presented in Wilcock, et al. (1990) should be required for all future development unless the developer pays a fee-in-lieu of more strict stormwater management. Details on this recommendation are presented in Section 10.3.

Conclusion

The Bird River watershed has been impacted significantly by past decades of development. Future land use changes suggest continued degradation that will prevent the restoration of healthy riparian and estuarine systems. Baltimore County will need to implement the stream- and source-based controls that are recommended by this plan in order to reduce non-point source pollution in accordance with federal mandates and its partnership with the State of Maryland for the restoration of the Chesapeake Bay.