Total Maximum Daily Loads for the Mill Creek Basin

Final Report

prepared by

Ohio Environmental Protection Agency
Division of Surface Water

with contributions by

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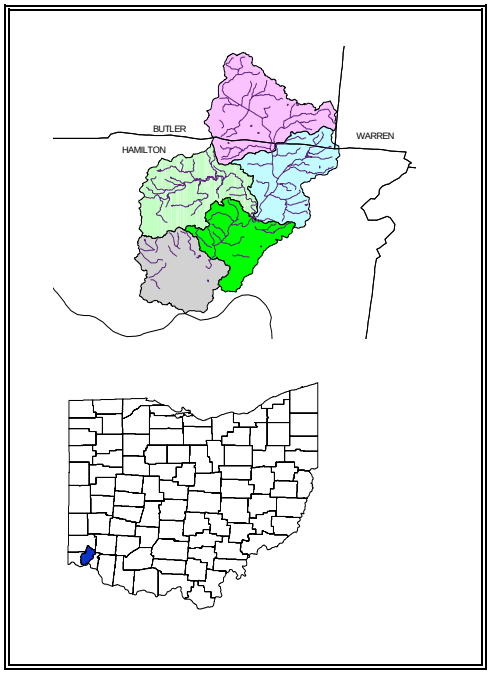

The TMDL in Brief:

Basin:	Mill Creek watershed in the Ohio River Basin
Study Area:	From the headwaters in Butler County to the confluence with the Ohio River, including the Cincinnati urban area
Goal:	Attainment of Aquatic Life Uses
Causes:	Basinwide: phosphorus, nitrogen, habitat modifications; sub-watersheds have additional causes, Table 1.
Sources:	Municipal & Industrial discharges, combined & sanitary sewer overflows, urban & agricultural runoff, onsite sewage systems, construction, hydromodification and channelization.
Measure:	Long-term attainment of biological WQS
Restoration Options:	Reduction of loadings, and increase in the ability of streams to assimilate pollutants, including improving habitat

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EXECUTIVE SUMMARY

Section 303(d) of the Clean Water Act and Title 40 of the Code of Federal Regulations Part 130 require states to develop total maximum daily loads (TMDLs) for waters not meeting designated uses under technology-based controls for pollution. The TMDL process quantitatively assesses the impairment factors so that states can establish water-quality based controls to reduce pollution from both point and nonpoint sources, and to restore and protect the quality of their water resources.

Mill Creek in Butler and Hamilton Counties, Ohio, was identified as a priority impaired water, initially on the 1998 303 (d) list, based on monitoring results from 1992 and earlier biological and water quality survey data. Requirements to develop a TMDL for Mill Creek resulted from the watershed initially being listed on the 1998 303 (d) list. Data collected in 1997 and 2002 confirmed the impairment conditions, and the watershed continues to be listed on the 2004 303 (d) list.

Ten waterbodies in the Mill Creek watershed are listed in the 1998 303 (d) list. These waterbodies are impaired by various pollutants including nutrients, ammonia, unknown toxicity, several metals, oil and grease, organic enrichment/dissolved oxygen, pesticides, priority organics, contaminated sediments, habitat modification, siltation and suspended solids. Six of the ten waterbodies listed in the 1998 303 (d) are addressed by this TMDL. Two of the other waterbodies, Sharon Creek and Winton Woods Lake, require additional chemical and field data to complete TMDLs. The habitat modifications of Bloody Run are so severe that restorability is listed as essentially none. Two of the six waterbodies listed in this TMDL are described as West Fork Mill Creek and were given different identification numbers in the 1998 303 (d) list. In actuality, these are the same stream. West Fork Mill Creek was biologically surveyed during three separate years. During computer entry of the data, an error occurred and an incorrect identification number was assigned. In reality, the total number of waterbodies that should have been listed in the 1998 303 (d) list for the Mill Creek watershed is nine, not ten.

In addition to the chemical and biocriteria impairments documented in the Mill Creek watershed, other environmental and recreational issues are also of concern: 1) An “all fish species” consumption advisory was issued by the State of Ohio, recommending only one meal per month is consumed for fish caught from landmark I-275 to the confluence with the Ohio River due to PCB contamination; 2) Bacteria exceedences of recreational use criteria are of major concern, although this was not included in the 1998 303 (d) list because of database entry problems, it is listed on the 2004 303 (d) list; 3) Subsequent sampling in 1997 and 2002 indicated flow and habitat alteration, urban runoff and flashy urban flows are also of concern. The variety of pollutants of concern is dependent on location of the sub-waterbody within the watershed. Common parameters of concern throughout the majority of the watershed are nutrients (phosphorus and nitrogen), which exceed expected levels for streams in the Interior Plateau ecoregion (Ohio EPA, 1999); bacteria, which exceeded the State standards of Primary and Secondary Contact recreation waters; and habitat modifications. Restoration of Mill Creek will be phased in by initially addressing phosphorus and nitrogen as parameters that encompass the majority of the watershed. Other contaminants will be addressed at later phases of the TMDL process as the restoration of the watershed progresses during subsequent years.

Approximately 20 facilities in the watershed hold National Pollutant Discharge Elimination System (NPDES) permits (see Appendix for details). The largest of these facilities is the Butler County Upper Mill Creek Water Reclamation Facility, discharging approximately 8 million gallons per day. Butler County has been given approval to expand this operation to discharge 16 million gallons per day.

Approximately 100 residences have on-site, non-mechanical sewage systems in the Upper Mill Creek sub-watershed in Butler County. None of the systems is known to have discharges. In Hamilton County, 1541 homes have on-site sewage systems in Mill Creek watershed which are authorized by the Hamilton County and City of Sharonville Departments of Health. Although the watershed is dominated by urbanization, agricultural activities, including smaller livestock operations, exist in the of the watershed. The lower section of the Mill Creek watershed is industrialized and several former landfills line the banks of streams. Ninety-eight documented combined sewer overflows and 48 documented sanitary sewer overflows discharge to the Mill Creek mainstem and its tributaries. Urbanization dominates the watershed with impervious surfaces, and development encroaches into the flood plain. Storm water controls in many areas have been minimal to nonexistent during construction and have deposited significant amounts of silt into the waterways.

The stream channel has been modified in some areas numerous times to accommodate development, promote drainage and control flooding. U.S. Army Corps of Engineers (USACOE) is again evaluating a flood damage reduction project for the watershed in Hamilton County. The General Reevaluation Report for the flood reduction strategy should be available for public comment in December 2004.

Very strong stakeholder participation existed in the Mill Creek watershed prior to Ohio EPA's activities in the official TMDL process. The Mill Creek Watershed Council was established in 1995, after the results of the 1992 Ohio EPA survey of the watershed were released, with goals of protecting and restoring Mill Creek. Local organizations (Rivers Unlimited, Mill Creek Restoration Project, Hamilton County Environmental Action Commission, Butler County Department of Environmental Services, Butler Soil and Water Conservation District, Ohio-Kentucky-Indiana Regional Council of Governments, Hamilton Soil and Water Conservation District, Metropolitan Sewer District of Greater Cincinnati, Hamilton County General Health District, and many others) have participated in environmental education programs and restoration activities since the middle 1990s. The Hamilton County Park District has participated in education activities and received a Section 314 Clean Lakes grant for the Winton Lake watershed in the late 1980s. Many of these organizations are partners in the Mill Creek Watershed Council. Habitat enhancement, restoration projects, and a Greenways Master Plan have been developed by stakeholders, with some of these activities already implemented. The watershed council is working with stakeholders to develop Watershed Action Plans for several of the subwatersheds in the basin to address nonpoint source pollution and habitat issues. The *Upper Mill Creek Watershed Action Plan* (UMCWAP) was drafted by stakeholders working with Mill Creek Watershed Council and submitted to Ohio Department of Natural Resources and Ohio EPA in October 2003. The Council has received 319 funds to complete revisions of the UMCWAP and will move forward to finalize this document in 2004.

Table 1. Components of the Mill Creek TMDL process	
Study Area	Mill Creek from headwaters in Bulter Co. to confluence with the Ohio River in Hamilton Co.
303 (d) listed Segments	OH62 23 Mill Creek (*West Fork Mill Cr. to Ohio River*) OH62 30 Mill Creek (*headwaters to Sharon Creek*) OH62 27 Mill Creek (*Sharon Creek to West Fork Mill Creek)* OH62 31 East Fork Mill Creek OH62 26 West Fork Mill Creek *(upstream*) OH62 24 West Fork Mill Creek (*downstream*) OH62 28 Sharon Creek OH62 23.2 Bloody Run OH62 26-166 Winton Woods Lake
Target Identification	Applicable biological and habitat indices (i.e., IBI, ICI, QHEI). Phosphorus target values for Interior Plateau Ecoregions: Warmwater Habitat (WWH) recommendations. Nitrite-Nitrate target values for Interior Plateau Ecoregions: WWH recommendations
Applicable Water Quality Standards (WQS)	*OAC 3745-1-04* Free-from suspended solids and other substances that enter the waters as a result of human activity and that will settle to form objectionable sludge deposits, or that will adversely affect aquatic life. Free from nutrients entering the waters as a result of human activity in concentrations that create nuisance growths of aquatic weeds and algae. *OAC 3745-1-07* Ecoregion Biocriteria, refer to Table 3. *OAC 3745-1-30* Mill Creek Drainage Basin rule *OAC 3745-1-34* Water Quality Criteria for the Ohio River Drainage Basin
Current Deviation from Target	Exceedences of recommended nutrient concentrations (Tables 9 and 10). Exceedences of the biocriteria have also been evaluated (Table 3).
Sources	Municipal and other sewage treatment plants, combined and separate sewer overflows, urban runoff, landfills, land disposal, industrial point sources, construction, land development/suburbanization, on site sewage systems, channel modification
Load Allocations	Discussed in Section 4.
Critical/Season Conditions	Summer conditions of higher temperatures and lower flows are the critical conditions. Annual loads were used to determine the TMDL.
Safety Margin	Implicit in calculations
Implementation Plan	Summaries of potential implementation plans are listed in the executive summary. Ohio EPA has regulatory authority over the NPDES issues only, and therefore will work with the local agencies, communities and watershed groups for implementation of additional plans outside Ohio EPA's regulatory authority.
Validation	Tiered approach to validation; assessment progression includes: 1. Confirmation of completion of implementation plan activities 2. Evaluation of attainment of chemical water quality criteria 3. Evaluation of biological attainment
Public Participation	Coordinated by Ohio EPA, Mill Creek Watershed Council and Watershed Council partners; ongoing; increased involvement in implementation phases.

1.0 INTRODUCTION

The Total Maximum Daily Loads (TMDL) process, as established by the Clean Water Act (CWA), is a method for identifying and restoring impaired waterbodies. The CWA Section 303(d) and Title 40 of the Code of Federal Regulations Part 130.7, direct each State to identify and prioritize water quality limited segments for which pollution controls required by local, State or Federal authority are not stringent enough to achieve applicable water quality standards (WQS). Further, TMDLs for pollutants from point and nonpoint sources that prevent the identified segments from attaining WQS must be established. TMDLs are quantitative assessments of water quality problems contributing to the impairment of these segments.

The Mill Creek watershed was identified as a priority impaired water on Ohio's 1998 303(d) list and in subsequent submissions of the list. Biological and chemical stream surveys indicate nutrients, bacteria, organic enrichment, organic chemical pollutants, metals and habitat alterations are some of the primary causes of impairment in the watershed. This TMDL report focuses on nutrients (phosphorus and nitrogen).

A number of factors signal the need for a creative solution to the impairments of the Mill Creek watershed and the possibility of the solution coming to fruition:

- an excessive amount of nutrients (phosphorus and nitrogen)
- poor stream habitat that compounds the unwanted consequences (degraded fisheries) of elevated nutrients
- large established urbanized/industrial areas
- rapidly developing urbanization of the upper watershed
- stream monitoring that reflects the presence of high nutrient concentrations, compromised stream habitat conditions in some areas, and associated biological impacts
- existing water quality criteria in the State's Water Quality Standards (WQS, administrative regulations) for nitrogen and phosphorus do not effectively address these problems
- local parties interested in planning and carrying out necessary nutrient reductions and stream habitat restoration plans.

Ohio EPA is using the State's biological criteria for aquatic life uses as the implementing tool to complete a TMDL in the Mill Creek basin. Biological criteria are direct measurable end points that determine whether a stream can support the healthy community of fish and macroinvertebrates expected in Ohio streams that are not adversely impacted by pollution. Where biological criteria indicate the presence of pollution from nutrients, a flexible approach that includes intermediate nutrient targets is needed. These targets represent "no effect" or "no impact" based concentrations that have been associated with aquatic life use attainment. In most situations, higher concentrations of nutrients can reasonably be expected to carry an increasing risk of impaired biological communities and failure to attain the respective aquatic life use. However, the nutrient targets are only suggested guidelines, and a variety of factors are considered in selecting a specific nutrient target used in the TMDL process.

The presence of a locally-based watershed group, in this case the Mill Creek Watershed Council and its partners, that participate in developing a phased-in time frame to achieve necessary nutrient load reductions from a variety of sources, is key to the success of this flexible approach.

A phased approach (Table 2) to reaching the final TMDL nutrient target values can allow time for locally initiated nonpoint source controls and habitat/riparian restoration to be put in place in addition to nutrient reduction at local wastewater treatment facilities. If these are successful in mitigating the adverse impacts of elevated nutrient concentrations, the biological criteria end points will respond.

Table 2. Phasing of TMDL in the Mill Creek watershed.

Year	Action or Phase *	Loading Reduction(kg/yr)
2000	Completion of Lower East Fork Mill Creek habitat restoration project by Butler County	
2001	Beginning of the process for Development of Watershed Action Plans by Mill Creek Watershed Council	
2002	Ohio EPA Stream Assessment to evaluate Lower East Fork Mill Creek habitat restoration project	
2003	Ohio EPA Stream Assessment based on 2002 results to evaluate Mill Creek attainment.	
2004	Projected completion of the *Upper Mill Creek Watershed Action Plan*	
2006	If biological attainment not documented from the 2003 assessment, then both Glendale and Butler County will be required to reduce nutrient NPDES permit limits to **1 mg/l** Total Phosphorus and **5 mg/l** Dissolved Nitrogen at their Mill Creek watershed wastewater treatment plants	Dis.N TP 4540 12150 HUC1: 7% 29% HUC2: 4% 25%
2012	Ohio EPA Stream Assessment	
2015	Ohio EPA Stream Assessment	
2017	If biological attainment not achieved, then both Glendale and Butler County will be required to reduce nutrient NPDES permit limits to **0.25 mg/l Total Phosphorus** and **2.5 mg/l Dissolved Nitrogen** at their Mill Creek watershed wastewater treatment plants	Dis.N TP 33900 20440 HUC1: 37% 49% HUC2: 32% 43%

* U.S. EPA is requiring that all states adopt specific nutrient criteria within the next 2 years. This TMDL and load reductions that are listed in this table must be re-examined after Ohio adopts specific nutrient criteria. Different limits and load reductions may be called for in later NPDES permit cycles.

2.0 WATERBODY OVERVIEW

2.1 Description of the Study Area

Mill Creek flows 28.1 miles from the headwaters in southeastern Butler County through central Hamilton County to a confluence with the Ohio River (Figure 1). Mill Creek watershed drains an area of 166.2 square miles and is located in the Interior Plateau Ecoregion. Along its course, the stream has an average gradient of 11.9 feet per mile (ODNR, 1960). Most of Mill Creek flows atop a buried valley aquifer composed of highly permeable sands and gravel from past glacial deposits and outwash. Major tributaries included in the watershed are: East Fork Mill Creek, Beaver Run, Town Run, Sharon Creek, Amberley Creek, West Fork Mill Creek, Cooper Creek, Congress Run, Ross Run, Bloody Run, Seymour Nature Reserve Tributary, and West Fork Creek. These tributaries, as well as several smaller ones, enter Mill Creek from the hillsides that characterize the watershed. They are generally underlain by thinly inter-bedded shales and limestone bedrock except for the lower reaches at the confluences with Mill Creek. The average gradient for the major tributaries is 51.8 feet per mile.

Aquatic Life Use Designations for streams in the basin reflect the high degree of urban/industrial development that has occurred. Mill Creek is currently designated Warmwater Habitat (WWH) from headwaters in Butler County to river mile (RM) 7.9 in Hamilton County and Modified Warmwater Habitat (MWH) for the remainder of its length. Portions of West Fork Creek and Ross Run have also been designated Limited Warmwater Habitat (LWH) because of modifications to streams and the number and density of discharges they receive. The rest of the major tributaries are designated WWH. West Fork Mill Creek is additionally listed in State Water Quality Standards as State Resource Water (SRW) due to the presence of Winton Lake/West Fork Mill Creek Reservoir. Black Crowned Night Herons, an endangered Ohio species, have established a rookery in the lower three-mile section of Mill Creek, near the Ohio River. Adult birds have been sighted as far upstream as East Fork Mill Creek and west on the Great Miami River. This is the only documented Black Crown Night Heron rookery in the state of Ohio in the Ohio River basin.

2.2 Water Quality Assessment

The Ohio Water Quality Standards (WQS) are established to determine if a particular stream, river, or lake is achieving the Clean Water Act (CWA) goals of being fishable and swimmable. The WQS are contained within the Ohio Administrative Code, Chapter 3745-1 and define a set of uses a water body has the potential to support. These uses are divided into two broad groups: those applicable to the health of the aquatic community (aquatic life use) and those generally associated with human activities such as drinking water or recreational contact (e.g., swimming, wading). The WQS also establish levels of pollutants that are protective of each waterbody use, and provide methods to evaluate fish and macroinvertebrate (mostly aquatic insects) communities to determine if the waterbody is achieving its potential. The rules in the WQS set benchmarks (or numeric criteria) for each use which can then be used to determine if a waterbody is supporting its designated uses or is designated appropriately.

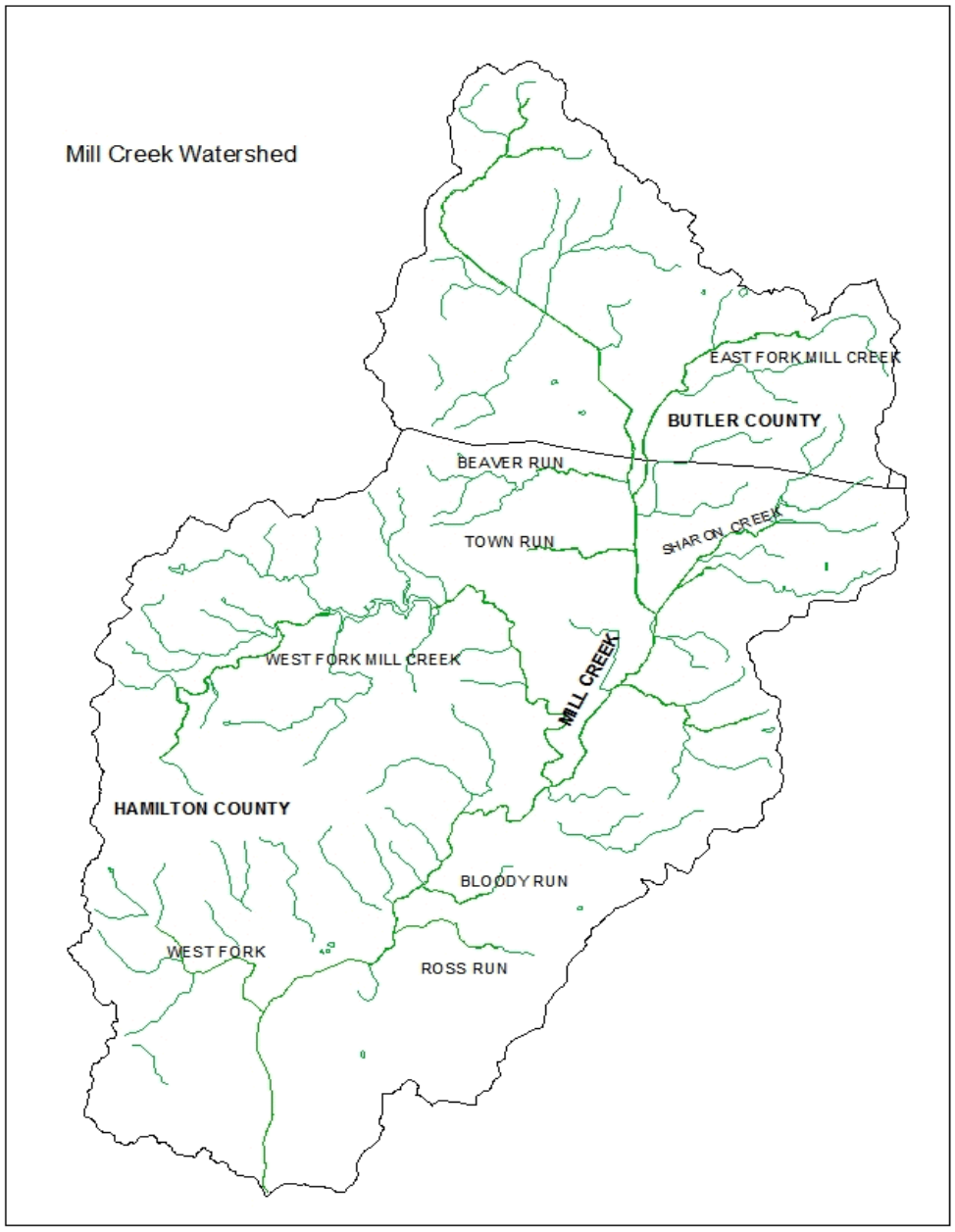


Figure 1. Mill Creek Watershed

Assessment of water quality includes an evaluation of the available chemical and physical (water column, effluents, sediment, flows), biological (fish and macroinvertebrate assemblages), and habitat data collected by Ohio EPA pursuant to the Ohio Long Term Monitoring Schedule and NPDES Permit Reissuance. Other data may be used provided it was collected in accordance with Ohio EPA methods and protocols as specified by the Ohio WQS and Ohio EPA guidance documents. Other information which may be evaluated includes, but is not limited to, NPDES permittee self-monitoring data, effluent and mixing zone bioassays, and water quality assessments conducted by Ohio EPA, the permittee, or U.S. EPA.

Ohio EPA relies on a tiered approach to link administrative activity indicators (*i.e.*, permitting, grants, enforcement) with true environmental indicators (*i.e.*, stressor, exposure, and response indicators). Stressor indicators generally include activities which have the potential to degrade the aquatic environment such as pollutant discharges (permitted and unpermitted), land use effects, and habitat modifications. Exposure indicators include whole effluent toxicity tests, tissue residues, and biomarkers, each of which provides evidence of biological exposure to stressor or bioaccumulative agents. Response indicators include the more direct measures of community and population response and are represented here by the biological indices which comprise Ohio EPA's aquatic biological criteria. The key is in using the different types of indicators within the roles which are the most appropriate for each. Describing the causes and sources associated with observed impairments relies on an interpretation of multiple lines of evidence including the water chemistry data, sediment data, habitat data, effluent data, biomonitoring results, land use data, and biological response signatures within the biological data itself. Thus the assignment of principal causes and sources of impairment represents the association of impairments (defined by response indicators) with stressor and exposure indicators.

Three aquatic life use designations apply to the Mill Creek basin study area: Warmwater Habitat (WWH), Modified Warmwater Habitat (MWH) and Limited Resource Water (LRW). Waters designated as Warmwater Habitat are capable of supporting and maintaining a balanced integrated community of species indicative of warmwater aquatic organisms. Modified Warmwater Habitats are assessed waterbodies found to be incapable of supporting a WWH community due to irretrievable modifications of the physical habitat (such as extensive channel modification), but are still able to support a less diverse biological community. The Limited Resource designation is generally reserved for small waterbodies with extremely limited physical habitat due to natural limitations or irretrievable human-induced conditions. The waters are often severely impaired and are incapable of meeting even modified criteria.

Use attainment is a term which describes the degree to which environmental indicators or pollution levels compare to criteria specified by the Ohio WQS. In rivers and streams, an assessment of aquatic life use attainment relies on the Ohio EPA biological criteria (OAC 3745-1-07; Table 7-14). The criteria are derived from multimetric biological indices which include the Index of Biotic Integrity (IBI) and modified Index of well-being (MIwb), which indicate the quality of the fish community, and the Invertebrate Community Index (ICI), which indicates the quality of the macroinvertebrate community. Numerical endpoints are stratified by ecoregion, use designation, and stream size. Three attainment status results are possible at each sampling location - full, partial, or non attainment. Full attainment indicates that all of the applicable

indices meet the biocriteria. A warmwater stream in full attainment of the biocriteria is generally of good to exceptional quality. Partial attainment means that some, but not all of the applicable indices meet the biocriteria and is often indicative of fair to good quality streams. Non attainment means that none of the applicable indices meet the biocriteria or at least one organism group reflects poor or very poor performance. Non attainment warmwater streams are typically of fair or poor quality. A use attainment table (Table 4) is constructed based on the sampling results and is arranged from upstream to downstream and includes the sampling locations indicated by river mile, the applicable biological indices, the use attainment status (*i.e.*, full, partial, or non), the Qualitative Habitat Evaluation Index (QHEI), and comments and observations for each sampling location.

The following summary was compiled from the information and analyses contained in *Water Quality Permit Support Document to Assess the Proposed Expansion of the Butler Co. Upper Mill Creek WWTP (1PK00016) August 1998* (Ohio EPA Division of Surface Water, Monitoring and Assessment Section), Addendum (June 2004) to: *Water Quality Permit Support Document to Assess the Proposed Expansion of the Butler Co. Upper Mill Creek WWTP (1PK00016) August 1998* (Ohio EPA Division of Surface Water, Monitoring and Assessment Section), *Technical Memorandum Water Quality Survey East Fork and Mill Creek for Butler County Department of Environmental Services, Butler County, Ohio* (Jordan, Jones & Goulding, 1996) and *Biological and Water Quality Study of Mill Creek and Tributaries, Butler and Hamilton Counties, Ohio* (Ohio EPA Technical Report SWS/1993-12-9, 1994) and additional data collected by Ohio EPA and Woolpert LLP, a contractor for Butler County, Department of Environmental Services in 1999, 2000, 2002, and 2003. Data for the Jordan, Jones & Goulding report, were collected in 1995 and Ohio EPA data were collected in 1992, 1997, and 2002.

Biological and chemical sampling was conducted by Ohio EPA throughout the Mill Creek basin in 1992, the upper half of the mainstem and the East Fork Mill Creek in 1997, and the mid to upper portion of the watershed in 2002. Fish and macroinvertebrates were also collected in 1997 from three locations in the lower 3.1 miles of Mill Creek. In addition, fish were sampled at four mainstem sites in 1988 and habitat assessments (QHEIs) were calculated at four other mainstem sites in 1993. Refer to Table 4 at the end of this section.

2.2.1 Habitat Assessment (Table 4)

Mill Creek mainstem can generally be divided into three sections based on physical habitat conditions. In 1997, the upper headwaters (RM 24 to 27) were generally unmodified except for localized impacts at bridge and sewer line crossings. Coarse substrates, moderate cover, and fair to good channel development reflected relatively intact stream habitat and riparian borders; a mean QHEI score of 62 indicated habitat quality adequate to support WWH communities. In 2001, Ohio EPA staff noted significant new residential and commercial developments in these upper reaches of the watershed, some of which had directly impacted the stream. Assessment of these developments on the aquatic ecosystem were conducted during 2002. Habitat enhancement projects were also conducted in Butler County in the upper reaches of the mainstem of Mill Creek during 2001. Effects of these projects on the stream were assessed in 2002.

The section of Mill Creek from RM 24 to RM 8 has had channel modifications, but some recovery to natural conditions was evident in 1997 and 2002. Substrates were generally finer,

and the channel less sinuous, and riparian borders were often reduced to a thin row of trees in the increasingly urbanized and industrialized landscape. Mean QHEIs were somewhat marginal in 1997 (mean QHEI = 57.25), but still considered adequate to support warmwater communities. Mean QHEI score for this same reach in 2002 was 60.9. In contrast, habitats in the lower eight miles were fair to poor (mean QHEI = 37.9) due to previous channel modifications. Out of the eight stream miles, 3.3 were entirely lined with concrete and most non concreted areas lacked a riparian canopy, had fair to poor channel development, and a predominance of fine, sandy substrates. In addition, the lower two miles of the mainstream are impounded by backwater from the Ohio River. Due to the extensive, often permanent stream modifications, the Modified Warmwater Habitat (MWH) use designation was determined appropriate for the lower eight miles of the mainstem.

Information included in *The Mill Creek Watershed Greenway Master Plan* from June 1999, prepared by Fuller, Mossbarger, Scott and May, stated that areas within the modified section of the lower reach that do not have permanent concrete and rip-rap substrates are recovering some sinuosity. In some sections, functional wetlands are developing in the modified stream channel. US Army Corps of Engineers received approval through the Clean Water Act (CWA) 404 process to dredge some of these areas, but used bioengineering techniques in the stream channel to lessen the negative impacts of the dredging.

In East Fork Mill Creek, Butler County Department of Environmental Services, spearheaded a habitat enhancement project which installed riffles and J-Hooks in a one mile segment of the stream. The project was funded in part by Clean Water Act, Section 319 Grant monies and Butler County.

2.2.2 Biological and Water Quality Assessment (Table 4)

Mill Creek has been identified as a priority impaired water on Ohio's 1998 and subsequent 303 (d) lists. Biological and chemical stream surveys were conducted throughout the basin in 1992 (Ohio EPA 1994), the upper half of Mill Creek and in the East Fork Mill Creek in 1997 (Ohio EPA 1998), and the mid to upper section in 2002. Results from all surveys indicate that nutrient enrichment, habitat alteration, and sedimentation are the primary causes of impairment in the upper half of the mainstem. Ammonia toxicity was also apparent in 2002. The main sources of impairment include major and minor municipal point source discharges (Upper Mill Creek Water Reclamation Facility, Glendale WWTP), channelization (recent and historic), construction-development activities, and urban runoff. Increasing suburban development and hardening of the landscape is also considered a major threat to the few remaining good quality segments in the upper basin.

In addition to lingering impacts from upstream, the lower 17 miles of Mill Creek have been impacted from old industrial and municipal landfills, hazardous waste sites, industry, combined sewer overflows, raw sewage discharges, leaking sewer lines and general urban runoff. Major causes of impact included habitat alteration (channelization and concreted stream channels), organic and nutrient enrichment, (CSOs, SSOs, WWTPs, urban runoff), sediment contamination, and impacts associated with heavy metals, pesticides, priority organics, and oil and grease. The 1997 survey suggests some improvement in water quality and macroinvertebrate communities following improvements in the East Fork Mill Creek. However, the 2002 fish data indicates severe declines in the biota downstream from the Upper Mill Creek Water Reclamation facility.

The lower 17 miles of the mainstem have remained in non attainment for virtually its entire length. Since 1988, 75 percent of biological index scores and evaluations between RM 17.7 and the mouth (n=56) have reflected poor or very poor quality (Table 4).

Most Mill Creek tributaries are extensively urbanized and many drain areas of current or historic industrial land usage. All tributaries sampled in 1992, 1997, and 2002 exhibited some type of pollution problem and many were impacted by stream channel modification. Parameters indicative of sewage treatment plant discharges were documented in the mainstem downstream from East Fork Mill Creek (Upper Mill Creek Reclamation Facility or UMC WWTP) and Town Run (Glendale WWTP). Tributaries in the lower reaches exhibited contamination indicative of industrial activity and combined sewer overflows (Ohio EPA, 1994).

2.2.2.1 Upper Mill Creek Watershed 1992 and 1997

During the 1992 and 1997 surveys, good quality biological communities were limited to the extreme headwaters of Mill Creek (RM 26.4) and East Fork Mill Creek upstream from the Upper Mill Creek Water Reclamation Facility (RMs 4.7-1.9). These segments were characterized by relatively intact stream channels and riparian borders, few chemical water quality problems, and low development pressures. However, both segments are threatened by increased pressure from development and hardening of the surrounding landscape since the Interstate 75/Union Centre Blvd. interchange was opened in 1997.

Impacts in the upper mainstem were associated with stream channelization (both recent and historic), increasing suburban development and construction activity. Upstream from East Fork Mill Creek, chemical water quality and macroinvertebrate performance remained relatively high but fish communities in the fair to poor ranges reflected habitat disruption and excessive sedimentation.

Excessive nutrient enrichment, associated with the Butler County Upper Mill Creek Water Reclamation Facility (RM 17.9, 1.09), impacted biological and chemical water quality in East Fork Mill Creek and the mainstem of Mill Creek for several miles downstream in 1997 (Tables 3 and 4). The effluent dominated nature of the stream (i.e., >16 times more effluent volume than upstream 7Q10 flow) was reflected by dramatic increases in nutrients and other chemical parameters. Increases in phosphorus, nitrate/nitrite, ammonia, TKN and conductivity were observed in the lower East Fork Mill Creek with similar increases observed in the mainstem downstream. The WWTP influence extended into Mill Creek at least as far downstream as RM 13.35 (Koenig Park), the most downstream 1997 survey site. Ammonia concentrations in 1997 declined from values approaching exceedences of WQS near the confluence of East Fork Mill Creek and Mill Creek, to just above minimum detection levels at Koenig Park. However, median phosphorus concentrations were highly elevated throughout this reach (1.99 mg/l at RM 17.6 and 1.34 mg/l at RM 14.76) and clearly exceeded a suggested state concentration of 0.08-0.1 mg/l for headwater and wadeable streams (Ohio EPA Tech Bull. 1999). Similar trends were observed in 1997 median nitrate concentrations which exceeded 3 mg/l in East Fork and ranged from 3.4 to 2.0 mg/l in Mill Creek downstream. A 1.0 mg/l nitrate criterion has been suggested for headwater and wadeable streams in Ohio (Ohio EPA Tech. Bull.1999). It is important to point out however, that conditions in 1997 represented a marked improvement in water quality compared to 1992. Significant reductions in ammonia and fecal coliform bacteria concentrations

observed in 1997 were attributable to the upgrade and expansion of the WWTP in 1993 and repair of a leaking MSD sewer line near RM 17.9.

With the addition of such a large nutrient load from the WWTP into East Fork Mill Creek, heavy algal growth and wide swings in dissolved oxygen would be expected, however, this was not observed in the downstream reach. East Fork Mill Creek downstream from RM 1.07 possesses a relatively narrow channel with a narrow dense closed canopy. Sunlight becomes a limiting factor to algal growth. Additionally, results from an algal nutrient bioassay conducted by Ohio EPA suggested some toxicity in the form of growth inhibition from the Upper Mill Creek Water Reclamation Facility effluent. Bioassays conducted of the effluent at concentrations greater than 50 percent dilution, resulted in inhibition of algal growth in the test chambers. Tests conducted on the dilutions of 50% effluent, resulted in a biostimulatory effect. Additional studies need to be conducted to explore the probability of this initial algal bioassay. In 2002, fish, cladoceran, and another algal bioassays were conducted. The bioassays on the fish and cladoceran exhibited no toxicity. The bioassay conducted on the algae (Bioassay Report Number: 02-2671-SW) indicated an inhibition of growth toxicity from the effluent and the acute mixing zone. Upstream water control and laboratory control exhibited no toxicity.

Table 3. Median chemical results from the Ohio EPA 2002 and 1997 biological and water quality surveys of the Upper Mill Creek watershed.*

Stream Site Location	RM	Phosphorus-T (mg/l) 2002 / 1997	NO_3-NO_2-N (mg/l) 2002 / 1997	NH_3-N (mg/l) 2002 / 1997	TKN (mg/l) 2002 / 1997	Conductivity (µmhos/cm) 2002 / 1997
Mill Creek						
Liberty Fairfield Rd	26.35	0.07 / 0.05	0.33 / 0.1	< 0.05 / < 0.05	0.42 / 0.2	823 / 776
Rialto Rd	20.98	0.10 / 0.14	0.22 / 0.44	0.05 / < 0.05	0.51 / 0.26	461 / 642
Crescentville Rd	18.69	0.09 / 0.28	0.27 / 0.91	0.06 / 0.05	0.54 / 0.40	515 / 642
East Fork Mill Creek confluence with Mill Creek RM 17.95						
Kemper Rd	17.61	1.00 / 1.99	0.57 / 3.42	0.31 / 0.10	1.98 / 0.80	1250 / 1032
Town Run confluence with Mill Creek RM 16.93						
Sharon Rd	16.57	0.99 / 1.28	1.11 / 1.99	0.49 / 0.31	1.85 / 0.75	1170 / 890
Formica entrance	14.75	0.89 / 1.34	0.84 / 2.19	0.11 / 0.12	1.00 / 0.70	1095 / 915
West Columbia Rd	13.35	0.34 / 0.65	1.65 / 2.15	0.07 / 0.07	0.78 / 0.4	902 / 826
North Bend Rd	8.90	0.18 / -	1.19 / -	0.07 / -	0.61 / -	875 / -
East Fork Mill Creek						
Barrett Rd	4.69	0.08 / 0.14	0.12 / 0.1	< 0.05 / < 0.05	0.45 / 0.20	831 / 652
West Chester Rd	3.19	0.10 / -	0.12 / -	< 0.05 / -	0.34 / -	819 / -
Allen Rd	1.85	0.13 / 0.19	0.1 / 0.17	< 0.05 / < 0.05	0.39 / 0.20	695 / 678
Butler County Upper Mill Creek WRF effluent	1.07	1.65 / 3.07	0.41 / 4.83	0.15 / 0.17	1.83 / 1.10	1360 / 1220
Crescentville Rd	0.77	1.54 / 3.12	0.32 / 3.89	0.21 / 0.16	1.83 / 1.05	1360 / 1165
near mouth	0.01	1.65 / 2.97	0.72 / 3.76	0.31 / 0.14	2.00 / 0.75	1380 / 1115
Town Run						
Upstream Glendale WWTP	0.93	0.16 / -	0.545 / -	0.05 / -	1.03 / -	2585 / -
Downstream Glendale WWTP (Chester Rd)	0.70	1.69 / -	1.525 / -	3.35 / -	5.70 / -	1018 / -

- Location not sampled in 1997.

* Per the USGS gage on Mill Creek at Carthage, lower flows were recorded in 2002 on specific water chemistry sampling days with respective median and maximum flows of 26.5 cfs and 96 cfs compared to 1997 median and maximum flows of 35.5 cfs and 300 cfs.

Improvement in biological performance in East Fork Mill Creek downstream from Upper Mill Creek Water Reclamation Facility was also attributed to WWTP upgrades in 1993. However,

biological communities remained in partial or non attainment of the WWH criteria and this attainment status was strongly linked to elevated nutrient concentrations. A compositional shift manifested in the macroinvertebrate community downstream from the WWTP mix zone and into the mainstem of Mill Creek was characteristic of nutrient enrichment impacts documented in other areas of the state. Additionally, an analysis of risk associated with elevated concentrations of total phosphorus, nitrate-nitrite and ammonia revealed that all three parameters increased into the high risk range downstream from the WWTP and at least three miles downstream in Mill Creek. Increased flow at existing nutrient levels may cause this problem to extend further downstream in Mill Creek.

2.2.2.2 Nutrient Risk Assessment

Biological index values meeting the WWH criteria are less frequently found when nutrient concentrations deviate strongly from the normal reference distribution. The greater the deviation from the normal range (i.e., the 90th or 95th percentile) of reference values or ranges associated with aquatic life use attainment, the higher the probability that the sample site will not attain WWH criteria. Nutrient concentrations increased from no risk (NO3-NO2, NH4) and moderate risk ranges (T-P) upstream from the UMC WWTP, to high risk downstream and into the mainstem of Mill Creek. These results indicate a link between reduced instream biological performance and the increased nutrient concentration seen in East Fork Mill Creek and Mill Creek. Depending on drainage area, total phosphorus criteria of 0.08 and 0.10 mg/l have been proposed for protection of aquatic life in headwater and wadeable streams in Ohio (Ohio EPA 1999[1]), although stream specific concentrations may be more appropriate based on available data.

2.2.2.3 Lower Mill Creek

The lower 17 miles of Mill Creek have been impacted from old industrial and municipal landfills, hazardous waste sites, industry, combined sewer overflows, raw sewage discharges, leaking sewer lines and general urban runoff. In 1992, water chemistry impairments in Mill Creek were mainly found in the lower 17 miles of the mainstem and included elevated concentrations of heavy metals, organic compounds, pesticides, ammonia, nutrients, and bacteria from sewage contamination. Sediment analysis indicated moderate toxicity and elevated concentrations of heavy metals, PCBs, organic compounds and pesticides in the same section of Mill Creek. Contaminated fish tissue has prompted the State of Ohio to issue a limited consumption advisory for all fish species.

In addition to chemical pollution impacts, permanent stream channel modifications to the lower eight miles of Mill Creek made it improbable that this section can achieve the WWH use and therefore, a modified warmwater habitat (MWH) use designation was determined to be appropriate. While the 1997 survey suggested some improvement in mainstem chemical quality and macroinvertebrates following improvements in East Fork Mill Creek, the lower 17 miles remained almost consistently in non attainment of the WWH and MWH use designations.

Many of the sewers in the lower half of the basin were designed to carry combinations of domestic sewage, storm water, and industrial wastes. Combined sewer overflows occur at 98 locations in the basin (R. D. Zande, 2000) and generally discharge to the lower 14 miles of the mainstem. These overflow points were originally incorporated into the collection system by

design to discharge during higher flow events resulting from precipitation. Overflows contribute fecal bacteria, BOD, COD, nutrients, solids, and industrial wastes to the streamflow.

Pollutant and habitat modification impacts in Mill Creek have reduced the biological community composition to a predominance of pollution tolerant species based on data gathered in 1992, 1995, 1997, and 2002 (Table 4). Toxic conditions in certain areas of Mill Creek resulted in high percentages of external anomalies in fish and tissue analyses identified PCB concentrations in some species in exceedence of maximum FDA recommended levels. Fish communities throughout the lower half of Mill Creek were generally poor. However, in the lower five miles, communities were severely degraded by toxic stresses as well as oxygen demanding wastes conditions based on data collected in 1992 and 1997.

Macroinvertebrate community health echoed the results of the fish biosurvey. Assessment in the urban and industrialized areas of Mill Creek indicated declining quality with poor to very poor macroinvertebrate communities in 1992 (based on qualitative sampling) and marginally good to poor communities in 1997 (based on artificial substrate sampling). Most improvements in the macroinvertebrates between the 1992 and 1997 surveys were attributable to water quality improvements in East Fork Mill Creek because of the upgrades made to the Butler County Upper Mill Creek Water Reclamation Facility. Differences in sampling methodologies (natural substrate vs. artificial substrate sampling) may have also contributed to some differences in the assessment of macroinvertebrate community health. During both surveys, 1992 and 1997, poorest quality macroinvertebrates were found in the lower three to five miles of the mainstream. Obvious evidence of raw sewage discharges was also observed in this same reach in 1992 and 1997.

2.2.2.4 Upper Mill Creek Basin 2002

The upper Mill Creek basin was reassessed in 2002 to evaluate biological performance, particularly in the East Fork Mill Creek downstream from the Upper Mill Creek Water Reclamation Facility (WRF). Since a similar survey was conducted in 1997, the WRF increased the design capacity to 16 million gallons per day (MGD), installed ultraviolet disinfection, and upgraded other facilities. Also, in order to augment habitat quality, Butler County installed a series of 32 boulder riffles (*i.e.,* "Newbury Riffles") in 1999-2000 in the lower mile of the East Fork between the WRF and the mouth.

Based on 2002 sampling results, the Upper Mill Creek WRF continues to have a significant impact on biological and water quality conditions in the East Fork Mill Creek and in Mill Creek downstream. Fish community health plummeted from the good range upstream from the WRF, to the poor and very poor ranges downstream. Macroinvertebrates were not as severely impacted but, still declined from exceptional quality upstream, to marginally good quality downstream from the discharge.

Excessive nutrient enrichment associated with the Upper Mill Creek WRF was considered the primary cause of impairment in 1997. In 2002, macroinvertebrates continued to suggest enrichment impacts from sewage while fish communities, dominated by tolerant and pioneering species, along with low relative abundance, reflected symptoms associated with toxicity (Yoder and Rankin 1995). Water chemistry continued to reflect significant nutrient enrichment with elevated phosphorous levels and several Water Quality Standards criterion exceedences for

ammonia detected downstream from the WRF. Twenty-six NPDES permit violations were documented at the Upper Mill Creek WRF between 2000 and 2003. For the nearly 4 years of data evaluated, violations for total suspended solids (18) and ammonia (5) were reported most frequently. Forty-two percent of the violations occurred between 2002 and 2003. Nutrient enrichment was also reflected in sediment samples where phosphorus levels exceeded Severe Effect levels in the East Fork downstream from the Upper Mill Creek WRF and for several miles downstream in the Mill Creek mainstem. Algal bioassays conducted on the WRF effluent in 1997 found no chronic toxicity at high concentrations but a biostimulatory effect, likely associated with elevated nutrients, at about 50% dilution. The inference is that chronic toxicity occurred at the high concentration but it was not caught statistically. Year 2002 results confirmed chronic effluent toxicity to algae but a biostimulatory effect was not detected at lower concentrations.

The installation of Newbury Riffles downstream from the WRF had not resulted in significant improvement in biological conditions by 2002. In the absence of water quality impacts, fish communities would be expected to show the most positive response to habitat improvements in this reach. However, fish community performance actually declined since 1997. Based on analysis of biological recovery patterns from other disturbed stream reaches in Ohio, the 2 to 3 year period following riffle installation in the East Fork Mill Creek should be more than adequate for post-construction recovery (*e.g.*, Scioto River downstream Columbus [file data], Ohio EPA 2000 [Mill Creek (Scioto) Draft TMDL], Tinkers Creek [Twinsburg, Ohio] channel relocation [file data]). These results, coupled with the severe, apparently toxic response in the fish, point to the Upper Mill Creek WRF as the primary source of impairment. The placement of Newbury riffles in this reach did serve to increase speed over the riffle, a positive habitat attribute that would not otherwise be found in the historically channelized reach. However, potential benefits of the structures have not been fully realized due to the overriding water quality impairment. (Note: Initial results from more recent sampling in 2003 by Butler County consultants suggests some improvement in East Fork biological communities compared to 2002, but use attainment remains impaired.)

In Mill Creek, full attainment of the WWH aquatic life use remains limited to the extreme upper reaches of the mainstem near Liberty Fairfield Road (RM 24.6). Biological performance was good, stream habitat has remained intact, and encroaching suburban development has not yet affected community health. Moving downstream, biological impairment became increasingly severe as a result of channelization, increased suburban development, and possible sewage impacts based on strong odors of raw sewage at Rialto Road (RM 21.1). Fish and macroinvertebrate communities declined to fair and poor quality by Windisch Road (RM 18.7), prior to the East Fork Mill Creek confluence. Biological impairment in this reach may have been exacerbated by the extreme low flow conditions encountered during the summer of 2002.

Additional mainstem impacts were observed downstream from the Upper Mill Creek WRF and Glendale WWTP discharges via the East Fork Mill Creek and Town Run, respectively. Fish community health dropped to the very poor range downstream from the confluences at Sharon Road (RM 16.5) and, like the East Fork, fish populations suggested possible toxic impacts. In contrast, Mill Creek macroinvertebrates exhibited slight to moderate improvement in the 9-mile reach downstream from the East Fork confluence. Factors that may have contributed to the positive trend included far field improvements well downstream from the Upper Mill Creek

WRF, improvements in the Hamilton County Metropolitan Sewer District (MSD) collection system, or the general lack of urban runoff and combined sewer overflow (CSO) discharge events during the 2002 summer drought.

In Town Run, poor effluent quality from the Glendale WWTP resulted in grossly polluted conditions, numerous severe Water Quality Standards criterion exceedences, and very poor biological community performance downstream from the discharge.

Table 4. Aquatic life use attainment status for stations sampled in the Mill Creek watershed based on data collected July-September, 1988-2003.

RIVER MILE Fish/Invert.	IBI	Modified Iwb	ICI[a]	QHEI[b]	Attainment Status[c]	Comments
East Fork Mill Creek (2003) Woolpert						
	Interior Plateau - WWH Use Designation (Existing)					
0.8$^{(H)}$/0.8	30*	na	32	-	**NON**	Crescentville Rd.
0.3$^{(H)}$/0.3	18*	na	40	-	**NON**	Dst. Crescentville Rd.
0.1$^{(H)}$/0.1	32*	na	28^{ns}	-	PARTIAL	Near Mouth
East Fork Mill Creek (2002)						
-- /4.7	--	–	F*	-	**(NON)**	Barret Rd. (intermittent)
3.2$^{(H)}$/3.2	42	na	36	69.0	FULL	West Chester Rd.
1.9$^{(H)}$/2.0	45	na	46	76.5	FULL	Allen Rd.
0.8$^{(H)}$/0.8	17*	na	26^{ns}	-	**NON**	Crescentville Rd.
-- /0.5	--	–	26^{ns}	–	**NON**[d]	Dst. Crescentville Rd.
0.3$^{(H)}$/0.1	21*	na	32	62.5	**NON**	Near Mouth
East Fork Mill Creek (2002) Woolpert Data						
0.8$^{(H)}$/0.8	20*	na	30	–	**NON**	Crescentville Rd.
0.3$^{(H)}$/0.3	22*	na	36	–	**NON**	Dst. Crescentville Rd.
0.1$^{(H)}$/0.1	22*	na	28^{ns}	–	**NON**	Near Mouth
East Fork Mill Creek (2000) Woolpert Data						
– /0.8	–	–	22*	–	**(NON)**	Crescentville Rd.
– / 0.3	–	–	34	–	(FULL)	Dst. Crescentville Rd.
– / 0.1	–	–	28^{ns}	–	(FULL)	Near Mouth
East Fork Mill Creek (1999) Woolpert Data						
– /0.8	–	–	12*	–	**(NON)**	Crescentville Rd.
– / 0.3	–	–	24*	–	**(NON)**	Dst. Crescentville Rd.
– / 0.1	–	–	24*	–	**(NON)**	Near Mouth
East Fork Mill Creek (1997)						
3.1$^{(H)}$/4.7	46	--	MG	80.5	FULL	W. Chester Rd./Barret Rd.
1.9$^{(H)}$/2.0	36^{ns}	--	46	53.0	FULL	Allen Rd.
1.0$^{(H)}$/1.0	*38*	--	*24*	--	*na*[c]	*UMC WRF Mixing Zone*
0.9$^{(H)}$/0.8	31*	--	28^{ns}	69.0	PARTIAL	Crescentville Rd.
0.3$^{(H)}$/0.1	34*	--	24*	64.0	**NON**	Near Mouth
East Fork Mill Creek (1995-Jordan, Jones & Goulding)						
1.9$^{(H)}$/1.9	38^{ns}	--	14*	60.5	PARTIAL	Allen Rd. ust. UMC WWTP
1.0$^{(H)}$/1.0	*44*	--	*8*	*62.5*	*na*[c]	*UMC WRF mixing zone*
0.8$^{(H)}$/0.8	34*	--	6*	61.5	**NON**	Crescentville Rd.
0.3$^{(H)}$/0.1	32*	--	6*	59.5	**NON**	dst. lowhead dam
East Fork Mill Creek (1992)						
4.7$^{(H)}$/4.7	40	--	MG	74.0	FULL	Barret Rd.
3.8$^{(H)}$/3.9	40	--	MG	72.0	FULL	Station Rd.
1.9$^{(H)}$/1.9	38^{ns}	--	MG	61.0	FULL	Allen Rd.
0.8$^{(H)}$/0.8	28*	--	F*	60.5	**NON**	Crescentville Rd.
0.3$^{(H)}$/0.1	28*	--	F*	66.0	**NON**	ust. near mouth

Table 4. continued.

RIVER MILE Fish/Invert.	IBI	Modified Iwb	ICI[a]	QHEI[b]	Attainment Status[c]	Comments
East Fork Mill Creek (1991)						
-- /3.3	--	--	18*	--	(**NON**)	Beckett Rd. (intermittent)
East Fork Mill Creek (1988)						
3.3$^{(H)}$/ --	44	--	--	45.5	(FULL)	Beckett Rd. (intermittent)
Mill Creek (2002)						
		Interior Plateau - WWH Use Designation (Existing)				
26.2$^{(H)}$/26.3	42	na	G	74.5	FULL	Liberty-Fairfield Rd.
21.0$^{(W)}$/21.1	23*	na	F*	47.5	**NON**	Rialto Rd. (channelized)
18.7$^{(W)}$/18.9	25*	na	F*	67.5	**NON**	Windisch Rd.
17.5$^{(W)}$/17.6	22*	5.0*	32	51.5	**NON**	Kemper Rd.
16.5$^{(W)}$/16.5	14*	2.8*	22	62.5	**NON**	Sharon Rd.
14.8$^{(W)}$/14.9	19*	4.7*	28^{ns}	62.0	**NON**	Formica Entrance
-- /13.3	--	--	38	--	(FULL)	Koenig Park
– / 8.0	–	–	26^{ns}	–	(FULL)	North Bend Rd.
Mill Creek (1997)						
		Interior Plateau - WWH Use Designation (Existing)				
26.2$^{(H)}$/26.4	43	na	MG	60.0	FULL	Liberty-Fairfield Rd.
21.0$^{(W)}$/21.0	26*	6.1*	28^{ns}	40.0	**NON**	Rialto Rd.
18.9$^{(W)}$/18.8	29*	6.0*	44	49.5	PARTIAL	Windisch Rd.
17.5$^{(W)}$/17.6	26*	5.0*	26^{ns}	59.0	**NON**	Kemper Rd.
16.5$^{(W)}$/16.5	24*	4.1*	30	67.5	**NON**	Sharon Rd.
14.8$^{(W)}$/14.9	27*	5.3*	22*	61.5	**NON**	Formica Entrance
13.5$^{(W)}$/13.3	25*	5.0*	30	70.5	**NON**	Koenig Park
		Interior Plateau - MWH Use Designation (Existing)				
3.1$^{(W)}$/3.1	18*	4.3*	14*	38.0	**NON**	ust. Hopple St.
0.7$^{(B)}$/0.6	30	8.2	6*	34.0	PARTIAL	dst. Lowhead Dam
0.3$^{(B)}$/0.3	22*	8.0	6*	--	PARTIAL	ust. Barrier Dam
Mill Creek (1995-Jordan, Jones & Goulding)						
			WWH Use Designation (Existing)			
19.1$^{(W)}$/19.1	24*	5.9*	10*	55.0	**NON**	Windisch Rd. (ust. E. Fk.)
			WWH Use Designation (Existing)			
17.6$^{(W)}$/17.6	26*	5.4*	6*	55.5	**NON**	Kemper Rd. (dst. E. Fk)
16.6$^{(W)}$/16.6	26*	5.0*	8*	52.0	**NON**	Sharon Rd.
Mill Creek (1992)						
			WWH Use Designation (Existing)			
26.4$^{(H)}$/26.4	39^{ns}	--	MG	64.0	FULL	Liberty-Fairfield Rd.
19.1$^{(W)}$/19.1	26*	6.9*	F*	60.0	**NON**	Windisch Rd.
			WWH Use Designation (Existing)			
17.6$^{(W)}$/17.6	22*	6.0*	F*	62.5	**NON**	Kemper Rd.
16.5$^{(W)}$/16.6	24*	5.7*	P*	63.0	**NON**	Sharon Rd.
14.8$^{(W)}$/14.8	23*	4.8*	P*	60.0	**NON**	Formica Entrance
13.2$^{(W)}$/13.3	22*	4.3*	P*	60.5	**NON**	Koenig Park
8.7$^{(W)}$/8.7	25*	5.7*	P*	66.0	**NON**	SR 561

Table 4. continued.

RIVER MILE Fish/Invert.	IBI	Modified Iwb	ICI[a]	QHEI[b]	Attainment Status[c]	Comments
			MWH Use Designation (Existing)			
7.8[(W)]/7.8	24	6.3	P*	64.5	PARTIAL	Center Hill Road
5.1[(W)]/5.1	18*	4.9*	P*	52.0	**NON**	Salway Park
3.1[(W)]/3.1	12*	2.3*	VP*	40.0	**NON**	ust. Hopple St.
Mill Creek (1992)						
0.3[(B)]/0.3	21*	6.8	VP*	26.0	**NON**	ust. Barrier Dam
Mill Creek (1988)						
			WWH Use Designation (Existing)			
17.7[(W)]/ --	20*	6.1*	--	59.5	(**NON**)	Kemper Rd.
14.8[(W)]/ --	20*	2.5*	--	63.0	(**NON**)	Sharon Rd.
13.3[(W)]/ --	22*	5.6*	--	63.5	(**NON**)	Formica Entrance
12.2[(W)]/ --	20*	3.7*	--	71.0	(**NON**)	Koenig Park
Beaver Run (1997)						
			Interior Plateau - Undesignated; Evaluated using WWH criteria			
1.0[(H)]/0.9	28*	--	P*	55.0	**NON**	Heritage Hill ford

* Significant departure from ecoregion biocriterion; *poor* and *very poor* results are underlined.

[ns] Nonsignificant departure from ecoregion biocriterion (≤4 IBI or ICI units; ≤0.5 MIwb units).

[a] A narrative evaluation based on the qualitative sample (MG-*marginally good*, F-*fair*, P-*poor*, VP-very *poor*) is used in lieu of the ICI when artificial substrate data are not available.

[b] All Qualitative Habitat Evaluation Index (QHEI) values are based on the most recent version (Rankin 1989).

[c] biocriteria do not apply in mixing zones.

[W] Wading site type

[H] Headwater site type

[B] Boat site type

Ecoregional Biocriteria: Interior Plateau Ecoregion (IP)
(OAC Chapter 3745-1-07, Table 7-17)

INDEX -	Site Type	WWH	EWH	MWH[d]
IBI -	Headwater/Wading	40	50	24
Mod. Iwb -	Wading	8.3	9.4	6.2
IBI -	Boat	40	48	24
Mod. Iwb -	Boat	8.7	9.6	5.8
ICI		30	46	22

[d] - Modified Warmwater Habitat for channelized habitats

2.3 Causes and Sources (Table 5, Figure 2)

The determination of impairment in rivers and streams in Ohio is straightforward. The numeric biocriteria are the principal arbiter of aquatic life use attainment and impairment. The rationale for using biocriteria has been extensively discussed elsewhere (Karr, 1991; Ohio EPA, 1987a,b; Yoder, 1989; Miner and Borton, 1991; Yoder, 1991).

Ohio EPA relies on an interpretation of multiple lines of evidence including water chemistry data, sediment data, habitat data, effluent data, biomonitoring results, land use data, and biological response signatures to describe the causes (e.g., nutrients) and sources (e.g., municipal point sources, septic systems) associated with observed impairments. Thus the initial assignment of principal causes and sources (Table 1) of impairment that appear on the Section 303 (d) list do not represent a true "cause and effect" analysis, but rather represent the association of impairments (based on response indicators) with stressor and exposure indicators whose links with the biosurvey data are based on previous research or experience with analogous situations and impacts. The reliability of the identification of probable causes and sources is increased where many such prior associations have been identified (Ohio EPA, 1999b).

Table 5 summarizes the causes and sources identified in the Mill Creek watershed based on information in the 1998 303 (d) list and the 1997 assessment of available data. The information in the 1998 303 (d) list for Mill Creek was based on data evaluated in 1992 or prior to that. Figure 1 is a schematic which indicates the location of point sources and major tributaries which may influence the water, sediment and biological quality in the Mill Creek watershed.

Causes and sources of impairment in 2002 were generally similar to 1997 observations. Habitat alteration related to development and increased suburban development in Upper Mill Creek has had a significant impact on biological communities. Impairments in the upper basin appeared exacerbated by the summer drought.

In the East Fork Mill Creek, phosphorus levels downstream from the Upper Mill Creek WRF decreased compared to 1997 but remained quite elevated compared to background levels. In addition to nutrients, impacts from ammonia appeared to increase in severity between the surveys. Permit violations, WQS exceedences detected in chemical sampling, and increased ammonia-N loadings point to the potential for increased ammonia toxicity and oxygen demand downstream from the WRF. Variable effluent quality, possibly attributable to inflow and infiltration influences, treatment process disruptions, or inadequacies were of particular concern in evaluating the downstream impacts. Ammonia was also a concern in 1997, but concentrations were within water quality standards and, unlike 2002 results, the magnitude of impacts to fish were not so severe.

Impairment in Town Run downstream from the Glendale WWTP should be attributed to excessive organic enrichment and ammonia. Upstream from the WWTP, organic enrichment associated with sewage bypasses and storm water, coupled with flow alteration and urban runoff, were considered the primary causes and sources of impairment, respectively.

Causes and sources of impairment in Mill Creek noted in 2002 downstream from the East Fork and Town Run remain similar to the findings of the 1997 survey. However, the magnitude of

impairment associated with ammonia loadings from point sources appeared to increase. Further downstream, an improving trend in the macroinvertebrates may reflect changes in the relative contribution of impairment sources since 1997. However, specific reasons for the trend were uncertain and may be related to far field improvements, well downstream from point source discharges, upgrades in the MSD sewer system, or simply a lessening of runoff and CSO discharge events during the extended summer drought. Fish were not collected from the lower reaches of the mainstem segment so possible changes in fish community performance are unknown.

Table 5. Causes and sources of impairment in the Mill Creek watershed based on 1992 and 1997 survey results.

Stream Segment \ Water Body ID# [Upper River Mile/ Lower River Mile]	In 1998 303 (d)	Aquatic Life Use Desig: 1998 303 (d): *2001 WQS*	Attainment Status (Miles)				Causes of Impairment* 1998 303 (d) list (1992 survey) /*1997 survey*	Sources of Impairment* 1998 303 (d) list (1992 survey) / *1997 survey*
			Full	Full but Threatened	Partial	Non		
East Fork Mill Creek\OH62 31 (RM 7.10 to mouth)	yes	WWH	5.20 *4.00*	0.00 *4.00*	0.00 *0.50*	①**1.90** *0.50*	Ammonia - H/*S* Organic enrichment/DO - H Pesticides - S *Nutrients - H*	Municipal Point Source - H/*H* *Land development/ Suburbanization - T*
West Fork Mill Creek ②**(downstream)** ③OH62 **24**	yes	④**LRW**	0.00	0.00	0.00	⑤**5.00**	Unknown toxicity - H Organic enrichment/DO - H Flow alterations - H Siltation - M Habitat alteration - M	Industrial Point Source - H Combined Sewer Overflows - H Urban runoff/storm sewers - H Streambank modification/ destablization - M
West Fork Mill Creek ⑥**(upstream)** OH62 26	yes	WWH	0.00	0.00	0.00	4.70	Ammonia - H Organic enrichment/DO - H	Combined Sewer Overflows - H Hazardous waste - S Contaminated sediments - S
Mill Creek\OH62 27 (Sharon Creek to West Fork Mill Cr., RM 15.63 to 11.57)	yes	⑦**WWH** *WWH*	0.00	0.00	0.00	4.06 *4.06*	Ammonia - H/*S* Organic enrichment/DO - H/*H* ⑧Taste & odor - H Habitat alteration - S/*M* *Nutrients -M* *Priority Pollutants - M*	Combined Sewer Overflows - H/*H* Industrial Point Source - M Urban runoff/storm sewers - M Landfills - M/M Contaminated sediments - M/*M* Channelization - S/*M* *Major Municipal Point Source - M*

Stream Segment \ Water Body ID# [Upper River Mile/ Lower River Mile]	In 1998 303 (d)	Aquatic Life Use Desig: 1998 303 (d): *2001 WQS*	Attainment Status (Miles)				Causes of Impairment* 1998 303 (d) list (1992 survey) /*1997 survey*	Sources of Impairment* 1998 303 (d) list (1992 survey) / *1997 survey*
			Full	Full but Threatened	Partial	Non		
Mill Creek\OH62 23 (West Fork Mill Creek to Ohio River, RM 11.57 to 0.00)	yes	⑦**WWH** *WWH-MWH*	0.00 *0.00*	0.00 *0.00*	0.00 *1.00*	11.57 *10.57*	Unknown toxicity - H/*H* Ammonia - H/*M* Organic enrichment/DO - H/*H* Habitat alteration - H/*H* Oil & grease - H/*M* ⑧Taste & odor - H *Pesticides - M* *Metals - M* *Priority organics - M*	Combined Sewer Overflows - H/*H* Urban runoff/storm sewers - H/*M* Channelization - H/*M* Stream bank modification /destablization (concrete) - H/*H* Industrial Point source - M/*M* Landfills - M/*M* Contaminated sediments - M/*M*
Sharon Creek\OH62 28 (RM 5.50 to mouth)	yes	WWH	0.00	0.00	0.00	0.50	Unknown - H	Urban runoff/storm sewers - H
Bloody Run\OH62 23.2 (RM 3.90 to mouth)	yes	⑨**LRW** *LRW*	0.00	0.00	0.00	0.50	Organic enrichment/DO- H Pesticides - M Priority organics - M	Combined Sewer Overflows - H Industrial Point Source - M
Mill Creek\OH62 30 (Headwaters to Sharon Creek, RM 28.35 to 15.64)	yes	⑩**WWH** *WWH*	3.60 *4.42*	0.00 *4.42*	0.00 *1.00*	9.10 *7.30*	Organic enrichment/DO - H, *S* Habitat alteration - H/*H&M* *Nutrients - H* *Ammonia - S*	Combined Sewer Overflows - H Hydromodification - M *Major Municipal Point Source - H* *Channelization , H&M* *Urban runoff/storm sewers - S* *Land development/ Suburbanization - S&T*

Stream Segment \ Water Body ID# [Upper River Mile/ Lower River Mile]	In 1998 303 (d)	Aquatic Life Use Desig: 1998 303 (d): *2001 WQS*	Attainment Status (Miles)				Causes of Impairment* 1998 303 (d) list (1992 survey) /*1997 survey*	Sources of Impairment* 1998 303 (d) list (1992 survey) / *1997 survey*
			Full	Full but Threatened	Partial	Non		
❶Trib. to West Fork OH62 24.1	yes	⑨**WWH** *WWH*	0.00	0.00	0.00	2.00	Unknown toxicity - H Nutrients - H Organic enrichment/DO- H Flow Alteration - H ⑧Taste & odor - H Suspended Solids - H Siltation - M	Combined sewer overflow - H Flow regulation/modification - H Highway/road/bridge/sewer line - M Removal of riparian vegetation - M Highway maintenance and runoff - M
Winton Woods Lake OH62 26-166	yes	EWH**	0.00	0.00	183.0 (acres)	0.00	Organic enrichment/DO - H Nutrients - M Siltation - M Oil & Grease - M	Combined sewer overflow - H Removal of riparian vegetation - H Stream bank modification /destablization - H Construction - M Urban runoff/storm sewers - M Nonindustrial Permitted - M Industrial Permitted - M Other urban runoff - M Spills - M Natural - M

*The magnitude (i.e. relative contribution) of the cause or source of impairment is indicated as follows: H-High; M-Moderate; S-Slight; T-identifies a threat
** All lakes are designated as EWH by default

Numerous corrections were needed to the 1998 303 (d) list, these are listed below:

① This value should be 1.0.
② This should read "(Headwaters to mouth)," evaluated in 1988 and 1991.
③ This waterbody id # should read OH62 26.
④ This use designation should be WWH based on 1998 Water Quality Standards.
⑤ 15.2 miles of stream were in Non attainment.
⑥ This should read "(Headwaters to mouth)," evaluated in 1992.
⑦ This use designation should read LWH (Limited Warmwater Habitat) based on 1998 Water Quality Standards.
⑧ Taste & Odor were entered in error under the "causes" section.
⑨ This stream was Undesignated in 1998
⑩ This use designation should have read WWH/LWH based on the 1998 Water Quality Standards for this section of Mill Creek.
❶ This stream should be listed as Trib. to Winton Lake, RM 8.48\OH62 26.1.

Figure 2. Mill Creek schematic. River Miles based on PEMSO river mile system.

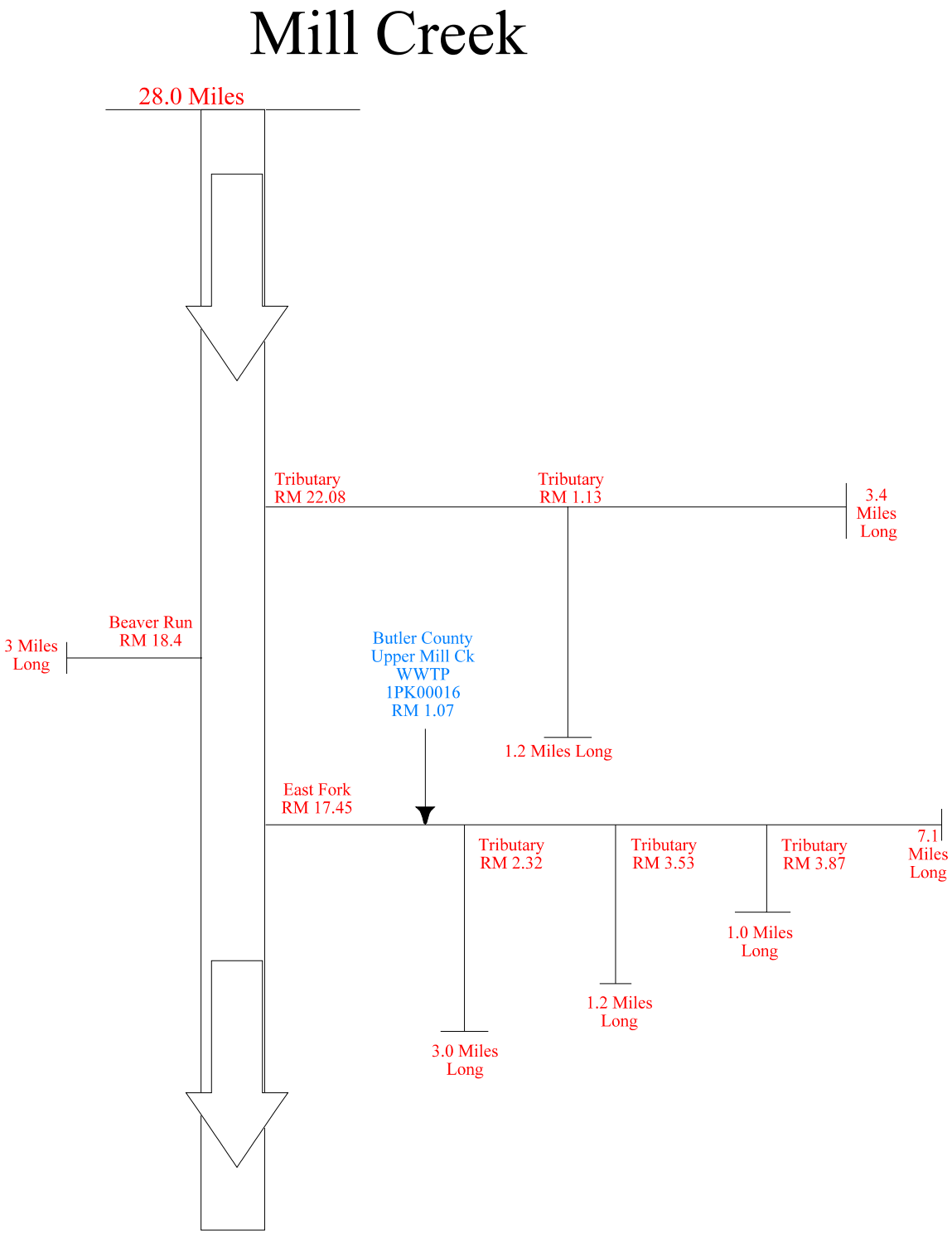


Figure 2 continued. Mill Creek schematic.

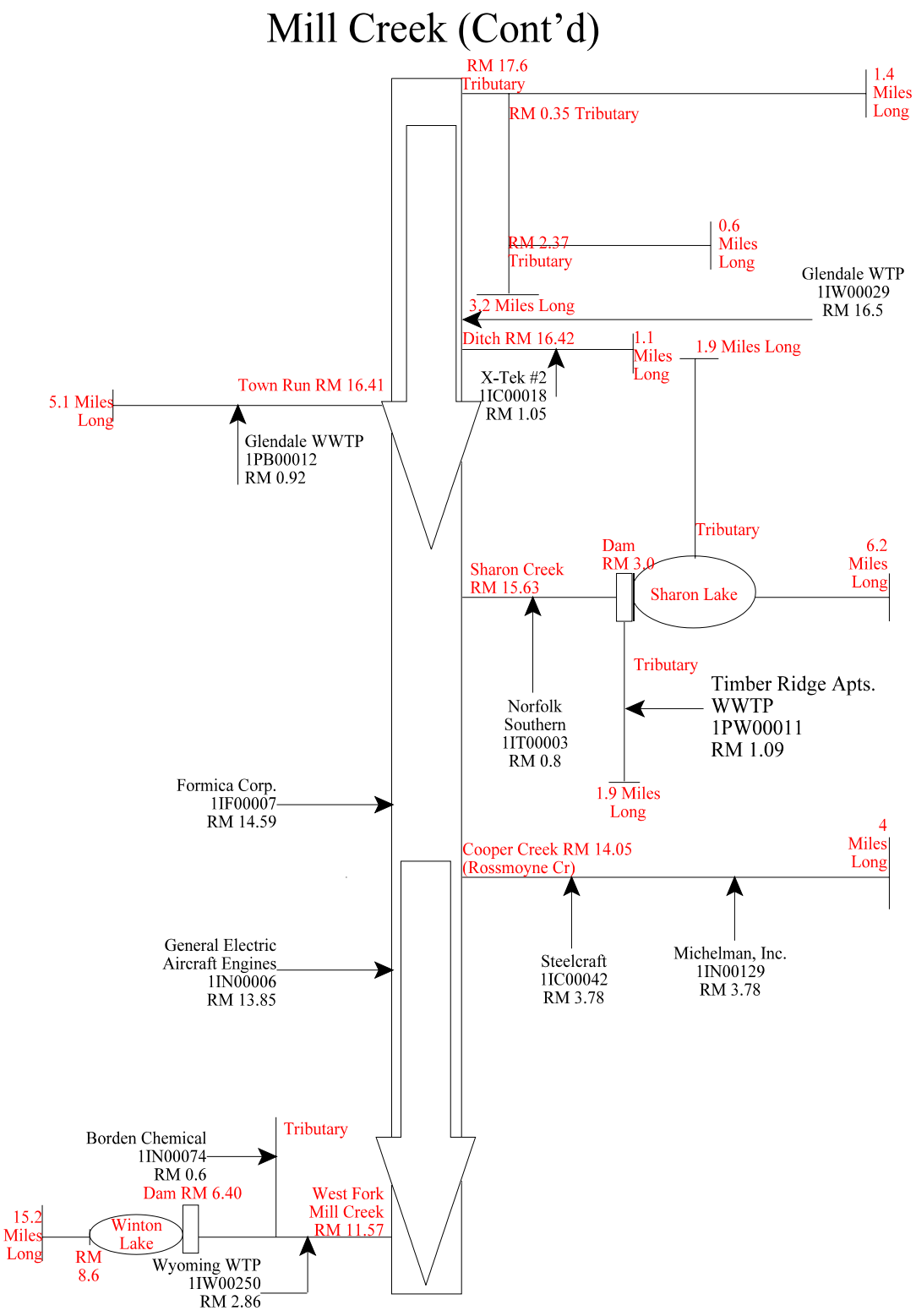
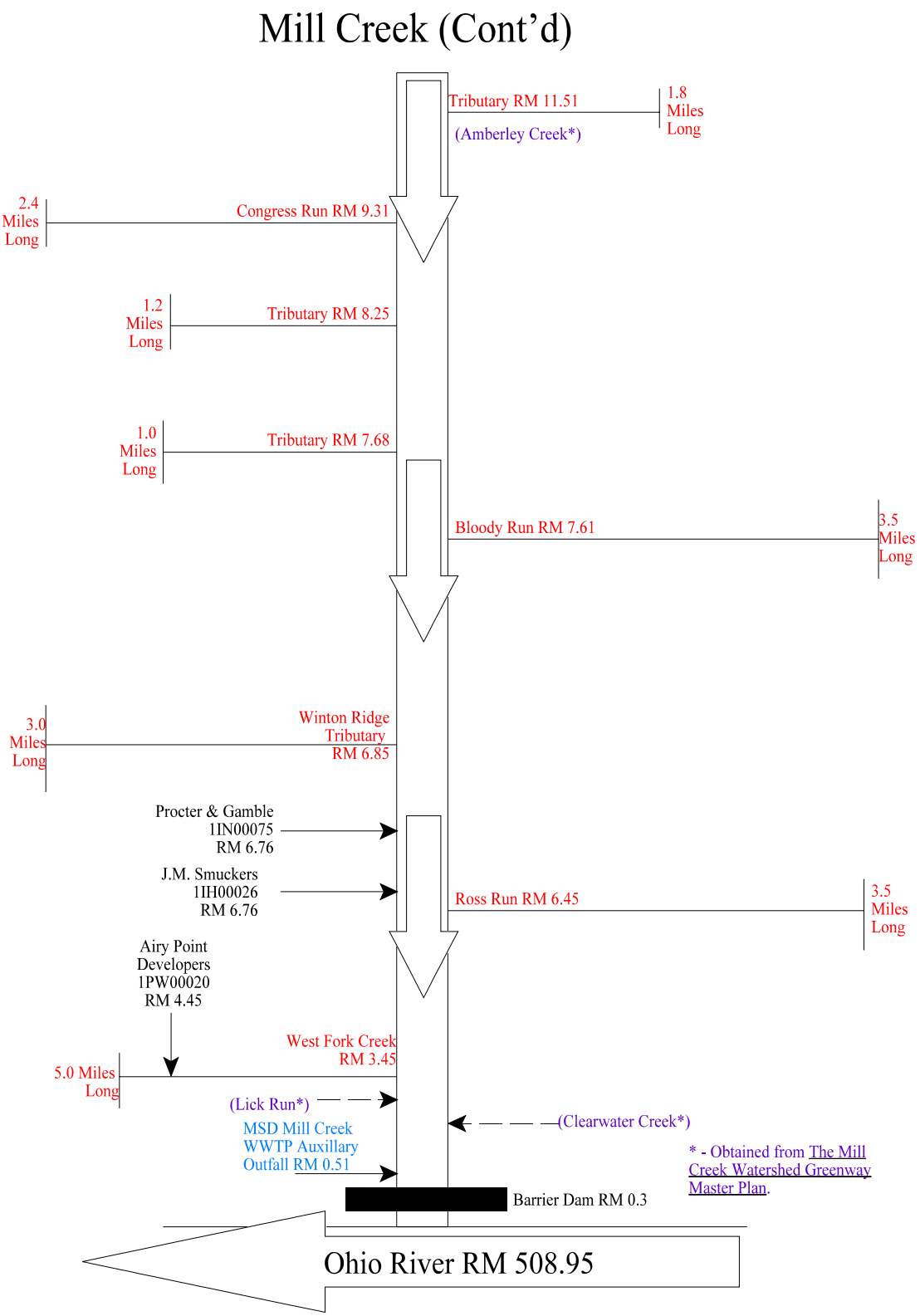


Figure 2 continued. Mill Creek schematic



2.3.1 Summary of Point Sources

There are approximately 20 point source facilities in the Mill Creek watershed which hold National Pollutant Discharge Elimination System (NPDES) permits. This results in approximately 16 MGD of either treated sanitary wastewater, process wastewater or cooling water being discharged into the watershed. The largest facility discharging treated sanitary wastewater in the watershed is Butler County Upper Mill Creek Water Reclamation Facility. This plant discharges to East Fork Mill Creek at RM 1.07. It currently discharges approximately 8 MGD and has been given the approval to expand its volume up to 16 MGD. Butler County is adding a denitrification process to the treatment facility, prior to discharge to East Fork Mill Creek, for the expansion to 16 MGD. The new expansion will also be constructed with anoxic zone, which is specifically designed to effectively reduce nitrate-nitrogen and ammonia-nitrogen. The facility is also required to install nutrient removal treatment by 2006. General Electric Aircraft Engines facility in Evendale has the largest volume of cooling water and storm water discharges in the Mill Creek watershed. It releases approximately 5.4 MGD of cooling and storm water to Mill Creek. A complete list of the NPDES permit holders can be found in Appendix B.

Butler County Sanitary Sewer Overflows

Butler County spent significant resources between 1999 and 2003 to improve three reoccurring sanitary sewer overflows (SSOs) in the Upper Mill Creek collection system (Windisch Rd., North Pisgah, Sharon Creek). This has essentially eliminated the overflows located in the Upper Mill Creek sub-watershed.

Metropolitan Sewer District of Greater Cincinnati (MSD), Combined Sewer Overflows

Discharges from the Combined Sewer Overflow (CSO) locations in Hamilton County are operated under Ohio EPA NPDES Permit No. 1PX00022*AD, effective August 1, 1992. The effective permit period expired July 28, 1997. MSD is continuing the CSO program in the interim, under guidance established by the permit.

MSD has made changes and improvements to the collection system. As a result, a number of CSOs have been eliminated since the permit was issued. These changes to the original permit list have resulted in a total number of 98 CSO locations within the Mill Creek watershed.

The data collected during the original permit period has been evaluated, along with drainage basin characteristics, SIU information and other relevant data. Each CSO was ranked and a revised priority listing had been created. A revised monitoring plan was submitted to the Ohio EPA Southwest District Office November 18, 1998. MSD's CSO Operational & Maintenance Plan (Nine Minimum Controls) has been approved by Ohio EPA and the MSD CSO Long Term Control Plan (LTCP) has been submitted to Ohio EPA for review and approval.

State and Federal regulators have required an update of the 1996 LTCP. A major component of the update is a water quality monitoring and modeling program that incorporates Mill Creek from the Hamilton County border to its confluence with the Ohio River. Other update elements include consideration of a deep tunnel proposal (in conjunction with Army Corps of Engineers) that would provide flood control and CSO capture and treatment. Also, the update will evaluate emerging treatment technologies and use MSD's System Wide Model to quantify CSO and SSO

volumes. This work is being undertaken as per conditions of the recently signed federal Consent Decree and the updated LTCP is to be submitted by June 2006.

MSD Sanitary Sewer Overflows (SSOs) Elimination Program

Unlike Combined Sewers, Sanitary Sewers are not designed to overflow. Despite this, SSOs do occur in many systems, including MSD's, as the result of extraneous water during wet weather. Following lengthy negotiations between MSD and State and Federal regulators, an Interim Partial Consent Decree (IPCD) was entered with the Federal Court in February, 2002. The IPCD specified a program to be used by MSD to model and evaluate its SSOs and develop recommendations for the elimination/correction of these SSOs.

Due to the significance of SSO 700, it received special attention in the IPCD. The IPCD requires MSD to install an interim capture and treatment system. The capture and treatment system design concept is presented in SSO 700 Interim Remedial Measure Plan presented and approved by USEPA and Ohio EPA on February 15, 2003. Modeling results using the System Wide Model (SWM) determined that for the typical year of rainfall (1970), SSO 700 overflows approximately 57.2 MG in 47 events for 890 hours in a year. Historical flow data collected at SSO 700 substantiates that SSO 700 is very active during wet weather period. The facility has been designed to capture and/or treat the flow for the typical year using a combination of 3.6 MG storage and a peak treatment capacity of 15 MGD. Also, modeling using MSD's SWM has shown that the facility is also sized adequately to treat all flows diverted to the facility for the 10 year design event. The capture and treatment system is currently under design and construction is required to be completed by June 2006.

Residential Sewage Systems In Hamilton County

The Upper Mill Creek Watershed Action Plan (October, 2003) reports 1541 on-site sewage systems exist in the Mill Creek watershed which are authorized by Hamilton County and City of Sharonville health departments. Hamilton County General Health District provided information of the residential sewage systems. According to their information, approximately 1382 residential sewage systems exist in the Mill Creek watershed in Hamilton County (Table 6). These types of potential pollution sources fall into both point source and nonpoint source pollution categories because of the sewage system designs: mechanical and non-mechanical. Mechanical systems discharge and have a flow volume of roughly 400 gallons/day (Ohio EPA's Greenbook). The majority of the non-mechanical systems are non discharging, on-site sewage disposal systems (septic tank/leach field), however a small number of the non-mechanical systems in Hamilton County discharge to sand filters. Of the 1382 systems, 572 are non-mechanical and 810 are mechanical sewage systems. Hamilton County has an annual inspection program for the sewage systems and a water quality sampling program for area streams to determine bacteria levels. If a system is identified as failing, then the owner is ordered to repair or replace the system. Table 6 details the sub-watershed location of the different types and numbers of residential sewage systems.

Table 6. Residential sewage systems in Mill Creek watershed, Hamilton County

Sub-Watershed	Mechanical Systems	Non-Mechanical Systems
East Branch	35	63
Pleasant Run	52	18
South Branch	368	206
West Branch	355	285

Semi-Public Systems

In 1992, approximately 70 semi public facilities discharged into the Mill Creek watershed in Hamilton County and at the Hamilton-Butler County border. Semi public facilities are those dischargers that release 25,000 gallons or less per day and their status is monitored by the Hamilton County Combined Health District. Since 1992, 46 of the semi public facilities have been eliminated, 22 of them connected to the sanitary sewer system of Butler County. Only 24 semi public facilities presently exist in Hamilton County in the Mill Creek watershed. These facilities discharge roughly 31,254 gallons per day of treated effluent. Appendix B lists the present number of facilities, locations and volume of effluent. The number of semi public facilities in the upper watershed in Butler County and their combined discharge volume is unknown since no local agency monitors this.

2.3.2 Summary of Non Point Sources

Butler County Residential Sewage Systems

Butler County Health District provided information related to the residential systems in the upper Mill Creek watershed. Approximately 100 residences have on-site, non-mechanical sewage systems. None of these are known to have any discharges. Butler County does not have a routine inspection program for these systems, but if a sewage system is identified as failing (via complaint or other means of notification), the owner will be ordered to repair or replace the system.

Agricultural and Livestock Operations

Much of the Mill Creek watershed has undergone significant development from agriculture to urban land use. However, a few pockets of agriculture still exist, primarily in the upper watershed. Data provided from the Upper Mill Creek Sub-Watershed Action Plan (UMCSWAPWG, October 1, 2003) identified 5860 acres still under agricultural use in the upper watershed. The action plan predicts agricultural lands will be converted to other uses in the next five to ten years.

Agricultural information for the Mill Creek watershed in Hamilton County does not appear to be housed in one agency, so gaps exist in the data. Agricultural and livestock activities are not concentrated in any one location, but are isolated to small operations spread throughout the watershed in Hamilton County. Several nurseries, greenhouses and small horse farms are present in the watershed, but no specific information is available.

Construction and Storm Water Issues

Hamilton and Butler Counties are two of the counties in southwest Ohio experiencing significant construction activities. Under the requirements of the NPDES storm water program, which was initiated in Ohio in 1992, prior to March 10, 2003, Ohio EPA received Notices of Intent (NOIs) for construction sites disturbing five acres or more. After March 10, 2003, responsible parties disturbing one or more acres are required to submit an NOI. Since 1992, approximately 5618 acres of land in the Mill Creek watershed in Hamilton and Butler Counties have been covered by NPDES storm water control permits for construction.

Table 7 summarizes the acreage under construction permits in Butler and Hamilton Counties in the Mill Creek watershed. The numbers in this table are conservative for several reasons. From 1992 until March 2003 sites owned by smaller cities were not required to apply for coverage under the construction storm water general permits. Initially under phase I of the NPDES Stormwater program, compliance rates in terms of applying for coverage under the NOIs were low, and the permit numbers may not reflect the true number of sites under construction in the early years of the program. Many NOIs submitted did not include enough location information to determine if the sites were located in the Mill Creek watershed.

Table 7. Construction site summary in Hamilton and Butler Counties

Start Year From NOI	**Butler County** (Acres)	**Hamilton County** (Acres)	**Total Acres**
1992	32	287	319.0
1993	74.8	56	130.8
1994	149.6	171.9	321.5
1995	225.7	118.95	344.7
1996	163	140.7	303.7
1997	729.1	238.4	967.5
1998	1043.4	142.1	1185.5
1999	157	997.65	1154.7
2000	557.2	333.6	890.8
2001	NA	NA	NA
2002	NA	NA	NA
2003	206.8	134.0	340.8
2004	194.5	220.5	415.0
Totals	3533.1	2840.3	6374.0

NA - data not available at this time.

3.0 PROBLEM STATEMENT

The large number of variables impacting water quality in the Mill Creek basin makes it imperative to choose a goal that, when reached, will show that the designated constraints have been overcome. The goal of the Mill Creek TMDL is to achieve full attainment of the applicable biological and chemical water quality standards. As indicated elsewhere in this report, causes of non-attainment throughout most of the basin can be associated with nutrient enrichment (phosphorus and nitrogen) and habitat alteration. In some segments of Mill Creek there is impairment of aquatic life caused by toxicity attributed to ammonia and other chemicals. These toxicity problems related to ammonia are being addressed through permit actions and are not covered in the TMDL. The other sources of toxicity will be addressed through additional iterations of the TMDL process.

Nutrients, except under unusual circumstances, rarely approach concentrations in the ambient environment that are toxic to aquatic life. U.S. EPA (1976) concluded that "levels of nitrate nitrogen at or below 90 mg/l would not have [direct] adverse effects on warmwater fish." However, nutrients, while essential to the functioning of healthy aquatic ecosystems, can exert negative effects at much lower concentrations by altering trophic dynamics, increasing algal and macrophyte production (Sharpley et al., 1994), increasing turbidity (via increased phytoplanktonic algal production), decreasing average dissolved oxygen concentrations, and increasing fluctuations in diurnal dissolved oxygen and pH. Such changes are caused by excessive nutrient concentrations that contribute to shifts in species composition away from functional assemblages of intolerant species, benthic insectivores and top carnivores (e.g., darters, insectivorous minnows, redhorse, sunfish, and black basses) typical of high quality warmwater streams towards less desirable assemblages of tolerant species, niche generalists, omnivores, and detritivores (e.g., creek chub, bluntnose minnow, white sucker, carp, green sunfish) typical of degraded warmwater streams (Ohio EPA, 1999).

The parameters selected for the Mill Creek TMDL are total phosphorus and NO_3+NO_2. Ohio EPA staff believe that nutrient load reductions must occur before improvements in habitat would impact the affected segments. Based on the results from the 2002 biological and water quality study, this belief is supported. The habitat improvement project conducted by Butler County Department of Environmental Services on East Fork Mill Creek downstream from the Upper Mill Creek Water Reclamation Facility did not result in the stream attaining its aquatic life use designation. The county is now in the process of installing nutrient removal in the plant.

3.1 Target Identification

The establishment of instream numeric targets is a significant component of the TMDL process. The numeric targets serve as a measure of comparison between observed instream conditions and conditions that are expected to restore the designated uses of the waterbody. The TMDL identifies the load reductions and other actions that are necessary to meet the target, thus resulting in the attainment of applicable water quality standards.

Biological Criteria

In Ohio the applicable numeric targets are the appropriate biocriteria contained in the State's Water Quality Standards (WQS). The biocriteria that apply to streams in the Mill Creek basin are shown in Table 8). Determinations of current aquatic life use attainment are based on a comparison of biological scores to the appropriate criteria. Similarly, the success of any implementation actions resulting from the TMDLs will be evaluated by observed improvements in biological scores.

The biocriteria are the ultimate measure of whether a stream is meeting its use designation. Ohio EPA incorporated biological criteria into its WQS ((OAC 3745-1-07, Table 7-15) in1990. These criteria consist of numeric values for the Index of Biotic Integrity (IBI) and Modified Index of Well-Being (MIwb), both of which are based on fish assemblage data, and the Invertebrate Community Index (ICI), which is based on macroinvertebrate assemblage data. Criteria for each index are specified for each of Ohio's five Ecoregions, and are further organized by organism group, index, site type, and aquatic life use designation.

Table 8. Biocriteria for aquatic life use designations (in bold) and other biocriteria-based narrative evaluations, for the Mill Creek watershed, Hamilton and Butler Counties.[1]

IBI (Sampling Methods)			**MIWB** (Sampling Methods)		**ICI**	Narrative Evaluation or Aquatic Life Use Designation
Headwater	Wading	Boat	Wading	Boat	All	
50-60	50-60	48-60	≥9.4	≥9.6	46-60	Exceptional
50	**50**	**48**	**9.4**	**9.6**	**46**	**EWH**
46-49	46-49	44-47	8.9-9.3	9.1-9.5	42-44	Very Good
40-45	40-45	38-43	8.1-8.8	8.7-9.0	30-40	Good
40	**40**	**38**	**8.1**	**8.7**	**30**	**WWH**
36-39	36-39	34-37	7.6-8.0	8.2-8.6	26-28	Marginally Good
28-35	28-35	26-33	5.9-7.5	6.4-8.1	14-24	Fair
24	**24**	**24**	**6.2**	**5.8**	**22**	**MWH**
18-27	18-27	16-25	4.5-5.8	5.0-6.3	8-12	Poor
12-17	12-17	12-15	0-4.4	0-4.9	<6	Very Poor

[1] Applicable State wide or Interior Plateau ecoregion biocriteria calculated from fish community survey results (Index of Biotic Integrity, Modified Index of Well-being) and macroinvertebrate community survey results (Invertebrate Community Index) according to the sampling methods identified in OAC 3745-1-03.

Nutrients (NO_3+NO_2 and Total Phosphorus)

Nutrient targets are necessary to complement the biocriteria and to help evaluate the impact of nutrient loadings. Data from reference sites in Ohio, especially headwater and wading streams, show that total phosphorus during low flow is lower in stream sites with higher quality habitats as measured by the QHEI. The proportion of the phosphorus that is assimilated instream by improving habitat quality versus the proportion of nutrient load kept from reaching the stream

compared to poor quality habitats is not known. Further work is needed to examine specifically how instream and riparian habitat mediates nutrient assimilation in Ohio streams.

Ohio EPA currently does not have statewide numeric criteria for nutrients but potential targets have been identified in a technical report entitled *Association Between Nutrients, Habitat, and the Aquatic Biota in Ohio Rivers and Streams* (Ohio EPA, 1999). This document provides the results of a study analyzing the effects of nutrients on the aquatic assemblages of Ohio streams and rivers. The study reaches a number of conclusions and stresses the importance of instream nutrient concentrations, in addition to habitat and other factors, as having an impact on the health of biologic communities. The study also includes suggested targets for NO_3+NO_2 concentrations and total phosphorus concentrations based on observed concentrations at reference sites. Reference sites are relatively unimpacted sites that were used to define the expected or potential biological community within an ecoregion.

The ecoregion specific NO_3+NO_2 and total phosphorus target values were used for initial model runs in the Mill Creek basin. As described elsewhere in this report, Mill Creek has many unique features of stream habitat, flood protection measures and varied aquatic life use designations (Warmwater Habitat and Modified Warmwater Habitat) that collectively support the selection of a basin specific set of nutrient targets. The reader is referred to *Legal and Technical Basis for Nutrient Target Values Used in TMDL Projects, DSW Water Quality Standards Guidance #4, November 27, 2000* for a general discussion of the approach being used. These adaptive management concepts were applied to develop Mill Creek basin specific nutrient targets that are compatible with recovery and protection of the biological community (Table 9). As discussed below, achieving the reductions necessary to meet these targets will be challenging, but within reasonable expectations of success.

Table 9. Mill Creek basin nutrient TMDL targets compared to State-wide and ecoregion targets and the range considered protective of aquatic life uses in Mill Creek.

	Nitrate + Nitrite (mg/l)	**Total Phosphorus** (mg/l)
Mill Creek Basin Specific Targets	2.5	0.25
State-wide Targets		
Warmwater Habitat	1.0	0.10
Modified Warmwater Habitat	1.6	0.28
Interior Plateau Ecoregion Targets		
Warmwater Habitat	0.54	0.15
Modified Warmwater Habitat	1.4	0.50
Range of values considered protective	0.5 - 4.0	0.1 - 0.5

Nitrogen

NO_3+NO_2 concentrations in the range of 0.5 to 4.0 mg/l are considered protective of eventual attainment of the Warmwater Habitat biological criteria in the Mill Creek watershed when the following factors are considered:

- A meso-eutrophic boundary value of 1.5 mg/l NO_3+NO_2 has been reported in the literature from a wide range of streams (Dodd, 1998 reported in OEPA, 1999, page 4).
- the threshold for observed degradation of WWH communities is in the range of 3-4 mg/l NO_3+NO_2 (OEPA, 1999, page 2); and,
- non-impaired biological communities occur in streams located in the Interior Plateau and Eastern Cornbelt Plains ecoregion 75% of the time when average low flow NO_3+NO_2 concentrations exceed 3.6 mg/l.

The target value selected, 2.5 mg/l NO_3+NO_2, provides an adequate margin of safety and a reasonable expectation that the WWH biocriteria will be met in this given situation.

Phosphorus

Data from the Interior Plateau and Eastern Cornbelt Plains Ecoregions were examined to determine the relative frequency of total phosphorus concentrations and WWH attainment. The target values used, 0.25 mg/l TP, is at the upper limit or threshold where we can reasonably expect attainment of the WWH biocriteria. In other words, other similar sized streams in the ecoregion are attaining the WWH use designation when total phosphorus concentrations are at 0.25 mg/l, but it is very unusual the find WWH attainment at higher TP concentrations. Therefore, the margin of safety provided through the selection of the TP target value is small.

3.2 Identification of Current Deviation from Target

Table 10 illustrates the median concentrations collected in Mill Creek watershed compared to the target values for the nutrients derived for Mill Creek. Median values exceeded recommended target values in some reaches of the watershed and were below target values in other reaches. Data was evaluated from Ohio EPA water quality studies in 1992 and 1997 and MSD studies in 1994 and 1997.

Table 10. Comparison of conditions and target values of NO_3+NO_2 and total phosphorus in the Mill Creek watershed.

Stream Segment (Upper/Lower RM)	*Drainage Area Classification	NO_3+NO_2 (mg/l)		Total Phosphorus (mg/l)	
		Median (# samples)	Target value	Median (# samples)	Target value
Mill Creek (HUC 1) (Headwaters to Crescentville Rd) (RM 26.35 to 18.69) (RM 26.35 to 19.05) (RM 26.35 to 19.05) (RM 26.35 to 19.05)	H-W	 0.41 (17) [1] 0.26 (8) [4] 0.63 (8) [3] 0.38 (24) [2]	2.5	 0.12 (17)[1] 0.160 (8) [4] 0.37 (8) [3] 0.10 (24) [2]	0.25
Mill Creek (HUCs 1 & 2) (Crescentville Rd to West Columbia Rd) (RM 18.68 to 13.35) (RM 19.04 to 13.35) (RM 19.04 to 13.35) (RM 19.04 to 13.35)	W	 2.3 (24) [1] 2.17 (16)[4] 1.83 (16) [3] 3.38 (48) [2]	2.5	 1.16 (24) [1] 0.82 (16) [4] 0.96 (16) [3] 1.22 (48) [2]	0.25
Mill Creek (HUC4) (West Columbia Rd to Ohio R.) (RM 13.34 to mouth)	W	1.23 (40) [3] 1.20 (72) [4] 1.67 (108) [2]	2.5	0.62 (37) [3] 0.58 (72) [4] 0.46 (108) [2]	0.25
East Fork Mill Cr (HUC 1) Upstrm Upper Mill Cr WWTP (RM 7.10 to 1.85)	H-W	0.10 (11) [1]	2.5	0.14 (11) [1]	0.25
East Fork Mill Cr (HUC 1) Dnstrm Upper Mill Cr WWTP (RM 1.84 to mouth)	H-W	3.96 (18) [1]	2.5	3.11 (18) [1]	0.25

[1] Data from 1997 Ohio EPA Survey
[2] Data from 1992 Ohio EPA Survey
[3] Data from 1994 MSD Survey
[4]Data from 1997 MSD Survey

***** Association Between Nutrients, Habitat, and the Aquatic Biota in Ohio Rivers and Streams (Ohio EPA Technical Bulletin MAS/1999-1-1)
"H" indicates headwater drainage area **"H-W"** indicates headwater and wadeable drainage area

3.3 Source Identification

Mathematical water quality models are a useful tool to examine loads in a watershed and make informed decisions. Nutrient loading in the Mill Creek watershed was simulated using the Generalized Watershed Loading Function or GWLF model (Haith et al., 1992), which is described in Appendix A.

Ohio EPA used the 14-digit hydrology units which delineate the watershed into 5 subwatersheds. Table 11 shows the extent of the subwatersheds and relates the subwatersheds to stream locations discussed elsewhere in this report. The 1992 data set was the most complete available in terms of the number of observations and extent of coverage and 1997 data covers HUC1 and a small portion of HUC2. Therefore, the 1997 data was used for HUC1, and 1992 data was used for the rest of the watershed.

Table 11. Median 1992 and mean 1997 values and target values for NO_3+NO_2 and total phosphorus for the Mill Creek watershed

Stream (Segment)	**Hydrologic Subbasin**	**Drainage Area** (mi^2)	**NO_3+NO_2 Target** (mg/l)	**NO_3+NO_2** median in mg/l (# of samples) [RM sampled]	**TP Target** (mg/l)	**Total P** median mg/l (# of samples) [RM sampled]
Mill Creek (Headwater to dstm. East Fork RM 17.95)	HUC1	42	2.5	3.29* (5) [RM 17.61]	0.25	2.18* (5) [RM 17.61]
Mill Creek (dstm. East Fork to ustm. West Fork Mill Creek)	HUC2	74	2.5	2.88 (12) [RM 13.35]	0.25	0.76 (11) [RM 13.35]
West Fork Mill Creek (Headwater to the Mill Creek)	HUC3	36	2.5	0.86 (12) [RM 11.57/0.19]	0.25	0.12 (12) [RM 11.57/0.19]
Mill Creek (dstm. West Fork Mill Creek to Mitchell Ave. RM 5.85	HUC4	135	2.5	1.63 (12) [RM 5.85]	0.25	0.43 (12) [RM 5.85]
Mill Creek (Mitchell Ave. to RM 2.9)	HUC5	164	2.5	1.53 (10) [RM 2.9]**	0.25	0.38 (10) [RM 2.9]**

* Fewer than 10 observations, so mean of values was used.

** To avoid the effects of backwater, data from RM 2.9 represent instream quality (instead of data from the mouth).

The GWLF model was calibrated for stream flows for the whole watershed by comparing USGS flow data from the period of April 1989 to March 1999 to the predicted flow data for the same period (R2 = 0.76). The model was then calibrated for load for the area upstream from the USGS gage (# 03259000 Mill Creek at Carthage) by comparing observed average monthly load from the summer of 1992 to the predicted monthly nutrient loadings for the same period (R^2 = 0.88 for total phosphorus and R^2 = 0.82 for total nitrogen). Once the model had been calibrated, it was used to evaluate each of the subwatersheds listed as impaired for nutrients.

4.0 TOTAL MAXIMUM DAILY LOADS

A TMDL is a means for recommending controls needed to meet water quality standards. U.S. EPA guidance (USEPA, 1991). 40 CFR 130.2(i) states that a TMDL calculation is the sum of the individual wasteload allocations for point sources and the load allocations for both natural background inputs and nonpoint sources in a given watershed. The TMDL calculation must also include either an implicit or explicit margin of safety that accounts for the uncertainty concerning the relationship between pollutant load and water quality.

4.1 Method of Calculation

Mathematical water quality models are a useful tool to examine loads in a watershed and make informed decisions. Nutrient loading in the Mill Creek watershed was simulated using the Generalized Watershed Loading Function or GWLF model (Haith et al., 1992). The complexity of this model falls between that of detailed, process-based simulation models and simple export coefficient models which do not represent temporal variability. The GWLF model provides a simplified simulation of precipitation-driven runoff and sediment delivery. Solids load, runoff, and ground water seepage are used to estimate particulate and dissolved-phase nutrient delivery to a stream, based on nutrient concentrations in soil, runoff, and ground water. GWLF has been used for TMDL development in Rocky River, Ohio; Donegal Creek, Pennsylvania; Rock Creek Lake, Iowa; and Peña Blanca and Arivaca Lakes, Arizona and is a recommended model in USEPA's Protocol for Developing Nutrient TMDLs (USEPA, 1999).

GWLF simulates runoff and streamflow by a water-balance method, based on measurements of daily precipitation and average temperature. Precipitation is partitioned into direct runoff and infiltration using a form of the Natural Resources Conservation Service's (NRCS) Curve Number method (SCS, 1986). The Curve Number determines the amount of precipitation that runs off directly, adjusted for antecedent soil moisture based on total precipitation in the preceding 5 days. A separate Curve Number is specified for each land use by hydrologic soil grouping. Infiltrated water is first assigned to unsaturated zone storage where it may be lost through evapotranspiration. When storage in the unsaturated zone exceeds soil water capacity, the excess percolates to the shallow saturated zone. This zone is treated as a linear reservoir that discharges to the stream or loses moisture to deep seepage, at a rate described by the product of the zone's moisture storage and a constant rate coefficient.

Flow in streams may be derived from surface runoff during precipitation events or from ground water pathways. The amount of water available to the shallow ground water zone is strongly affected by evapotranspiration, which GWLF estimates from available moisture in the unsaturated zone, potential evapotranspiration, and a cover coefficient. Potential evapotranspiration is estimated from a relationship to mean daily temperature and the number of daylight hours.

The user of the GWLF model must divide land uses into "rural" and "urban" categories, which determines how the model calculates loading of sediment and nutrients. Nutrient loads from rural land uses may be dissolved (in runoff) or attached to sediment loading as calculated by the Universal Soil Loss Equation (USLE).

For "urban" land uses, soil erosion is not calculated, and delivery of nutrients to the water bodies is based on an exponential accumulation and wash-off formulation. All nutrients loaded from urban land uses are assumed to move in association with solids.

The GWLF model was calibrated to the Mill Creek watershed by comparing observed data from the period of April 1989 to March 1999 to the predicted flow data for the same period (R^2 = 0.76). The model was then calibrated for load for the area upstream from the USGS gage (# 03259000 Mill Creek at Carthage) by comparing observed average monthly load from the summer of 1992 to the predicted monthly nutrient loadings for the same period (R^2 = 0.88 for total phosphorus and R^2 = 0.82 for total nitrogen). Lack of appropriate flow data prevented further calibration of the other subwatersheds. Once the model had been calibrated, it was used to predict nutrient loadings during the 1989 to 1999 period. Several years were modeled to obtain better average loadings and smooth out the effects of unusually wet or dry years. Refer to the Appendix A for more details on the GWLF modeling.

A significant area of the Mill Creek watershed is serviced by combined sewers. Overflows from the combined sewer (CSO) and separate sanitary sewer (SSO) systems contribute significant loads to Mill Creek and some of its tributaries. The nature of the load is typically short term, following precipitation events. Since the nutrient target values are associated with long-term exposure, they do not directly apply to the CSO and SSO nutrient loads. CSO nutrient load calculation methodology evaluates annual urban runoff and combined sewer load together; therefore, GWLF was not appropriate to apply to the parts of watershed which have CSO areas. The load contributions from CSO and SSO are calculated separately in Section 4.5. The results of the estimated loadings for each subwatershed are presented in Section 4.4.

4.2 Critical Conditions and Seasonality

TMDL development should define the environmental conditions that were used when determining the allowable loads. Many TMDLs are designed around the concept of a "critical condition." The critical condition is defined as the set of environmental conditions that, if controls are designed to be protecting of them, will ensure attainment of objectives for all other conditions. For example, the critical condition for control of a continuous point source discharge is the drought stream flow. Point source pollution controls designed to meet water quality standards for drought flow conditions will ensure compliance with standards for all other conditions. The critical condition for a wet weather-driven source may be a particular rainfall event, coupled with the stream flow associated with that event.

Nutrient inputs in the Mill Creek watershed arise from a mixture of continuous and wet weather-driven sources. The critical condition to the aquatic biota is expected to be the summer low-flow period because dissolved oxygen levels are reduced, temperature levels are increased and water levels are low. Algal growth increases in the summer months, which can produce significant diel swings in dissolved oxygen and pH. Therefore, it is the observed summer nutrient concentrations that are compared to the targets and used to estimate the necessary loading reductions. Since load reductions will be protective of the summer condition they are also expected to be protective of all other conditions.

Seasonality is addressed in the TMDL by utilizing the GWLF model to predict monthly loadings over a multi year period using actual weather conditions and observed seasonal point source loadings. The estimated loads are therefore reflective of seasonal changes in weather, treatment facility operating practices, and other conditions that can vary over the course of a year (e.g., agricultural practices).

4.3 Margin of Safety (MOS)

The statute and regulations require that a TMDL include a margin of safety to account for any lack of knowledge concerning the relationship between load and wasteload allocations and water quality (CWA § 303(d)(1)(C), 40 C.F.R. § 130.7(c)(1)). EPA guidance explains that the margin of safety (MOS) may be implicit, i.e., incorporated into the TMDL through conservative assumptions in the analysis, or explicit, i.e., expressed in the TMDL as loadings set aside for the MOS. If the MOS is implicit, the conservative assumptions in the analysis that account for the MOS must be described. If the MOS is explicit, the loading set aside for the MOS must be identified.

A margin of safety is incorporated implicitly into these TMDLs. An implicit margin of safety is incorporated in the 303(d) listing process, in the model inputs and application, and in the implementation plan. An explanation for each of these areas is provided below.

4.3.1 303(d) Listing

It is important to keep in mind during the evaluation of the TMDL a major difference in Ohio's program from other state programs. In Ohio, one way a stream segment is listed on the 303(d) list is for failure to attain the appropriate aquatic life use designation as determined by direct measurement of the aquatic biological community. Many other regional or state programs rely solely on chemical samples in comparison to chemical criteria to determine water quality and designated use attainment. However, relying solely on chemical data does not take into account any of the parameters or other factors for which no criteria exist but that affect stream biology. Also chemical criteria does not account for multiple stressor situations. Therefore, the chemical specific approach misses many biologically impaired streams and may not detect a problem until it is severe. Ohio's approach incorporates an increased level of assurance that Ohio's water quality problems are being identified. Likewise, de-listing requires attainment of the aquatic life use determined by the direct measurement of the aquatic biological community. This provides a high level of assurance (and an implicit margin of safety) that if the TMDL allocations do not lead to sufficiently improved water quality then the segments remain on the list until true attainment is achieved.

4.3.2 Model Inputs and Application

GWLF only calculates loads to the stream, it does not simulate instream process such as decay. This results in an overestimation of what actually is present in the water column. This additional load represents an implicit margin of safety.

Another important assumption deals with the relationship between measures of dissolved nitrogen and NO_3+NO_2 nitrogen. As discussed in Section 3.1 the instream targets are expressed as NO_3+NO_2. However, the GWLF model outputs loadings as dissolved nitrogen (which

includes NO_3+NO_2, NH_4+, and NH_3). Since dissolved nitrogen is typically comprised primarily of NO_3+NO_2 (usually 90% based on observed Mill Creek data), the allowable loads for these TMDLs will be expressed in terms of dissolved nitrogen. The estimate of the necessary loading reductions are obtained by comparing the observed instream NO_3+NO_2 concentrations to the target NO_3+NO_2 concentrations.

Most of the instream chemical data was collected during the summer low flow season. In effluent dominated streams, this probably results in higher nutrient concentrations, because dilution from higher stream flows is not considered. The summer low flow period is also the period in which the biota is most stressed by environmental conditions, and is reflective of these conditions. Since these higher concentrations were used to determine the percentile load reductions needed to meet nutrient targets, they represent an implicit margin of safety.

4.3.3 Nonpoint Source Margin of Safety

Mill Creek watershed has experienced decades of extensive human activities. As a result groundwater is a source of nutrients in Mill Creek. Increase of impervious sections in one hand and some other implementation plans on the other hand will result in nutrient reduction in groundwater over the long term. This load reduction could be considered as a long term implicit margin of safety.

Some parts of Mill Creek have habitat improvement projects scheduled or in progress. Some of these habitat improvements provide a margin of safety because they will enable a better biological community to populate the stream.

4.4 TMDL Calculations

Necessary loading reductions for the Mill Creek TMDL were estimated by comparing the instream 1992 summer concentrations to the desired targets (see Section 3.1). For example, if the observed total phosphorus concentration was 0.34 mg/l and the target is 0.17 mg/l, it is assumed that loadings must be reduced by 50%. This approach assumes a direct relationship between loadings and concentrations and a constant assimilation factor (i.e., the instream concentrations of total phosphorus and NO_3+NO_2 will respond to future changes in loading in the same manner as they respond to current loads). These simplifying assumptions are warranted by the fact that it is the cumulative, rather than the acute, loadings of nutrients that are impairing the biologic communities. Refer to *Association Between Nutrients, Habitat, and the Aquatic Biota in Ohio Rivers and Streams* (OEPA Technical Bulletin MAS/1999-1-1) for a full discussion of the cumulative impacts of nutrients on Ohio rivers and streams.

The Mill Creek watershed was divided into five sub-watershed to accommodate the recommended watershed size for GWLF and to increase the resolution (especially helpful during the implementation phase). These divisions were based on physical and geological characteristics and drainage area size. Subwatershed 1 covers the headwaters of the Mill Creek to downstream of East Fork Mill Creek. Subwatershed 2 begins at downstream from East Fork and extends to Upstream of West Fork Mill Creek. Subwatershed 3 contains West Fork Mill Creek. Subwatershed 4 includes Mill Creek, downstream of West Fork Mill Creek to Mitchell Ave. Subwatershed 5 covers Mill Creek from Mitchell Ave. to the mouth at the Ohio River. All

listed segments in the study area are included in one of these 5 subwatersheds. Unlisted and attaining stream segments are also included because they are sources of load regardless if they are locally impaired or not.

Table 12 lists the existing loads, the needed reduction, the TMDL value, and the allocations for total phosphorus and dissolved nitrogen for each of the five nutrient impaired subwatersheds (HUCs) in the Mill Creek watershed. The existing NPS category covers agricultural runoff, urban runoff, and septic systems. The loading capacity (TMDL) was separated into wasteload (WLA) allocations for point sources, load allocations (LA) for nonpoint sources, and natural background for groundwater sources.

$$TMDL = WLA + LA + \text{Natural Background}$$

Table 12. TMDLs and allocations for the Mill Creek watershed*

Sub-watershed	Existing Conditions			Percent Reduction	TMDL	TMDLs for existing discharge flow			TMDLs for point sources at design flow		
	NPS	PS**	Total			Natural	WLA***	LA	Natural	WLA****	LA
Dissolved Nitrogen (kg/year)											
1	28840	61260	90100	24%	68476	13980	46558	7938	13980	74195	7938
1+2	42860	63250	106110	13%	92316	20940	55028	16348	20940	82665	16348
3	Existing concentration is below target level; therefore, No reduction is necessary										
1+2+3+4	Existing concentration is below target level; therefore, No reduction is necessary										
Total	Existing concentration is below target level; therefore, No reduction is necessary										
Total Phosphorus (kg/year)											
1	18530	23200	41730	88%	5008	540	2784	1684	540	5548	1684
1+2	24520	24447	48967	67%	16159	860	8067	7232	860	13184	7232
3	Existing concentration is below target level; therefore, No reduction is necessary										
1+2+3+4	33400	24447	57847	42%	33551	1250	14179	18122	1250	18989	18122
Total	35900	24447	60347	34%	39829	1310	16135	22384	1310	20840	22384

* The CSOs, SSOs loadings are not included (see Section 4.5).

** Upper Mill Creek and Glendale WWTPs Mean annual reported value (1994 to 2001). Assume Glendale WWTP has TP concentration as Butler County.

*** To achieve this WLA at existing condition (8 MGD discharge flow for Upper Mill Creek WWTP and 0.5 MGD for Glendale WWTP) dissolved N should be limited to 4.2 mg/l, and TP should be limited to 0.25 mg/l.

**** Butler County WWTP has a design flow of 16 MGD. To maintain the nutrient target values, the nutrient concentration in the final increased discharged flow from existing to 16 MGD may have to be limited to target values (dissolved N 2.5 mg/l, TP 0.25 mg/l).

4.5 CSO and SSO Nutrient Loadings

Table 12 does not include nutrient loadings from CSO and SSO sources because there are comprehensive plans for addressing SSOs and CSOs as required in the Interim Partial Consent Decree and the Global Consent Decree.

The impacts of CSOs and urban storm water runoff must be considered beyond potential temporary effects on the water column. The most important effects on aquatic life are the *cumulative* result of what each individual CSO and runoff event leaves behind, not merely what happens to water column chemistry during an event. Thus, evaluating the effects of CSO discharges is often complex, site specific, and requires ambient monitoring and other information beyond water column chemistry alone. The predicted annual average CSO loads for nitrogen and phosphorus by subwatershed are given in Table 13. More details about how the CSO and SSO loads were determined are shown in Appendix A.

Table 13. Average Annual CSO Loads

Subwatershed	Nitrogen (kg-N/yr)	Phosphorus (kg-P/yr)
1	0	0
2	8,969	2,283
3	7,140	1,821
4	56,592	14,398
5	149,984	37,921
Total	2.2E+5	5.6E+4

The predicted annual average SSO loads for nitrogen and phosphorus by sub-basin are given in Table 14.

Table 14. Average Annual SSO Loads

Subwatershed	Nitrogen (kg-N/yr)	Phosphorus (kg-P/yr)
1	0	0
2	83003	12456
3	15117	2324
4	1,443	222
5	40	3
Total	1.0E+5	1.5E+4

SSO number 700 contributes 67% of the nitrogen load and 70% of the phosphorus load in HUC 2.

5.0 PUBLIC PARTICIPATION

The Ohio EPA convened an external advisory group (EAG) in 1998 to assist the Agency with the development of the TMDL program in Ohio. The EAG met multiple times over eighteen months and in July 2000 issued a report to the Director of Ohio EPA on their findings and recommendations. The Mill Creek TMDL has been completed using the process endorsed by the EAG.

Ohio EPA began work on a TMDL for the Mill Creek in Hamilton and Butler counties in 1999. Ohio EPA worked the Technical Advisory Committee of the Mill Creek Watershed Council (MCWC) from August 1999 to April 2001. The MCWC is composed of over 40 communities and industries that share an interest in improving environmental quality in the watershed. However, due to time constraints and deadlines that Ohio EPA had set with U.S. EPA, full participation of the workgroup was curtailed in the final stages of preparing the TMDL. This created a report that was not as holistic and comprehensive as it could have been, and the local acceptance of the TMDL was practically nil as evidenced in the strong comments submitted by the MCWC. The initial draft TMDL report focused on effluent requirements. It provided no mechanisms to promote other ways of reducing pollutant loadings and improving stream habitat, a crucial component necessary for stream ecosystem recovery.

Ohio EPA decided to hold a series of three additional public participation meetings with area stakeholders and concerned parties to discuss the issues and brainstorm possible strategies to improve water quality of the Mill Creek watershed. Chronology of the public participation events is depicted in Table 15. The Agency shifted its position from completing a TMDL report by a certain date to creating a framework for local stakeholders to address the pollutant and habitat problems in the watershed. A professional facilitator kept the meetings focused and on track. The public participation meetings concluded with consensus that the local community would develop a Watershed Action Plan which was proposed to address the concerns of the TMDL by developing implementation strategies to improve water quality in the watershed. The Watershed Action Plan will also address other issues of a broader scope than just those of the TMDL, which will improve the quality of the entire watershed for the communities that are located in the region.

In October 2003, the Mill Creek Watershed Council submitted a draft *Upper Mill Creek Watershed Action Plan* to ODNR and Ohio EPA. The report stated that "Using the lists of watershed related issues developed by community representatives during the September 24, 2001 meeting, UMC WAP participants met eight times during 2002 and 2003 to develop, evaluate and prioritize action items in the WAP". The Council has committed to completing the UMC WAP toward the end of 2004.

Consistent with Ohio's current Continuous Planning Process (CPP), the draft TMDL report was available for public comment from June 23 through July 26, 2004. A copy of the draft report was posted on Ohio EPA's web page (www.epa.state.oh.us/dsw/tmdl/index.html) and copies were available upon request. Comments and responses are contained in the responsiveness summary.

Table 15. Mill Creek watershed stakeholders forum.

Date	Time	Subject(s)
08/20/99	1:30 p.m.	Mill Creek Watershed Council Meeting; Ohio EPA led discussion providing background, scope of project, proposed timetable, Ohio EPA stressed need for stakeholder involvement; Council voted to form Technical Advisory Group (TAG) for TMDL from existing Water Quality Committee
08/30/99		MCWC sent letters of invitation to participate on TAG
09/21/99	9:30 a.m.	Mill Creek Canoe Trip: OKI, Ohio EPA, U.S. Army Corps, various stakeholders
10/01/99	9:00 a.m.	Ohio EPA coordinated conference call with major stakeholders; Butler County Department of Environmental Services (BCDES), Metropolitan Sewer District of Greater Cincinnati (MSD), Mill Creek Restoration Project, MCWC; Discussed public involvement needs, and existing data sources, reviewed initial project timetable
10/18/99	3:00 p.m.	First Official TAG meeting; Ohio EPA provided overview of TMDL concepts, Group discussion on potential causes and sources of impairment, project timetable, data availabity; Ohio EPA discussed proposed rule-making for change in Use Designations; meeting dynamics and scheduling
11/22/99	2:00 p.m.	TAG meeting; Ohio EPA presented Proposed Beneficial Use Re-Designations, stakeholder input and group discussion; Discussed pollutants of concern, U.S. EPA grant proposal by consultant
02/17/00	1:00 p.m.	Ohio EPA reviewed stream assessment data, use attainment tables, MSD and BCDES data collection, Group discussion on causes and sources, request for external data submittal to Ohio EPA
04/04/00	2:00 p.m.	Ohio EPA meeting with major stakeholders (BCDES, MSD & its Consultants- R.D. Zande Associates and XCG Consultants, Inc.); MSD Combined Sewer Overflow (CSO) Issues, CSO Long Term Control Plan; Phased TMDL approach; Possible Restoration Scenarios;
04/20/00	10:00 a.m.	First TMDL Small Workgroup meeting (subgroup of TAG) Discussed time-line, target parameters, modeling approaches, target levels, Sources,
5/17/2000	9:00 a.m.	TMDL Small Workgroup meeting: Project timing issues, Target flow defined, RD Zande bacterial data presentation, GWLF model discussion, Storm water management programs in watershed, Planning for Public Information Session

Date	Time	Subject(s)
06/07/00	1:00 p.m.	Presentations by Butler and Hamilton County General Health Districts regarding on-site and Discharging Sewage Systems; Ohio EPA presentation on GWLF model for nutrients, and model input needs; Group discussion on modeling considerations; Segmentation of Mill Creek for TMDL; Planning for July Public Information Session
06/26/00	10:00 a.m.	TMDL Workgroup meeting: Modeling issues
06/28/00	9:30 a.m.	TAG meeting: Modeling discussion; mapping needs; Ohio EPA request information needed for model inputs
07/07/00	9:00 a.m.	Planning for July 27, 2000 Public Information Session, agenda developed with volunteers for presentations and public notification
07/27/00	7:00 p.m.	Ohio EPA Public Information Session for Mill Creek TMDL; Presentations by: Ohio EPA Introduction to TMDL,; OKI- Recreational and Historic Value of Mill Creek; Ohio EPA - State of Mill Creek ; MCWC Stakeholder Involvement; Ohio EPA TMDL Progress Update; BCDES - Restoration Activities; Ohio EPA - Upcoming Regulatory Intitiatives; Citizen Q&A
09/11/00	10:30 a.m.	TMDL Workgroup meeting: Best Management Practices identification, Restoration Scenarios discussion
09/29/00	10:00 a.m.	Mill Creek Watershed Council Meeting; Ohio EPA Update on TMDL Status
10/06/00	10:00 a.m.	TAG meeting: BMP's, Restoration Scenarios, Timetable, Report needs
04/20/01	1:00 p.m.	TAG meeting: Discussion of further development of the report, additional public involvement
05/01/01	9:00 a.m.	Public participation meeting: Additional public input for implementation scenarios
05/29/01	9:00 a.m.	Public participation meeting: Continuation of the public input - consensus building
06/08/01	9:00 am	Public participation meeting: Continuation of public input - reaching consensus regarding direction of implementation strategy via a Watershed Action Plan

Date	Time	Subject(s)
11/21/02	10:00	Ohio EPA meeting with Mill Creek Watershed Council, Mill Creek Restoration Project and Butler County DES to discuss results from 2002 biological and water quality survey and direction of TMDL regarding point sources.
1/22/03	10:00	Ohio EPA meeting with Butler County DES and Woolpert to discuss survey results from 2002.
1/29/04	10:00	Meeting between Ohio EPA, MCRP, MCWC, Butler County and XCG consultants to discuss watershed action plan development.
3/27/03	10:00	Meeting between Ohio EPA, OKI, Mill Creek Watershed Council, Butler County DES to discuss TMDL nonpoint source projects and 319 funding.

6.0 IMPLEMENTATION AND MONITORING RECOMMENDATIONS

The following are recommended actions to implement this nutrient phase of the TMDL for the Mill Creek watershed. *Responsible parties other than Ohio EPA are indicated by italics.*

1. The *Mill Creek Watershed Council* is developing a series of watershed action plans (WAP) to address restoration of the Mill Creek Watershed in a holistic and comprehensive way. The Mill Creek Watershed Council submitted a Draft Report entitled *Mill Creek TMDL Nonpoint Source Pollution Load Reductions* which was developed June 9, 2003. This report proposed 33 projects/actions which would address nutrient load reduction. Since the development of the document, some of the actions may not be feasible due to funding constraints, but it is believed by *MCWC* at least 23 of the proposals, particularly in the upper watershed, remain viable. These actions will be incorporated into the appropriate basin-specific WAPs. Part of the WAPs will address the nutrient issues of this TMDL by focusing on nonpoint source pollution controls, and restoring habitat and riparian in the watershed, and;

2. Institute the NPDES Stormwater Phase II program. The Stormwater Phase II NPDES permit requires development and implementation of Storm Water Management Plans (SWMPs) by 21 political jurisdictions within the watershed that own or operate a separate storm sewer system. Both Hamilton and Butler Counties have formed Storm Water Management Districts which have submitted SWMPs on behalf of their member jurisdictions. SWMPs have also been independently submitted by the Cities of Forest Park, Reading, Springdale and Cincinnati. Implementation of the phase 2 SWMPs is anticipated to improve the quality of urban run-off. Ohio EPA has the role of regulatory oversight to ensure compliance with the terms of the NPDES permit for discharge of storm water from the municipal separate storm sewer systems program regulates development/construction sites greater than one acre. The program comprises six minimum control measures including:

- Public Education and Outreach
- Public Participation/Involvement
- Illicit Discharge Detection and Elimination
- Construction Site Runoff Control
- Post Construction Runoff Control
- Pollution Prevention/Good Housekeeping

All political jurisdictions in the watershed were subject to submittal of plans to meet the 2003 Phase II Stormwater Regulations. *Hamilton and Butler County Stormwater Districts* were formed. Individual communities not belonging to the Districts were required to submit individual permit applications.

3. Support the ongoing efforts of the *Hamilton County Combined Health District's* home septic system inspection and maintenance program as well as the existing Ohio House Bill 110 contracted inspection/enforcement program for semi-public wastewater treatment systems through Ohio EPA's regulatory authority;

4. Encourage *Butler County Health District* to develop inspection programs similar to those described above in Hamilton County;

5. Continued cooperation with and oversight of the *Metropolitan Sewer District of Greater Cincinnati (MSD)* in proceeding with projects identified in the federal consent order as well those to be identified in the updated Long Term Control Plan;

6. Work with and oversee *Metropolitan Sewer District* in the implementation of projects identified in the federal consent order to eliminate Sanitary Sewer Overflows (SSOs) (www.msdgc.org/downloads/consent_decree/final_cd.pdf) as well as additional elimination projects to be identified in the Capacity Assurance Program Plan;

7. Continue to work with *Butler County Department of Environmental Services* to continue to eliminate sewage overflows;

8. Encourage *Butler County Department of Environmental Services* to continue its progressive involvement in habitat enhancement projects in the Mill Creek watershed;

9. Encourage local stakeholder and environmental groups to continue restoration projects that provide water quality benefits and direct Federal 319 grant funds managed by Division of Surface Water (DSW), Ohio EPA, to qualifying habitat restoration and educational programs, and natural resource loans available through the Water Resource Restoration Sponsor Program (WRRSP) managed by Division of Environmental Financial Assistance (DEFA) to qualifying habitat restoration that will document water quality benefits. Encourage local stakeholder and environmental groups to continue work on projects funded by the Clean Ohio Fund and watershed action planning strategies;

10. Encourage both *Butler and Hamilton Counties* and the local jurisdictions to develop more comprehensive and progressive development, flood plain and storm water plans and ordinances;

11. Encourage the *Butler Soil and Water Conservation District (SWCD*) to work more closely with the livestock operators to reduce and eliminate nonpoint source (NPS) pollution entering the waterways. Loan funding is available through DEFA through the Water Pollution Control Loan Program (WPCLP) to assist with this;

12. Encourage *U.S. Army Corps of Engineers* (USACOE) to develop a comprehensive, environmentally protective, flood damage reduction plan for the watershed;

13. Ensure *MSD* completes implementation of SSO 700 IRM (Interim Remedial Measures Plan) as approved by USEPA and Ohio EPA on February 15, 2003.

14. Support local jurisdictions and communities in developing best management practices for sediment and erosion controls in the upper watersheds of Winton Lake and Sharon Lake which will reduce the need for regular maintenance dredging of sediments from these impoundments.

Work with *Hamilton SWCD* through the MOU between *Hamilton SWCD* and Ohio EPA to ensure the enforcement of NPDES Storm Water Phase I regulations;

15. Act as a technical resource and provide support for the implementation of best management practices (BMPs) for addressing nutrient inputs from rural and urban sources; including both management, structural, and vegetative measures as well as institutional programs;

16. Work with *MSD* and *Hamilton County General Health District* to identify and eliminate residential onsite treatment systems discharging in close proximity to sanitary sewers, where possible. Phase II of the NPDES Stormwater Program will require permit holders to develop a plan to prioritize and eliminate illicit discharges to storm sewers that impair water quality. Ohio EPA has the authority to require commercial or industrial onsite sewage treatment systems that are within 200 feet of the sewer system and causing impairment to tie into sanitary sewers.

17. Increase surveillance and enforcement of existing regulations to reduce illegal dumping and NPDES violations;

18. Continue to administer the regulations for the NPDES Storm water Phase I program;

Monitoring and sampling to verify attainment of Water Quality Standards will occur as part of the Ohio EPA five year basin rotation strategy once the recommended actions have been instituted. Further sampling for the other contaminants not addressed in this TMDL will also occur during this later study.

Butler County and Glendale Point Source Reduction Implementation Plan

Ohio EPA has provided regulatory flexibility for Butler County and Glendale by extending the schedule for total phosphorus and nitrogen point source reductions. The revised Implementation Plan extends the initial Point Source nutrient schedule (TP 1 mg/l and NO_2 5 mg/l) to 2006 and the final total nutrient reduction schedule to 2017. Under the revised schedule, Ohio EPA will assess water quality and biological attainment status in 2010 after installation of initial nutrient reduction at both the Butler County and Glendale facilities, stream restoration projects and nonpoint source best management practices from locally developed WAPs. There is a commitment by Ohio EPA and local stakeholders engaged in the Mill Creek WAP process to reevaluate appropriate nutrient reduction scenarios in 2011. If it is determined that biological indicators have achieved attainment, Ohio EPA may not require additional nutrient removal. Conversely, if biological health has not demonstrably improved, additional point and nonpoint nutrient reductions will be necessary.

The Butler County Upper Mill Creek Water Reclamation Facility currently discharges approximately 8 MGD. While Butler County has the operational capacity and an NPDES permit to treat and discharge 16 MGD, the County's projections indicate that the facility may not reach 16 MGD until FY 2010 or later. In the TMDL modeling calculations the 16 MGD flow value and accompanying discharge amounts were used because of the potential for Butler County to discharge this amount of wastewater.

Since stream corridors have been disturbed and modified in large portions of the watershed, a primary focus on the first phase of the TMDL restoration strategy by the local stakeholders will be improvements to riverine-riparian zones along with nutrient removal treatment installation at the Butler County and Glendale sewage treatment facilities. A major restoration project was completed in 2000 by Butler County in partnership with Mill Creek Restoration Project (MCRP) and with partial funding from Ohio EPA 319 funds.

Watershed Action Plan Process

Sub-watershed Plans

MCWC and MCRP organized a series of meetings with local government officials and other community representatives within each of the subbasins to initiate the process to identify water quality and riverine-riparian problems and to help develop consensus on short and long-term action steps local governments can take to address them.

For TMDL and other strategic reasons, MCWC and MCRP proposed to concentrate first on the Upper Mill Creek and East Fork Mill Creek sub-watersheds in Butler County and the Lower West Fork Mill Creek (WFMC) sub-watershed in Hamilton County.

Even though the TMDL evaluation for West Fork Mill Creek did not show nutrient reductions needed in West Fork MC, the community support for improving the watershed in general was strong, and the local stakeholders felt development of a WAP would be of benefit to the community and the environment.

In 2003, The Mill Creek Watershed Council submitted a draft Watershed Action Plan for the Upper Mill Creek basin that contained a community-based action plan to address water quality, habitat, greenways and green space, erosion and sedimentation, stormwater, water quantity/flooding, and public education and outreach. Based on comments received from Ohio EPA and Ohio Department of Natural Resources in 2004, the Council will update and revise the plan and resubmit for approval in late 2004. The MCWC received $25,000 in 319 funds to complete the Upper Mill Creek WAP and continue WAP development of one of the other remaining basins.

6.1 Reasonable Assurances

EPA guidance calls for reasonable assurances when TMDLs are developed for waters impaired by both point and nonpoint sources and for waters impaired solely by nonpoint sources. The purpose of the reasonable assurances requirement is for EPA to be comfortable that the identified activities will in fact be implemented and will have the expected results. Reasonable assurances for reductions in nonpoint source loadings may be non-regulatory, regulatory, or incentive-based, and should be consistent with applicable laws and programs. Because Ohio EPA does not have direct authority/jurisdiction over many of the identified nonpoint sources, it will be important to coordinate these activities with those governmental agencies that do (e.g., county health departments and local political jurisdictions). Having signed memorandums of agreement, relying on entities with proven track records of performance, and documenting that the required funding levels are available can strengthen reasonable assurances for nonpoint source activities.

Ohio EPA has the regulatory authority over the NPDES permit program and will be working with the permit holders to implement the recommendations of the TMDL. Local agencies, environmental groups and jurisdictional authorities have also initiated water quality improvement projects with the goal of restoration of the Mill Creek watershed.

Several watershed communities have already made significant financial investments in early greenway pilot projects, including the City of Cincinnati, Butler County, and the Village of Woodlawn. Other major stakeholders that are expected to participate in the WAP process include the Cincinnati-Hamilton County MSD, local governments, developers and homebuilders, industrial permittees, property owners, businesses, and concerned citizens.

Two watershed organizations, the Mill Creek Watershed Council (MCWC) and the Mill Creek Restoration Project (MCRP), have initiated work in WAP process. MCWC is a publicly funded, nonprofit corporation that was organized in 1995 by an intergovernmental agreement between 17 political jurisdictions who agreed to work together to improve the Mill Creek to provide environmental, aesthetic, recreational and economic benefits for current and future generations. Current members include local political jurisdictions, agencies and organizations, businesses, universities, environmental groups, community groups and residents. The Council functions as a forum for watershed-level decision making.

MCRP is a community-based organization that provides educational and environmental improvements in partnership with people who live and work in the watershed. The MCRP served as a cosponsor for the WAP, providing technical assistance and funding for WAP publications, consistent with its scope of work for grants from the USEPA and Ohio EPA (319 FY 2001), however due to funding resources, MCRP has not been able to continue with this process. MCRP is spearheading implementation of the *Mill Creek Watershed Greenway Master Plan* that is taking a multi-objective approach, providing environmental, social and economic benefits in the watershed. The greenway plan is consistent with the goals of the WAP and provides an important foundation for local stakeholder implementation of the WAP.

6.2 Process for Monitoring and Revision

Monitoring of the progress provided by the recommendations of the TMDL will proceed on the five year monitoring strategy of Ohio EPA after several of the recommendations have been implemented. Recommendations for revision of the TMDL and/or the 303 (d) list will depend on the findings of future monitoring.

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Responsiveness Summary for 2004 Public Comments

Ohio EPA began the development of a nutrient Total Maximum Daily Load (TMDL) for the Mill Creek in 1999. Discussions with stakeholder groups and the public were started in August 1999 and continued until October 2000. The Agency released a draft TMDL report dated January 29, 2001. The availability of this document was public noticed and comments were received through March 2, 2001. As a result of these comments three public participation meetings were held in 2001 to establish consensus between stakeholders and Ohio EPA regarding development of a restoration strategy for the Mill Creek TMDL project. Local stakeholders were to develop watershed action plans to address nutrient nonpoint source pollution concerns in subwatersheds of the Mill Creek basin and Ohio EPA would address permitting issues through its regulatory authority in the watershed. Additional water quality and biological assessment work was conducted by Ohio EPA in 2002.

A final draft nutrient TMDL report was public noticed June 23, 2004. Public comments were accepted through July 26, 2004. The comments received are included here in their entirety, with responses inserted in *italic* type. Comments were received from five parties:

- Metropolitan Sewer District of Greater Cincinnati (MSD)
- Butler County Department of Environmental Services
- Mill Creek Watershed Council
- Harry Stone, PhD, citizen
- Ohio-Kentucky-Indiana Regional Council of Governments.

Ohio EPA and others agree that many studies by a number of parties have been conducted to assess Mill Creek; the serious condition of Mill Creek is well known. This nutrient TMDL for Mill Creek was one of the first TMDLs started by Ohio EPA and has been in progress for a number of years. It began when the agency was addressing TMDLs on a stream segment basis and working on a limited number of pollutants. It is fair to say that if this TMDL were to be started today, a more comprehensive product would result. Ohio now completes TMDLs on a watershed basis and to the extent practicable includes an analysis of all identified causes of impairment to the Aquatic Life and Recreation Uses. However, this new approach does not mean that the existing Mill Creek report is not valid for addressing the nutrient issues in the basin. In the interest of completing this report so that on-the-ground improvements could be initiated, Ohio EPA decided to move forward without substantially updating the report. Additional TMDLs to address other impairments will be needed in the Mill Creek watershed. This TMDL report should not be viewed as the final word on the restoration of Mill Creek, but rather as another step in the right direction. Assessments of the watershed will continue and restoration strategies will be developed as this process evolves.

MSD GREATER CINCINNATI

We have completed a review of the Total Maximum Daily Loads for Mill Creek Basin, Draft Final Report, June 2004 and have prepared the following review comments. The review has been undertaken from the perspective of the Metropolitan Sewer District of Greater Cincinnati (MSD).

Many of the comments reflect clarification of information based on recent initiatives by MSD as a result of ongoing work and in response to the Interim Partial Consent Decree and the final Global Consent Decree actions.

The initial comment presents itself throughout the report in regards to the impact of CSO and SSO on Mill Creek. There are a number of editorialized statements throughout the report that identify CSO and SSO as "significant" or "major" contributors to stream impairment. However there is no body of data presented to support the cause – effect linkage between CSO and SSO discharges and stream impairments. We suggest that the report be reviewed to remove what we consider to be editorial comments.

Response: The statements will be reviewed and appropriate revisions will be made.

The following presents specific comments and references:

1. Executive Summary, Page iv, 2nd paragraph starting "Approximately 100…" Revise sentence starting "More than one hundred.." to, **Currently, there are 98 documented combined sewer overflows and 48 documented sanitary sewer overflows that discharge to the Mill Creek main stem and its tributaries**.

Response: The correction will be made to the report.

2. Section 2.2.2, last sentence in the section on Page 8, "Tributaries in the lower….". This statement does not clearly identify contaminants that are "indicative" of industrial activity and CSO, nor does it establish the nature of the link between contaminants and sources. This statement should be further substantiated or removed.

Response: This summary is based on the information contained in the 1994 report of the 1992 water quality and biological survey conducted by Ohio EPA of the Mill Creek. Strong links were made between contaminants and sources based on the water, sediment and bacteriological data. A reference to the 1994 report will be made to the TMDL report.

3. Section 2.2.2.3, Page 11, 3rd paragraph. CSOs were never intended to provide a high degree of stormwater retention in the combined sewer system. Suggested revision to 3rd sentence starting "While these overflows…" to, **These overflow points were originally incorporated into the collection system by design to discharge during higher flow events resulting from precipitation.**

Response: The suggested language will be incorporated.

4. Section 2.2.2.3, Page 11, 4th paragraph, last sentence starting "However, in the lower five miles…" It is not clearly established that CSO discharges are the only cause of the oxygen demands in the stream. We suggest the following rewording of this statement. **However, in the lower five miles, communities were severely degraded by toxic stresses as well as oxygen demanding conditions based on data collected in 1992 and 1997.**

Response: The suggested wording change will be incorporated.

5. Figure 2 – Mill Creek Schematic, page 24. Mill Creek enters the Ohio River at River Mile 472.5 based information from ORSANCO, US Coast Guard Navigation Charts and the COE 1997 Ohio River survey.

Response: Ohio EPA uses the PEMSO River Mile system to designate locations in water bodies. The PEMSO system indicates the confluence of Mill Creek on the Ohio River is RM 508.95. Clarification of the use of the PEMSO system will be made.

6. Section 2.3.1; subsection Metropolitan Sewer District of Greater Cincinnati, page 25. The following comments are based on the Consent Decree and clarify statements made in this section.
a. 2nd paragraph in sub-section, last sentence "There area.." should read "There are"

Response: The correction will be made.

b. Revise the last paragraph starting "State and Federal…." with the following. **State and Federal regulators have required an update of the 1996 LTCP. A major component of the update is a water quality monitoring and modeling program that incorporates Mill Creek from the Hamilton County border to its confluence with the Ohio River. Other update elements include consideration of a deep tunnel proposal (in conjunction with Army Corps of Engineers) that would provide flood control and CSO capture and treatment. Also, the update will evaluate emerging treatment technologies and use MSD's System Wide Model to quantify CSO and SSO volumes. This work is being undertaken as per conditions of the recently signed federal Consent Decree and the updated LTCP is to be submitted b June 2006.** The current paragraph refers to the LTCP as a revised plan when it is an update to the LTCP.

Response: The change will be made.

c. Page 26, 1st paragraph under MSD SSO Elimination Program. Remove the last two sentences in this section starting with "Due to intervention…" These statements are not accurate.

Response: The change will be made.

d. SSO 700 information has been updated based on the preparation of the SSO 700 Interim Remedial Measures Plan presented and accepted as part of the Interim Partial Consent Decree. The 2nd paragraph on page 26 dealing with SSO 700 does not reflect the current understanding of SS0 700 and should be revised. The following wording is provided for the 2nd and 3rd paragraph in this subsection. **Due to the significance of SSO 700, it received special attention in the IPCD. The IPCD requires MSD to install an interim capture and treatment system. The capture and treatment system design concept is presented in SSO 700 Interim Remedial Measure Plan presented and approved by USEP and Ohio EPA on February 15, 2003. Modeling results using the System Wide Model determined that for the typical year of rainfall (1970) SSO 700 overflows approximately 57.2 MG in 47 events for 890 hours in a**

year. Historical flow data collected at SSO 700 substantiates that SSO 700 is very active during wet weather period. The final design concept included additional features to provide a higher level of control than required. The facility has been designed to prevent SSO activity for the typical year using a combination of 3.6 MG of storage and a peak treatment capacity of 15 MGD. Also, modeling using MSD's SWM has shown that the facility is also sized adequately to treat all flows diverted to the facility for the 10 year design event. The capture and treatment system is currently under design and construction is required to be completed by June 2006.

Response: After reviewing the suggested language, Ohio EPA has determined it would be more appropriate to write:
Due to the significance of SSO 700, it received special attention in the IPCD. The IPCD requires MSD to install an interim capture and treatment system. The capture and treatment system design concept is presented in SSO 700 Interim Remedial Measure Plan presented and approved by USEP and Ohio EPA on February 15, 2003. Modeling results using the System Wide Model determined that for the typical year of rainfall (1970) SSO 700 overflows approximately 57.2 MG in 47 events for 890 hours in a year. Historical flow data collected at SSO 700 substantiates that SSO 700 is very active during wet weather period. ~~*The final design concept included additional features to provide a higher level of control than required.*~~ *The facility has been designed to* ~~*prevent SSO activity*~~ *capture and/or treat the flow for the typical year using a combination of 3.6 MG of storage and a peak treatment capacity of 15 MGD. Also, modeling using MSD's SWM has shown that the facility is also sized adequately to treat all flows diverted to the facility for the 10 year design event. The capture and treatment system is currently under design and construction is required to be completed by June 2006.*

7. Section 4.5, page 43. The first two paragraphs in this section contain a number of editorial comments and it is suggested the section deals with nutrient loadings directly. We suggest the first paragraphs be removed and replaced with the following: **Table 12 does not include nutrient loadings from CSO and SSO source because there are comprehensive plans for addressing SSOs and CSOs as required in the Interim Partial Consent Decree and the Global Consent Decree.**

Response: Some of the suggestion will be incorporated. The paragraphs in this section contain more than just editorial comments. These statements are based on experience of Ohio EPA's sampling watersheds in areas impacted by combined sewer overflows and sanitary sewer overflows.

8. There is also a table reference error in the last sentence on page 43, reference should be to Table **14** not 12.

Response: The correction will be made.

9. Page 44, last sentence. Suggest reword the sentence to **SSO 700 contributes 67% of the nitrogen load and 70% of the phosphorus load in HUC 2**.

Response: The suggestion will be incorporated.

10. Section 6.0, page 49 item 13. Reword item 13 with the suggested. **Complete implementation of SSO 700 IRM as approved by USEPA and OEPA on February 15, 2003.**

Response: The suggestion will be incorporated.

BUTLER COUNTY DEPARTMENT OF ENVIRONMENTAL SERVICES

The following comments are divided into two sections: repeated comments and new comments. The page number(s) from the TMDL Report is (are) included for reference purposes.

REPEATED COMMENTS

1. Page 1. The Mill Creek TMDL only addresses nutrients. Though OEPA states that TMDLs are to address watershed-wide pollutants, this Draft Report looks at just one. While sediments and bacteria are both serious problems throughout the watershed and impact habitat and recreation – and ultimately aquatic attainment – they are hardly mentioned in this Report.

a. How does OEPA expect the Mill Creek to achieve water quality standards (WQS) without addressing all the causes and sources of impairment?

b. What are the timeframe and plan for addressing the other causes and sources of impairment? What assurances are given to point sources and other stakeholders that these sources of impairment will be addressed - prior to requiring additional and substantial investments by the point sources for the implementation of the final phases of the nutrient limits as currently proposed?

Response: Due to the complexity of the Mill Creek watershed, Ohio EPA decided to take a phased approach in the TMDL efforts. This decision was discussed at the beginning of the process with stakeholders. This TMDL is the first phase of the process and addresses nutrients. Later phases of the process will address other impairments. Once this TMDL is allowed to move forward, then other phases of the Mill Creek TMDL process can proceed. The State of Ohio is required by the Clean Water Act to address the causes of impairment.

2. Page 1. There is a lack of definitive information provided to support a supposed causal link between nutrient levels and biological indicators. In Ohio EPA's technical bulletin *Association Between Nutrients, Habitat, and the Aquatic Biota in Ohio Rivers and Streams*, the importance of sediment, habitat and riparian quality is factored heavily in determining the water body health. Yet, Ohio EPA has all but ignored these important components in the Mill Creek TMDL.

Response: Based on data from a decade of stream assessments from a number of parties, including Ohio EPA, Ohio EPA believes there is sufficient information to support the content of the Mill Creek TMDL report. The base stream flow in parts of East Fork Mill Creek and the mainstem of Mill Creek are dominated by wastewater effluent. Adequate pollution controls on major wastewater parameters are essential for the health of the stream. Excessive nutrient levels (nitrogen and phosphorus) were pollutants that contributed to poor biological criteria

performance and were selected for TMDL development. The factors mentioned in the comment (sediment, habitat and riparian quality) are important in all waters and the TMDL's permit limit implementation schedule provides an opportunity for local initiatives within the Mill Creek watershed to manage these factors, demonstrate attainment of biological criteria and subsequently modify the TMDL.

While OEPA admits that "a number of factors" – including poor habitat and urbanization – "signal the need for a creative solution to the impairments of the Mill Creek watershed", the Agency's chosen *creative solution* is simply to restrict even further the operations of two (2) point sources. A solution to impairments that looks at neither significant habitat issues nor nonpoint source pollution can hardly be called "*creative*". A TMDL focusing only on nutrients as a cause of impairment is unacceptable. The scope of the TMDL needs broadened to incorporate other causes of impairment such as habitat modifications, and other sources of impairment such as urban and agricultural runoff, construction runoff, CSOs, SSOs, and hydromodification and channelization.

Response: Due to the complexity of the Mill Creek watershed, Ohio EPA decided to take a phased approach in the TMDL efforts. This decision was discussed at the beginning of the process with stakeholders. This TMDL is the first phase of the process and addresses nutrients. Later phases of the process will address other impairments. Once this TMDL is allowed to move forward, then other phases of the Mill Creek TMDL process can proceed. The State of Ohio is required by the Clean Water Act to address the causes of impairment. Combined Sewer Overflows (CSOs) and SSOs are being addressed in Hamilton County through a signed federal Consent Decree and updated Long Term Control Plan. The local stakeholders agreed to address NPS pollution sources by developing watershed action plans and implementation strategies. We have recently received a letter from Nancy Ellwood, Executive Director from the Mill Creek Watershed Council, stating that the council will move forward to finalize the Upper Mill Creek WAP. However, it should be noted that ***both*** *point source and nonpoint source nutrient loadings have to be reduced for the goals of the TMDL to be achieved,* ***not*** *one or the other. The modeling indicates that both loading reductions must occur.*

The Upper Mill Creek Watershed Action Plan (UMC WAP) – developed locally by the Mill Creek Watershed Council – is truly a "creative solution" to the many impairments of the Mill Creek. This WAP takes a holistic approach to water quality improvement, habitat and riparian restoration, and community outreach. Butler County recommends that OEPA supports, endorses and utilizes the Upper Mill Creek WAP in this sub basin as part of the implementation plan for the TMDL.

Response: At the time of the release of the draft TMDL report, the Mill Creek Watershed Council had voted on April 29, 2004 to temporarily put a hold on the work of the draft Upper Mill Creek WAP due to the extent of the comments received from Ohio Department of Natural Resources and Ohio EPA and the lack of resources. Nancy Ellwood, Executive Director for MCWC, had indicated in a June 9, 2004, email that if funding could be obtained, the Council would move forward with completing the UMC WAP, but at the release of the report, no information of funding or the continuation of the work had been received by Ohio EPA. The UMC WAP is the type of initiative needed to address NPS impairments in the watershed, but we

will reiterate that nutrient load reductions must occur from point sources and nonpoint sources for the goals of the TMDL to be achieved.

3. Page 3. Table 2 – 'Phasing of TMDL in the Mill Creek watershed'. The Butler County Department of Environmental Services (BCDES) opposes more stringent permit limits on the Upper Mill Creek (UMC) WRF when OEPA has laid out no plan for reducing other known sources of nutrients. Butler County is currently in the process of upgrading its UMC WRF facility in order to meet NPDES nutrient limits effective January 2006. These nutrient permit limits were derived by OEPA and Butler County based on extensive modeling analysis, stream surveys and discussions. The current upgrade will cost the County over $7 million, and will not increase capacity.

In recommending more stringent nutrient limits as detailed in the TMDL (0.5 mg/l Total Phosphorus and 3 mg/l Dissolved Nitrogen in 2012, and 0.25 mg/l Total Phosphorus and 2.5 mg/l Dissolved Nitrogen in 2017), OEPA seems to ignore the whole point of the TMDL development process, which is to address nonpoint sources first, BEFORE placing additional restrictions on point sources. The Mill Creek TMDL significantly underestimates, or else entirely overlooks, the nutrient contribution of nonpoint sources such as urban and agricultural runoff, SSOs/CSOs, and construction/development activities.

To achieve the nutrient limits laid out in phase one of the TMDL (1 mg/l for phosphorus and 5 mg/l for nitrate/nitrite), Butler County will spend about $10 million on a major plant upgrade over the next year and a half. To meet the second phase of effluent nutrient limits as proposed in the TMDL (0.5 mg/l for phosphorus and 3 mg/l for nitrate/nitrite), Butler County would incur substantial additional operating costs associated with chemical addition, filtering, and increased solids production, handling and disposal.

Response: Ohio EPA has considered load reduction in both NPS and point source during development of the time table for load reduction. If NPS load reduction and habitat enhancement projects had not been considered, then the final total phosphorus and dissolved nitrogen limits for point sources would have been implemented in a much earlier time frame than 2017. The approach outlined in the TMDL provides flexibility to explore NPS improvements.

4. Page 35. Butler County still has serious reservations about the accuracy and applicability of the GWLF model for simulation and examination of nutrient loadings in the Mill Creek. The GWLF model is known to rank poorly with regard to calibration. In addition, the model's time scale is continuous, meaning it cannot incorporate CSOs and SSOs loadings. Furthermore, GWLF is a medium detail model and is not well-suited, according to USEPA's *Compendium of Tools for Watershed Assessment and TMDL Development* (May 1997), for developing TMDL implementation requirements or permit limits. Finally, Butler County questions the validity of the model because its application relative to the Mill Creek TMDL is based on literature values and outdated, faulty land use data.

Response: According to the USEPA's Compendium of Tools for Watershed Assessment and TMDL Development (May 1997), GWLF is considered suitable to calculate nutrient loads from

urban and agricultural watershed as well. It can be applied to relatively large watersheds, multiple land uses, and point source discharges. The model is recommended by Tetra-Tech based on the availability of data. The available data did not allow the use of a more complex model. Mid-size models such as GWLF and SITEMAP are the well known models that deal with the assessment of both rural and urban areas as well as total Phosphorus and Nitrogen. SITEMAP requires N and P concentration data in the runoff from different land uses, which were not available data for the Mill Creek watershed.

The GWLF model focuses on low-flow condition with the assumption that CSOs will not have impact during the low flow conditions; therefore, the available low flow summer data were used for model calibration.

GWLF was not used to allocate limits for point sources. The TMDL report includes limits of 0.25 mg/l for phosphorus, and 2.5 mg/l for nitrogen.

5. Page 35 and Appendix page 2 (Table 1. Land uses in Mill Creek watershed, 1989-1994). Butler County still has serious reservations about the land use data utilized by OEPA as input for the GWLF nutrient loading simulation model. For the Upper Mill Creek sub watershed, at least, the land use data is remarkably outdated. So much development and commercialization has occurred over the past ten years that the sub watershed today looks very dissimilar to the sub watershed from 1994. In fact, whereas ten years ago the sub watershed might have been described as "rural with suburban/commercial/industrial encroachment", it can now only be described as "suburban/commercial/industrial with rural pockets". Butler County believes more up-to-date land use data MUST be used in this model, otherwise the validity of all model results will remain highly questionable.

In the Appendix on page 92, OEPA states that it will reassess the percent land use in various categories before preparing a final report. Butler County requests that OEPA conduct a land use reassessment prior to finalizing this report.

Response: Digital Land Use/Land Cover for the Mill Creek Watershed were obtained from National Land Cover Dataset (NLDC). NLCD is widely used by EPA agencies for TMDLs. The category of the land use in NLCD can be easily re-categorized when using GWLF. At the time of doing the modeling, 1994 was the latest available land use data. Recently NLCD has developed 2002 land use data which still is not available for external use. Since this information is not available, Ohio EPA cannot reassess prior to finalizing this report.

NEW COMMENTS

1. Page 3. Table 2 – 'Phasing of TMDL in the Mill Creek watershed'. There is a typo in the sixth row, first column of this table. The year should be **2006**, NOT 2005. There is another typo in the last row, middle column of this table. The sentence should read "If biological attainment not achieved from the **2015 assessment**, then both…", NOT 2010.

Response: The correction of 2005 to 2006 will be made. Discussions within the Division of Surface Water have indicated modifications to later time frames in Table 2 may need to be made.

2. Page 7. The Mill Creek TMDL states that "ammonia toxicity was apparent in 2002", and implies that the UMC WRF was a main source of this toxicity. Included below is a chart of ammonia concentrations over time discharged from the UMC WRF. Figure 1 below shows a general decline in ammonia concentrations – a result of plant upgrades and operational improvements and modifications.

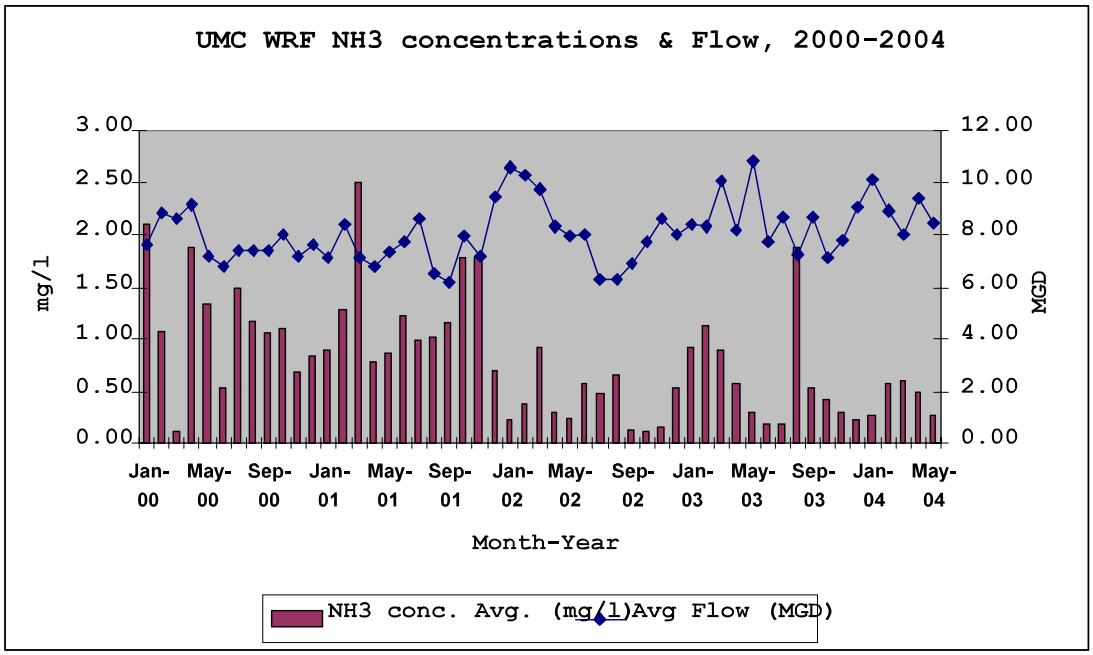

Figure 1. Ammonia concentration and flow from UMC WRF, 2000-present

Based on the actual ammonia data and our associated increase in flow, Butler County does not believe that OEPA's position is valid that "ammonia toxicity was apparent in 2002". Rather, Butler County believes that OEPA should consider the other factors that led up to the stream assessment, including but not limited to the Crescentville Road bridge construction project, a downstream MSD sewer line crossing, and numerous land development activities (for example, the Streets of West Chester is less than one mile upstream and site development was underway prior to the assessment). Figure 2 below illustrates the actual loadings to the stream from 1997-2003. Butler County has made a marked improvement in reducing loadings even while flow has been slowly increasing.

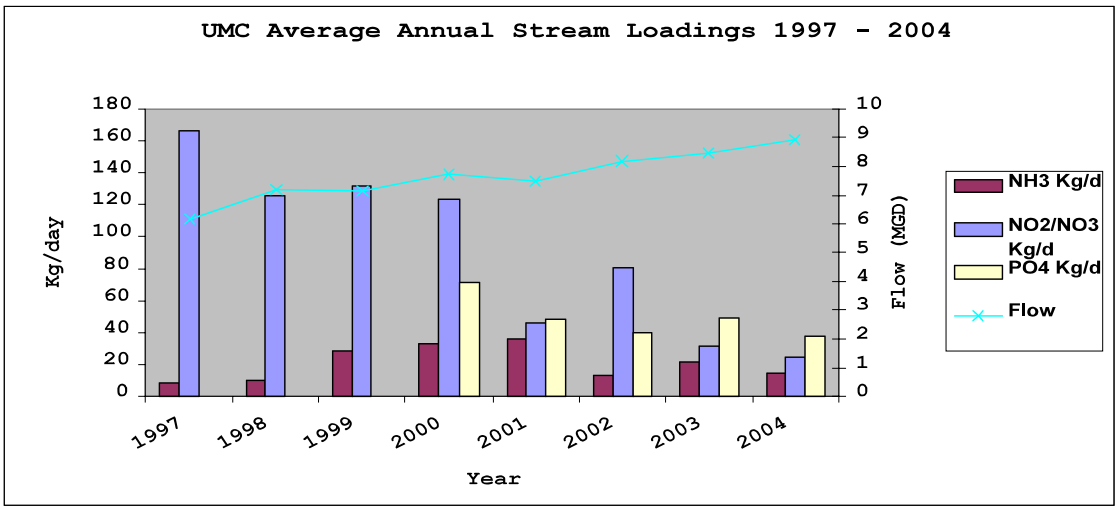

Figure 2. Annual stream loadings of NH_3, NO_2-NO_3, and PO_4 (and flow) from UMC WRF, 1997-present

Response: Ohio EPA does not dispute the data shows a declining trend in WRF effluent ammonia concentrations in recent years. However, biological response in the fish community in 2002 suggests a toxic impact that was not noted upstream (i.e., very low relative numbers, a predominance of pioneering species, poor/very poor quality downstream from the WRF, compared to high relative numbers, low percentage of pioneering species and good to very good quality upstream). Biological impacts coincided with WQS exceedences for ammonia detected during chemical sampling in 2002. The Upper Mill Creek WRF was the primary source of ammonia as effluent concentrations of 4.89 mg/l were measured on the same date. Based on these observations, ammonia was considered a likely source of impairment. This information is illustrated in the Addendum (June 2004) to: Water Quality Permit Support Document to Assess the Proposed Expansion of the Butler County Upper Mill Creek WWTP August 1998, Based on Biological and Water Quality Sampling Conducted July-September, 2002. This document is also available with the draft TMDL report at: www.epa.state.oh.us/dsw/tmdl/MillCrDraftTMDL.

Ohio EPA disagrees that the other nonpoint sources or physical factors listed are primarily responsible for the near 30 point decline in the IBI downstream from the WRF. Ohio EPA fish collections were downstream from Crescentville Road bridge at RM 0.8 but bridge construction was complete and the fish zone did not include the immediate vicinity of the bridge. The next sampling site was well downstream but IBI scores were similar, both to the RM 0.8 site and to other consultant sites that same summer. After an additional year for recovery, Woolpert's most recent 2003 fish sampling results show some improvement but continue to reflect impairment with community health ranging from poor (IBI = 18 at RM 0.3) to fair (IBIs = 32 and 30 at RMs 0.8 and 0.1, respectively). While perhaps not to the same degree as downstream, the East Fork upstream from the WWTP at Allen Road is also subjected to urban runoff, increased suburban development, and has undergone historic channelization (i.e.,1992 Ohio EPA QHEI sheets list Allen Road as "recovering" from channelization and 1995 JJ&G consultant QHEIs describe the channel as "recovered"). Despite these influences, biological communities maintain good to exceptional performance at the upstream site and were in Full attainment of the biological criteria.

3. Page 9. The Mill Creek TMDL states that 2002 nutrient bioassay studies conducted by OEPA on algae (Bioassay Report Number: 02-2671-SW) indicated an inhibition of growth toxicity from the effluent of the Upper Mill Creek WRF and the acute mixing zone. Butler County disputes this statement. On March 4, 2003, BCDES summarized our concerns with the 2002 bioassay results in a letter to OEPA; BCDES never received a response from the Agency.

Based on Butler County's review of the data and test results, we believe there are critical problems with OEPA's test and ultimate conclusion. Below are the three main points identified in our March 2003 correspondence to the Agency:

First, test results appear to be confounded by the presence of nutrients in the receiving water. Consequently, it is impossible to deduce whether exposure to undiluted effluent is likely to produce any adverse effect (including stimulation or inhibition of algae cell growth).

Second, the data OEPA relied on was generated using a method that is no longer valid. U.S. EPA modified the green algae procedures prior to OEPA's 2002 test to reduce excessive analytical variability and the high incidence of test errors.

Third, the state laboratory did not verify that they complied with U.S. EPA requirements to conduct monthly reference toxicant tests on algae. Without such data, results from tests performed using *Selenastrum capricornutum* may not be valid.

Butler County would like to have all statements related to these bioassay studies removed from the final TMDL Report as study results cannot be considered valid. BCDES welcomes a meeting to discuss these issues with OEPA. In general, there are serious innate flaws in whole effluent toxicity testing, and the results we have seen in Butler County are no different than those being discussed and litigated nationally. In a recent study by the Western Coalition of Arid States (WESTCAS – WESTCAS WET Method Blank Study), 17 labs analyzed 25 nontoxic sample blanks using *Ceriodaphnia dubia*. The water analyzed in the WESTCAS Study had been activated carbon, deionized and microfiltered to produce presumptively nontoxic water. The Study's test results are alarming and call into question the validity of such WET testing. There were no test failures based on survival, however nine of the 23 valid tests (39%) reported toxicity based on reduced reproduction. Six of the nine reproduction failures reported IC-25 (25% impairments) estimates greater than 2 TUc (chronic toxicity units). The NOEC endpoint had seven failures in 23 tests and three of the seven were greater than 2 TUc. Legally, all nine WET test failures may constitute potential permit violations regardless of the magnitude of failure.

Response: The August 2002 Selenastrum capricornutum green algae chronic toxicity tests of Butler County Upper Mill Creek WWTP effluents (Ohio EPA Bioassay Report Number 02-2671-SW) were conducted using testing and statistical analysis procedures from "Short-term methods for estimating the chronic toxicity of effluents and receiving water to freshwater organisms. Third Edition (EPA-600-4-91-002)". These were the U.S.EPA recommended methods at the time the tests were conducted. The tests met the criteria of growth in the controls of at least 2.0 X 10^5cells / milliliter (mL) and variation of less than 20 percent among the replicates that were required for them to be valid tests and provide usable data. Algal growth in the four replicate

East Fork Mill Creek diluent controls was 6.88 X 10^6, 5.90 X 10^6, 6.85 X 10^6, and 6.88 X 10^6 cells/mL which averaged 6.63 X 10^6 cells/mL with a coefficient of variation of 7.3 percent.

The nutrient bioassay report did not, but should have, indicated that the effluent and receiving water each received 1 mL/L of each of the five nutrient stock solutions (four macronutrients and one micronutrient) used to prepare the algae culture media that served as the secondary laboratory control. The nutrients were added to eliminate false negative results if there had been low nutrient concentrations in the WWTP effluent or receiving water.

The response pattern in the definitive test was a good example of a toxic dose response curve. Mean algal cells per milliliter was greatest in the East Fork Mill Creek diluent control with a continuous stepwise decrease in algal production at each succeedingly higher effluent concentration. Average algal production in the undiluted full-strength 100 percent by volume (%) effluent and in the 50% effluent was statistically significantly different (reduced) from the mean cells/mL produced in the diluent control.

The test methods Ohio EPA used was that recommended by U.S. EPA at the time the tests were conducted. A continuous dose response curve was evident. Succeedingly higher effluent concentrations produced fewer algal cells/mL. The coefficient of variation [(mean number of algal cells produced per milliliter/standard deviation) X 100] for each tested solution ranged from 7.3 to 19.0 indicating little variability in the solution replicates. The overall test variability was also low. The percent minimum significant difference (PMSD) detectable with the data set was a change of 17.5 percent from the East Fork Mill Creek upstream diluent control. This PMSD is within the lower and upper PMSD bounds of 9.1 and 29 established when the U.S. EPA subsequently revised the green algae test method to reduce variability.

Ohio EPA has no standard reference toxicant data for algae. This should not disqualify these algal tests from use. We have cultured the green algae S. capricornutum for several years as part of the food supply for Ceriodaphnia dubia. Culture includes aseptic technique, inoculation of new cultures, and cell counts which are important parts of the test method. The tests met the growth and variability criteria required for valid tests and therefore the data may be used.

We believe the referenced Western Coalition of Arid States lawsuit was settled long ago. Part of the settlement involved a document on variability in whole effluent toxicity (WET) tests and ways to reduce the variability. As part of that document, or another one, guidance on interpreting WET test results was included in a U.S. EPA publication. This also was an effort to reduce test variability. This guidance was incorporated into current revisions of the U.S. EPA WET test method manuals. The U.S. EPA continues to support the use of WET tests in the permit process. Except for the use of EDTA which was an option but not a requirement in 2002, the 2002 S. capricornutum green algae tests meet the current U.S. EPA criteria for valid tests just as they met the criteria that applied at the time the tests were conducted.

4. Page 10. Table 3 – 'Median chemical results from the Ohio EPA 1997 biological and water quality survey of the upper Mill Creek watershed'. The effluent sample results from Butler County's Upper Mill Creek WRF outfall are from 1997 or before. These chemical results therefore do not represent current conditions. Since 1997, the UMC WRF has been upgraded,

expanded and generally improved. Effluent water quality has improved, resulting in greater nutrient removal efficiencies. For example, in 1997 the average effluent phosphorus (total) concentration was 3.07 mg/l; in 2003, average concentration was 1.5 mg/l. This represents a 51% reduction (improvement) in effluent phosphorus concentration from the UMC WRF over a period of just 7 years. Similarly, in 1997 average effluent nitrate-nitrite (total) concentration was 4.83 mg/l; in 2003, average concentration was 1.03 mg/l. This represents an 80% reduction (improvement) in effluent nitrate-nitrite from the UMC WRF over the same 7 years.

Figure 2 is repeated below, showing stream loadings for phosphorus, nitrate-nitrite, and ammonia from the Upper Mill Creek WRF, from 1997-present (same chart from NEW COMMENTS #2). The figure is repeated here to reinforce the fact that all trends indicate a substantial decline in nutrient loading rates attributable to the WRF, despite a sustained increase in flow.

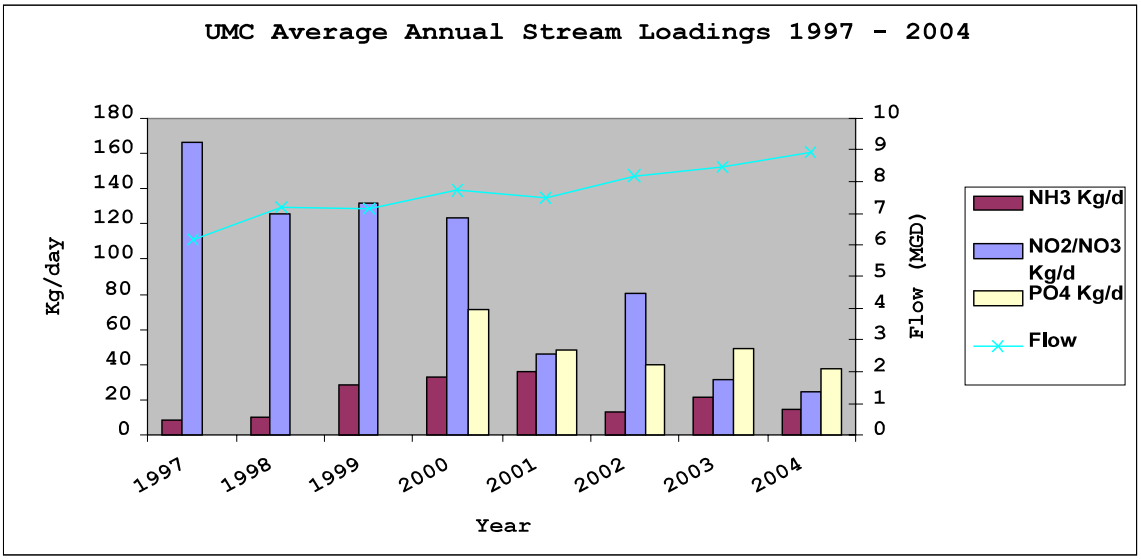

Figure 2 (repeated). Annual stream loadings of NH_3, NO_2-NO_3, and PO_4 (and flow) from UMC WRF, 1997-present

As shown above, the UMC WRF has dramatically improved its nutrient removal capabilities over the past few years, and will continue to do so in order to meet upcoming NPDES permit limits, effective January 2006. With the new permit limits, then, this point source is adequately "controlled" for the purposes of the TMDL. Additional restrictions and tighter discharge limits are unnecessary. The Mill Creek TMDL should therefore focus on the nutrient contributions of nonpoint sources, and encourage a watershed-wide implementation and improvement strategy to achieve designated water quality standards, similar to those initiatives developed through the Upper Mill Creek Watershed Action Plan (UMC WAP).

Response: The addition of the 2002 data to Table 3 of the TMDL report was an oversight on the part of Ohio EPA. That data is contained within the Addendum (June 2004), but will be added to the TMDL report. There is no doubt that phosphorus and nitrate-nitrite concentrations have been reduced in the effluent since 1997, however they are still exceeding the target concentrations, and instream ammonia has increased downstream from the WRF. The reader should note that the median concentrations downstream from the WRF are significantly higher than those documented upstream from the facility. The concentrations upstream from the facility meet the target values, and the biology is in full attainment.

5. Page 12. The TMDL Report states that "Chronic NPDES permit violations for ammonia and suspended solids (n=26) were also documented at the (UMC WRF) plant between 2000 and 2003." Butler County rejects this statement. According to Butler County records, the UMC facility reported 22 permit violations (5 for ammonia, 18 for TSS) in the four year period from 2000 to 2003. While Butler County agrees that 22 violations are too many, we must remind Ohio EPA that eight (8) of the suspended solids violations occurred in 2000, prior to the plant upgrade. Since the upgrade, the facility has averaged less than two (2) suspended solids violations per year and just over one (1) ammonia violation per year. Furthermore, the facility has had no suspended solids violations since July, 2002 and no ammonia violations since August, 2003.

Response: The sentence from page 12 summarized the trend in violations but the total number (26) was mistakenly attributed to ammonia and TSS only. There were 18 violations for TSS, 5 for ammonia, plus 3 "others". Ohio EPA will remove the word "chronic" and simply state: "Twenty six NPDES permit violations were documented at the Upper Mill Creek WRF between 2000 and 2003. For the nearly 4 years of data evaluated, violations for total suspended solids (18) and ammonia (5) were reported most frequently. Forty-two percent of violations occurred between 2002 and 2003."

Without question, the UMC WRF has made significant strides in improving the quality of its effluent. By January of 2006, the facility will be even better as a result of improved nutrient removal capability. As mentioned above, then, this point source is adequately "controlled". The TMDL should therefore focus on nonpoint sources as opposed to already limited point sources such as Butler County's water reclamation facility.

Response: Ohio EPA does agree that nutrient loadings have declined since the last survey but phosphorus levels remain elevated above target levels. Nitrate levels also declined but potential benefits to biological communities appear offset by increases in ammonia.

Incidentally, Butler County would like to know what number of violations constitutes a "chronic" situation. Additionally, how does OEPA differentiate between TSS discharge from a point source and sediment loadings from land development that has been occurring at a more rapid pace each year, throughout the watershed?

Response: Ohio EPA agrees to remove the word "chronic".

6. Page 12. See NEW COMMENTS, number 3.

Response: See response under New Comments, number 3.

7. Pages 12-13. The Mill Creek TMDL Report states, "The installation of Newbury Riffles downstream from the (UMC) WRF had not resulted in significant improvement in biological conditions by 2002."

Butler County is concerned with OEPA's judgment of the Newbury Riffles and the general lack of acknowledgment on the Agency's part that there were some significant long-term construction projects and impacts on the East Fork Mill Creek leading up to OEPA's 2002 assessment. Repeatedly, Butler County and our consultants brought concerns to OEPA about impacts associated with the replacement of Crescentville Road bridge, denuding of riparian areas, and unauthorized discharges that would impact biological results and make recovery that much more difficult. The placement of riffles, while a good first step, was not intended to be a full scale restoration project that was going to solve all the problems. It was an attempt to provide better habitat and mitigate the impacts of sedimentation and substrate embeddedness. Unfortunately, because there are such great impacts throughout the upper watershed, the riffles are challenged to counter all the other issues related to habitat degradation, riparian removal and nonpoint source pollution. Additionally, constant log jams along the East Fork and significant commercial development directly upstream from the WRF – with minimal erosion and sediment control and limited preservation of riparian corridors – continue to limit the effectiveness of the habitat improvements.

Response: See response to New Comments, number 2. The potential influence of these factors is considered secondary to the WRF effluent discharge.

While Butler County accepts the fact that the recovery rate of Mill Creek's in-stream biological communities may not parallel those observed on the Scioto River downstream of Columbus and on Tinkers Creek in Twinsburg, Ohio, we assert that the communities are indeed recovering. Nevertheless, looking at biological data (Index of Biotic Integrity and Index of Community Integrity, IBI and ICI) from 1995 through 2003, Butler County sees marked improvement – especially in terms of the macroinvertebrate community structure. Please see Figure 3 below for more information:

ICI Scores on East Fork Mill Creek, 1995 - 2003			
Year, Data Source*	Crescentville Road (RM 0.8)	Downstream Crescentville (RM 0.3)	Near Mouth (RM 0.1)
1995, JJG	6	No data	6
1997, OEPA	28	No data	24
1999, W	~~10~~ *12*	~~22~~ *24*	~~28~~ *24*
Restoration Event: Installation of Newbury Riffles			
2000, W	22	34	28

2002, W	~~34~~ *30*	~~38~~ *36*	~~30~~ *28*
2002, OEPA	26	26	32
2003, W	32	~~42~~ *40*	28

Figure 3. ICI scores from 3 sites on East Fork Mill Creek downstream from UMC WRF, from 1995-2003
*JJG = Jordan, Jones & Goulding; OEPA = Ohio Environmental Protection Agency; W = Woolpert
Woolpert 2003 results are included and have been recalculated to meet Ohio EPA data analysis guidelines. The corrected values are italicized in the table.

Looking at the ICI scores from Crescentville Road and Downstream Crescentville Road prior to restoration, we generally see nonattainment per ecoregion criterion. However, in three (3) sampling events post-restoration, ICI scores indicate attainment (30 +/- 4) at both of these sites, and further downstream. Butler County contends that the biological communities are improving as a result of habitat improvement, which supports our claim that poor habitat is at least as significant a cause of impairment as nutrient enrichment in the Mill Creek basin.

Response: As discussed in previous meetings with Butler County and their consultant, the artificial substrates samplers tend to minimize the influence of the natural substrates by providing a consistent, high quality colonizing surface from site to site. For this reason, the macroinvertebrate communities primarily reflect water quality conditions, not habitat quality. Therefore, changes in the ICI primarily reflect declining or improving trends in the water column.

There has been improvement in the macroinvertebrates since 1999 but, based on BCDES data provided, there was also a significant decline from 1997 to 1999 (an 18 point drop, from the fair to poor range, immediately downstream from the WRF at RM 0.8). With few exceptions, the most recent ICI scoring trends show minimal improvement (i.e., >4 ICI points) when compared to the highly enriched, pre-restoration, conditions in 1997.

For example:
RM 0.8 (1997 ICI = 28)** – Number of post-restoration samples with ICIs greater than 28 + 4 ICI points = **0 of 4

RM 0.5 – 0.3 (1997 - Not sampled)** - Number of post-restoration samples with ICIs greater than 26 (average of 1997 ICIs dst. WRF) + 4 ICI points = **3 of 4

RM 0.1 (1997 ICI = 24)** - Number of post-restoration samples with ICIs greater than 24 + 4 ICI points = **1 of 4

Significant improvement in ICI scores appears mostly limited to the middle stations and, even then, scores tend to level off to 1997 performance levels at the mouth. While the WRF is not considered the only source of impairment in the lower East Fork, it is considered the primary source.

Butler County believes that while fish community scores (IBI) are not yet in attainment of ecoregion criterion, attainment is possible now that insect communities have begun to flourish. However, attainment is still contingent on improved habitat.

Response: Water quality and habitat quality (currently considered adequate to support WWH communities) are primary factors in determining the quality of the fish community. Insectiverous fish found downstream from the UMC WRF are predominated by a tolerant species (Green sunfish), a further indication of degraded water quality.

BCDES is attaching a technical report prepared by Woolpert LLP on the significance of the biological sampling results from the East Fork of Mill Creek. The report supports BCDES' claim that the habitat restoration project did indeed positively influence the biota of the stream, especially macroinvertebrates. To summarize, the report states there is a clear trend between 1999 (pre-restoration) and 2003 of increased numbers of macroinvertebrate species, increased diversity, increased numbers of intolerant species, decreased numbers and abundance of tolerant species, and higher populations of (indicator) species common in higher quality waters.

Response: See comment number 6. Habitat improvements in the lower East Fork roughly coincided with a major plant expansion and improved plant performance (see BCDES Figures 1 and 2, New Comment #3 on permit violations trends). Given the changes at the plant, why is the condition of the macroinvertebrates attributed only to changes in habitat quality? As stated previously, artificial substrate samplers tend to diminish the influence of habitat so ICI scores are primarily considered a reflection of water quality conditions.

8. Page 13, 14-15. Table 4. Butler County would like to see the inclusion of the IBI and ICI data collected by Woolpert in 2003. Additionally, we believe that the IBI and ICI scores collected by Woolpert in 2002 and the ICI scores collected by Woolpert in 1999 are incorrect as displayed in Table 4. 2003 scores and revised 2002 and 1999 scores are supplied below, in Figure 4.

Response: Woolpert 2003 results are included and have been recalculated to meet Ohio EPA data analysis guidelines. Woolpert biological scores currently listed in the TMDL Attainment Table are considered correct. The raw biological data provided by Woolpert were adjusted and recalculated and the index scores are listed in the TMDL Attainment Table. Adjusted scores are also noted in Tables 3 and 4.

ICI Scores on East Fork Mill Creek, 1999-2003			
Year, Data source*	**Crescentville Road (RM 0.8)**	**Downstream Crescentville (RM 0.3)**	**Near Mouth (RM 0.1)**
1999, Woolpert	~~10~~ 12	~~22~~ 24	~~28~~ 24
2002, Woolpert	~~34~~ 30	~~38~~ 36	~~30~~ 28
2003, Woolpert	32	~~42~~ 40	28

IBI Scores on East Fork Mill Creek, 2002-2003			
Year, Data source*	**Crescentville Road (RM 0.8)**	**Downstream Crescentville (RM 0.3)**	**Near Mouth (RM 0.1)**
2002, Woolpert	~~26~~ 22	~~28~~ 22	~~24~~ 20
2003, Woolpert	32	~~42~~ 18	~~28~~ 30

Figure 4. 2003 scores and revised 2002 and 1999 scores for ICI and IBI analyses performed on East Fork Mill Creek

9. Page 17. See NEW COMMENTS, number 5. What constitutes "chronic" permit violations?

Response: The term chronic will be removed.

10. Page 17. Butler County would like to know how OEPA defines "variable effluent quality".

Response: In the case of the Upper Mill Creek WRF, the phrase was used to describe inconsistent treatment or plant performance. Examples would include the occasional detection of WQS exceedences for ammonia downstream from the WRF or the wide range in effluent concentrations (from near detection limits to nearly 5 mg/l) during 2002 chemical sampling. The number of NPDES violations in the years leading up to the 2002 survey and erratic loadings trends, as evidenced by the wide range between median and 95th percentile loadings trends would also suggest variability in the quality of the effluent (see addendum Figure 1).

*As noted on the 2002 Addendum Page 12 under **Pollutant Loadings: Upper Mill Creek Water Reclamation Facility**:*
"All conventional parameter characteristics mimicked one another in percentile variance and lack of a discernible trend reflected in NPDES violations for TSS and ammonia-N (Figure 1). Notable percentile variances may be indicative of unpredictable flow volumes, possibly attributable to inflow and infiltration influences or treatment process disruptions, or inadequacies. From 1994 until 2001, median percentiles exhibited a general increasing trend and percentile variability is evident mostly attributable to nitrate variances (incomplete nitrification) probably linked to operational controls. The increase in the ammonia-N load increases the potential for increased ammonia toxicity and oxygen demand downstream from the Upper Mill Creek WRF with nitrification occurring in the stream rather than the WRF. Unpredictable parameter load characteristics, however, did not result in reported permit violations for Carbonaceous Biochemical Oxygen Demand ($cBOD_5$)."

11. Pages 19-21. Table 5. Under 'Causes of Impairment' for East Fork Mill Creek (RM 7.10 to mouth), Butler County would like to see Siltation and Habitat Alteration added to the list. Similarly, under 'Sources of Impairment' for East Fork Mill Creek, Butler County would like to see Urban Runoff/Storm Sewers, Streambank Modification/Destabilization, and Channelization added to the list.

Response: These influences can be listed, but the magnitude of impacts is considered comparatively small. Biological impairment in the lower East Fork exceeds levels typically associated with simple habitat alteration. Excessive enrichment and an apparent toxic response in the fish were considered the primary influences affecting the biology and these were

attributed to the UMC WRF, a major point source discharger.

Generally speaking, Butler County suggests that Ohio EPA conduct another survey of the Mill Creek watershed – and especially the East Fork and headwaters regions – as so much has changed in terms of development and (sub)urbanization since 1997. In relying on (causes and sources of impairment) data that is at least seven (7) years old, OEPA cannot accurately understand the current state of the Upper Mill Creek, and therefore cannot effectively develop a TMDL.

Response: The Mill Creek watershed was resurveyed in 2002 and included chemical, biological, sediment and continuous monitor sampling and analysis of loading trends. Causes and Sources of impairment were also re-evaluated based on the 2002 survey.

12. Page 19-21. Table 5. Butler County believes that Ohio EPA should reevaluate the Aquatic Life Use Designation for East Fork Mill Creek (RM 7.10 to mouth). Based on the channelized nature of the stream (and the significant number of both causes and sources of impairment), we believe East Fork Mill Creek from the mouth to just upstream of the treatment plant, should be redesignated as Modified Warmwater Habitat (MWH).

Response: The existing WWH designation for the East Fork Mill Creek was field verified following the1992 survey (Ohio EPA 1994) and subsequent surveys have supported the designation. Ohio EPA QHEI scores from the lower mile of the creek averaged 63.3 (n = 6); scores greater than 60 are generally considered adequate to support WWH communities.

13. Page 25. In Summary of Point Sources section (2.3.1), OEPA states that the Upper Mill Creek WRF "is required to install nutrient removal treatment by 2005". Per permit specification, this statement should read, "nutrient removal treatment by January 2006".

Response: The correction will be made.

14. Page 25. The Mill Creek TMDL Draft Report claims, "Three reoccurring sanitary sewer overflows (SSOs) exist in the Upper Mill Creek collection system (Windisch Rd., North Pisgah, Sharon Creek)". Butler County rejects this claim – all SSOs have been eliminated. To eliminate SSOs, Butler County spent over $8 million on improvements to Windisch, North Pisgah and Sharon Creek between 1999 and 2003. Figure 5 below shows the significant achievements of Butler County relative to SSO elimination from 1996-present:

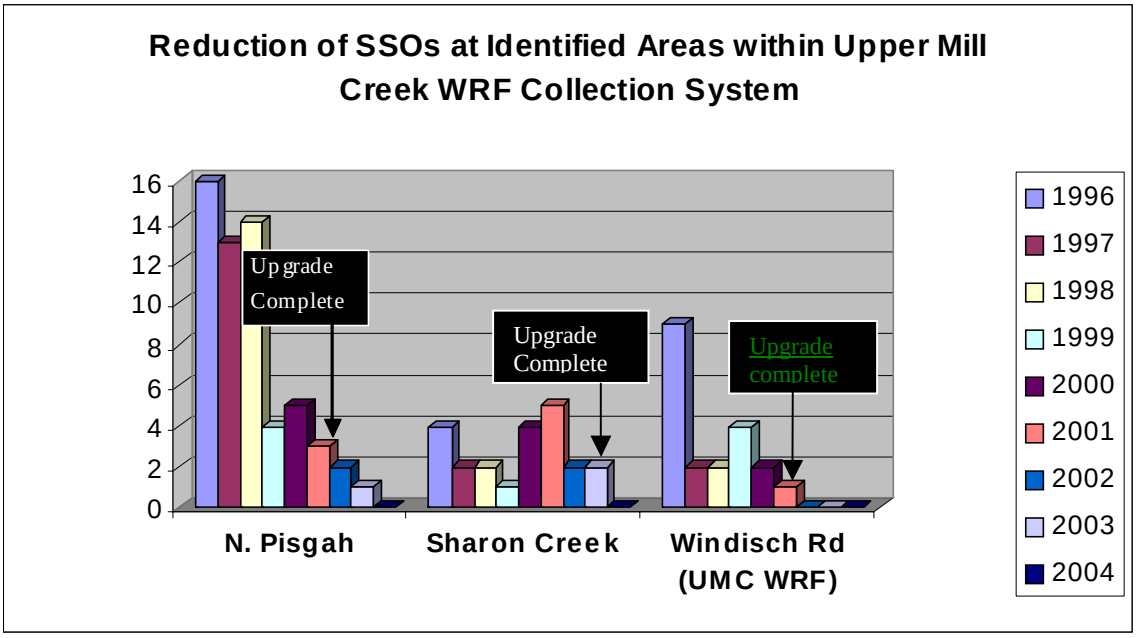

Figure 5. Number of SSOs by year associated with the three identified problem areas within the Upper Mill Creek WRF Collection system. Year of final upgrade is noted for each area.

Response: This statement was based the assessment of the sewer overflows from information reported to Ohio EPA by Butler County (see Addendum, Appendix Table 2). The latest entries to this table were from early 2003 data provided by Butler County which documents overflows occurring from Sharon Creek Pump Station and North Pisgah Pump Station. Changes will be made in the language to acknowledge the improvements in the system.

15. Page 26. MSD Sanitary Sewer Overflows (SSOs) Elimination Program. According to the Mill Creek TMDL Draft Report, MSD is required per an Interim Partial Consent Decree to install a capture-treatment system for SSO 700 prior to December 31, 2007. Butler County supports this initiative fully. Because of the significance of this SSO and its contribution to nutrient enrichment in the Mill Creek, Butler County proposes that the OEPA stream assessment (scheduled for 2010) and future UMC WRF nutrient reductions be contingent on the successful installation and full operation of the treatment system for at least two years. For example, if MSD does not get the treatment system installed and fully functional until sometime in 2008, then the OEPA stream assessment and associated permit changes shall be postponed until 2011.

Response: MSD has already submitted and been issued a PTI for the capture-treatment system at SSO 700. In addition, as part of the consent decree, the construction must be completed December 31, 2007. This should allow adequate time for the stream assessment. In addition to the work being conducted by MSD, Butler County and Glendale need to move forward with nutrient load reduction at their sewage treatment facilities. The permit changes at these facilities need to implemented as proposed.

16. Page 27. Butler County would like to know how Ohio EPA defines "treated effluent". If semi-public treatment facilities are discharging "treated effluent" according to OEPA, and OEPA feels no need to qualify the terminology, then how can the Agency state in the TMDL that the Upper Mill Creek WRF discharges effluent of "variable…quality"? Does this mean that semi-public systems do a better job at treating wastewater than Butler County's facility? What sample data does OEPA have from semi-public systems?

Response: Ohio EPA has monitoring data for the semi-public systems that discharge under an NPDES permit. The Hamilton County Combined Health District has information of the systems in Hamilton County. The flows from these systems is less than 32,000 gallons per day. The loadings are significantly less than those from the Butler County Upper Mill Creek WRF, and is considered during the assessment of point source influence in the watershed.

17. Page 29. Table 7. How accurate are the construction acreages reported in Table 7? Since these numbers are based essentially on voluntary reporting, Butler County contends that they cannot be accurate. Furthermore, the number of acres under construction from year to year varies dramatically according to the table – which again points to the fact that these numbers are not consistent with reality. For example, it is hard to believe that in 1999 only 157 acres were developed in Butler County, whereas the year before over 1000 acres were developed.

Response: The information reported in the table is a result of the values entered on the NOI application submitted by the developers. Those values are only as accurate as reported. Butler County is correct, the acreage totals may be suspect, but it is the only database available to Ohio EPA.

18. Page 31. Table 8. See NEW COMMENTS, number 12. Based on the channelized nature of the stream (and the significant number of both causes and sources of impairment), Butler County believes East Fork Mill Creek should be designated as Modified Warmwater Habitat (MWH).

Response: The existing WWH designation for the East Fork Mill Creek was field verified following the1992 survey (Ohio EPA 1994) and subsequent surveys have supported the designation. Ohio EPA QHEI scores from the lower mile of the creek averaged 63.3 (n = 6); scores greater than 60 are generally considered adequate to support WWH communities.

19. Page 42. Table 12. Butler County would like the following <u>underlined</u> statement deleted from the table, as it is inconsistent with Table 2 (page 3), 'Phasing of TMDL in the Mill Creek watershed' and the consensus that was achieved by the stakeholder meetings:

"****Butler County WWTP has a design flow of 16 MGD. <u>To maintain the nutrient target values, the nutrient concentration in any increased discharged flow from existing 8 MGD to 16 MGD should be limited to target values (dissolved N 2.5 mg/l, TP 0.25 mg/l).</u>"

Response: Some modification to the report language will be made.

20. Page 50. Butler County and Glendale Point Source Reduction Implementation Plan, See NEW COMMENTS, number 13. The NPDES permit for the UMCWRF requires nutrient removal to become effective January 2006, not 2005.

Response: The correction will be made.

MILL CREEK WATERSHED COUNCIL, submitted by Nancy Ellwood, Executive Director

Executive Director Comments

As Executive Director of the Mill Creek Watershed Council (MCWC), I would like to take this opportunity to provide comments on the June 2004 Ohio Environmental Protection Agency (OEPA) Total Maximum Daily Loads (TMDL) for the Mill Creek Basin Draft Report. In 1999, MCWC began working with OEPA and other stakeholders on the development of the Mill Creek TMDL and we are pleased that this process is nearing completion for the first of the TMDLs for our watershed.

The comments presented below have been divided into two categories: general and specific. The general comments are presented first.

General

1. The report seems to focus primarily on one point source, the Butler County East Fork wastewater treatment plant, as the source for nutrients within the Mill Creek watershed. Little effort seems to have been focused on identifying and quantifying nonpoint sources (NPS) for nutrients in the watershed. These must exist as nutrient impairments are found throughout the watershed and in areas not affected by the wastewater treatment plant. Developing a strategy for addressing NPS nutrient impairments in the watershed will be difficult without identified sources and estimated loads.

Response: Only two of the NPDES point source facilities in the Mill Creek watershed discharge effluent containing nutrients. This TMDL report addresses both of these facilities. The other NPDES permit holders discharge non-contact cooling water. This information is contained in the Appendix for the Mill Creek TMDL report. Any sanitary or process wastes from these other facilities are discharged to the sewer system of the Metropolitan Sewer District of Greater Cincinnati, and therefore these facilities were not included in the TMDL development for nutrients. Combined Sewer Overflows and SSOs are to be addressed by the signed federal Consent Decree and the revised Long Term Control Plan. It is Ohio EPA's responsibility to address these facilities. Based on comments and consensus at public meetings held in 2001, it was the stakeholders responsibility to develop Watershed Action Plans with implementation strategies which would identify and address nonpoint source pollution sources. Only the draft Upper Mill Creek Watershed Action Plan has been submitted to Ohio EPA and Ohio Department of Natural Resources for comment and until very recently, the Council had put further development of this WAP on hold until additional funding could be obtained.

2. Those impairments, causes and sources of impairments, estimated loads and proposed TMDLs that are presented in the TMDL report appear to be based on old data – with the exception of the headwaters region which have been the focus of more recent monitoring efforts. OEPA monitoring data from 1992 were used to draw conclusions regarding these items for much of the lower two-thirds of the watershed. Within the last 12 years this region has seen changes in land use, water quality, riparian habitat and imperviousness that are likely to have impacted the Mill Creek and its tributaries. Without current monitoring data, it is difficult to gage their overall impact on water quality.

Response: The watershed was assessed in 1992, 1997, and 2002. The 2002 assessment covered the watershed from RM 8.0 to the headwater region at RM 26.3. The 2002 assessment is included in the Addendum (June 2004). Ohio EPA recognizes that a "perfect" data set is not available – and in reality is unattainable – so flexibility is incorporated into the TMDL analysis, most notably in the selection of the target values and in the timing of improvements to point sources.

3. The report does not fully describe, map, quantify, or suggest actions to counter the impact that nonpoint source (NPS) urban runoff has on stream health in the Mill Creek watershed. There is a very general discussion of increased urbanization and suburbanization and some description of increased siltation, but no description of the types and sources of NPS contaminants or the quantities that enter our streams after contact with rooftops, parking lots, roads, lawns, and golf courses. At the very least, the report should discuss and attempt to quantify the amount of nutrients entering our streams during and after wet weather events from various sources such as over-fertilized lawns and golf courses. Without this basic information, formulation of an implementation strategy to address these sources is problematic.

Response: See response to comment 1. It was agreed that it would be the stakeholders responsibility to develop Watershed Action Plans with implementation strategies which would identify and address nonpoint source pollution sources. This is noted in the meeting notes of the 2001 public meetings and recorded in the Appendix. A Load Reduction Strategy was submitted to Ohio EPA, but as of June 6, 2004, the MCWC was unsure how the information in this document could be used since "much has changed since then", meaning much had changed since it was submitted. Ohio EPA and USEPA have provided significant funds over the past several years for development of WAPs and mapping to stakeholders in the watershed. Several of the inventories and maps have been developed, but they are not housed in one location to be used by all parties interested in working toward the restoration of Mill Creek. To date, only the draft Upper Mill Creek WAP has been submitted to Ohio EPA and ODNR for comment. The various parties in the watershed should work together toward a common goal to accomplish what was discussed at the public meetings in 2001.

4. State "319" funding for nonpoint source projects is currently tied to specific impairment locations, causes, actual or potential sources, and estimated loads for nonpoint source contaminants listed in the TMDL report for each watershed. If the TMDL does not provide this information, it will be difficult for local stakeholders to obtain the funding necessary for mitigation of nutrient problems within the watershed.

Response: The requests for proposals for 319 applications have concentrated on "projects that implement specific action items from TMDL Reports and/or the endorsed components of watershed action plans" as such, there is no absolute requirement for 319 funding that every detail be listed in the TMDL. It is possible for projects to focus on specific stream segments when there are water quality data or documented local best professional judgement as to sources of pollution or on USGS 14 digit HUCs with similar knowledge. When possible, estimates of NPS loading can now be incorporated into a WAP with the assistance of ODNR's Resource Management Specialist and an estimate of potential reductions is required for implementation applications. When endorsed, a local WAP should include discussion of TMDLs goals but should not focus solely on those goals.

5. The report did not make it clear whether the West Fork Mill Creek sub-basin is considered to be impaired with respect to nutrients. There have been discussions with OEPA in the last year indicating that it is not. The third paragraph of Section 4.4 (TMDL Calculations) implies it is.

Response: Table 12 in Section 4.4 indicates that the subwatershed containing West Fork Mill Creek does not require nutrient load reduction.

6. Except for the tiny (unreadable) map on the cover of the report, there are no watershed maps delineating the streams, sub-basins (HUC units) or political jurisdictions in the report – just Figure 2 - an engineering schematic that does not appear to be to scale. The report should also include aquatic life use attainment maps, an impairment map (including riparian habitat impairments) and land use maps.

Response: See response to comment 3.

7. There are no demographics included in the report. In a rapidly changing watershed, particularly the headwaters regions, there should be figures or tables to show the magnitude of such changes.

Response: The GWLF model requires the input of land use data rather than the demographic data. Land use data are needed to calculate the non-point source loading. The demographic data will affect point source loading rather than NPS.

8. To recognize the enormous amount of effort local stakeholders have put into the process, some or portions of the draft Upper Mill Creek Basin Watershed Action Plan (UMCWAP) (October 2003) and the Mill Creek TMDL Nonpoint Source Pollutant Load Reductions report (June 2003) should have been included as appendices to the Mill Creek TMDL report. The WAP and load reductions report included 17 site-specific actions to be undertaken in the Upper Mill Creek sub-basin (HUC 1) including estimated load reductions where there were quantifiable, as well as two educational programs to address nonpoint source pollution within the basin. While the UMC WAP is a draft document, many of the HUC 1 activities proposed, particularly those in the Load Reductions Report will be carried forward into the final plan when it is submitted. (None of these HUC 1 activities were affected by recent decisions not to fund 319 projects in the remaining four sub-basins.) The UMCWAP also contained other programs that communities had agreed to implement that would have either direct or indirect impacts on

water quality including implementation of Phase II stormwater permits in all basin communities, greenway and greenspace projects, and public education efforts.

Response: At release of the draft TMDL report, Ohio EPA's understanding was that the decision to continue with development of the WAP had been deferred until the July 29th (MCWC Spring Newsletter) Council meeting. Until this comment letter, the final decision of the Mill Creek Watershed Council had not been given to Ohio EPA. During email communication with Nancy Ellwood on June 9, 2004, Nancy indicated "I'm not really sure what to do here" with the Load Reduction Strategy. The plan was submitted in 2003, but much had changed since then and many of the projects listed to be funded by 319 monies were not funded. It appeared from her email there were too many "ifs" involved and the decision was made not to include the document in the appendix. If the Council would like to indicate what sections or complete documents to be included in the Appendix for the TMDL draft, then these documents or sections of documents will be included.

9. All reference to Army Corps of Engineers projects appear to have been deleted from the report. Existing and proposed Corps projects will and do have an impact on water quality in the watershed and a description should be provided.

Response: The Executive Summary notes channel modification and the evaluation of the flood reduction project by U.S. Army Corps of Engineers. Some additional information will be given regarding the General Reevaluation Report project.

10. Update the discussion of the Metropolitan Sewer District of Greater Cincinnati consent decrees to address CSOs and SSOs. These were recently signed by the Department of Justice and have a strong water quality component. Included in the global consent decree are three Mill Creek environmental projects that should impact water quality and stream health.

Response: Information will be revised as provided by MSD.

Specific Comments

1. Section 2.2.2.3 deleted the description of the lowermost two miles of the Mill Creek – an area that has tremendous riparian habitat, is home to a Black-Crowned Night Heron rookery (a state endangered bird), and has seen a resurgence in avian and piscine wildlife in the last 10 years – that had been incorporated into the previous Mill Creek TMDL report. The current report leaves the reader with the impression that the last remaining miles of the Mill Creek are an ecological wasteland.

Response: The Black Crowned Night Heron rookery is noted in Section 2.1.

2.The spelling of Windish Road (page 13, paragraph 2) should be amended to read Windisch.

Response: The correction will be made.

3. Section 2.3.1 should contain a reference to the large volumes of treated groundwater released to the Mill Creek from the remediation of groundwater contamination at the Pristine Superfund

site.

Response: Ohio EPA has evaluated the groundwater discharge data from January 1, 2003 to June 30, 2004 for the Pristine Superfund site and the results do not indicate any significant loadings to Mill Creek. Ammonia data from this site is below detection limits.

4. Sections 2.3.1 and 2.3.2 indicate that Hamilton County residential sewage systems are point sources and Butler County residential sewage systems are nonpoint sources. Is this correct? If so, what is the rationale for delineating them as such?

Response: This information is correct. As mentioned in the previous responsiveness summary from the first draft of the Mill Creek TMDL report and during discussions, the mechanical residential sewage systems have a discharge and are considered point sources, the nonmechanical residential sewage systems are considered nonpoint sources.

5. Table 7, "Construction Site Summary in Hamilton and Butler Counties," should be updated to include information from more recent years.

Response: More recent data will be added to the table.

6. Section 4.1 states that the GWLF model is not appropriate for areas of the watershed which have combined sewer overflows (CSOs). Since CSOs are prevalent in the lower half of the watershed, how were estimated loads for those areas calculated?

Response: Most CSOs impact is limited to the lower part of the watershed. In calculating the NPS loadings, the urban CSO portion was subtracted out of the total allocated loadings. Model calibration was performed for the upper portion of the watershed which was not impacted by CSOs.

7. The Section 4.3.3, "Implementation Plan" title does not seem to fit in this section. Could it be re-titled?

Response: Ohio EPA will consider changing this title.

8. Section 5.0, paragraph 1 should be amended to read that OEPA worked with the Technical Advisory Group of the Mill Creek Watershed Council from August 1999 to April of 2001 and not for several months as is stated in the text. Table 15 bears this out.

Response: The change will be made.

9. Section 6.0
a. Should all mentioned entities in each item be italicized? This means of identifying responsible parties seems to have disappeared after item 4.

Response: The suggested change will be made.

b. Item 1 should be amended to read (Boldface type indicates changed text): The *Mill Creek Watershed Council* is developing a series of watershed action plans (WAP) to address restoration of the Mill Creek in a holistic and comprehensive way. **At the request of Ohio EPA**, the Mill Creek Watershed Council **developed and** submitted, **on June 9, 2003,** a Draft Report entitled *Mill Creek TMDL Nonpoint Source Pollution Load Reductions*. **With respect to water quality improvements in the Mill Creek watershed, this report proposed 33 projects/actions to reduce nutrient loads. Since the report was written, some of these actions may not be feasible due to funding constraints, but at least 23 (particularly those in the Upper Mill Creek basin) remain viable. These actions will be incorporated into the appropriate basin-specific WAPs.** Part of the WAPs will address the nutrient issues of the TMDL by focusing on nonpoint source pollution controls, and restoring habitat and riparian **corridors** in the watershed, and;

Response: Some of the proposed language can be added to the report. It is important that the reader realizes that the load reduction document was developed to fulfill the consensus reached during the public meetings in 2001, where the Watershed Council agreed to take the lead to develop watershed action plans and nonpoint source load reduction strategies. As long as the Council can provide reasonable assurances that the projects in the upper watershed are going to move forward, Ohio EPA will include them in the TMDL report.

c. Item 2 should mention that all political jurisdictions were subject to submittal of plans to meet the 2003 Phase II Stormwater Regulations. Since then, Hamilton and Butler County Storm Water Districts have been formed. Communities within the watershed who did not opt to join these districts have submitted individual permit applications that meet the six minimum criteria of the new stormwater regulations. Actions taken under these district or jurisdictional permits should have a positive impact on water quality.

Response: The suggestion will be considered.

d. Page 51. Watershed Aaction Plan Process should be corrected to read Watershed Action Plan Process.

Response: The correction will be made.

e. Page 51. *Sub-watershed Plans*, the following should be substituted for the last paragraph: In 2003, the Mill Creek Watershed Council submitted a draft Watershed Action Plan for the Upper Mill Creek basin that contained a community-based action plan to address water quality, habitat, greenways and greenspace, erosion and sedimentation, stormwater, water quantity/flooding, and public education and outreach. Based on comments received from by OEPA and the Ohio Department of Natural Resources in March 2004 the Council will update and revise the plan and resubmit for approval in late 2004.

Response: The suggested changes will be made.

The Mill Creek Watershed Council recently received funding that will permit the completion of the Upper Mill Creek WAP and continued WAP development of one of the remaining basins.

This will be completed after the Upper Mill Creek plan is approved. Available resources and willingness of communities to participate will dictate the order and timeframe in which the remaining WAPs are completed.

Response: Ohio EPA will note the Mill Creek Watershed Council's commitment in the TMDL report. Our understanding is that $25,000 of 319 funds will be awarded through ODNR to the Council to complete the UMC WAP and continue development of the other subbasin WAPs.

HARRY STONE, Ph.D., CITIZEN OF EVENDALE

Achievement of the Warm Water Habitat, as established for the upper Mill Creek by Ohio law, requires an IBI of 40. Recently I developed a model to evaluate the likelihood of observing an IBI of at least 40 in the Interior Low Plateau Ecoregion. I then applied the model to the upper Mill Creek (and East Fork Mill Creek) to evaluate the likelihood of observing an IBI of 40 or greater through reduction in nutrients alone. The results indicate that reduction of the nutrient concentrations alone are unlikely to restore impaired water quality of the Mill Creek and East Fork, given the levels of impervious surface and habitat conditions (QHEI).

The collaborative watershed-based approach, being included in the TMDL, is addressing habitat factors that must be improved to achieve the Warm Water Habitat standards. However, it is highly unlikely that issues related to impervious surface and habitat quality will be adequately resolved in the next decade to allow pollutant reductions by wastewater treatment plants to be adequate to restore an IBI of 40 in the upper Mill Creek. Therefore, it is highly likely that follow-on TMDL phases will require the wastewater treatment plants to make additional or repeated reductions to their effluent concentrations.

To prevent repeated and expensive on-going retrofits, it would seem advisable to either 1) set the nitrate + nitrite and total phosphorus at a level that is likely to support a IBI of 40 if habitat and impervious surface issues are adequately addressed or 2) recognize that use attainability is unlikely and set limits appropriate for a Modified Warm Water Habitat. The IBI standard, as indicated in the Draft, is often achieved at 2.5 mg/L for nitrate + nitrite. Therefore, this level seems appropriate for an adaptive management approach. However, an IBI of 40 is unlikely to be observed with total phosphorus at 0.25 mg/L, unless impervious surface and habitat conditions are outstanding – conditions highly unlikely to be achieved in the Mill Creek watershed.

Response: As a general premise, Ohio EPA agrees that impervious surfaces and poor habitat are significant stressors in the Mill Creek watershed and contribute to impairment. However, staff reviewed the supplemental materials supplied by the commenter and do not entirely agree with the author's data interpretations and conclusions. These questions about the predictive accuracy of the author's model suggest to Ohio EPA that an adaptive management approach for nutrient control is preferable to the all or nothing approach offered by the commenter. Given our experience seeing other streams from around the state recover to WWH from analogous conditions, we are confident in expecting water quality improvement in the East Fork Mill Creek and upper Mill Creek.

The Agency appreciates Mr. Stone's interest and work with ecological data and encourages his participation in the continuing discussion and implementation of restorations options in the Mill Creek watershed.

OHIO-KENTUCKY-INDIANA REGIONAL COUNCIL OF GOVERNMENTS

Executive Summary:
Page iii:
The executive summary needs some additional revisions and addition of more timely data and information. The summary should be a more comprehensive overview of water quality in terms of nonpoint source pollution and point source issues. The citations and references to these issues should be highlighted as separate sections in the executive summary. There is no logical flow to the current format. OEPA should revisit the summary and divide it into three or four topical sections.

Response: Ohio EPA will be revising the summary.

The summary references 1998 303(d) listings as the only document about water quality impairments in the Mill Creek. Other reports with more current data should be referenced to emphasize the critical nature of why watershed stakeholders should implement the recommendations of this document.

The following are a list of examples and paraphrased items from these various references that demonstrate water quality impairment issues:
1. The 2002 and 2004 Integrated Water Quality Monitoring and Assessment Reports,
2. 2002 Ohio Nonpoint Source Assessment Hydrologic Unit Water Quality Report,
3. The 2000 Water Resource Inventory 305(b) Report,
4. Ohio EPA 2002 Integrated Report Assessment Unit Summaries: the entire Mill Creek watershed in Butler and Hamilton Counties have ten waterbodies listed in the 303(d) list of impaired waters. These water bodies suffer from impairments from a number of different pollutants. These pollutants include nutrients, siltation, several metals, oil and grease, organic enrichment/dissolved oxygen, habitat alteration, pesticides, and other causes from ammonia, unknown toxicity, priority organics, contaminated sediments, and suspended solids. The sources of these pollutants include industrial point sources, major municipal point sources, combined sewer overflows, urban runoff/storm sewers (NPS), channelization, and streambank destabilization/development… the Mill Creek watershed is impaired. In sampling years 1992 and 1997, of small streams (sites with <50 square miles of drainage), 69.2% were in non-attainment for aquatic life uses, 13.3% in partial attainment, and 17.5% were in full attainment. Of large streams (sites with >50 square miles of drainage) 94.4% were in non-attainment, 5.6% partial attainment, and 0% in full attainment. This underscores that the Mill Creek is in critical condition due to the aforementioned causes and sources of impairment.
5. Various studies conducted by the Metropolitan Sewer District of Greater Cincinnati between 1998 and 2003.

Response: The 1998 303 (d) list was referenced because this was the document that resulted in the initiation of the TMDL process. The comment correctly points out that many reports on the

condition of Mill Creek have been completed by a number of parties; the serious condition of Mill Creek is well known. The TMDL for Mill Creek was one of the first TMDLs started by Ohio EPA and has been in progress for a number of years. It began when the agency was addressing TMDLs on a stream segment basis and working on a limited number of pollutants. It is fair to say that if this TMDL were to be started today, a more comprehensive product would result. Ohio now completes TMDLs on a watershed basis and to the extent practicable includes an analysis of all identified causes of impairment to the Aquatic Life and Recreation Uses. However, this new approach does not mean that the existing Mill Creek report is not valid for addressing the nutrient issues in the basin. In the interest of completing this report so that on-the-ground improvements could be initiated, and mindful of severe resource constraints at Ohio EPA, the agency decided to move forward without substantially updating the report. Additional TMDLs to address other impairments will be needed in the Mill Creek watershed. This TMDL report should not be viewed as the final word on the restoration of Mill Creek, but rather as another step in the right direction.

6. A statement at the bottom of the page states that "approximately" 20 facilities in the watershed hold NPDES permits. Is this accurate? It seems like it should be much more. And if Ohio EPA is the permit grantor, it should know exactly how many permits have been granted and not approximately.

Response: The word "approximately" was used because this "NPDES permit holder" number is constantly changing (two or three dischargers had been eliminated since the first draft)….especially if the industrial general permit holders (for stormwater and non-contact cooling water) are included. The NPDES holders and description of the facilities are listed in the appendices.

Page iv:
OEPA should work with local health agencies to update or validate the numbers for on-site sewage systems.

Response: This too is constantly changing and during the information gathering stage of the Mill Creek TMDL, these were the number of systems deemed accurate. The number of on-site sewage systems for Butler County was taken from the draft 2003 Upper Mill Creek watershed action plan. Since Butler County was a party to drafting that report, this number was taken as accurate.

Total percentage of land uses in the entire watershed is not mentioned.

Response: Total percentage of land uses in the entire watershed (100%) has been reflected in Appendix, Table 1. This is posted on the website with the TMDL report.

There is no mention of any census figures from 2000. This includes total number of residents in the watershed, urbanized area figures, poverty statistics, household data, employment statistics, census tracts, census blocks, etc. This is important in laying the groundwork that nearly 400,000 people live within the watershed.

Response: While this is important information for many issues, it is not directly related to the issues of developing a nutrient TMDL. Land use data was needed for the model used to develop the TMDL.

The second paragraph states… "Storm water controls in many areas have been minimal to nonexistent during construction and have deposited significant amounts of silt into the waterways." The emergence of Phase II communities and programs has greatly increased since March 2003. The current statement may not be true for the term "many areas." Siltation is also a problem of streambank erosion, not just construction. The Mill Creek watershed has tens of thousands of linear stream feet with moderate to severe erosion that is contributing to siltation.

Response: Based on the field experiences of Ohio EPA's Stormwater Program staff, the text in the report will stand.

The executive summary lacks references to any Watershed Action Planning work completed in the last 3 years. An example is the Upper Mill Creek WAP. It has extensive inventories that have described threats and impairments to the Mill Creek. This includes work done by Butler County Department of Environmental Services and the Mill Creek Watershed Council.

Response: Several attempts to draft watershed action plans have occurred in the Mill Creek watershed since 1995 by a number of organizations. Mention of Upper Mill Creek Watershed Action Plan will be made since the Mill Creek Watershed Council has received 319 funds to support its completion.

The executive summary needs to make the connection between the TMDL and any completed draft, conditionally endorsed, or endorsed WAPs in the Mill Creek. This should be made in the last paragraph when discussing stakeholder involvement.

Response: In 1995 OKI produced a watershed plan for Mill Creek that was funded by a water quality planning contract with Ohio EPA. This plan does not meet the current requirements for WAP to be funded by Section 319 grants. During the course of TMDL development, local stakeholders committed, and Ohio EPA agreed, to make a local watershed action plan serve as the implementation strategy for nonpoint source pollution. At the time, one stakeholder was beginning a two-year $250,000 grant from USEPA headquarters to write a "Wet Weather Watershed Action Plan" and it was anticipated that this plan would include all of the necessary information for the TMDL implementation. At the end of the grant no plan was completed and there was no submission of any draft to Ohio EPA. In 2002 the MCWC and other stakeholders began development of a WAP for the HUC 1 that coincided with the TMDL. This WAP was submitted to Ohio EPA and Ohio DNR in November 2003 and is currently being revised in response to comments from the agencies. Since it was recently decided that the MCWC will receive supplemental 319 funds to complete this action plan, Ohio EPA will mention it in the summary. However, due to the dated OKI watershed action plan and other attempted drafts of action plans, these will not be included in the TMDL report.

The last paragraph should place more emphasis on the Mill Creek Watershed Council's current mission and vision. The current version only states the date of the Council's inception, and a

broad restoration goal.

Response: The Mill Creek Watershed Council has an excellent website that expresses its mission and vision. This will serve as the venue for those wishing more information regarding the Council.

Page v:
Table 1. Components of the Mill Creek TMDL process

Current Deviation from Target- Do exceedances of biocriteria include habitat alterations? That is a known impairment in many parts of the watershed.

Response: Yes, biological assessments do consider habitat alteration and can distinguish habitat impairment from chemical impairment in most situations. Biological impairment due to habitat alteration has been documented in parts of the watershed.

Implementation Plan- No link is made to potential or completed watershed action plans. For 3 years, Ohio EPA has assumed that WAPs would be the implementation vehicle for the TMDL document. Is this assumption still valid and in writing? If yes, it needs to be mentioned in this table. If no, then WAPs should be mentioned in some format.

Response: The section which is referenced in this comment states "Ohio EPA has regulatory authority over the NPDES issues only , and therefore will work with the local agencies, communities and watershed groups for implementation of additional plans outside Ohio EPA's regulatory authority." Watershed action plans will fall into this statement and are mentioned in other sections in the report.

1.0 Introduction

Last sentence, first paragraph, pg. 1 should mention that “water quality problems” in regards to a TMDL include both point and nonpoint sources of pollution.

Paragraph 3, the list of factors should include a bulleted item for Phase II impacts on water quality.

First sentence, last paragraph, pg. 1, for grammatical purposes, a comma and verb change are needed...”variety of sources, is”

First sentence, pg. 2, “a phased approach” should be “a phased approach (see Table 2, pg 3)”

Response: The suggestions will be made.

Table 2 on page 3 should reference the Upper Mill Creek Watershed Action Plan for the year 2004.

Response: Reference will be made.

Page 7, third paragraph, "In East Fork Mill Creek", this section highlights only habitat enhancement projects by Butler DES. In addition, OKI Regional Council of Governments, Mill Creek Watershed Council, Butler DES and Mill Creek Restoration Project have completed several habitat restoration and riparian restoration projects in the Upper Mill Creek, specifically the Port Union to Gilmore Ponds Conservation Corridor. These projects should be mentioned.

Response: Ohio EPA will mention some of these projects, assuming details have been shared with us. It was our understanding from the draft Upper Mill Creek Sub-Watershed WAP that the Gilmore Ponds portion of the watershed does not lie in the Mill Creek basin. The WAP states: "After careful evaluation initiated by the 2000 Butler County Upper Mill Creek Drainage and Detention study, the Gilmore Ponds portion of the watershed west of Alternate SR 4 was excluded from the watershed. The study found that a significant portion of this 8.2 square mile area does not appear to drain either to Mill Creek or to Pleasant Run."

Pg 8, the last paragraph seems to attribute heavy nutrient loadings, as far as Koenig Park in the main stem in Hamilton County, to the Upper MC WWTP. Is this a fair statement? With various industries along Mill Creek and a history of flooding problems because of runoff in this heavily urbanized watershed, isn't it possible that NPS, an illicit discharge or other source (other NPDES) share responsibility for impacted chemical and biological water quality?

Response: Nutrient impacts were documented as far downstream as Koenig Park in the mainstem of Mill Creek. This may be a combination of Glendale WWTP and Upper Mill Creek WRF, as well as some NPS contribution, but by far the impacts are strongly associated with the point source discharges. The industrial discharges into Mill Creek consist mainly of non-contact cooling water. The process waste from these facilities is discharged into the sewer system of MSD of Greater Cincinnati and transported to their sewage treatment facility.

P. 10 continues the assumption that the Upper MC WWTP is the main contributor of nutrients for a three-mile stretch of the Mill Creek. Have there been samples that can test for household or commercial fertilizers?

Response: Ohio EPA sampled the same parameters upstream from the plant as downstream from the plant. The effluent of the plant was also sampled for the same parameters. Ohio EPA is confident in the conclusions.

P.11 describes problems with lower MC. One aspect that is missing surrounds Phase II issues. There is no mention about the serious impact of stormwater runoff. In the TMDL document, it is generically called "urban runoff," but urban runoff does not necessarily equate to stormwater runoff. MSD of Greater Cincinnati conducted several studies of the lower MC during 199-2004. One of their reports attributes the high NPS causes coming from stormwater runoff. Also, the TMDL document makes many generalizations. Are there any statistics about rainfall amounts and expected runoff that cannot be handled by the CSO's and SSO's?

Response: Addressing Phase II stormwater was not required prior to November 2002 and the data was not available during the modeling.

Pgs. 12 and 13 continue the case for the Upper MC WWTP as a source of problems. Has any sampling other than fish sampling been done above this facility? Suburbanization north of the plant has destroyed several riparian zones and exacerbated erosion. A hypothesis can be created that the new residential and commercial development of the East Fork certainly has added to nutrient and sediment loads in the East Fork that can travel downstream.

Response: Fish, chemical, and macroinvertebrates were collected from several stations upstream from the WWTP in 1992, 1997, and 2002. Allen Road (RM 1.9) and Beckett Road (RM 3.2) sites remain in Full attainment with good to exceptional biological performance. Further upstream, macroinvertebrates at Barret Road (RM 4.7) were Fair but this was attributed to intermittent conditions during the 2002 drought. Nutrient levels upstream from the WWTP remain low, particularly when compared to levels found downstream from the WWTP discharge. To this point, development pressures upstream from the WWTP have not resulted in detectable impacts in-stream.

In the TMDL, biological results from upstream sites are included in the Attainment Table but discussion in the text was limited since the stream was in attainment and conditions were similar to previous surveys.

Pgs. 12 and 13 do not address the growing development pressures of the East Fork basin and the Mill Creek in West Chester and Fairfield townships. The Upper Mill Creek discussions are mainly centered on the Upper MC WWTP. The significant NPS that have greatly impacted the Upper Mill Creek basin in Upper East Fork, and the Upper MC in West Chester, Fairfield and Liberty Townships, have not been described.

Response: The above response also addresses this comment.

In addition, this section (as well as other early pages) of the document, describe sampling dates of 1992, 1997, and 2002 as evidence of water quality issues in sub-basins. The sampling sites in those three time periods, especially 2002, do not give wide coverage to the Upper MC or Upper East Fork. Most of the sampling stations are near or below the Upper MC WWTP facility. Also, sampling sites are not always the same for subsequent years. It is difficult to highlight pollution causes and pollution sources over a 10 year time period when sampling locations are not the same in each of the alternating 5-year monitoring studies.

Response: Ohio EPA disagrees that less coverage was given to Upper MC or Upper East Fork in 2002. There were 5 upstream sites in 1992, six in 1997 and six in 2002. In 2002, the focus of sampling was the Upper Mill Creek watershed, essentially a repeat of the 1997 survey, plus sites extending further downstream in the mainstem were added. Intensive sampling was conducted immediately downstream from the Upper MC WWTP to assess the WWTP and the recently installed Newbury riffles. It may also appear that sampling was concentrated below the WWTP since several years of the Butler County's consultant's sampling data are included in the Attainment Table.

In 2002, there was not the need or resources to extend sampling through the remaining length of Mill Creek. Unfortunately, not all the fish sites scheduled for sampling were completed due to

resource issues, so there is a gap in coverage at the lower end of the study area (Koenig Park and North Bend Road sites). Normally, there is a conscious attempt to resample the same sites from one survey to the next but that is not always possible.

Also, there is less emphasis on the Upper East Fork in the TMDL since it is not impaired.

Pgs 25-27 mention point source issues. The TMDL needs to add comments about the work being completed by Hamilton and Butler County wet weather initiatives. It also should make a chart of the 37 political jurisdictions of the Mill Creek, indicating who holds a Phase II permit for that community, and any progress in mapping illicit discharges. Illicit discharges are a large problem in Hamilton County. They can possibly contribute to organics, oil and grease, nutrients and pesticides that impact use designations and biological criteria.

Response: All political jurisdictions that drain into the Mill Creek watershed are covered under the NPDES General Permit for Storm Water discharged from MS4s. The only exclusions are those sections of communities that are served by combined sewers. The MS4 General permit allows five years for the completion of mapping of stormwater systems and location of illicit discharges. The majority of the MS4 permitees plan to complete 20% of the necessary work for illicit discharge identification per year.

Pg 30, Problem Statement, 3rd paragraph, sentence 3…" Based on the results of the 2002 biological and water quality study, this belief (about selected parameters of phosphorus and NO3 + NO2) is supported (by Ohio EPA)." This statement may be true, because the sampling locations as mentioned focused on lower East Fork and Main Mill Creek near the Upper MC WWTP. Does the 2002 water quality study indicate that the aforementioned parameters are equally important in the lower Mill Creek, West Fork, Mill Creek at Sharonville, and the Upper reaches of the headwaters region?

Response: The 2002 water quality and biological study included surveying the mainstem of Mill Creek from RM 8.0 to 26.3. The survey did not concentrate on just the upper reaches influenced by the Upper Mill Creek WRF. The Addendum (June 2004) which was posted on the website with the draft TMDL report discusses the extent of the survey. The 303 (d) list and previous surveys, as well as the assessment for the modeling for the TMDL, identify areas of the watershed where these parameters are an issue.

Page 30 continues to reiterate that Butler County is working on nutrient reductions. Phosphorus may also be attributed to the tens of thousands of linear feet of moderately to severely eroded streambanks and eroded areas of fertilized soil in the heavily developed areas above the WWTP. This was discovered during the inventory phase of the Upper Mill Creek WAP in late 2002.

Response: According to the Upper Mill Creek WAP:
Table 3.6 Erosion and Barriers

Erosion and Barriers	***Segments***	***Length (feet)***
Moderate Erosion	*24*	*29650*
Severe Erosion	*15*	*21400*

Perched Culvert or Concrete Slab	*6*	*Na*
Instream Drop	*2*	*Na*
Natural Waterfall	*2*	*Na*
Drop Structure	*2*	*Na*

Eliminating all these sources of phosphorus would only reduce the load by 939 kg per year. The bulk of the nutrient loading is not coming from streambanks and eroded areas of fertilized soil.

Page 47, Table 15 stops at 2001. Many other TMDL meetings and associated discussions have been held since that date. This table should be updated.

Response: The few additional TMDL meeting dates involving Ohio EPA and other parties can be added to the table. Meetings regarding 319 issues will not be added to the table. Ohio EPA has not been privileged to all the meetings held regarding WAP development. Language from the Upper Mill Creek WAP states: "Using the lists of watershed related issues developed by community representatives during the September 24, 2001 meeting, UMC WAP participants met eight times during 2002 and 2003 to develop, evaluate and prioritize action items in the WAP." This language can be inserted into the TMDL report.

Implementation and Monitoring Recommendations (beginning pg 48)

Implementation Strategy #1 mentions the *Mill Creek TMDL Nonpoint Source Pollution Load Reductions* submitted by the Mill Creek Watershed Council on June 9, 2003. This document was prepared as the final requirement for this TMDL document, and its nonpoint source pollution reduction strategies and load calculations should be applied and explained in this TMDL document. Even though the Upper Mill Creek WAP addresses many NPS threats, the aforementioned report should be integrated into specific recommendations in the TMDL.

Response: During email communication with Nancy Ellwood on June 9, 2004, Nancy indicated "I'm not really sure what to do here" with the Load Reduction Strategy. The plan was submitted in 2003, but much had changed since then and many of the projects listed to be funded by 319 monies were not funded. It appeared from her email there were too many "ifs" involved and the decision was made not to include the document in the appendix. If the Council would like to indicate what projects are going to be implemented, then this information can be included in the TMDL report or its appendix.

Implementation strategy #2- grammatical error- take off the letter ”s” from the end of the word “involves” in the first sentence.

Response: The correction will be made.

Implementation strategy #6 - MSD has specific actions and dates for mitigating the impacts of SSO 700. These timelines should be included in the TMDL.

Response: The Interim Partial Consent Decree for SSOs can be found on MSD’s web site

www.msdgc.org/downloads/consent_decree/final_cd.pdf . This has all the target dates for eliminating the discharge from SSO 700. Reference to this website will be put in the TMDL report or its appendix.

Page 49, #9, encourages stakeholders to continue restoration projects under the Federal 319 program. The 319-application process itself has been problematic in the last several years. While the headwaters region has consistently been listed as priority one in the request for proposals, the Mill Creek has yet to receive Section 319 assistance for this region. After a July 29, 2003 public meeting in Reynoldsburg, Ohio to discuss FY2004 applications, the Mill Creek application was unfairly singled out by Ohio EPA staff as not ranking higher in the statewide list due to an unendorsed TMDL or Upper Mill Creek WAP. The request for proposals only required that Mill Creek be at Step 8 or higher in the TMDL process. The Ohio EPA desired endorsements of a TMDL or an Upper Mill Creek WAP. This was outside the expectation from the request for proposals. Mill Creek's FY2004 application was the cutoff line for funding. All 8 projects that ranked above the Mill Creek project were funded, and even the next project below the Mill Creek project was partially funded with monies from a previous 319-program year. It was the same story for the Mill Creek proposal in the FY2002 program year. Mill Creek was the cutoff project and was not funded. Therefore, we advise the Ohio EPA to ensure that the 319 program is indeed a reliable funding source to assist in the implementation of NPS reduction strategies in the Mill Creek watershed.

Response: Changes to the Section 319 grants program have come about as a result of more stringent requirements from USEPA to produce measurable and quantifiable improvements in water quality as a result of the grants. Limits are also placed on some activities due to the Phase II Stormwater regulations that require activities that would have been eligible if not in a Phase II community. Since all of the Mill Creek watershed is within Phase I or II Stormwater communities Ohio EPA must be careful to ensure that only eligible practices are installed with grant money. To ensure the strongest possible applications the local stakeholders need to get the WAP endorsed and have the applications focus on measurable and quantifiable improvements.

Recommendation #11, encouraging the Butler SWCD to use the Water Pollution Control Loan Program to assist in the reduction of livestock wastes. While useful, the loan programs are impractical with local agencies in tight budget situations. The Butler SWCD was included and would have received $35,000 in the FY2004 Section 319 Mill Creek application. This cost included work with livestock operations. This education and outreach program received some criticism from the 319 state selection committee in the July 24, 2003 public meeting. In Mill Creek's FY2005 Section 319 application, the Butler SWCD would receive $35,000 to do education and outreach activities, including livestock operations.

Response: The 319 Grant funds are limited and competition for those funds is steep throughout the State of Ohio. The Water Pollution Control Loan Program was suggested as another funding source.

Recommendation #12 should have specific target dates attached to the recommendation. The U.S. Army Corps of Engineers is finishing the General Reevaluation Report in early 2005. It

may be an unrealistic expectation or recommendation that the Army Corps do a watershed-wide plan, as the current GRR process has been arduous and consumed more than 13 years of on-and-off again problems.

Response: Ohio EPA has no control over the U.S. ACOE schedule.

Ohio EPA may consider adding a recommendation. OKI has implemented a 5-acre constructed wetland as part of its FY2000 Section 319 award. This site, started in October 2002 and enhanced through early June 2004, has been hugely successful in reduction of sediments and nutrients as demonstrated by extensive sampling completed by University of Cincinnati, Greenacres, OKI and MSD. It not only has impacted NPS loads, but also has reclaimed part of the creek's natural floodplain. Specific recommendations for reclaiming the stream's natural floodplain are both realistic and achievable, and should be a specific recommendation for the Upper Mill Creek. Many other wetlands grants and conservation programs for the US Fish and Wildlife Service and the Clean Ohio Fund would complement this wetland effort.

Response: Recommendation # 9 in the TMDL report does this.

Pg 50, the discussion of monitoring and sampling to verify attainment of WQS. We suggest that Ohio EPA adopt a site standardization process for its 5-year basin rotation strategy. In 1992, 1997 and 2002 assessments, the stream mile sampling sites varied throughout the years. It is difficult to ascertain the effectiveness of the implementation recommendations if the exact same stream miles locations are not re-sampled every 5 years.

Response: Some of this discussion has already been addressed earlier in this responsiveness summary. Ohio EPA agrees it is important to sample similar sites from one survey to the next, particularly if trend analysis is desired. There are other reasons to add additional sites or move sampling locations, such as to bracket an area of new development, habitat disturbance or a new discharge. Resources don't always allow as much coverage for survey work as desired, so decisions must be made as how to best spend those limited resources.

In general, the implementation and monitoring recommendations do not make substantial references to the Clean Ohio Fund projects and watershed action planning strategies that complement implementation efforts.

Response: This will be added to recommendation # 9.

In addition, there are no watershed maps of the Mill Creek sub-basin. Many of Ohio EPA's grant projects require applicants to provide detailed maps and critical areas, but the EPA has created no watershed maps in the TMDL. Maps of land use, floodplains, 8-digit, 11-digit, and 14-digit hydrologic unit codes (HUCs), and other important natural features that impact pollution should be created.

Response: Ohio EPA and USEPA have provided significant funds to stakeholders in the watershed over the past several years for development of WAPs and mapping. Several of the inventories and maps have been developed, but they are not housed in one location to be used by

all parties interested in working toward the restoration of Mill Creek. Ohio EPA will look through what maps it has been provided to determine if any will enhance the TMDL report.

To conclude, the OKI Regional Council of Governments, like the Ohio EPA, endorses a "creative solution to the impairments of the Mill Creek watershed."* To that end, we offer the following overall suggestions for the TMDL document:

We believe that much of the "creative solution" depends on public perception and political will, not just technology and regulation. We therefore recommend that the final report should:

Propose public funding for activities that re-establish people's sense of connection with the Mill Creek and its tributaries. Such activities would include educational canoe outings, creek walks, stream cleanups, monitoring projects, inventory projects, planting events and restoration projects.

Response: This appears to be a function of local stakeholders.

Point out that the Mill Creek is a threat to public health. It is especially hazardous to the health of children, who are still developing their immunities but cannot resist the temptations to play at the nearby Mill Creek. Many do not realize the inherent risks of exposure to the stream's high levels of bacteria, viruses and other pathogens.

Response: A fish consumption advisory is listed on Ohio EPA's website, and Mill Creek is listed for limited consumption of all species of fish. This information is also available when purchasing fishing licenses in the State of Ohio. The TMDL report and supporting technical documents already point out the bacteria issues in the watershed.

Point out the importance of the Ohio EPA's re-designation of many stream miles from secondary contact recreation to primary contact recreation. Bacteria levels must be reduced to bring the Mill Creek in compliance with secondary contact standards and the primary contact standards are even more stringent.

Response: This is addressed in the above response.

Recognize that the Mill Creek is not just a collection of problems, but is also a fascinating place with significant assets and even greater potential. It is rich in heritage, views and wildlife. Rather than treat it as only an impaired stream that consistently falls short of water quality standards, we must also regard it as a unique urban resource that shows the resurgent powers of nature.

Response: Ohio EPA acknowledges the importance of the Mill Creek ecosystem. Many State and Federal resources have been directed to this watershed for assessment, enhancement, and TMDL development.

Recognize that Mill Creek has an unfair disadvantage in federal funding programs that emphasize the number of stream miles brought into attainment of designated uses. Incremental

improvements may not dramatically reduce the Mill Creek's impaired stream miles, but they give relief to the many people who live or work nearby.

Response: Ohio EPA will not make this statement.

Acknowledge that higher than average percentages of the Mill Creek watershed's residents are impoverished, elderly, handicapped or classified as minorities. This will shed light on the complex issues of public perception and political will.

Response: These issues are far beyond the purpose of the TMDL.

Emphasize the gains already made by a variety of stream restoration projects in the Mill Creek watershed. Among the projects worthy of description are Brandywine Creek in Glendale, Beaver Run in Springdale, the Newberry riffles along the East Fork in Sharonville, the constructed wetland along the main stem in West Chester Township, and the reduced herbicide spraying along the main stem in Cincinnati.

Response: Ohio EPA would welcome information regarding water quality improvements from some of the projects mentioned. The East Fork Newberry riffle assessments have been ongoing and contentious. We feel potential benefits of the structures have been largely nullified by water quality impacts from the UMC WRF, and therefore have moved forward with Butler County to address nutrient removal at this facility.

* In its Introduction to *Total Maximum Daily Loads for the Mill Creek Basin – Draft Report*, the Ohio EPA states: "A number of factors signal the need for a creative solution to the impairments of the Mill Creek watershed and the possibility of the solution coming to fruition."

Propose added support for more stream restoration projects through innovative combinations of public funds from the Section 319 program, Clean Ohio Fund, NatureWorks, Supplemental Environmental Project Funds, Section 104 (b)(3) program, Phase II stormwater management program, wetland programs, Land and Water Conservation Fund and others.

Response: This can be added to recommendation # 9.