Comment Letter on Hinkson Creek TMDL from Lathrop & Gage

Shoemaker, Charlene R. to: R7TMDL 12/01/2010 03:59 PM
Cc: "Farley, Judie", "Davenport, Aimee", "Shorr, David"

History: This message has been replied to.

Ms. White,

This email follows up on our conversation today. As you know I called to confirm receipt of our email dated today December 1, 2010 regarding Comment Letter on Hinkson Creek TMDL. This letter and several attachments were emailed to you around 2:33 p.m. today. The document was sent to you in several emails since the document was so large. As of our conversation at 3:48 p.m. you had not received the emails and said you would check with your IT people to see if it is pending. You indicated that sometimes large emails get held over until after business hours and then processed. You indicated to me that since I called to verify receipt that would you accept it filed as of today. I indicated to you that we will also be sending a hard copy via Federal Express for receipt tomorrow (December 2, 2010) and you told me that was acceptable. Please confirm receipt of this email and thank you so much for your consideration and cooperation.

If you have any questions regarding this, please feel free to contact me at 573-761-5002 or Judie Farley at 573-761-5003.

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December 1, 2010

VIA E-MAIL r7tmdl@epa.gov
AND FEDERAL EXPRESS

Environmental Protection Agency, Region 7
Water and Pesticides Division
901 North 5th Street
Kansas City, KS 66101

ATTN: Ms. Debby White
Water Quality Management Branch
Hinkson Creek

Re: Hinkson Creek Total Maximum Daily Load Comments

Dear Ms. White:

The undersigned represents the County of Boone, Missouri; the City of Columbia, Missouri; and the University of Missouri ("MS4 Permit Holders" or "Permit Holders"). The Permit Holders object to the issuance of the Total Maximum Daily Load ("TMDL") for the Hinkson Creek. The 303(d) listing of the Hinkson Creek is not supported by evidence and the TMDL unlawfully attempts to mandate a reduction in flow contrary to EPA's authority under the Clean Water Act.

The Permit Holders agree with the goal, objective, and necessary outcome desired of this TMDL – conditions such to remove Hinkson Creek from the 303(d) impaired waters listing. They do not agree with this TMDL's means and methods to achieve the outcome, and believe the strategy as proposed may result in the opposite effect.

This draft TMDL ignores all representative available evidence supporting the delisting of Hinkson Creek. Judging by the hasty timing this TMDL has been placed on public notice, it is clear that the EPA is issuing this TMDL only to meet a deadline in the 2001 Consent Decree[1] in the face of all evidence to the contrary. It is also evident that EPA has failed to conduct any fact finding to validate its TMDL findings as no

[1] American Canoe Association et. al. v. Carol M. Browner and the United States Protection Agency, Case Nos. 98-1195-CV-W and 98-482-CV-C-5, U.S. District Court for the Western District (ordered August 21, 2000).

stakeholders have been contacted regarding this document. It is disturbing that EPA openly admits that it is "establishing the TMDL to meet the milestones of the 2001 Consent Decree. Issuing a flawed TMDL only to meet a consent decree timeline is not a scientifically supported basis by which to issue this TMDL and wholly ignores the Congressional intent for public participation as a major element of the TMDL process.

As such, the Permit Holders demand that EPA withhold this TMDL and conduct an adequate review of all relevant evidence available for the Hinkson Creek and engage the principal stakeholders who will be subject to any TMDL – , the County of Boone, the City of Columbia, and the University of Missouri.

All prior comments submitted to the Missouri Department of Natural Resources by the Permit Holders and several interested stakeholders are hereby incorporated into this correspondence and have been included as appendices to this letter.[2] The Geosyntec Consultants Report dated November 30, 2010, is also hereby incorporated into this correspondence. The Permit Holders submit the following additional general and specific comments for this TMDL:

I. The Clean Water Act Prohibits the Listing of the Hinkson Creek Where No *Pollutant* Has Been Identified

The identification of a pollutant is expressly required under the Clean Water Act before a TMDL can be developed.[3] Section 303(d) only requires the development of TMDLs:

> "for those *pollutants* which the Administrator identifies under section 1314(a)(2) of this title as suitable for calculation. Such load shall be established at a level necessary to implement the applicable water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality."[4] (Emphasis added.)

In addition, federal regulation requires States to identify the specific "pollutant(s) causing or expected to cause violations of applicable water quality standards" on their 303(d) lists.[5] This requirement has not been fulfilled.

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[2] *See* comment letters from Permit Holders and interested stakeholders to MDNR, Appendices A through I.
[3] *See* 33 USC 1313(d)(1)(C).
[4] *Id.*
[5] 40 CFR § 130.7(b)(4).

At the outset, the TMDL states that, "No pollutant, or suite of pollutants, appears to be the main cause of the impairment in Hinkson Creek."[6] It further states that the TMDL then states that "no one contaminant was discerned to be the primary pollutant of concern."[7] This conclusion is consistent with that reached by the Missouri Department of Natural Resources in its prior draft TMDL and confirms that this TMDL is being established without an identified pollutant in violation of Section 303(d) of the Clean Water Act.

The assertion that the stressors and pollutants listed in Tables 6 and 7 are "collectively causing the impairment"[8] is not supported by evidence in the record and does not meet EPA's requirement to identify a pollutant before a TMDL can be established. Many items listed in Tables 6 and 7 were attributable to direct sources that have been eliminated in the watershed, further undermining this conclusion.[9] Without the correlation between a specific pollutant of concern and the observed impairment, the requirement to identify a pollutant before the establishment of a TMDL has not been met.

The EPA appears to rely upon its 1998 listing guidance as the basis to develop this TMDL without an identified pollutant.[10] This reliance not only contradicts the clear statutory and regulatory mandate, but is flawed since the 1998 guidance does not address the development of TMDLs and only addresses a state's decision to *list* a waterbody on a 303(d) list when a pollutant has not been identified. This guidance in no way changes the Clean Water Act mandate that EPA must identify a pollutant before a TMDL can be developed.

II. The EPA Fails to Fulfill Its Non-discretionary Duty Under the Clean Water Act to Properly Identify Specific Pollutants as Required by Law.

The agency's failure to exercise its non-discretionary duty under the Clean Water Act is enforceable by citizen suit. The Administrator has the non-discretionary task of identifying pollutants in setting the goals and objectives of a TMDL as discussed above.

Because the specific pollutants designated for Hinkson Creek are, by admission of the agency, "unknown," the agency has failed to fulfill this non-discretionary duty.

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[6] Hinkson Creek (M)_1007 and _1008, Boone County, Missouri, Total Maximum Daily Load, page 8.
[7] *Id.* at 17, section 4.5.1.
[8] *Id.* at, page 17, section 4.5.1.
[9] *See* Lists of Watershed Activities, Appendices J and K.
[10] National Clarifying Guidance for 1998 State and Territory Clean Water Act Section 303(d) Listing Decisions.

Webster's Dictionary defines "unknown" as:

> not known;
>
> (a) not disclosed or identified; (b) not determine or verified.[11]

The statements are not consistent because "unknown" cannot be a "pollutant" as required by the Clean Water Act. The English language does not allow this fact to occur.

The failure of the agency to fulfill its non-discretionary duty to specifically identify pollutants under Sections 303 and 304 of the Clean Water Act must be addressed. Failure to address this non-discretionary duty is subject to enforcement by a citizens' suit pursuant to the Clean Water Act.[12]

III. The EPA Unlawfully Treats Flow as a Pollutant in the Hinkson TMDL.

Flow is not a pollutant under the Clean Water Act. Nothing in federal regulation authorizes the use of flow as a pollutant. Federal regulations are clear that EPA can only reduce pollution in a TMDL by identifying wasteload allocations for point sources and load allocations for nonpoint sources.[13] A "wasteload allocation" is defined as "The portion of a TMDL's pollutant load allocated to a point source of a *pollutant* for which an NPDES permit is required."[14] Not only is there no known pollutant to base a wasteload allocation upon, but nothing in the definitions of wasteload allocation or "pollutant" authorizes the EPA to regulate water flow, volume, or quantity through a TMDL.[15]

Further, there is no evidence in the record that flow was adequately studied to justify the treatment of flow as a pollutant in the TMDL. The EPA includes flow data (when comparing to reference streams) for the last three years – all abnormally wet years – speculating that fluctuations in aquatic life are related to flow.

The agency's supposition provides no legal basis to require a mandatory reduction in flow and is contrary to EPA's authority under the Clean Water Act and implementing regulations.

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[11] Unknown. 2008. In Merriam-Webster Online Dictionary. Retrieved November 30, 2010, from http://www.merriam-webster.com/dictionary
[12] *See* 33 U.S.C. 1365
[13] *See* 40 CFR § 130.2(h)(6).
[14] *See* 40 CFR § 130.2(g).
[15] *See* 40 CFR § 130.2(d).

IV. EPA's Conclusions in the Total Maximum Daily Load Are Unsupported By the Record.

A. EPA's Conclusion That Hinkson Creek Has an Impaired Biological Community is Flawed.

According to the studies upon which this TMDL is based, the Hinkson Creek supports a biological community required for the designated use. Many places sampled achieved a score of sixteen, which MDNR recognizes as fully supporting aquatic life. With the exception of MDNR's non-representative spring of 2002 assessment, macroinvertebrate samples collected by MDNR have shown the urban portion of Hinkson Creek to be *fully supporting or very nearly so each time the biological community has been evaluated* (MDNR 2002, 2004, and 2006). Even comparing to the study done for Potash Brook in Vermont - the TMDL cited as precedent or the Hinkson Creek TMDL – Hinkson Creek could be considered a high quality urban reference stream to which other streams in Missouri cities should be compared for attainment of aquatic life. This data hardly supports the agency's conclusion that this stream is impaired.

The last comprehensive investigation of the macroinvertebrate community was conducted by MDNR in the fall of 2001 and spring of 2002, over eight years ago. The data derived from this assessment is not representative of current conditions in the Hinkson Creek since it does not reflect improvements in the watershed from the MS4 Permit Holders' implementation of control equipment, best management practices, and elimination of discharges in the Hinkson watershed.

Also, throughout this TMDL document, an erroneous assumption has been made that the biological community was attaining the beneficial use prior to increased urbanization and that restoring hydrology to historical levels will restore biological health. This assumption is baseless in that the biological health of Hinkson Creek has not been adequately documented for the reference time period and anecdotal evidence suggests that the water quality and biological health of Hinkson Creek was poor and has actually improved considerably since the 1960's. For instance, nearly 54 on-site or small wastewater treatment facilities have been eliminated and replaced with regional wastewater treatment facilities to improve water quality in the Hinkson watershed. Agricultural practices have also improved in the past 50 years.[16]

There is insufficient evidence that the biological community was attaining beneficial uses in the 1960-1990 period and EPA's conclusions are improperly based on this assumption.

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[16] *See* Geosyntec Report, Appendix L at page 9.

B. EPA's TMDL Conclusions Ignore Evidence that Water Quality Has Improved in Hinkson Creek.

The TMDL relies on incomplete data and ignores the fact that the Hinkson Creek has continually improved. Farming practices of the early 20th century removed most of the forest in the watershed which caused damage to the stream. Many of the harmful effects said to stem from urban development today also came from farming practices in the early 20th century, including low baseflow as forests and prairies were replaced with pastures and row crops. The baseflow noted in the study to have been present in the late 1960's certainly contained a high percentage of effluent from water treatment plant effluent. Most of this effluent baseflow resulted from the delivery of piped, potable water to households in the watershed as opposed to rain water falling on the watershed. This effluent was known to be of poor quality. This is why the City of Columbia has removed those facilities from the watershed over the years. Since the middle of the last century, the City of Columbia, has eliminated approximately 10 million gallons per day of poor quality treated effluent from Hinkson Creek. (This estimate is based upon the actual or design flows for 54 wastewater treatment plants that were eliminated.)

While the removal of sewage treatment plant effluent from smaller treatment plants has improved the quality of water in the Hinkson, the TMDL reflects no analysis that the continued removal of "baseflow" or too much control of volume and flow will not be damaging to the aquatic community in the watershed.

The TMDL further ignores the reality that mandating the expenditure of all available public funds in an effort to reach an impossible target will diminish the Permit Holders' capability to implement numerous other water quality controls that will improve the watershed.

C. EPA Has No Evidence that a Reduction in Flow Will Improve Water Quality in the Hinkson Creek.

This TMDL is based on the unsupported conclusion that the aquatic invertebrate community has been negatively impacted by the increase in urbanization (imperviousness) which has increased either the amount of water in the creek; or the amount of water at the extreme event (Q.03%). The purpose of the TMDL is to determine the pollutant loading a water body can assimilate without exceeding the water quality standards for that pollutant. This Draft TMDL uses flow (or volume) as a surrogate for any pollutant that may be found in stormwater runoff.

Without understanding the sources of pollutants and delivery pathways from certain landuses, basin-wide reductions could actually increase in-stream pollutant

concentrations due to less dilution. Lumping of all urban landuses for the landuse-based TMDL allocations may cause further increases in concentrations. Commercial and industrial areas will have fewer opportunities for reducing runoff volumes than residential areas and infiltration may even be prohibited for some types of industries. If residential areas reduce runoff volumes more than commercial and industrial areas, then in-stream concentrations could increase.[17]

Understanding pollutant generation, transport, and delivery processes are necessary in developing effective control and restoration measures. Application of a catchment-wide surrogate for a pollutant is likely to yield unintended consequences. Reducing runoff volume (transport medium) on a basin-wide basis infers that beneficial uses as measured by macroinvertebrate scores respond in a continuous, linear, and negative manner to pollutant load. However, toxicological responses are frequently concentration-driven, often threshold in nature (not continuous), and may be non-linear (sigmoid). If periodically lower biological metrics are the result of discrete activities that have been remediated or abated, such as chloride wash-off from road salt storage facilities, then basin-wide runoff reductions will not necessarily lead to ecological health. Further, any assumptions that impacts are related to chloride or other 'urban' contaminants, reducing runoff from agricultural land will not improve the biological community.[18]

Because there is no data to support that a reduction in flow or volume will improve water quality standards, a mandatory reduction in flow is inappropriate and against the weight of the evidence in the record.

D. A Reduction in Volume is Impossible.

It is still unclear from the language in the Draft TMDL, if a reduction in flow (or volume) is the target. If a volume reduction is required, then the community has to remove that amount of water from the watershed. Once the required volume is captured, what can be done with it?

The TMDL states reduction by either infiltration or evapotranspiration are allowable methods. Ninety percent of the soils in this watershed have slow to very slow permeability. That is less than a half an inch per hour, under ponded conditions. Evapotranspiration rates are difficult to calculate. Using the PAN Method evapotranspiration rates, we could expect about ½ inch per day. At that rate, it would take weeks to evaporate and infiltrate the water from a 0.5 inch storm. That is just from one event. The average rainfall for Boone County is 38 inches per year. For the last two

[17] *See* Geosyntec Report, Appendix L at page 5.
[18] *Id.*

years, this area received over 50 inches of precipitation. Even through detention and slow release, the same volume or amount of water is flowing through the channel, just spread out over a longer time period. A volume reduction of that magnitude is scientifically impossible.

V. The Total Maximum Daily Load Contradicts EPA's Own Guidance By Not Allowing Phased Wasteload Allocation Approach.

EPA guidance supports the use of a phased approach for TMDLs when (1) significant data uncertainty is present; or (2) when using a surrogate to interpret a narrative standard; or (3) when uncertainty about the effectiveness of implementation activities exists. These are clearly the situation demonstrated with the Hinkson Creek. EPA guidance states:

> ***Phased TMDLs***
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> We recommend the use of the term "phased TMDLs" be limited to **TMDLs that for scheduling reasons need to be established despite significant data uncertainty** and where the State expects that the loading capacity and allocation scheme will be revised in the near future as additional information is collected. In other words, phased TMDLs would be reserved for the second scenario described in the 1991 Guidance.
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> **The phased TMDL approach would be used in situations where limited existing data are used to develop a TMDL** and the State believes that the use of additional data or data based on better analytical techniques would likely increase the accuracy of the TMDL load calculation and merit development of a second phase TMDL. **Such significant uncertainty may arise, for example, because the State is using a surrogate to interpret a narrative standard**, or because there is little information regarding the loading capacity of a complex system such as an estuary and **it is difficult to predict how the a water body will react to the planned load reductions...**
>
> ***TMDLs with Adaptive Implementation and Trading Provisions***
>
> Adaptive implementation is an iterative implementation process that makes progress toward achieving water quality goals while using any new data and information to reduce uncertainty and adjust implementation activities. The National Research Council report suggests that adaptive implementation include "immediate actions, an array of possible long-term actions, success monitoring, and experimentation for model refinement". By using the adaptive implementation approach, one can utilize the new information available from

> monitoring following initial TMDL implementation efforts to appropriately target the next suite of implementation activities.
>
> Phased TMDLs are an example of the adaptive implementation approach because each new phase utilizes new information to reevaluate the original TMDL....Implementation of TMDLs can take many years and **when uncertainty about the effectiveness of implementation activities exists, TMDLs would benefit from containing elements that would facilitate adaptive implementation such as, for example, provisions for a flexible load allocation/waste load allocation scheme....**
>
> ...EPA believes that in appropriate cases it should be feasible for States to develop TMDLs that facilitate implementation of practicable controls while additional data collection and analysis are conducted to guide implementation actions. **Follow-up monitoring is integral to the adaptive implementation approach**. Monitoring addresses uncertainty in the efficacy of implementation actions and can provide assurance that implementation measures are succeeding in attaining water quality standards, as well as inform the ongoing TMDL implementation strategy...[19] (Emphasis added.)

The Hinkson Creek TMDL lends itself squarely to the use of a phased approach due to the limited data upon which it is based and the scientific uncertainty of the impacts a flow reduction of this magnitude will have in the watershed. In fact, MDNR supported the use of a phased approach in its October 21, 2009 correspondence and attachment.[20] It is unclear why this applicable EPA recommended approach was dismissed while considerable effort was made to fit the existing limited data to an inapplicable, unworkable approach, namely the use of reference streams. It is clear that the phased approach is the most workable solution, which would allow the Permit Holders to continue improvements in the watershed. Ignoring this approach is arbitrary, capricious, and unsupported by any evidence in the record.

VI. EPA Should Incorporate the Current Ordinances and Work With the Local Stormwater Management Planning to Address the Hinkson Creek.

Hinkson Creek is a unique urban stream in Missouri. Throughout the city, the riparian corridor is mainly intact. This is due to Columbia's Flood Plain Ordinances.[21] These protections have recently been increased to include the entire stream network with

[19] EPA Guidance for Water Quality Based Decisions; The TMDL Process, EPA 440/4-91-001, April 1991.
[20] *See* Electronic Correspondence from MDNR to K. Miller, April 22, 2010, and attachment, Appendix M.
[21] *See* City of Columbia Ordinances, Appendix N.

the new City/County Stream Buffer Regulations.[22] The riparian corridors protect and stabilize stream banks, reduce stream temperatures, as well as add important nutrients and habitat for aquatic organisms. Although there are some sections of Hinkson that have been channelized, most of the stream system retains some sinuosity. These features may explain why the agencies' studies find the aquatic invertebrates in Hinkson are partially to fully supporting over time.

The Permit Holders have continuously engaged stakeholders to develop stormwater planning approaches in the community. Though this process, the Permit Holders have enacted comprehensive ordinances to address water quality and flow reductions throughout the watershed.[23] For instance, the Stormwater ordinances for the city and the county require that the water volume (1.3 inches) be treated through a filtration BMP. This storm is frequently called the first flush, as it contains the majority of contaminants. The Draft TMDL does not reflect these ordinances and will potentially conflict with measures.

VII. This TMDL Will Have Adverse Consequences in the Community.

This TMDL will lead to adverse consequences, presumably unintended by the agency, in the watershed.[24] They include:

- Detention Basins – to be the most effective, stormwater detention basins would have to be constructed low in the watershed. This would remove the riparian corridor, and established hardwood forest. MDNR just developed nutrient criteria for reservoirs. During that process it was determined that impounded water needed a retention time of 6 months or more to achieve pollutant reduction. (Jones, 2008). Most stormwater detention basins drain in 48 hours or less.

  If the residents of Boone chose regional detention, it would be difficult to design a regional basin large enough to hold 6 months of flow. Therefore, this TMDL could create additional water quality impairments in those detention basins. Slow release of the stormwater, and fluctuating stream flow may increase the amount of time that the channel is full, destabilizing banks, and cause more erosion.

- Starve the stream – As stated during the public meeting on 4-20-10, Engineers will design facilities to capture the runoff from a specific storm

[22] *Id.*
[23] *See* City and County Ordinances, Appendices N and O.
[24] *See* April 22, 2010, Boone County Commission comment letter, Appendix C.

event. Runoff from storms under that threshold are also detained. Therefore, the potential exists to remove so much water that the stream and invertebrates are actually starved of water during drought times.

- Increase in the level of pollutants – This TMDL suggests that the community should capture the relatively clean water from rooftops, and lawns. This would mean that a larger percentage of the water that reaches the creek is from high polluting sources such as parking lots and streets. This could in fact increase the concentration of contaminants that enters the stream.

- Increased sprawl – The TMDL and its methodology will result in the unintended consequence of increased sprawl by limiting the ability to develop in the Hinkson Creek watershed. The proposal calls for a substantial reduction in volume, flow or quantity. To achieve such a reduction, significant structures at significant costs will be required. Structures will be required to be constructed in the existing footprint of the City and County to meet the reduction objective. This will come at considerable public and private expense. New development will seek to maximize cost benefit ratios. New projects will seek other watersheds with fewer restrictions, all of which are outside the core of the central Columbia area. This will result in an expansion of infrastructure and increase the footprint of the current City further into the County, placing adjacent watersheds under stress. While Boone County storm water ordinances will provide some protection, the outward expansion of the urbanized area will be the unintended consequence of the Hinkson Creek TMDL.

- Loss of funding – Unlike wastewater treatment plants that receive billions of dollars in financial aid, grants and loans, there is very little federal or state money available for Stormwater programs. Municipalities must either fund activities out of general revenue, utility fees or taxes. Nonpoint source funding is only available if the activity is not covered in either the permit, or the Stormwater Management Plan (SWMP). Retrofits are currently not a requirement of the permit, or spelled out in the SWMP. By placing the volume reduction requirements in the WLA section of the TMDL, they become part of the MS4 permit. Therefore, any activities that would reduce the volume or move us toward that goal are unable to be funded through nonpoint source funding (319).

- Cost to implement this TMDL – Cost estimates range up to $300,000,000 dollars to implement the TMDL in Hinkson Creek. The Vermont Potash Brook TMDL is similarly situated. The Hinkson Creek watershed is 13 times larger. In January 2010, the Vermont Department of Environmental Conservation found the cost to implement that TMDL would be $25 million for the 7 m^2 watershed. They have chosen not to implement the Potash Brook TMDL until funding is available.

- Loss of public trust – Currently the Hinkson Creek Restoration Project, and the clean sweep events help to tie the community to the watershed. The magnitude of the requirements in this TMDL, the inadequately proven science and the cost could unite the community against doing anything to help the creek.

The TMDL should be withdrawn and reassessed using current representative data, consistent with EPA guidance, to avoid future adverse impacts on community watersheds.

VIII. The TMDL Is Unclear.

Throughout the TMDL, flow is used interchangeably with volume, but these are two distinctly different hydrologic metrics that have very different control strategies. Flow rate reductions may be achieved using detention storage with controlled release to shave peaks, while volume reductions require increased infiltration, evapotranspiration, and/or harvest and use. Because the target reductions are based on a comparison of flow duration curves at the 1-year return period, one may surmise that flow rate reductions are required such that the 1-year peak flow in Hinkson Creek must match the target 1-year peak flow of the attainment streams. The applicability of these reductions for any other flow return period is not supportable because the differences between Hinkson Creek and the attainment streams vary with the frequency of occurrence.[25]

If the intent is to require volume reductions, then flow-duration analyses are inappropriate. *Instead, a comparison of average annual runoff volumes or a comparison of design storm runoff volumes should have been conducted.* The agency should clarify the proposed metric for this TMDL and at what temporal scale it applies. If flow-duration curves are determined to be the parameter of interest, then flow-duration matching should be the TMDL goal vs. volume reduction, with specified parts of the flow-duration curve based upon geomorphic analyses supporting the beneficial use.[26]

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[25] *Id.*
[26] *Id.*

Further, the data first used claim some impairment of Hinkson Creek, aquatic invertebrate community testing, is only mentioned as a secondary goal of the TMDL; reduction of the recorded flow from the single USGS gauge is sited as the primary target. But in spite of the agency's attempts to use a surrogate of flow in this TMDL, restoring the aquatic invertebrate community should be the primary target. The document should be specific as to what percentage of sampling sites for what period of time will be considered supporting. It appears the TMDL is targeting 100% attainment, even while the reference streams do not achieve this goal. This target is arbitrary and capricious.[27]

IX. The EPA Failed to Undertake Any Fact-Finding to Support Its Total Maximum Daily Load.

The agency has adopted regulations for making TMDL determinations that do not contain a adequate fact-finding process.[28] As a result, the determinations regarding the Hinkson Creek are not supported by substantial evidence and are entitled to de novo review.

X. The TMDL Fails to Address Downstream Impacts of the Endangered Pallid Sturgeon at the Confluence of Perche Creek and the Missouri River.

The TMDL fails to address downstream impacts upon the pallid sturgeon at the Missouri River. The biological opinion provided by the U.S. Fish and Wildlife Service for the operation of the Missouri River establishes an increased need for sediment in the River. Specifically, the biological opinion indicates a need for increased sediment to support pallid sturgeon reproduction. Known populations of pallid sturgeon exist downstream at the mouth of Perche Creek. Perche Creek receives the sediment contributions of Hinkson Creek. Removal of sediment contribution from the Hinkson Creek watershed at the mouth of Perche Creek will be detrimental to the pallid sturgeon. The TMDL implies that contributions of sediment into Hinkson Creek should be removed. Yet, the very same "habitat improvements" are being created by the U. S. Army Corps of Engineers with the blessing of USEPA and the U. S. Fish and Wildlife Service in the Missouri River to enhance populations of pallid sturgeon in the reaches of the Missouri River impacted by Hinkson Creek.

There is no evidence of consultation. There is no evidence of any shared information between any federal agencies other than the USEPA.

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[27] *Id.*
[28] *See* 40 CFR § 130.7.

When comparing the biological index numbers on Hinkson Creek and the fact that they are near performing, the removal of sediment from the Perche Creek watershed may be detrimental and result in a taking of potential pallid sturgeon yearlings. The failure to properly protect and address the impact on the pallid sturgeon by this specific TMDL results in a potential violation of the Endangered Species Act which may be supported by members of the public through their right to sue for the failure of any agency involving a federal action from properly addressing its impact. The TMDL as proffered may impact the pallid sturgeon with no attempt to address the consequences.

XI. The TMDL Inhibits the Legal Rights of Downstream Riparian Landowners With Regard to Both Their Legal Ownership Interests in Their Land and Their Legal Rights Regarding Volume, Flow or Quantity on Private Property.

The confiscation and/or modification of the riparian landowners' property and water-related rights represent independent takings by administrative actions. As landowners in the watershed, the Permit Holders object to the manner and action of this TMDL and place the agency on notice that their actions result in a regulatory taking of both riparian property and rights to water and encourage a change in direction.

The agency does not have the legal authority to implement the surrogate approach presented in the TMDL as it impacts the rights of riparian landowners and is not authorized by law. No regulation has been developed to implement such authority, if such should exist.

XII. The Hinkson Creek TMDL is a Federal Action of Sufficient and Unique Impact to Require a Basin Specific NEPA Analysis Versus Acceptance of a Programmatic Authorization.

By admission of the MDNR at public meetings, the Hinkson Creek TMDL and its surrogate of volume, flow or quantity is unique. By admission of the MDNR to implement this TMDL to control volume, flow or quantity will require structural alternatives of consequence not normally required in a TMDL. By the MDNR's and EPA's admission, they rely upon an example from a small watershed in Vermont in developing the surrogate strategy.

The MDNR nor EPA can determine whether concentrations of "unknown" pollutants will increase or decrease as a result of this strategy. The MDNR nor EPA can confirm that improvements required as a result of this strategy may not limit base flow and thereby create stress upon biological indicators.

The unique and special character of the solution provided in this TMDL mandates a specific evaluation under the National Environmental Policy Act ("NEPA") for this federal action. There is no denial that this TMDL will be incorporated into the USEPA's overall TMDL action strategy for the State of Missouri. There is no denial that this is a federal action.

By virtue of the unique character, unknown consequences on the overall environment, and impact on the human environment, a site specific NEPA analysis is necessary.

For the reasons so stated, the Permit Holders request the agency to reconsider the methodologies, designations, and implementation of this TMDL to place it in comport with the law and support the efforts of these communities to improve water quality.

XIII. Specific Comments.

Section 2.1

Impaired section described here does not match that shown in the drawing on page 2.

Section 2.2

Section 2.2 states "Land use within the Hinkson Creek watershed has changed substantially within the past decade." That would seem to imply the past 10 years, 2000 – 2010. However the data reviewed is from 1993 and 2000-2005.

Areas that have been urban for some time in Flat Branch and County House Branch are shown as Grassland or Forest in the 1993 graphic. Those watersheds were essentially built out by 1993 and very little development has occurred in them since.

Much of the development noted on page 2 in the second paragraph (inset) was in Bear Creek. Therefore this overstates the case.

Section 2.3

The assertion in the first paragraph that soils become more permeable in the lower third of the watershed is not supported by the following paragraphs. In those paragraphs it is noted that most of the land in the lower third, though well-drained has slow infiltration. More accurately, the soils become a little more permeable as one moves from the ridge of the watershed to the floodplain. And, in fact, the more permeable floodplains remain remarkably untouched and open through Columbia.

Most soils in the watershed provide less than the recommended ½" per hour for infiltration which is the minimum generally recommended for infiltration type practices. This will limit the effectiveness of vegetated infiltration practices like rain gardens, especially their effectiveness to increase baseflow.

Section 2.4

The first sentence in this section is incorrect. Hinkson was originally listed as unspecified pollutant from urban nonpoint lagoon runoff on the 1998 Missouri 303 (d) list. This would imply bacteria from septic waste was the pollutant. Therefore, how do the citizen reports relating to hydrology (flooding, reduced base flows, erosion) contribute to the original listing?

The TMDL states "MDNR water quality studies did reveal, however, that a large percentage of the problems, including increased sediment and low dissolved oxygen at low flows can be attributed to urban runoff conditions..." Could low dissolved oxygen at low flows also be due to lagoon runoff? Why was that option not explored?

The TMDL document states "Specifically, this TMDL is aimed at restoring the stream's natural peak and base flow dynamics. Creating more natural stream flows will restore habitat and reduce the release of toxic pollutants into Hinkson Creek." There is no peer-reviewed literature to corroborate that statement The preliminary results from the EPA wetland grant study of PL-566 structures in Northern Missouri seems to contradict that statement. Impounded streams with highly disrupted "natural flows" and reduced habitat contained higher quantities and diversity of aquatic life (invertebrates) than the "natural" stream comparisons.

If the purpose of a TMDL is to determine the pollutant loading a water body can assimilate without exceeding the water quality standards for that pollutant, and EPA/DNR has not defined a pollutant, then how can the water quality standards be exceeded?

Section 3.2.2

In the second paragraph, fourth sentence, the math appears to be incorrect.

Section 3.2.3

Given the discrepancies noted in Section 2.2, the information in this section is suspect. Riparian areas in the Hinkson Creek watershed are remarkably well preserved.

Approximately 63% of the riparian corridor is forest, woodland or grassland. The City and the County have recently enacted Stream Buffer regulations that protect 100 feet of riparian corridor on both sides of main stem of Hinkson Creek. Additionally, the MKT trail system encourages restoration and protection of hardwood forests along the creek, while the City's Floodplain regulation prevents development in these areas.

Section 4.2

This is not consistent with Section 2.2.

Section 4.5.1

EPA regulations do not support the use of a surrogate for an unidentified pollutant. It is even questionable whether EPA can use a surrogate for a pollutant that has been identified and is difficult to measure or regulate, and for which a clear relationship between the surrogate and the pollutant(s) can be established. No such relationship has been established here.

The regulations clearly do support the use of a phased approach to TMDLs. The ability to use a phased approach appears to have been included in Federal regulations for just this situation; an inconclusive study coupled with the need to begin addressing the situation as soon as possible.

It appears that this is the first time that stormwater flow has been used for an unidentified pollutant. In the past, (in the Potash Brook, VT TMDL, for example) a pollutant has been identified and then stormwater has been used as a surrogate for that pollutant. The studies noted are broad-brush planning level studies that are very useful for determining what to study, but they are inappropriate for watershed-specific work such as this.

The groundwork has been laid to identify a pollutant or pollutants causing damage to Hinkson Creek. Further is essential to develop a well-supported, targeted TMDL and would not pose as a risk to the creek as this draft TMDL does. A phased TMDL, something truly supported by previous work in the watershed, is what is needed to address water quality in the Hinkson Creek and will avoid unintended harmful consequences.

The TMDL states, "Based on data collected during the Hinkson Creek water quality studies, Tables 6 and 7 were constructed to list stressors and conditions found in the Hinkson Creek main stem and selected stormwater outfalls." These tables would carry more credibility if the water quality results (median values) from the Hinkson Creek studies were displayed on the tables. For example, what was the amount of

caffeine found in the stream? What was the mean summer temperature in stagnant pools? What was the dissolved oxygen level? The data on Chloride is helpful, but actual numbers are not supplied. Additionally, would the winter 2008 and spring 2009 readings be classified as acute or chronic?

Sections 4.5.2.1 -4.5.2.3

The sample size of the biological assessments is small. Some of the poor scores were explained by things that were immediately addressed such as salt laden runoff from a road maintenance facility and poorly stored insecticides. The limited number of assessments done reveal a stream that is at or near attainment making the costs of the TMDL out of proportion compared to the issues being addressed.

Table 8, Stream Condition Index Scores for Hinkson Creek, raises more questions than answers. Which reference streams are fully supporting? What percent of the time? Are any reference streams predominantly (60% or greater) urban? Which ones? Is it appropriate to expect an urbanized stream to have the same stream condition index as a forested stream? Are any Missouri steams both fully supporting aquatic life and an urban stream? The TMDL should provide supporting documentation to address these type questions.

Section 4.5.2.2

Most of the runoff from the area noted now runs through water quality BMPs, and the road salt storage facility is no longer there.

Section 4.5.3

First Paragraph, Item 2: Baseflow from effluent of small waste water treatment plants and septic systems has gone down. (The effluent from the ones for which records were readily available is estimated to be 15cfs. A significant portion of that would have reached the stream as baseflow.) Baseflow from land has gone up over the last 40 years as farming practices kept improving and former strip mine lands become more stable and vegetated.

First Paragraph, Item 4: Channels are seldom enclosed in Columbia and the riparian corridors of Hinkson and its tributaries are remarkable well preserved. The County regulations prevent the use of concrete lined channels.

Paragraph 5: The comparison given does not show anything except that there was more flow during four months in 2007 than the same four months in 1967. There are

many reasons why this could be true. A much longer study time is needed to show a relationship.

Paragraph 6: Another reason that base flow has decreased since the 1960s is that numerous small waste water treatment facilities have been removed by diverting this often-polluted flow to the City's waste water treatment plant. The ultimate origin of this baseflow was well water from much lower in the watershed and/or the Missouri river floodplain, not infiltration of rainwater

The flow duration curves for April – July 1967 and 2007 are inadequate. Flow duration curves can be a useful tool in generalizing hydrologic condition. However, the curve should contain 10 – 30 years of daily average flow data. The use of a 4 month window to compare two years is not applicable, and does not illustrate a trend. The authors are drawing conclusions from two snapshots in time. The 1967 low flows may be due to sewage discharges, while the 2007 flows were during the 2nd of a two year drought, which may have depleted base flows. Without additional data and information, any number of conclusions could be drawn about these flow characteristics.

The reference for table 9 on page 27 should actually be for table 10. On table 10, yearly precipitation should also be included for comparison reasons. The precipitation for October 2009 through September 2010 was almost 65 inches. What was the precipitation for the 1967 – 1991 years? Also where was the precipitation data collected? How are the data in figure 5 and 6 normalized for higher than average annual precipitation that occurred during the past three years?

Paragraph 7: When trying to establish a relationship between flows in 1967 and 2007 the flows need to be compared to rainfall and antecedent moisture in order to truly compare the flows. There are other reasons besides the conclusion that EPA has drawn to explain the difference in flows.

Paragraph 7: Hinkson was placed on the impaired list in 1998, but here it is stated that "The impairment occurs in the last decade." Further, rainfall and flow data from very wet years after the study was complete are used as proof that stormwater flows have impaired the stream. This line of reasoning makes the conclusion suspect.

Table 10. How did the Peak, Average and Median rainfall events compare for this period?

Section 4.6

The TMDL states that "An ecoregion is a collection of watersheds that share a common zoogeographical history, physiographic and climatic characteristics and

therefore likely to have a distinct set of freshwater assemblages and habitats. In addition, since the ecoregion has similar climatic characteristics, precipitation over time should be similar for the reference and impaired streams." Generally speaking, Hinkson and the comparison streams should have the same aquatic invertebrates and precipitation. But how can one compare flow conditions for watersheds with different land-uses, sizes, aspects, slopes, as well as dissimilar bed and bank materials?

Section 4.6.1

Last sentence: Even when using reference streams from the same ecoregion, there are still differences, and the importance of those differences get magnified when small samples of data are used. This region is noted for its volatile climate and large differences can be noted within a few miles. For instance, the year-to-date rainfall (as of 11/19/10) total at Sanborn Field gauge is 50.7 inches whereas the value at Bradford Farm (~5 miles southeast of Sanborn) is 42.6 inches. A long rainfall and streamflow record is needed to attenuate the differences.

The TMDL states "controlling the highest flows will limit pollutant loads from urban runoff therefore decreasing potentially toxic water quality conditions and increasing baseflow through increased infiltration of stormwater runoff." Previous research from EPA has determined that the first flush rain events move the majority of pollutants into the stream. The water quality storm for Missouri is approximately 1.3 inches, and considerably lower than the highest flows that EPA is requiring the community to control. Is EPA reversing previous claims to assert only the high flows are to blame?

The use of comparing Hinkson Creek to a synthetic flow record by calculating discharge per square mile was not normalized for slope, precipitation, or antecedent soil moisture conditions. Therefore the comparison is invalid.

How do the authors know which flows are needed for aquatic life? Flow does not control the release of toxic pollutants; it is only the transport mechanism. Please substantiate the reasoning behind setting a reduction of the Q0.3 flow, without an increase in base flow. Please define the historic flow we are trying to achieve with this TMDL, and provide a hydrograph of historic flows.

Section 4.6.2

How does the use of a reference stream that is 3-7 times greater than Hinkson Creek provide an adequate comparison? The smaller the watershed and the farther up the headwaters, the more the stream is subject to flash increase events as an example. Compare Hinkson creek to the Missouri river at the Jefferson City Bridge. A runoff

event that causes a 2 foot increase in stage would be orders of magnitude different for these two watersheds. A larger watershed has the ability to attenuate and therefore dampen the effects downstream, where a smaller watershed would not. The difference in aspect of the reference streams should also be noted. Most Missouri storms track from SW to NE, running the full Hinkson watershed. All of the reference streams are orientated from NW to SE, and therefore may not get the full impact of many storm systems. Additionally, the proximity to the Missouri River and the micro-climate of Columbia could affect local weather patterns, providing more intense rain storms, hotter temperatures, and humidity differences.

Section 5

"...the LC is the greatest volume of stormwater runoff Hinkson Creek can receive and still maintain a fully supporting warm water aquatic life designated use." The TMDL uses volume and flow interchangeably. Is the target a reduction in the peak flow, or a reduction in the stormwater volume? Please provide peer-reviewed data to support the claim that volume controls aquatic life in Hinkson or any other stream system.

The TMDL states "Hinkson creek does not currently meet aquatic life beneficial uses". However, the last data recorded in the TMDL was for spring of 2006 – a drought year. Hinkson has not been sampled in 9 sampling seasons (Fall 2006 – Fall 2010). Therefore there is no way of knowing if the creek is currently meeting aquatic life uses.

Last paragraph: Since non-attainment of biological criteria is why the stream is on the 303(d) list, this should be the primary target and it should be made explicit that, when the biological criteria are in attainment, the efforts to meet the flow targets can cease. There is a danger that meeting those targets can cause unintended damage to the stream.

Table 15 is confusing and unclear. What flow reduction is required for 3% and 5 % flow exceedance? How does that translate to storm event or flood event? If the objective of this TMDL is to improve the aquatic community, then sediment, habitat, and flow regime should be examined as well.

The impaired section of the stream does not start at the city limits. Why is EPA pursuing a jurisdictional approach when a watershed and/or subwatershed approach is needed?

Section 12

EPA and MDNR have conspicuously ignored the public participation of the three MS4 permittees – the County of Boone, the City of Columbia, and the University of Missouri – in spite of the fact that they will be required to implement this TMDL.

XIV. Conclusion.

The proposed TMDL is not supported by comprehensive, representative data and studies conducted on the creek. The effort required by the proposed TMDL is far out of proportion to the findings of the studies to date. Judging from what is known and surveyed by the Permit Holders in the watershed in the early-to-mid twentieth century, the stream has improved and continues to improve. The Permit Holders' current strategies are working, are cost effective and have been developed with extensive public participation. The TMDL as proposed will undermine those efforts and has the potential to waste millions in public expenditures.

The Permit Holders' current strategy and effort provide for further improvement with a directed focus on those actions that the Hinkson Creek actually needs rather than an expensive, unfocused approach which is impossible to implement and unsupported by the existing evidence. Federal guidelines support the use of a phased approach to TMDLs in situations such as this. We propose that a phased approach be used and additional data collected to provide for a continued strategic investment in Hinkson Creek's future and the current TMDL proposal be abandoned.

Very truly yours,

LATHROP & GAGE LLP

By: 
David A. Shorr

DAS/jf
Enclosures
cc w/enclosures:
Karen Miller, Boone County Commission
Bill Watkins, City of Columbia
Steve Owen, University of Missouri
Kip Stetzler, Acting Director, MDNR

LIST OF APPENDICES TO
HINKSON CREEK TOTAL MAXIMUM DAILY LOAD COMMENTS
SUBMITTED BY LATHROP & GAGE LLP
DECEMBER 1, 2010

A	Lathrop & Gage comment letter on Hinkson Creek TMDL dated December 8, 2009
B	Lathrop & Gage comment letter on Hinkson Creek TMDL dated April 22, 2010
C	Boone County Commission comment letter on Hinkson Creek TMDL dated April 22, 2010
D	City of Columbia, Missouri comment letter on Hinkson Creek TMDL dated March 20, 2010
E	University of Missouri comment letter on Hinkson Creek TMDL dated April 21, 2010
F	Geosyntec Consultants Final Memorandum, Technical Evaluation of Draft Hinkson TMDL dated April 21, 2010
G	Metropolitan St. Louis Sewer District comments on Draft TMDL for Hinkson Creek dated April 22, 2010
H	Allstate Consultants, comments on the March 2010 version of the Hinkson Creek TMDL dated April 22, 2010
I	Dan Obrecht's Comments and Questions concerning the Hinkson Creek TMDL dated April 22, 2010
J	Watershed activities, Exhibits A through E, from Lathrop & Gage comment letter dated April 22, 2010
K	Watershed activities from the University of Missouri
L	Geosyntec Consultants Report, Final Memorandum, Technical Evaluation of Draft Hinkson TMDL dated November 30, 2010
M	Electronic correspondence from John Hoke, Missouri Department of Natural Resources, to Karen Miller dated April 22, 2010, with attachment
N	City of Columbia Ordinances, Chapter 12A, Land Preservation
O	Boone County Stormwater Ordinance and Boone County Zoning Regulations, Chapter 26, Stream Buffer Regulations

APPENDIX A

LATHROP & GAGE LLP

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December 8, 2009

VIA E-MAIL AND U.S. MAIL

Mr. Scott Totten, Acting Director
Water Protection Program
Missouri Department of Natural Resources
PO Box 179
Jefferson City, MO 65102

Re: Hinkson Creek TMDL

Dear Mr. Totten:

The undersigned represents the City of Columbia, the County of Boone, the University of Missouri, and the Boone County Regional Sewer District.

Thank you for your efforts and willingness to reconsider issues relating to the Hinkson Creek Total Maximum Daily Load (TMDL). We appreciate the Department's efforts to meet with various interested parties to discuss our concerns relating to the strategy and direction originally presented by the Department and our objections and concerns relating to the strategy.

We provide the following comments and concerns and examples of activities that have occurred since the posting of Hinkson Creek to the 303(d) list. This correspondence supplements materials provided on December 1, 2009. It also provides additional information from the Boone County Regional Sewer District and information from quasi-public agencies (such as Transportation Development Districts). We believe these support our position that (a) data collection is inadequate and dated, (b) Hinkson Creek may meet the required water quality standards, and (c) the broad-based approach employed by the proposed TMDL is unnecessary. For reasons stated herein, we request that the TMDL for the Hinkson Creek be reopened and that the current approach be reconsidered.

The sampling data relating to Hinkson Creek is dated and does not reflect current activities.

The last data collection on Hinkson Creek was conducted in the Spring of 2006. Since that time, numerous activities have taken place within the watershed as a result of concerns expressed by the 303(d) listing. These actions, including significant regulatory changes locally, are specifically delineated later in this letter. It is our position that prior to imposing a broad-based strategy to address "unknown" pollutants that have not been properly quantified, the Department is obligated to re-test to determine the current status and take all steps necessary to delineate the "unknown" designation.

Since the original designation of Hinkson Creek to the 303(d) list, numerous activities have taken place in an effort to reduce potential impacts on Hinkson Creek.

Since the original listing of the Hinkson Creek on the 303(d) list, numerous activities have taken place within the watershed that address numerous impacts. Each of the public entities in the watershed have taken steps to enhance the water quality in the watershed. These include improvements by quasi-public entities. A summary of each area's activities is below.

1. Improvements reducing or eliminating impacts to the Hinkson Creek watershed by the Boone County Regional Sewer District appear in Exhibit A.

2. Improvements reducing or eliminating impacts to the Hinkson Creek watershed by the City of Columbia appear in Exhibit B.

3. Improvements reducing or eliminating impacts to the Hinkson Creek watershed by the University of Missouri appear in Exhibit C.

4. Improvements reducing or eliminating impacts to the Hinkson Creek watershed by Boone County appear in Exhibit D

5. Activities by private or quasi-public agencies appear in Exhibit E.

The activities presented in the exhibits clearly demonstrate **SIGNIFICANT** actions on the part of the public to enhance Hinkson Creek and to reduce impacts. Despite these improvements, no additional studies have been conducted. Additional sampling and evaluation is justified to determine if a problem still exists.

Because the TMDL is based on data that may not reflect the current condition of Hinkson Creek, because activities to improve the creek have been implemented (see Exhibits A through E), and because the pollutants are still unknown, we formally request the reopening of this TMDL and the abandonment of the current strategy proposed.

We request a comprehensive sampling analysis, a pollutant specific TMDL which presents a triage approach to address the "unknown" pollutants, and a reasonable methodology which incorporates the activities currently being conducted by this community and our efforts to protect Hinkson Creek.

Your attention to this matter and support of the process currently moving forward is most appreciated. Please contact me at (573) 761-5005 with any questions.

Very truly yours,

LATHROP & GAGE LLP

By: David A. Shorr

DAS/jf
Attachments
cc: Karen M. Miller

EXHIBIT A

BOONE COUNTY REGIONAL SEWER DISTRICT
ACTIONS TO ENHANCE HINKSON CREEK WATERSHED
POST 303(D) LISTING

1. Closed the Fairway Meadows West Lagoon by installing a pump station and pumping flows to the City of Columbia. The Fairway Meadows West Lagoon discharged into a tributary of the north fork of the Grindstone, which is a tributary to Hinkson Creek.

2. Closed the Fairway Meadows East Lagoon by in installing a pump station and pumping flows to the City of Columbia. The Fairway Meadows East Lagoon discharged into the north fork of the Grindstone, which is a tributary to Hinkson Creek.

3. Closed the Lake of the Woods Wastewater Treatment Plant by installing a gravity sewer that connected to the City of Columbia's wastewater collection system. The Lake of the Woods Wastewater Treatment Plant discharged into the north fork of the Grindstone, which is a tributary to Hinkson Creek.

4. Closed the El Chaparral Lagoon by installing a gravity sewer that connected to the City of Columbia's wastewater collection system. The El Chaparral Lagoon was the largest remaining wastewater treatment plant in the Hinkson Creek watershed controlled by the public. It discharged into the south fork of the Grindstone, which is a tributary to Hinkson Creek.

5. Closed the Sunrise Estates Wastewater Treatment Plant by installing a gravity sewer that connected to the City of Columbia's wastewater collection system. The Sunrise Estates Wastewater Treatment Plant discharged into the south fork of the Grindstone, which is a tributary to Hinkson Creek.

6. Closed the OTSCON Wastewater Treatment Plant by installing a gravity sewer that connected to the City of Columbia's wastewater collection system. The OTSCON Wastewater Treatment Plant discharged into the south fork of the Grindstone, which is a tributary to Hinkson Creek.

7. Boone County voters approved a $21 million revenue bond issue in April, 2008, to further improvements to Hinkson Creek. These will close additional discharges to the Hinkson Creek watershed and/or improve wastewater treatment at existing Boone County Regional Sewer District facilities. These include the closure of the Sun Valley Lagoon, the Hillview Acres Lagoon, the Lake Capri Lagoon, the Fall Creek Recirculating Sand Filter, and the Sheraton Hills Wastewater Treatment Plant in 2011. All these facilities are in the Hinkson Creek watershed and are located along State Highway HH. The closure of these facilities will be accomplished by the construction of about five pump stations and forced mains along Highway HH with connection to the City of Columbia's wastewater collection system.

8. In 2010, the budget calls for closure of the Shaw Wastewater Treatment Plant by installing a gravity sewer that connects to the City of Columbia's wastewater collection system. This is a joint project with the City of Columbia. The Shaw Wastewater Treatment Plant discharges into the north fork of the Grindstone, which is a tributary to Hinkson Creek.

These improvements will result in the removal of over 700,000 gallons per day design capacity from discharging into the Hinkson Creek watershed, removing various pollutant loads and bacteria from the watershed, reducing impact.

The District has also increased its sewer system maintenance activities to reduce risk to sewer integrity, which might result in discharges to the environment during peak events and enhancing the integrity of the system.

EXHIBIT B

CITY OF COLUMBIA
ACTIONS TO ENHANCE HINKSON CREEK WATERSHED
POST 303(D) LISTING

1. A significant sewer line has been repaired, which had a direct impact on Hinkson Creek.

2. New storm water, illicit discharge, and stream buffer ordinances were passed from late 2004 to early 2007. A new Storm Water and Water Quality Manual was released in early 2007 and was revised in early 2009.

3. New ordinances require scoring for water quality treatment, which are established up front for development or redevelopment projects. The developer is required to add water quality treatments to the plan until the required score is achieved for the site. These include storm water best management practices that address volume reduction and hydrology modification.

4. All projects, both redevelopment and new development, are impacted by the new ordinance. These include modifications to impervious surfaces, BMP's, volume reductions, and hydrological modifications. Improvements such as rain gardens and bio-retention cells are included in the alternatives to provide scoring.

5. New rules encourage the use of edge buffer outfalls, which work together with the stream buffer ordinance. Water is dispersed through the buffer before reaching the stream so that more water is absorbed and stored in the buffer soil.

6. The point system provided in the rules encourages the preservation of existing soil strata and vegetation through point reductions.

7. The new rules allow for the use of channel protection detention rather than traditional detention in order to modify the hydrograph. The new rules and ordinances have resulted in significant extended detention wetlands being installed behind businesses on Conley Road (just west of Highway 63 and south of I-70) that were identified as hot spots in the original 303(d). These basins treat a significant amount of impervious area and can be expected to have significant beneficial effects on the Hinkson Creek watershed.

8. A number of other private businesses have been required to retrofit storm water treatment practices in the Hinkson Creek watershed as a result of the manual. Some examples include:

   A. Rain gardens and a wetland have been added and the stream buffer enhanced at Stevens Lake Park along the main reach of Hinkson Creek.

   B. Pervious pavement and underground detention are being installed at the Columbia City Hall development and redevelopment along the Flat Branch, which is a tributary to the Hinkson Creek.

C. Pervious pavement and a large bio-retention cell was installed with the help of grants at the City's new Fire Station No. 7, which discharges to Mill Creek, which is in the Hinkson Creek watershed.

D. Rain gardens were installed on the Harvard Drive Rehabilitation project, which discharges to County House Branch, a tributary to the Hinkson Creek.

E. MKT Trail Head Park redeveloped a former industrial area in downtown Columbia, removing contaminated soil and stabilizing stream banks with large rocks and planting. A rain guard was installed in the most recent phase. These all impacted the Flat Branch, which is a tributary to the Hinkson Creek.

CITY SANITARY SEWER CHANGES IN THE HINKSON CREEK WATERSHED

1. The City has implemented sanitary sewer changes that have benefited Hinkson Creek, which include the construction of interceptors that eliminate small treatment facilities and performed pipe and manhole rehabilitation projects. They include:

   A. The South Grindstone Interceptor and the Lake of the Woods Mobile Home Park Lagoon Interceptor removed several small treatment plants from the watershed and connected them to the City's sewer system. These were in cooperation with the Boone County Regional Sewer District.

   B. The City has implemented a program involving cured-in-place linings of old pipes and manholes. These projects stopped sewage from leaving old systems as well as preventing overflows by preventing storm water from entering the system.

   C. The City has undertaken an effort to eliminate "private sewer systems" that were prone to bad repair and overflow problems. An example is the Sewer District 154 Project in the Flat Branch watershed, which eliminated 20+ acres of failing sewers. The City has methodically taken over and rehabilitated private sewers that especially impacted the Hinkson Creek system.

2. The City has a history of eliminating wastewater treatment plants and direct discharges to Hinkson Creek. These include both City plants and County plants in an effort to improve the watershed. This began in the early 1970's and continues to this day.

EXHIBIT C

UNIVERSITY OF MISSOURI
ACTIONS TO ENHANCE HINKSON CREEK WATERSHED
POST 303(D) LISTING

1. Best Management Practices at the University Power Plant in conjunction with its NPDES permit have resulted in extremely low Total Suspended Solids (TSS) in spite of the Power Plant sitting directly on the Flat Branch, which is a tributary to the Hinkson Creek. A comprehensive street sweeping program at the Power Plant takes place every day coal is delivered, and there are numerous controls that have been established at storm sewer inlets in the area near the Plant.

2. Each of the University's large aboveground fuel storage units has individual NPDES permits, which require strict controls on discharge of storm water that accumulates in secondary containment. The University continues its history of having no illicit discharges from any of its AST's. The University has three Spill Prevention Containment and Control Plans covering parts of the watershed. These plans provide formal procedures to prevent release to waters of the state of any oil products, which include both inorganic and organic oils and fats.

3. All construction on the University Campus is coordinated by a designated land disturbance permitting authority on the campus. The campus has dedicated employees that provide weekly and post-rain event inspections on all University construction for compliance. Additional inspections are provided by University Environmental Health and Safety, and audits are conducted of all open land disturbance events.

4. The University's Master Plan for the entire campus, which is reviewed and revised annually, incorporates storm water concerns. All campus storm and sanitary sewers are mapped and are in the process of being inspected via in-line cameras.

EXHIBIT D

COUNTY OF BOONE
ACTIONS TO ENHANCE HINKSON CREEK WATERSHED
POST 303(D) LISTING

Boone County has taken significant administrative steps to pass ordinances, including stream buffer protection, that directly impact the quality of Hinkson Creek. None of these appear considered in the TMDL.

1. The County has passed a stream buffer ordinance. This ordinance has a setback requirement depending on stream size. Streams are categorized by USGS topographic maps. Blue line streams are categorized as Type 1 streams. They are required to have a setback of 100 feet from the ordinary high water mark. Type 2 streams (USGS-blue lines) and Type 3 streams (unmarked tributaries with drainage areas greater than 50 acres) have 50-foot and 30-foot setbacks respectively. Each of those setbacks is divided into two zones. The stream-side zone or "no-mow" zone is for undisturbed native vegetation. The outer zone can have managed landscape areas but no new structures. The ordinance went into effect in the county in 2009. The ordinance is not retroactive, but will prevent new structures from being built adjacent to the creek and increase stream bank vegetation and stabilization.

2. The County is in the final stages of a public review of a storm water ordinance that addresses the consequences and impacts of urban runoff and protects waterways from storm water-related pollutant load.

3. The county ordinance is based on the Center of Watershed's Protections model ordinance. The County uses a nested approach to storm water management to treat different runoff volumes. The details of the county ordinance, which is currently going through appropriate public participation, can be found on the County's website.

EXHIBIT E

ACTIVITES BY PRIVATE OR QUASI PUBLIC AGENCIES TO ENHANCE HINKSON CREEK WATERSHED POST 303(D) LISTING

1. The County has partnered with the City of Columbia and the University of Missouri on a 319 project in the Hinkson Creek watershed. The restoration project is updating the watershed management plan so that all of EPA's nine key elements are included. The project has developed a feasibility study to examine and provide cost estimates for retrofitting areas in the impaired section of the Creek. The next step in the 319 grant is to approach landowners to cost share the placement of retrofits that will reduce peak flows to the Creek in the impaired section.

2. The City, County, and University have worked cooperatively on clean-up activities. The last event was held on October 17, 2009. Over 400 local citizens volunteered at least two hours of time to clean up Hinkson Creek and remove debris.

3. University hydrology study of the Creek was initiated in 2008. The researcher has collected data for about one year. That data will be extremely helpful in the triage process, enhancement of the TMDL strategy, and validating the changes in the watershed due to the storm water ordinances and stream buffer regulations. It will assist in providing baseline information.

4. The Missouri Department of Transportation has relocated salt domes and distribution facilities. The facilities were formerly located off Conley Road on the banks of Hinkson Creek. They have been relocated with state-of-the-art storm water control structures. Chlorides have long been a suspect of concern, and they have had a major source removed.

5. Columbia Country Club has provided greater buffer zones along its golf course adjacent to Hinkson Creek.

6. The Conley Road Transportation Development District has constructed significant detention, treatment, and control facilities in an area suspected of impacts to Hinkson Creek. The area has significant parking lots with large impervious square footage and substantial roof structures.

APPENDIX B

LATHROP & GAGE LLP

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April 22, 2010

VIA E-MAIL TRANSMISSION
john.hoke@dnr.mo.gov
AND U.S. MAIL

Missouri Department of Natural Resources
Water Pollution Control Program
Water Quality Monitoring Assessment Section
PO Box 176
Jefferson City, MO 65102-0176

Re: Comments of the Central Missouri Development Council Regarding the Draft Hinkson Creek Total Maximum Daily Load

Gentlemen:

The undersigned represents the Central Missouri Development Council ("CMDC") and its individual members. The CMDC is a community organization which:

> Exists to improve communication between local and state government, citizens, and the development community, and to promote quality growth that results in thriving, vibrant communities that provide quality neighborhoods, economic stability, and opportunities for our citizens.

The majority of the CMDC members live, work, and operate their trades in the City of Columbia and Boone County. Hinkson Creek is the dominant watershed in our members' region. Many of our members live in the Hinkson Creek watershed.

The CMDC has been working since its inception with the City of Columbia ("City" or "Columbia"), Boone County ("County"), the University of Missouri ("University"), and the Boone County Regional Sewer District ("BCRSD") to improve development processes and impacts on the Hinkson Creek watershed from construction-related activities. They are active participants in local discussions relating to sewerage and storm water.

The CMDC has been involved in issues relating to Hinkson Creek and has, when necessary, challenged the authority and actions of the Missouri Department of Natural Resources ("MDNR") where it believes they are excessive and unnecessary either under the law or, from a practical standpoint, are incapable of success. The CMDC believes that the proposals presented in the draft Total Maximum Daily Load ("TMDL") for Hinkson Creek exceed the legal authority of the MDNR under Missouri statutes, represent a failure of meeting non-discretionary duties under the Clean Water Act by the United States Environmental Protection Agency ("USEPA") and, as a general matter, will not result in success to the detriment of the future of Columbia and Boone County.

The CMDC recognizes its role in supporting improvement to the Hinkson Creek, especially with regard to construction-related activities. To that end, the CMDC has worked with the City and the County on storm water ordinances in support of the joint requirements of the Columbia/Boone County/University of Missouri MS4 permit. While we have not agreed on all aspects of those local ordinances for storm water improvements, we acknowledge and continue to support the efforts of the City, the County, and the University and appreciate their efforts at communicating with the CMDC members. We believe many of the concerns of the CMDC members regarding the strategy and methods in this TMDL are shared by the representatives of the City, the County, the University, and the BCRSD.

Our comments are divided into two sections, general and specific.

GENERAL COMMENTS AND ISSUES

The TMDL calls for an approach that is unique. It first bases its priorities on the premise that Hinkson Creek is impaired. We believe that is not accurate. *We believe sufficient data exists to demonstrate that Hinkson Creek adequately supports aquatic populations and meets threshold requirements.*

The premise then relies on "unknown" pollutants as the focal point toward resolution of the impairment problem. *We believe there is no such thing as an "unknown" pollutant and that the law requires both the MDNR and the USEPA to designate pollutants so our community can properly address, with the most aggressive effort and least cost, the greatest prospects of success.*

In pursuit of these "unknown" pollutants in this "impaired waterway," the TMDL attempts to utilize a surrogate of restricting volume, flow or quantity in pursuit of the problem. In pursuit of such an unspecific problem, the MDNR uses the broadest approach humanly possible. A technique of triage employed by most public health officials is more appropriate. Rather than target the problems and find the solutions, the TMDL proposes a solution based on a presumption that has the most expensive cost. The

TMDL ignores the very activities provided at extensive public expense to improve Hinkson Creek listed in the appendix of their own document.

This TMDL can be best described as a midguided effort to undermine the success of the community and punish its citizens by diverting resources away from community demands that would have a greater beneficial impact upon the environment.

1. The TMDL and its methodology will result in the unintended consequence of increased sprawl by limiting the ability to develop in the Hinkson Creek watershed.

The proposal calls for a substantial reduction in volume, flow or quantity. To achieve such a reduction, significant structures at significant costs will be required.

Structures will be required to be constructed in the existing footprint of the City and County to meet the reduction objective. This will come at considerable public expense.

New development will seek to maximize cost benefit ratios. New projects will seek other watersheds with less restrictions, all of which are outside the core of the central Columbia area. This will result in an expansion of infrastructure and increase the footprint of the current City further into the County, placing adjacent watersheds under stress.

While Boone County storm water ordinances will provide some protection, the outward expansion of the urbanized area will be the unintended consequence of the Hinkson Creek TMDL.

The CMDC supports the ability to maximize the use of existing infrastructure and believes the surrogate approach has unintended consequences for the period of this experiment. Our specific comments address the flaws within the document itself in greater detail, but the unintended consequences are obvious and require general commentary.

2. The MDNR does not have the legal authority to make this recommendation.

The MDNR lacks the statutory authority to regulate volume, flow or quantity. The Missouri Clean Water Law does not provide authority to the MDNR to control, create or establish the volume, flow or quantity of any given watercourse in the State of Missouri. No statutory reference is provided in the TMDL establishing the direct authority to achieve such an objective. If one accepts the MDNR's rationale, the MDNR

could essentially order the damming of the Missouri River to address impairment on that watercourse. No such authority exists.

Assuming such authority exists in Missouri statutes, for which the CMDC does not concur, the MDNR has no rule to address the control of volume, flow or quantity as it applies to the control of pollutants. As such, the failure to have such a rule violates Chapter 536 as it would be a policy of general applicability over which independent parties would have the ability to challenge and the Missouri General Assembly would and the right to evaluate under the Joint Committee on Administrative Rules. No such rule exists because the MDNR is well aware that no such authority would be granted by the Missouri General Assembly.

3. The TMDL inhibits the legal rights of downstream riparian landowners with regard to both their legal ownership interests in their land and their legal rights with regard to volume, flow or quantity on their property.

> Clean Water Law ... did not explicitly or impliedly grant Commission power to determine riparian rights; thus, Commission had no authority to determine whether riparian rights were violated by flow of wastewater from utility's water purification lagoon into pond on adjoining landowner's property. *Curdt v. Mo. Clean Water Comm'n*, 586 S.W.2d 58 (Mo. Ct. App. E.D. 1979).

As stated above, the Missouri Clean Water Law does not empower the Missouri Clean Water Commission ("CWC") and therefore the MDNR to modify riparian interests of landowners.

The confiscation and/or modification of the riparian landowners' property and water-related rights represent independent takings by administrative actions. As landowners in the watershed, members of the CMDC object to the manner and action of this TMDL and place the MDNR and the USEPA on notice that their actions result in a regulatory taking of both riparian property and rights to water and encourage a change in direction.

The CWC and the MDNR do not have the legal authority to implement the surrogate approach presented in the TMDL as it impacts the rights of riparian landowners and is not authorized by law. No rule has been developed to implement such authority, if such should exist.

The members of the CMDC advise the MDNR of their belief that their actions to do a surrogate-based control of volume, flow or quantity and the failure to have proper legal authority and to properly establish a rule of general applicability are contrary to Missouri law and recommend reconsideration of the approach.

4. The MDNR and the USEPA fail to fulfill their non-discretionary duties under the Clean Water Act to properly identify specific pollutants as required by law. This failure to exercise non-discretionary duties is enforceable by citizen suit.

The USEPA administrator, and by delegation the CWC, is required to:

> ... estimate for such waters the total maximum daily load with seasonal variation and margins of safety, for those pollutants which the administrator identifies under Section 1314(a)(2) of this title as suitable for such calculation and for thermal discharges, at a level that would ensure protection and propagation of a balanced indigenous population of fish, shellfish, and wildlife. (Emphasis added.)

As such, the administrator, and thereby the CWC, has the non-discretionary task of identifying pollutants in setting the goals and objectives of a TMDL.

The pollutants designated for Hinkson Creek are, by admission of the agencies, "unknown."

Webster's Dictionary defines "unknown" as:

> (1) not known;
> (2) (a) not disclosed or identified; (b) not determine or verified.
> (Emphasis added.)

As a matter of fact, these two statements do not reconcile as "unknown" cannot be a "pollutant." The English language does not allow this fact to occur.

The data provided in the TMDL document ,which the CMDC contends is outdated, demonstrates, as a matter of law, a specified pollutant that exceeds the MDNR's standards. That pollutant is chlorides. As further discussed in our specific section, the standard for chlorides is 230 m/l. The Flat Branch, the major tributary to Hinkson Creek, was sampled at 285 m/l. Hinkson Creek was sampled at 333 m/l. Levels of chlorides in the impaired sections coincide with spring and winter thaws. Chlorides are known to sensitize invertebrates and fish to other pollutants. A reasonable starting point would be to address specific pollutants which have a likelihood of impact and are identified as required by law.

The failure of the administrator and the CWC to address their non-discretionary duty to specifically identify pollutants under Sections 303 and 304 of the Federal Water Pollution Control Act are required to be addressed. It is a failure that the citizens have a right to enforce under citizen suit provisions of the Federal Clean Water Act.

5. The TMDL fails to address downstream impacts of the endangered pallid sturgeon at the confluence of Perche Creek and the Missouri River.

The TMDL fails to address downstream impacts upon the pallid sturgeon at the Missouri River. The biological opinion provided by the U.S. Fish and Wildlife Service for the operation of the Missouri River establishes an increased need for sediment in the River. Specifically, the biological opinion indicates a need for increased sediment to support pallid sturgeon reproduction. Known populations of pallid sturgeon exist downstream at the mouth of Perche Creek. Perche Creek receives the sediment contributions of Hinkson Creek. Removal of sediment contribution from the Hinkson Creek watershed at the mouth of Perche Creek will be detrimental to the pallid sturgeon. The TMDL implies that contributions of sediment into Hinkson Creek should be removed. Yet, the very same "habitat improvements" are being created by the U. S. Army Corps of Engineers with the blessing of USEPA and the U. S. Fish and Wildlife Service in the Missouri River to enhance populations of pallid sturgeon in the reaches of the Missouri River impacted by Hinkson Creek.

There is no evidence of consultation. There is no evidence of any shared information between any federal agencies other than the USEPA.

When comparing the biological index numbers on Hinkson Creek and the fact that they are near performing, the removal of sediment from the Perche Creek watershed may be detrimental and result in a take of potential pallid sturgeon yearlings. The failure to properly protect and address the impact on the pallid sturgeon by this specific TMDL results in a potential violation of the Endangered Species Act which may be supported by members of the public through their right to sue for the failure of any agency involving a federal action from properly addressing its impact. The TMDL as proffered may impact the pallid sturgeon with no attempt to address the consequences.

6. The implementation of the TMDL will fall to the City of Columbia, Boone County, and the University of Missouri through their MS4.

The cost to the public to implement this shotgun approach is substantial. The economic costs to implement this surrogate approach are not evaluated or displayed for the public in their analysis of this TMDL. The increased cost on individuals through rate increases and rate creation for storm water utilities, structural construction, and the uncertainty of success demand this TMDL include an economic analysis. The CMDC believes that the scope and dollar value of this approach may rival the cost for improvements to the wastewater systems in the Hinkson Creek watershed. As such, the imposition of this action may violate the Hancock Amendment and result in the burden being placed upon the State of Missouri. Challenges under the Hancock Amendment may be brought by both the governments involved and the citizens of this state. Increases in rates and costs through the MS4 permit may result in Hancock impacts. The State

should be prepared to meet the appropriate economic tests and present the appropriate economic data in response to the State Constitution's requirements.

7. The Hinkson Creek TMDL is a federal action of sufficient and unique impact to require a basin specific NEPA analysis versus acceptance of a programmatic authorization.

By admission of the MDNR at public meetings, the Hinkson Creek TMDL and its surrogate of volume, flow or quantity is unique. By admission of the MDNR to implement this TMDL to control volume, flow or quantity will require structural alternatives of consequence not normally required in a TMDL. By the MDNR's admission, it relies upon an example from a small watershed in Vermont in developing the surrogate strategy.

The MDNR cannot determine whether concentrations of "unknown" pollutants will increase or decrease as a result of this strategy. The MDNR cannot confirm that improvements required as a result of this strategy may not limit base flow and thereby create stress upon biological indicators.

The unique and special character of the solution provided in this TMDL mandates a specific evaluation under the National Environmental Policy Act ("NEPA") for this federal action. There is no denial that this TMDL will not be incorporated into the USEPA's overall TMDL action strategy for the State of Missouri. There is no denial that this is a federal action.

By virtue of the unique character, unknown consequences on the overall environment, and impact on the human environment, a site specific NEPA analysis is necessary.

Again, the CMDC recommends reconsideration of the surrogate approach and adoption of a more traditional triage-based theory to place this TMDL in a consistent position for any programmatic NEPA-related review which may have been previously conducted.

For the reasons so stated, the members of the CMDC request the MDNR to reconsider the methodologies, designations, and implementation of this TMDL to place it in comport with the law and support the efforts of these communities to improve water quality.

SPECIFIC COMMENTS

Attached as Exhibit 1 to this letter are specific technical comments regarding failures and problems with the TMDL. These are addressed by section. The members of

the CMDC request the MDNR and the USEPA to reconsider the recent request of the City of Columbia, Boone County, and the University of Missouri to

A. Resample and reevaluate data to determine that a problem still exists.

B. Provide specific references for assertions and presumptions in the report which cannot be demonstrated or proven with the information provided.

C. Utilize a triage approach instead of the surrogate proposal.

D. Evaluate economic costs and unintended consequences.

CONCLUSION

The CMDC believes that the TMDL is unnecessarily overreaching and is attempting to control land use and human activity at a level unprecedented in the State of Missouri. The TMDL violates numerous Missouri and federal laws, and potentially violates the Missouri Constitution. The TMDL and its surrogate create the question of takings not necessary in this discussion.

For the reasons so stated, we request the MDNR and the USEPA to reconsider the surrogate approach in favor of a methodical triage approach to determine specific pollutants and their likelihood of impact.

On behalf of the members of the Central Missouri Development Council, I am

Very truly yours,

LATHROP & GAGE LLP

By: David A. Shorr

DAS/jf
Attachment

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Final Memorandum

Date:	21 April 2010
To:	Don Stamper, Central Missouri Development Council
	David Shorr, Lathrop & Gage
Copies to:	Eric Strecker, P.E., Geosyntec Consultants, Portland, OR
From:	Trent Stober, P.E., Geosyntec Consultants, Columbia, MO
Subject:	Technical Evaluation of Draft Hinkson Creek Total Maximum Daily Load (TMDL)

1. BACKGROUND

Hinkson Creek is a perennial Ozark-border stream draining a 90 mi^2 catchment in Boone County, Missouri. In 2004, Hinkson Creek was placed on Missouri's list of impaired waters ('303(d) list') as some monitored reaches did not fully attain applicable biocriteria metrics at frequencies specified by regulatory guidance. The pollutant initially listed as causing the aquatic life impairment was 'unknown'. Bioassessment and ecotoxicology evaluations performed by the Missouri Department of Natural Resources (MDNR) through 2006 did not conclusively identify a causative agent. A draft Total Maximum Daily Load (TMDL) document for Hinkson Creek included for Public Notice on March 8th, 2010 targets reductions in stormwater runoff as a surrogate for a cumulative, but unidentified mixture, of pollutants that may occur in urban and agricultural environments.

A Municipal Separate Storm Sewer System (MS4) permit is jointly held by the City of Columbia, MO, Boone County, and the University of Missouri. At the request of MS4 co-permittees ('permittees'), Geosyntec conducted a third-party technical review of the methods and approaches used in developing the TMDL. This memorandum conveys conclusions and specific comments identified during our review. Where possible, we have suggested approaches that may improve the usefulness or defensibility of TMDL elements. Section 2 summarizes the major findings of our review. Specific technical comments related to hydrologic, landuse, and biologic data interpretations are included in Section 3.

2. SUMMARY OF FINDINGS

Aquatic communities inhabiting streams and rivers flowing through urban areas are exposed to a variety of stressors that are either not present in undeveloped landscapes, or occur less frequently. Measures of aquatic community health and biologic integrity have been negatively correlated with impervious area metrics (Miltner et al. 2003, Schuler 1994, Klein 1979). However, as Adams (2003) points out, statistically significant correlation does not establish causation.

In order to meet mandated TMDL development timelines, MDNR and the U.S. Environmental Protection Agency (USEPA) are required to move forward with establishing a TMDL for Hinkson Creek. The draft TMDL currently on Public Notice prescribes a significant catchment-wide reduction in runoff as a surrogate for a stressor-effect relationship that MDNR has been unable to establish or quantify. In general, our review finds that runoff reduction targets cited in the TMDL are not well supported and are ambitious, given the uncertainty of key technical linkages. Uncertainties identified in our review include but are not limited to:

- Stressor-Effect Relationship. The draft TMDL does not establish causality between runoff and beneficial use attainment in either Hinkson Creek or 'attainment' streams. Information presented in the TMDL does not provide any assurance that benthic macroinvertebrate metrics will respond to changes in stormwater runoff. In fact, MDNR and volunteer water quality data collection efforts have documented chloride concentrations well above Missouri's chronic water quality criterion. However, this significant stressor was not evaluated during TMDL development and would not be effectively controlled by BMPs utilized to meet the proposed TMDL target.

- Runoff and Baseflow Time Trends. Information contained in the TMDL does not demonstrate that runoff volume has increased or that baseflow has decreased in the Hinkson Creek watershed over time.

- Comparability of Attainment Streams. It is not clear what methodology grounded in peer-reviewed literature, or agency guidance, supports the process used to select 'attainment' streams set forth in the TMDL.

- Current and Historical Impervious Landuse. Landuse data and analysis cited in the TMDL are inconclusive. While impervious area has likely increased in the Hinkson catchment to some degree, GIS coverages used in the TMDL are not well suited for demonstrating urban landuse changes at the scale of interest.

Given the documented increases in population and residential development in the Columbia area, there is little doubt that runoff into Hinkson Creek has increased compared to the 1960s. However, information presented in the draft TMDL does not demonstrate or quantify temporal changes in Hinkson Creek hydrographs. Little tangible evidence is offered in the TMDL that

supports changes in runoff volume are responsible in whole, or in part, for periodic depressions in benthic macroinvertebrate scores.

We believe that additional stressor-response data and a more refined hydrologic analysis approach are necessary to assure that compliance with TMDL targets will yield consistent attainment of Hinkson Creek aquatic life uses. In addition, we suggest that attainment of biocriteria at frequencies prescribed by Missouri's 303(d) listing methodology and biocriteria documents serve as the primary TMDL target as (1) bioassessment scores served as the rationale for listing Hinkson Creek as impaired and (2) site-specific causal relationships between runoff and ecological health have not been established in the TMDL.

3. SPECIFIC COMMENTS

3.A. HYDROLOGIC ANALYSIS AND INTERPRETATION

Comment 3.A.1. Periods of record for comparative analyses appear to be inconsistent.

Comparison of landuses from 1993 and 2005 are presented to support the claim of increased imperviousness. However, the flow-duration curves presented in Section 5.1 are compared for 1967 and 2007. Because the time periods of comparative analysis differ, potential changes to *the flow-duration curve are not clearly the result of unquantified changes in urbanization.* Is it possible that changes in farming practices or climatic patterns have influenced hydrograph and flow-duration characteristics?

We also request explanation of the following period-of-record related comments and observations:

- In Table 8, precipitation and flow statistics for 1967 and 2007 are compared for the April 1 – July 31 period. Why are only 4 out of 12 months of available data being used to describe precipitation and runoff? Should MDNR believe that conclusions drawn from fall biological surveys are relevant in assessing use attainment in Hinkson Creek, it would seem appropriate that flow data collected in the late summer/ fall season also be incorporated into hydrologic analyses and comparisons. How do we know that antecedent precipitation regimes did not influence the results a 4-month comparison? Furthermore, as precipitation and streamflow data generally do not follow a normal statistical distribution, we question the use of the arithmetic means to describe central tendencies. If the period of record is expanded to all available and comparable months for 1967 and 2007 (March 11 – December 31, n=296), we note that the median, geometric mean, and cumulative Period of Record (POR) streamflow values for 1967 (median=5.75 cfs) are greater than values for 2007 (median= 3.05 cfs). Side-by-side boxplots of the two data sets (Exhibit 1) indicate both years have very skewed daily average flows, *which suggests that the arithmetic mean is a biased estimator* and the median is a more appropriate metric of the central tendency of data. More importantly, the medians are not

statistically different from each other based on the non-parametric Mann-Whitney test (p=0.95).

The lack of statistical difference between the median daily average flow for 1967 and 2007 indicates that *the data do not support the claim that the flow regime in the creek has been significantly changed.* It is not clear why a truncated period of record was selected.

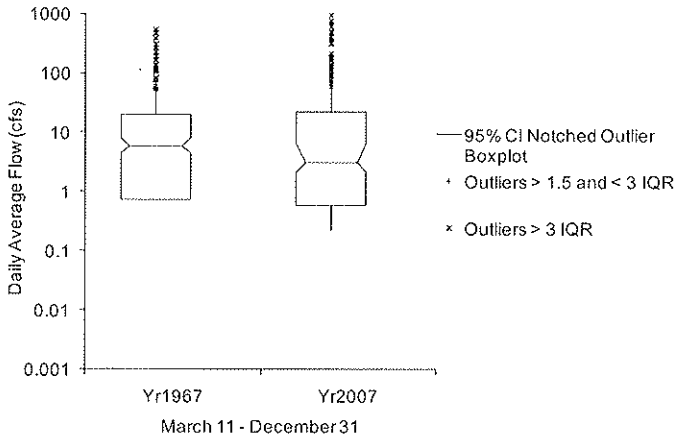

Exhibit 1. Side-by-side boxplots of daily average flows for 1967 and 2007 (USGS 06910230 Hinkson Creek in Columbia, MO)

- In reference to Figure 4 and based on the arguments presented above, the full available and comparable period of record (April 1 – December 31) should be presented to capture seasonal patterns in rainfall and runoff. In addition, we note that higher baseflows in 1967 (referenced in relation to Figure 4, Page 21) could be attributed to wastewater treatment facilities (WWTFs) that historically discharged to Hinkson Creek. Approximately fifty-three (53) WWTFs that discharged historically within the Hinkson Creek basin have been eliminated. *It is not clear that presumed reductions in baseflow can be wholly attributed to unquantified infiltration reductions in the catchment.*

  We also point out that Figure 8 suggests that Hinkson Creek has a relatively high normalized base or low-flow compared to reference streams. We suggest that MDNR conduct a baseflow separation and trend analysis on the entire period of record at the Hinkson gage to determine if baseflows from discharging groundwater have significantly decreased over time and whether any changes are due to other causes.

- Flow duration curves inherently require long-term continuous flow records to adequately capture the large variation in rainfall and runoff characteristics. *The selection of only four months (April 1 – July 31) for only two individual years (1967 and 2007, Figure 4) is not adequate for identifying differences in precipitation-runoff responses.* Presumed differences in the flow-duration curves could be attributed to differences in precipitation characteristics alone. A comparison of the intensity-duration curves should supplement the flow-duration curve analysis to ensure differences in precipitation characteristics are not the cause of the presumed differences in the flow-duration relationship. Also, the trend analysis uses precipitation data from two different rainfall gages without evaluating whether the observed trends are simply due to differences in rainfall characteristics at the two gages. The Columbia Regional Airport weather station (COOP ID 231791) includes hourly data from 1970 through 2010. *A single gage should be used or the differences between the gages should be quantified and accounted for in the analysis.*

Comment 3.A.2. Runoff volume trend analysis appears to be incomplete and may be inconclusive.

Long-term flow data from the USGS gauge in Hinkson Creek was used with rainfall records from two separate weather stations to develop a multivariate regression stormwater runoff model for the watershed. In addition to rainfall, the other independent variables included the year and month. There are several technical shortcomings present in this analysis. These concerns are discussed below.

- Figure 5 is a linear regression of rainfall versus storm event runoff volume, but there is no discussion of how rainfall events were defined (e.g., 24-hour totals, 6-hour hour minimum inter-event times etc.) or how storm event runoff volumes were computed (i.e., baseflow separation methods). Methods, models, or algorithms used to calculate runoff and baseflow volumes (Appendix C) from USGS streamflow records are not documented or described in the TMDL. A fundamental premise of the TMDL is that runoff volume has increased over time, yet there is no means of being able to determine how runoff volume was calculated or derived in the TMDL. MDNR should provide additional documentation that describes the methods and assumptions used in developing runoff and baseflow volumes, listed in TMDL appendices. All runoff calculations should be based on streamflow data averaged over the same time period. Runoff volumes computed from daily average flows are not comparable to volumes derived from hourly average flow values.

- The multivariate regression model shown on Page 22 that relates runoff volume to precipitation, year, and month has a low coefficient of determination (R^2). Pearson's coefficient of determination (R^2) describes the fraction of the variance in the dependent variable that is explained by one or more of the independent variables. An R^2 of 0.37 indicates that only 37% of the variation in runoff volume can be explained by precipitation and time. In other words, the majority (1-0.37=63%) of the runoff volume

record is explained by factors and variables other than time and precipitation. While the regression model as a whole may be statistically significant ($p<0.05$), the model is not particularly meaningful with such high unexplained variability. Also, the significance of the individual linear coefficients was not documented. A fundamental component of multivariate regression analyses is to evaluate the relative importance of the independent variables and ensure the residuals are independent and identically distributed. Most importantly, the statistical significance of the stated 3.4% increase in the logarithm of runoff volume must be provided to verify the validity of the model. *We recommend MDNR include p-values for each coefficient included in the model and then only include variables with $p<0.05$.*

Other factors that may influence changes in streamflow include precipitation type (rain or snow), changes in watershed characteristics, and rainfall intensity. Much of these data are likely available for the Columbia area and it is not clear why these other factors (independent variables) were not included in the multiple regression analysis. As currently presented, the multivariate regression does not add any substantive technical value to the TMDL.

- The t-test (Table 9) describing differences for the two periods, 1974-1991 and 2007-2009, was performed on runoff volumes adjusted for precipitation and season. It is not clear how these adjustments were made. If the multivariate regression model was used to predict the runoff volumes, the t-test is not valid because the differences would be a direct result of the presumed 3.4% increase in the logarithm of the runoff volume. MDNR should clearly describe the method for adjusting the runoff volumes so the analyses can be duplicated and independently verified. Also, the appropriateness of using the t-test on the logarithms of the runoff volumes should be demonstrated. The t-test is only valid on normally-distributed data. Therefore, the distribution of the logarithms of the volumes should be documented. For the purposes of transparency during re-analysis, it is recommended that MDNR use distribution-free methods (non-parametric) for evaluating statistical differences, unless normality is clearly demonstrated.

- It is not clear what rationale supports purposeful selection of unequal sample sizes in the t-test included as Table 9. *The period for 1974-1991 ($n=87$) has nearly twice the number of samples compared to 2007-2009 ($n=45$).* Furthermore, why was the period of 1974-1991 selected? We note that Figure 4 and Table 8 use 1967 as a reference for a less-impacted hydrograph.

Comment 3.A.3. Rationale for modeling approach and TMDL attainment stream analyses are unclear.

Four streams within the same ecoregion of Hinkson Creek that are achieving their biological metrics were selected for flow-duration comparisons. Flow-duration curves for these watersheds were adjusted based on watershed size and annual precipitation. However, the rationale for, and the details of, these adjustments are not provided. All of the attainment streams have larger watersheds with different landuse areas compared to Hinkson Creek. Dividing each flow rate by the watershed size and annual precipitation does not adequately account for differences in runoff volumes, flow rates, or rainfall characteristics (e.g. intensity, timing etc.). Many other watershed factors must be considered including imperviousness, soil types, and time-of-concentration. Time-of-concentration can have a significant impact on the flow duration curve and is affected by slope, degree of channelization, stream order, surface roughness, etc. *Because of these many factors, rainfall-runoff relationships are very non-linear and very watershed specific.* As such, the validity of the simple linear adjustment that was made to flow duration curves is highly questionable. Also, the selection of the 1-year return flow for the target flow appears arbitrary and is not supported by monitoring data or analysis that would suggest this return period is biologically or geomorphologically significant. The selection of a slightly different return period, such as 2 times per year or 2/365=0.5% instead of the 0.3% value, the target flow rate reductions would be nearly 50% less (i.e., target reductions would be approximately 25% instead of 50%).

Comment 3.A.4. TMDL requirements are unclear.

Throughout the TMDL, flow is used interchangeably with volume, but these are two distinctly different hydrologic metrics that have very different control strategies. Flow rate reductions may be achieved using detention storage with controlled release to shave peaks, while volume reductions require increased infiltration, evapotranspiration, and/or harvest and use. Because the target reductions are based on a comparison of flow duration curves at the 1-year return period, one may surmise that flow rate reductions are required such that the 1-year peak flow in Hinkson Creek must match the target 1-year peak flow of the attainment streams. The applicability of these reductions for any other flow return period is not supportable because the differences between Hinkson Creek and the attainment streams vary with the frequency of occurrence.

If the intent is to require volume reductions, then flow-duration analyses are inappropriate. *Instead, a comparison of average annual runoff volumes or a comparison of design storm runoff volumes should have been conducted.* MDNR should clarify the proposed metric for this TMDL and at what temporal scale it applies. If flow-duration curves are determined to be the parameter of interest, then flow-duration matching should be the TMDL goal vs. volume reduction, with specified parts of the flow-duration curve based upon geomorphic analyses supporting the beneficial use.

Comment 3.A.5. Volume reductions may cause increases of in-stream concentrations.

Without understanding the sources of pollutants and delivery pathways from certain landuses, basin-wide reductions may actually increase in-stream concentrations due to less dilution. Lumping of all urban landuses for the landuse-based TMDL allocations may cause increases in concentrations. Commercial and industrial areas will have fewer opportunities for reducing runoff volumes than residential areas and infiltration may even be prohibited for some types of industries. However, commercial and industrial landuses generally produce higher concentrations for several pollutants. *If residential areas reduce runoff volumes more than commercial and industrial areas, then in-stream concentrations could increase.*

Comment 3.A.6. Reductions in runoff may not proportionally reduce unidentified pollutant loading.

Understanding pollutant generation, transport, and delivery processes are necessary in developing effective control and restoration measures. Application of a catchment-wide surrogate for a pollutant is likely to yield unintended consequences. Reducing runoff volume (transport medium) on a basin-wide basis infers that beneficial uses as measured by macroinvertebrate scores respond in a continuous, linear, and negative manner to pollutant load. However, toxicological responses are frequently concentration-driven, often threshold in nature (not continuous), and may be non-linear (sigmoid).

If periodically lower biological metrics are the result of discrete activities that have been remediated or abated, such as chloride wash-off from road salt storage facilities, how will basin-wide runoff reductions improve ecological health? Furthermore, if impacts were related to chloride or other 'urban' contaminants, how will reducing runoff from agricultural land benefit biological scores?

Many contaminants may be transported by fine sediment in the adsorbed phase. Although not documented, contaminated sediments could be a critical exposure pathway for macroinvertebrate communities in Hinkson Creek. Adsorbed pollutants are subject to sediment transport and delivery phenomena that can operate at timescales much slower than the Hinkson Creek study period (2001 – 2006). It is possible, but uncertain, that biological scores may have been affected by contaminated sediment generated several years ago that is now being released from storage and delivered to the Hinkson Creek channel. *We note that MDNR survey reports suggest that evaluating the effects of sediment should be considered in subsequent investigations.* Where contaminated sediment may represent a significant exposure pathway, the role of sediment budgeting techniques (Walling and Owens 2003, Walling 1999) may be useful during TMDL re-analysis.

Comment 3.A.7. The runoff reduction approach does not adequately consider groundwater delivery processes or alterations in the water balance.

The runoff reduction approach posed by the TMDL does not adequately consider fate and transport of pollutants that may contaminate groundwater in urban areas. For example, if the unidentified pollutant(s) are discharged from groundwater sources during baseflow conditions then reducing runoff volumes could potentially increase overall in-stream concentrations. In addition, increasing infiltration in areas where soils are contaminated, or where known up-gradient plumes occur, could in fact cause an increase in pollutant(s) reaching Hinkson Creek.

Targeting runoff volumes calculated from the 1960s is an incomplete approach and does not consider the water balance as a whole. To achieve streamflow characteristics from the 1960's, we may actually have to infiltrate volumes of water that exceed historic rates due to potential reductions in evapotranspiration (Grimmond and Oke 1999). *The TMDL should consider propagated effects on the urban water balance if a runoff-reduction approach continues to be pursued.*

3.B. LANDUSE ANALYSIS AND INTERPRETATION

Comment 3.B.1. Landuse categories in the draft TMDL do not reflect underlying MORAP datasets.

Based on our analysis of the 1993 and 2005 Missouri Resource Assessment Program (MORAP) datasets, we note that there is no strictly "urban" landuse category as presented in the draft TMDL (Exhibit 2). Additionally, the landuse categories differ between the 1993 and 2005 MORAP data and are therefore not directly comparable.

Despite dataset differences, MDNR appears to have grouped the following landuse categories into a single "urban" category:

- 1993 MORAP landuse categories grouped as "urban" by MDNR:
  - Urban impervious
  - Urban vegetated
- 2005 MORAP landuse categories grouped as "urban" by MDNR:
  - Impervious
  - High intensity urban
  - Low intensity urban

Exhibit 2. Hinkson Creek landuse based on 1993 and 2005 MORAP landuse/land cover data

1993 Land Use Categories	Acres	2005 Land Use Categories	Acres
Urban Impervious	3,819	Impervious	2,758
Urban Vegetated	747	High Intensity Urban	1,288
Barren or Sparsely Vegetated	0	Low Intensity Urban	7,843
Row and Close-Grown Crop	7,462	Barren or Sparsely Vegetated	79
Cool-season Grassland	27,892	Cropland	6,641
Warm-season Grassland	11	Grassland	21,950
Glade Complex	0	Deciduous Forest	14,259
Eastern Redcedar and Redcedar -Deciduous Forest and Woodland	4,348	Evergreen Forest	366
Deciduous Woodland	874	Mixed Forest	0
Deciduous Forest	11,817	Deciduous Woody/Herbaceous	195
Shortleaf Pine-Oak Forest and Woodland	0	Evergreen Woody/Herbaceous	0
Shortleaf Pine Forest and Woodland	0	Mixed Woody/Herbaceous	0
Bottomland Hardwood Forest	59	Woody-Dominated Wetland	634
Swamp	0	Herbaceous-Dominated Wetland	49
March and Wet Herbaceous Vegetation	21	Open Water	1,389
Open Water	401		
Total	**57,451**		**57,451**

Note: Acreage values are based on the Hinkson Creek watershed boundary GIS shapefile provided by MDNR. Acreage values provided above may differ slightly than those found in Tables 1 and 2 in the draft TMDL. It appears that MDNR may have used different versions of the Hinkson Creek watershed boundary GIS shapefile to calculate acreage values in the draft TMDL.

By grouping 1993 and 2005 data in this manner, the draft TMDL infers that all urban landuses contribute equally to stormwater runoff. However, not all urban uses are equal and their impacts to stormwater runoff differ substantially. We also note that increases to "urban" area referenced in the TMDL are due to the definition of "low intensity urban" landuses. The 2005 MORAP metadata defines "low intensity urban" as "vegetated urban environments with a low density of buildings". It is highly unlikely that "low intensity urban" landuses contribute to stormwater runoff with the same magnitude as "impervious" landuses.

Comment 3.B.2. The assertion that percent "urban" land cover increased approximately 160% from 1993 to 2005 is not supported by the underlying MORAP datasets.

The 2005 landuse category "low intensity urban" has no "urban" landuse counterpart in the 1993 dataset. We note that comparison of the 2005 MORAP dataset with aerial imagery indicates that "low intensity urban" is primarily residential land. Based on our aerial imagery analysis, we also note that residential land is generally *excluded* from any "urban" landuse category in the 1993 MORAP dataset. As further evidence, we performed a GIS spatial analysis of the MORAP datasets and found that the 2005 "low intensity urban" landuse was identified by any one of 10 different categories in 1993 (Exhibit 3). Of the 7,843 acres categorized as "low intensity urban" in 2005, non-"urban" landuses, as identified by the 1993 dataset, accounted for 6,450 acres (i.e., 82.2%). However, this does not indicate an actual increase in "urban" landuse as suggested in

the draft TMDL. *Neighborhoods established well before 1993 are generally categorized as "cool-season grassland" or "deciduous forest" in the 1993 dataset.* Again, as noted above, few if any residential neighborhoods are identified under any "urban" category in the 1993 dataset. Therefore, it may not be appropriate to draw any conclusions regarding urban area increases attributed to the 2005 "low intensity urban" landuse category.

Exhibit 3. Distribution of 2005 "Low Intensity Urban" acreage within landuse categories established in 1993 for the Hinkson Creek watershed.

1993 MORAP Land Use Category	2005 "Low Intensity Urban" Acres
Urban Impervious	1,279
Urban Vegetated	114
Row and Close-Grown Crop	178
Cool-season Grassland	3,949
Warm-season Grassland	2
Eastern Redcedar and Redcedar -Deciduous Forest and Woodland	635
Deciduous Woodland	44
Deciduous Forest	1,627
March and Wet Herbaceous Vegetation	0
Open Water	15
Total	7,843

Note: Acres do not represent the total number of acres within the Hinkson Creek watershed, but rather the number of acres within the 2005 "low intensity urban" landuse category. This analysis was performed using the intersect tool in ArcGIS

A more appropriate comparison between the 1993 and 2005 MORAP datasets might be between the following categories:

- "Urban impervious" (1993 dataset) and "impervious" (2005 dataset), and
- "Urban vegetated" (1993 dataset) and "high intensity urban" (2005 dataset).

However, this would suggest a decrease of approximately 1,061 acres in impervious urban area from 1993 to 2005. Comparing "urban vegetated" to "high intensity urban" suggests a nominal increase of only 541 acres from 1993 to 2005 (Exhibit 2). We also note that our spatial analysis presented in Exhibit 3 suggests that 1,279 acres of "urban impervious" land was converted to "low intensity urban" from 1993 to 2005. Given the cited differences between 1993 and 2005 datasets, it is unlikely that definitive time-trend conclusions regarding urban landuse in Hinkson Creek may be determined from MORAP datasets.

Comment 3.B.3. Landuse data from 1976 was not presented or discussed.

We note that MDNR did not consider 1976 landuse GIS data as part of the TMDL. Landuse data provided by MDNR suggests there were approximately 6,978 urban acres within the Hinkson Creek watershed in 1976, whereas the draft TMDL suggests there were approximately 4,527 urban acres in 1993. There was likely no such decrease in urban landuse, but further underscores the questionable validity of available landuse datasets in establishing meaningful time-trends.

Comment 3.B.4. Inconsistencies between the MORAP datasets suggests inaccuracies and lack of comparability.

We note that Tables 1 and 2 in the draft TMDL suggest that open water acreage within the Hinkson Creek TMDL increased from 422 to 1,439 acres from 1993 to 2005. Closer inspection of the data and associated metadata suggests this does not represent an actual increase in open water acreage, but rather improved techniques for classifying waters between 1993 and 2005. Although the datasets suggest an increase of approximately 240% in open waters, in actuality there was likely no change. *This illustrates that landuse data digitized under different methodologies are not comparable.*

3.C. BIOLOGICAL ANALYSIS AND IMPLEMENTATION

Comment 3.C.1 Historical biological community health is not documented in the TMDL.

Throughout this TMDL document, an assumption has been made that the biological community was attaining the beneficial use prior to increased urbanization and that restoring hydrology to historical levels will restore biological health. There is really not much evidence that this was the case in the 1960-1990 period. The biological health of Hinkson Creek has not been adequately documented for this time period and anecdotal evidence suggests that the water quality and biological health of Hinkson Creek was poor and has improved considerably since the 1960's. MDNR should investigate their own records for water quality and biological data collected during this time period. We note that approximately 53 WWTFs historically discharged within the Hinkson Creek watershed and that agricultural practices may have changed in the past 50 years.

Comment 3.C.2. The return interval targeted by the TMDL does not establish a linkage with the beneficial use.

Although the use of a surrogate measure (stormwater runoff volume) for "pollutants" has merit in specific and targeted situations where multiple stressors exist, we believe that a TMDL must ultimately be linked to the protection of a beneficial use. For example, in the Potash Brook TMDL (VTDEC 2006) performed by the Vermont Department of Environmental Conservation, such a link was established. A stream geomorphic data assessment of Potash Brook performed in 2005 documented "less than stable" in-stream sediment conditions that provide the link to the impaired biotic community. The Potash Brook TMDL has been cited by MDNR as an example of a TMDL that has successfully used stormflow as a surrogate for multiple impairments. *We note that a link between Missouri attainment stream return intervals and biological endpoints has not been established.*

In the TMDL, MDNR appears to have assumed that higher biological scores in the four "flow attainment" streams are due solely to the differences between the upper 0.3% of the flow

hydrographs. While the literature (Hughes et al. 1986) and USEPA guidance (Barbour et al. 1996) support the reference approach when evaluating regional stream differences, MDNR has not provided sufficient data to quantify the assumed cause-effect relationship between storm flow and biological health in any of the study streams. No information is presented in the TMDL to suggest that the higher biological scores were directly linked to stormwater runoff or impervious area. At a minimum, a statistically significant ($p<0.05$) correlation relating biological scores and impervious area is needed to justify future studies capable of detecting and quantifying causation.

Although MDNR's series of stream evaluations did include elements of USEPA's Stressor Identification Guidance (Cormier et al. 2003), it appears as if MDNR's approach did not support the structured assessment methods recommended by USEPA and the technical literature. As a result of MDNR's approach, some important data (e.g., biological samples in Hinkson Creek and flow attainment streams) were collected inconsistently or, as MDNR itself admits, not collected at all. For example, on page 11 of the draft document, MDNR states the following:

"Sediment, a pollutant which could explain the low level of impairment, was not studied. Sediment has been established as the primary source of impairment in numerous TMDLs throughout the country."

MDNR should consider re-evaluating stressors in Hinkson Creek and attainment streams according to a structured watershed monitoring plan which adheres to stressor identification guidance and the technical literature. Adams (2003) offers several criteria useful in establishing causation between stressors and observed effects.

Comment 3.C.3. Biomonitoring endpoints should serve as the primary TMDL target.

The TMDL document suggests that a 50.5% reduction in stormwater runoff is required to attain acceptable protection of the biological community (Page 27, Table 12). If a linkage between stormwater runoff and the biological community does exist we question whether a 50.5% reduction or some other value would be required to achieve a fully supporting biological community based on macroinvertebrate data collected since 2001. *This further suggests that achieving a fully supporting biological community should be the primary water quality target rather than a reduction of stormwater input, since aquatic life impairment is the driver for placement of Hinkson Creek on the impaired waters list.* On Page 11, Section 2.6, 2nd paragraph of the Hinkson Creek TMDL it says that "Federal regulation also states that TMDLs may be established using a biomonitoring approach as an alternative to the pollutant-by-pollutant approach [40 CFR 130.7 (c)(1)])." Again, it is unclear to us why biomonitoring is not the primary water quality target instead of a technically unsupported runoff reduction.

Comment 3.C.4. The biological community in Hinkson Creek may not be currently impaired.

With the exception of the spring of 2002 assessment, macroinvertebrate samples collected by MDNR have shown the urban portion of Hinkson Creek to be *fully supporting or very nearly so each time the biological community has been evaluated* (MDNR 2002, 2004, and 2006). The last comprehensive investigation of the macroinvertebrate community was conducted by MDNR in the fall of 2001 and spring of 2002. To our knowledge the last macroinvertebrate sampling of any kind was performed by MDNR in the spring of 2006, nearly 4 years ago. We believe that a more methodical investigation into the biological community is warranted to better understand the biological health of Hinkson Creek.

Comment 3.C.5. Several significant differences exist between the Hinkson Creek TMDL and the Potash Brook template.

The Potash Brook TMDL has been cited as an example of a TMDL that has successfully used storm flow as a surrogate for multiple impairments. As such, this approach is being used as a template for the Hinkson Creek TMDL. However, there are several major differences between the two watersheds that must be recognized. Potash Brook is a 7.1 mi^2 watershed compared to Hinkson Creek which is approximately 90 mi^2. Potash Brook has a heavily impaired aquatic community as opposed to Hinkson Creek, which regularly is found to be between fully supporting and partially supporting. Are there lessons to be learned in the Potash Brook TMDL? Have the runoff reduction targets been achieved, and if so, has the biological community been restored as a result?

Comment 3.C.6. The attainment stream selection process cited in the TMDL is questionable.

The second paragraph of Section 4.5 in the TMDL ('Water Quality Targets') states that the linkage between "aquatic life impairment, and stormwater will be accomplished using streams that are physiographically similar to Hinkson Creek and where the biological community is attaining the aquatic life designated use." This is the framework that was used in the Potash Brook TMDL.

The Potash Brook TMDL also states that the use of "attainment" streams as opposed to "reference" streams is used "because reference tends to imply that the ultimate goal for the impaired steam approaches pristine. Instead, the attainment watershed(s), while meeting or exceeding the Vermont water quality standards criteria for aquatic life, should contain some level of development in order to better approximate the true ecological potential of the impaired stream." This use of "attainment streams" gave recognition to the fact that highly developed watersheds would not be expected to attain reference conditions.

A fairly rigorous approach was used for the selection of attainment streams by the Vermont Department of Environmental Conservation using an analysis described in Foley and Dowden (2005). These attainment watersheds were evaluated for similar size, slope, soils, climatic patterns, channel type and landuse/cover and were all in relatively close geographical proximity

to Potash Brook. In addition, they all contained some level of development in order to approximate what the true ecological potential might be.

Unfortunately, the streams selected for the Hinkson Creek TMDL are not physiographically similar to Hinkson Creek. To be physiographically similar, the "attainment" streams selected for the Hinkson Creek TMDL should be of similar size and should have similar levels of urbanization. The selected attainment streams are 3-7 times larger (313 – 620 mi^2) than the Hinkson Creek watershed area of ~90 mi^2 and all contain very low levels of urbanization. The "attainment" streams selected for the Hinkson Creek comparison were primarily based on the availability of macroinvertebrate data and the presence of a USGS gauging station in order to supply flow information.

It is our opinion that the selection process of attainment streams for this TMDL is inadequate and not sound. Two of the four "attainment" streams are actually "reference" streams for their particular Ecological Drainage Units, a comparison that we believe is not appropriate. On page 14 of the Potash Brook TMDL the authors state "However, haphazard matching of attainment streams, and thus flow targets, to Potash Brook could lead to targets with a high degree of uncertainty as to whether standards would be met." This is certainly the case with the attainment streams selected for the Hinkson Creek comparison. It is our opinion that either other urban streams that are attaining their beneficial uses, or other similar streams within the Ozark/Moreau/Loutre Ecological Drainage Unit be used for comparisons to Hinkson Creek.

Comment 3.C.7. Biomonitoring scores cited in the TMDL should be corrected

The Missouri Stream Condition Index (MSCI) scores in the TMDL (Page 8, Table 3) contains some errors and inconsistencies with previously published aquatic macroinvertebrate data in addition to those in italics that were recalculated based on more recent reference stream sampling. The largest error is the fall 2001 Rogers Road site (#8) which was changed from an MSCI score of 12 in the original report MDNR (2002) to a 16 in the TMDL report based on the recalculation using more current reference stream data. This analysis appears to be an error. The Rogers Road site remains a 12 even when compared to the new data. It is interesting to note that during the fall of 2001, the Walnut Street site (#6) scored better in 3 of the 4 individual metrics than the Rogers Road site (#8) even though its MSCI score is listed as 12 as opposed to the 16 listed for Rogers Road in this TMDL.

Another example is the Scott Road site (#1) of the fall 2001 survey. The recalculated MSCI score is 14 when it should correctly be scored as a 16 given in the original MDNR report (MDNR 2002). As noted in Table 3 (page 8) some of these changes were made due to rescoring, but at least some of the errors are a result of Metric Value assignment (5, 3, 1) based on the 25th percent quartile value and the bisection value. We therefore recommend that these scores be reevaluated to ensure their correctness.

Comment 3.C.8. Rescoring historic biomonitoring data is not appropriate.

Rescoring of historic data based on more recent sampling of reference streams (TMDL Table 3, italics) is not appropriate in our opinion. It makes it extremely difficult, if not impossible, to make impairment decisions that could change based on data that will be collected in the future. Study streams should be evaluated based upon the scoring criteria that are in effect at the time of sampling. For example, MSCI scores determined in the fall of 2001 should be assessed based on the reference stream criteria that were available and in effect in 2001. Changing or updating scores increases the likelihood of circular use attainment decision. For example, Rogers Road, (site #8) was not impaired in Fall 2001, but could be interpreted at impaired based on re-scoring the information collected in the Spring of 2002. This would clearly make impairment determinations difficult at best, especially of streams that regularly hover near the border between partially and fully supporting (14-16).

We strongly recommend that any given stream be scored based on the reference stream scoring criteria that is available at the time of sampling, and as scoring criteria for reference streams changes as a result of the collection of additional data, then only new data collected on study streams be appropriately compared to the new scoring criteria. Included below as Exhibit 4 is a table containing MSCI scores that we believe to be correct and consistent with previous reported results.

Exhibit 4. Corrected Missouri Stream Condition Indices for Hinkson Creek.

Missouri Stream Condition Index Scores for Hinkson Creek													
Site #	Site	Fall 2001		Spring 2002		Fall 2003	Spring 2004	Spring 2005	Fall 2005		Spring 2006		
8	Rogers Rd.	16	12	16	18								
7	Hinkson Creek Rd.	12		18		18	18	18	18				
6.5	Hwy 63 Connector						*17*						
6	Walnut St.	12		12		16	14	18	16	18			
5.5	Broadway St.					16	16	16	12	14			
5	Capen Park	16		14	12								
4	Rock Quarry Rd.	*17*		12	14								
3.5	Recreation Dr.							14	14				
3	Forum Blvd.	18		14							16		
2	Twin Lakes	16	18	14							12	14	
1	Scott Rd.	14	16	14							16		
			Correct Values										

Based on our interpretation of the above MSCI scores, the upstream sites (sites 7 and 8) score as fully supporting 78% (7 of 9) of the time. The lower Hinkson sites (sites 1-6) scored as fully supporting 52 % (13 of 25) of the time. It should be noted, however, that following the spring 2002 sampling event the MSCI scores within the urbanized portion of Hinkson Creek have been fully supporting nearly 70% of the time. This is *quite comparable* to MDNR's TMDL web page (http://www.dnr.mo.gov/env/wpp/waterquality/303d.htm) that indicate that reference streams in this Ecological Drainage Unit score as fully supporting approximately *75-80%* of the time.

In addition, it is not clear why MDNR is targeting a higher biocriteria attainment frequency (100%, see TMDL, Page 20) than what is typically achieved in reference streams. A 100%

attainment frequency for Hinkson Creek is unrealistic and not supported by MDNR biocriteria guidance. *Therefore, we recommend that attainment of biocriteria at frequencies prescribed by Missouri's 303(d) listing methodology and biocriteria documents serve as the primary TMDL target as (1) bioassessment scores served as the rationale for listing Hinkson Creek as impaired and (2) site-specific causal relationships between runoff and ecological health have not been established in the TMDL.*

Comment 3.C.9. The spring 2002 biomonitoring dataset may be an anomaly.

The spring 2002 sampling of macroinvertebrates seems to be the driver for the determination of impairment in the urban portion of Hinkson Creek. When compared to all of the other macroinvertebrate sampling events, the spring 2002 was the only sampling event that consistently showed MSCI scores below 16. It is possible that the 2002 sampling event was an anomaly. We recommend that a comprehensive bioassessment of Hinkson Creek similar to that conducted in 2001-2002 be performed to better assess the current status of the aquatic community.

Comment 3.C.10. Little data are presented to support the claim that reducing peak storm flow volume (Q = 0.3%) will increase baseflows, improve dissolved oxygen, and ultimately enhance the biological health of Hinkson Creek.

Several times throughout the draft TMDL document (e.g., Section 2.6, Section 4.5, Section 11), MDNR suggests that peak storm flow runoff volume reductions will result in increased baseflows and higher dissolved oxygen concentrations during baseflow periods. On page 11, MDNR states the following:

> "water quality studies did reveal, however, that a large percentage of the problems noted above, including increased sediment and low dissolved oxygen at low flows, can be attributed to urban runoff conditions which result in excessive stormwater runoff and lower than normal baseflow conditions."

MDNR has offered no data to support the claim that "lower than normal" baseflows are directly caused by urban runoff conditions. In fact Schuler (1994, page 2), a paper which is cited in the draft TMDL, states that actual data have demonstrated that this is rarely the case. Furthermore, MDNR's assumption that low dissolved oxygen concentrations indirectly result from urban runoff conditions is unsubstantiated. As MDNR is aware, recently collected continuous data demonstrated that prolonged periods of low dissolved oxygen (below 5.0 mg/L) occur in several Missouri reference stream reaches during baseflow conditions. As reference stream reaches represent the "best available representatives of ecoregion waters in a natural condition with respect to habitat, water quality, biological integrity and diversity, watershed landuse, and riparian conditions" (10 CSR 20-7.031(1) (U)), *it is unclear why MDNR believes that baseflow dissolved oxygen concentrations in Hinkson Creek can improve to acceptable levels when it has been demonstrated that baseflow dissolved oxygen conditions in reference streams cannot.*

Comment 3.C.11. Physical habitat limitation should be explored as a causal variable.

Habitat quality limits the biological potential for streams and rivers (Rabeni 2000). Reduced habitat quality within urban stream reaches is well documented in literature (Booth and Jackson 1997, among others). According to MDNR standard operating procedures (SOPs), habitat quality is measured during bioassessments. Furthermore, SOPs stipulate that habitat quality scores for study streams (e.g. Hinkson Creek) must be within a specified percentage of reference stream habitat scores, otherwise application of biocriteria to study streams is unjustified (i.e. habitat limited). Habitat limitation appears to offer a plausible explanation of periodically lowered macroinvertebrate scores in Hinkson Creek. *However available habitat data do not appear to be evaluated to any substantive degree in the TMDL.* Restoration strategies leading to improved habitat quality may differ from the volume reduction approach recommended in the TMDL.

Comment 3.C.12. Excessive chloride levels should be evaluated as a primary stressor and major contributor to the potential aquatic life impairment.

Chloride has long been considered a potential toxic to freshwater animals leading to development of national chronic and acute water quality criteria recommendations for protection of freshwater aquatic communities (USEPA 1988). USEPA (1988) established chronic and acute chloride water quality criteria of 230 and 860 mg/L, respectively, and subsequently Missouri adopted these recommendations within its water quality standards regulations (10 CSR 20-7.031).

Several MDNR and volunteer water quality data collection efforts found levels of chloride above Missouri's chronic water quality criterion within Hinkson Creek and developed tributaries. The pertinent sampling events occurred during winter conditions, which are likely attributed to salt application for ice control on paved surfaces. In fact, the Missouri Department of Transportation relocated a salt storage facility due to its identification as a major chloride contributor during MDNR's 2005 investigation. This facility was the primary contributor to an observed chloride concentration of nearly 23,000 mg/L (100 times higher than Missouri's water quality criterion) within a Hinkson Creek tributary. While this remedial action reduced chloride loading to Hinkson Creek, substantial chloride sources are still obviously present. For example, MDNR also observed a chloride concentration of 3,170 mg/L at a tributary at the I-70 intersection in February 2004. MDNR has also observed chloride levels above the chronic criterion directly within Hinkson Creek below Forum Boulevard and Flat Branch at the MKT Trail, a major Hinkson Creek tributary.

Despite documented high chloride levels during winter conditions, MDNR has not made concerted efforts to further evaluate the magnitude, duration and frequency of chloride criteria exceedences and the potential impacts to the resident aquatic community. In addition, MDNR did not consider chloride as a significant potential stressor during TMDL development. *We strongly recommend that MDNR conduct additional studies to evaluate potential impacts from*

excessive chloride levels and consider this constituent as a primary stressor within the Hinkson Creek TMDL.

3.D. IMPLEMENTATION FEASIBILITY

Comment 3.D.1. TMDL implementation targets are ill-defined.

As mentioned previously, the TMDL does not clearly define whether runoff volumes or flow rates must be reduced. The approximately 50% reduction target is based on a comparison of 1-year return flows in Hinkson Creek as compared to the median 1-year return flow from the four attainment streams. Therefore, one would assume that flow rates are being regulated not runoff volumes. However, Section 11 of the TMDL states that "stormwater runoff volume reductions can be accomplished by stormwater retention and enhanced infiltration and evapotranspiration." Therefore, it appears the TMDL is regulating runoff volumes, but it is not clear when or where these volume reduction requirements apply. On page 33 of Section 11, the TMDL references the one-year average annual storm as measured at the USGS stream gage near Providence Road and then describes how TMDL reductions shall be implemented if new monitoring data indicate water quality standards are not being met. However, the one-year average annual storm is not defined in terms of flow rate, volume, rainfall depth, intensity, duration, or any other metric that would allow one to quantify the reduction target.

Comment 3.D.2. TMDL implementation feasibility is uncertain.

Without a clearly defined target, it is difficult to assess the feasibility and cost implications associated with meeting the TMDL. Assuming the 1-year average annual storm is equal to the volume associated with the 0.3% normalized daily flow in Hinkson Creek as defined in the TMDL (53.6 cfs/mi^2), such that the volume upstream of the Providence gage would be:

$$V = \left(53.6\frac{cfs}{mi^2}\right) \times (69.8\ mi^2) \times (24\ hrs) \times \left(3600\frac{s}{hr}\right) = 323 \times 10^6 cf = 7421\ ac \cdot ft$$

A 50.5% volume reduction requirement would then result in a target volume loss of 3,748 ac ft. This volume is equivalent to requiring the complete retention and infiltration/evapotranspiration of approximately 1-inch of rainfall over the entire watershed, *which is significantly greater than the current volume reduction requirements of the Boone County Stormwater Ordinance.* The Ordinance requires that the runoff from 10% of the 1.3-inch water quality volume must be permanently reduced. However, the Ordinance allows for a waiver of this requirement if there is a risk for groundwater contamination or site constraints make infiltration infeasible. *The TMDL does not provide any consideration for site constraints that may inhibit volume reductions.*

For many parts of the watershed and during many times of year the retention of large runoff volumes may not be feasible due to:

- High groundwater table
- Permeability of soils
- Limited pervious space availability
- Limited areas for evapotranspiration in dense developed areas
- Desirability of dense development vs. sprawl
- Potential for water balance issues and un-natural baseflow impacts
- Lack of non-potable demand for harvested stormwater

For areas that are conducive to achieving volume losses, other site constraints may impact the practicability of implementing infiltration facilities due to the presence of existing infrastructure and location of available space relative to the tributary drainage area. The Mid-America Regional Council Manual of Best Management Practices for Stormwater Quality (MARC, 2009) recommends that infiltration basins have a maximum depth of 2 feet for an infiltration basin and 1 foot for a bioretention area. Therefore, when considering side slopes and pre-treatment requirements, between 2000 and 4000 square feet of land would likely be required per impervious acre. For the purposes of calculation, if we assume that the Hinkson Creek watershed is 20% urban and infiltration is feasible everywhere then 500 to 1000 acres of land would be needed to achieve the required volume reductions. This land would also need to be strategically located such that surface runoff could be routed by gravity; otherwise pump stations would be needed. According to the User's Guide to the BMP and LID Whole Life Cost Models (WERF, 2009), curb-contained bioretention systems without underdrains cost approximately $13 per square foot. Therefore, the capital costs associated with retrofitting the entire watershed with bioretention facilities could be as high as $500M. Additional costs could be incurred if pump stations or larger storage facilities are needed or if significant infrastructure conflicts arise.

For agricultural areas, infiltration facilities may be more attractable than bioretention facilities. However, the feasibility of achieving volume reductions in the agricultural areas is even more uncertain than it is for urban areas. Agricultural lands generally have very low imperviousness such that runoff and shallow subsurface interflow typically only occurs when the soils become saturated.

During these conditions infiltration rates would be expected to be reduced and infiltration basins would need to be sized to retain stormwater for longer periods of time in order to reduce volumes.

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APPENDIX C

Ken Pearson, Presiding Commissioner
Karen M. Miller, District I Commissioner
Skip Elkin, District II Commissioner

Roger B. Wilson
Boone County Government Center
801 East Walnut Room 245
Columbia, MO 65201-7732
573-886-4305 • FAX 573-886-4311

Boone County Commission

April 22, 2010

Mr. John Hoke
Water Quality Monitoring and Assessment Section
Water Protection Program
Missouri Department of Natural Resources
P.O. Box 176
Jefferson City, MO 65102-0176

Re: Hinkson Creek TMDL in Columbia, Boone County

Dear Mr. Hoke,

Thank you for the opportunity to comment on the Draft Hinkson Creek Total Daily Maximum Load. States and local governments across the nation are struggling with ways to manage waterbodies that are impaired by stormwater. Hinkson Creek is no different. This relatively large watershed is a cultural and economic asset for the citizens of Columbia, and Boone County. Each year, hundreds of citizens volunteer their time to the "Hinkson Clean-Sweep." The Katy Trail system that runs along Hinkson Creek and the refurbished Flat Branch Park are popular tourist locations and the site for local environmental events and activities. Most residents are familiar with the watershed and can even point out the sub-watershed in which they reside.

In 2001, the City and County partnered to develop the Joint Stormwater Task Force. This citizen based advisory board developed the framework of our current stormwater strategy. Those recommendations have been incorporated into both the City and County ordinances. Local pressure has altered business practices and waste storage facilities.

With the NPDES Phase II program, the University of Missouri - Columbia, City and County joined forces to provide a program that meets the extensive requirements of the MS4 permit. Some of the programs included "Show Me Yards and Neighborhoods" and the Hinkson Creek Watershed Restoration Project, Phase II.

Now, almost 10 years later, the community is well educated on the effects of stormwater and some of the methods to reduce pollution from homes, businesses, and facilities. The community of design engineers is engaged and vocal about the pros and cons of local ordinances and requirements. Scientists are examining the watershed in ways that have not previously been explored in an urban setting. All of these groups, seemingly unrelated, have partnered to find solutions and address stormwater problems throughout the community, and beyond.

[this section] for this permit duration until the department determines WLAs are being met or that water quality standards are being met.

Section 6 of the Draft TMDL addresses the WLA requirements for the MS4. "*These values represent the weighted proportion of storm water runoff volume that* ***must*** *be reduced…through regulated activities*"

It is, therefore, our conclusion that the MS4s would be required to reduce the volume/or flow of runoff flowing into Hinkson Creek in the urbanized area, or be at risk of violating the Missouri Clean Water Law. If that is not the intention, please clarify that in the WLA, implementation and monitoring sections of the TMDL. If a phased approach is to be done for this TMDL, please provide a roadmap and timeline in the WLA portion of the document.

Boone County does not support the conclusions in the TMDL. A different approach is warranted to define the water quality impairment and set the TMDL.

This TMDL is based on the questionable conclusion that the aquatic invertebrate community has been negatively effected by the increase in urbanization (imperviousness) which has increased either the amount of water in the creek; or the amount of water at the extreme event (Q.03%). The purpose of the TMDL is to determine the pollutant loading a water body can assimilate without exceeding the water quality standards for that pollutant. This Draft TMDL uses flow (or volume) as a surrogate for any pollutant that may be found in stormwater runoff. Is there any data to support that a reduction in flow or volume would achieve water quality standards and restore the designated uses?

It is still unclear from the language in the Draft TMDL if a reduction in flow or volume is the target. These are two very different requirements. If a reduction in flow was the target, then the community could use detention basins to capture and slowly release the volume of water over a longer period of time. (See potential consequences below) If however, a volume reduction is required, then the community has to remove that amount of water from the watershed. So, once the required volume is captured, what can be done with it? The TMDL states reduction by either infiltration or evapotranspiration.

Ninety percent of the soils in this watershed have slow to very slow permeability. That's less than a half an inch per hour, under ponded conditions. Evapotranspiration rates are difficult to calculate, but by the Pan Method, we could expect about ½ inch per day. At that rate, it would take weeks to evaporate and infiltrate the water from a 0.5 inch storm. Remember, that is just from one event. The average rainfall for Boone County is 38 inches per year. For the last two years, this area received over 50 inches of precipitation. Even through detention and slow release, the same volume or amount of water is flowing through the channel, just spread out over a longer time period. A **volume** reduction of that magnitude is scientifically impossible. Clarification on this point is essential.

Appendix A of this comment letter is the report prepared by Geosyntec Consultants. That report identifies additional questions, comments and concerns with the current approach in the Hinkson Creek Draft TMDL.

DNR should incorporate the current ordinances and work with the locally developed SW management approach to set the requirements of the TMDL.

Hinkson Creek is a unique urban stream in Missouri. Throughout the City, the riparian corridor is mainly intact. This is due to Columbia's Flood Plain Ordinances. These protections have recently been increased to include the entire stream network with the new City/County Stream Buffer Regulations. The riparian corridors protect and stabilize stream banks, reduce stream temperatures, as well as add important nutrients and habitat for aquatic organisms. Although there are some sections of Hinkson that have been channalized, most of the stream system retains some sinuosity. These features may explain why the DNR studies find the aquatic invertebrates in Hinkson are partially to fully supporting over time.

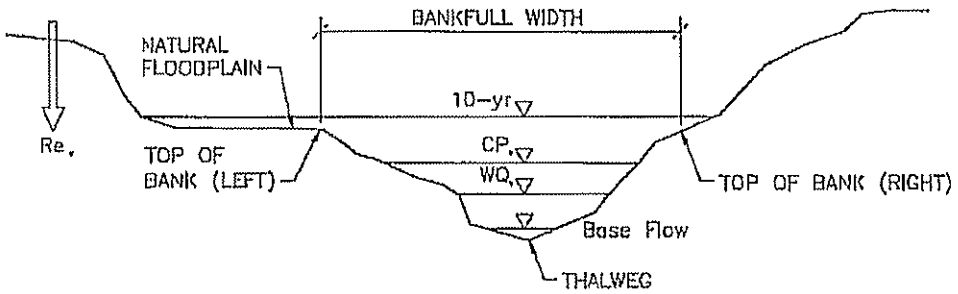
The community has worked since the early 2000's to develop our stormwater approach through engaged stakeholders and endless debates. Through that process the City and County have modified their approach; and finally have something the community can support. The enacted protective ordinances address water quality and flow reductions throughout the watershed. Both of the Stormwater ordinances for the City and the County require that the water quality volume (1.3 inches) be treated through a filtration BMP. This storm is frequently called the first flush, as it contains the majority of contaminants. The Draft TMDL should, at a minimum, incorporate the current City and County standards.

Suggested Approach

- More monitoring data is needed to correctly assess the health of the invertebrate community.
- Divide the watershed into subwatersheds
    - Determine if the problems are occurring from new development or previous development. If new, then recognize that the Phase II NPDES permit is addressing these. If previous, then set requirements for retrofitting in select areas of the watershed.
    - Determine the % impervious in each subwatershed; determine base flow needs; work with current ordinances to set Water Quality (WQ) storm and channel protection requirements.
- Use the Center for Watershed Protection (CWP) approach to segment and **treat** different runoff volumes.
    1. Runoff reduction – this is your recharge volume (Re). The center of watershed protection suggests 10% reduction. But with our heavy clay

soils, that is almost impossible to achieve. The Boone County ordinance requires 10% of the water quality amount or 0.14 inches.

2. Treat the Water Quality (WQ) storm. 90% of the rainfall events in Boone County are 1.3 inches or less. By requiring that this volume be run through a filtration BMP, we can capture the majority of pollutants in the runoff.
3. Provide channel protection. The two-year storm (3.5 inches in Boone County) will fill the creek channel. These bankfull events have the ability to modify the channel – often incising and eroding the banks. By capturing these flows and releasing them below the bankfull level, we reduce the amount of work that the water can do, thereby reducing channel erosion and degradation.
4. **Just doing those three levels of protection should treat and detain 96% of the rainfall events from new development.**



STREAM SECTION

Potential Consequences of this TMDL

- Detention Basins – to be the most effective, stormwater detention basins would have to be constructed low in the watershed. This would remove the riparian corridor, and established hardwood forest. DNR just developed nutrient criteria for reservoirs. During that process it was determined that impounded water needed a retention time of 6 months or more to achieve pollutant reduction. (Jones, 2008). Most stormwater detention basins drain in 48 hours or less.

  If the residents of Boone chose regional detention, it would be difficult to design a regional basin large enough to hold 6 months of flow. Therefore, this TMDL could create additional water quality impairments in those detention basins. Slow release of the stormwater, and fluctuating stream flow may increase the amount of time that the channel is full, destabilizing banks, and cause more erosion.

- Starve the stream – As stated during the public meeting on April 20, 2010, Engineers will design facilities to capture the runoff from a specific storm event. Runoff from storms under that threshold are also detained. Therefore, we could

potentially remove so much water that we actually starve the stream during drought times.

- Increase in the level of pollutants – This TMDL suggests that the community should capture the relatively clean water from rooftops, and lawns. This would mean that a larger percentage of the water that reaches the creek is from high polluting sources such as parking lots and streets. This could in fact increase the concentration of contaminants that enters the stream.

- Movement towards sensitive areas – The Grindstone Creek area has recently been connected to City sewer. It is now able to handle more growth than un-sewered watersheds like the Bonne Femme, Bear Creek or Perche Creek. If we increase the requirements of land-disturbance permits in the Hinkson Creek watershed, we may force development away from those areas. Our primary concern would be the Bonne Femme which is a sensitive area due to sinkholes, losing streams, cave recharge areas. Currently the majority of this watershed is unconnected to City infrastructure, such as sewer. On-sites in that area have a much greater potential to leak to the cave system.

- Loss of funding - unlike Waste Water Treatment Plants that receive billions of dollars in financial aid, grants and loans, there is very little federal or state money available for Stormwater programs. Municipalities must either fund activities out of general revenue, utility fees or taxes. Nonpoint source funding is only available if the activity is not covered in either the permit, or the Stormwater Management Plan (SWMP). Retrofits are currently not a requirement of the permit, or spelled out in the SWMP. By placing the volume reduction requirements in the WLA section of the TMDL, they become part of the MS4 permit. Therefore, any activities that would reduce the volume or move us toward that goal cannot be funded through nonpoint source funding (319).

- Cost to implement this TMDL. Cost estimates range up to $500,000,000 dollars to implement the TMDL in Hinkson Creek. The Potash Brook TMDL is in a similar situation, although Hinkson Creek watershed is 13 times larger. In January 2010, the VTDEC found the cost to implement that TMDL would be $25 million for the 7 m^2 watershed. Therefore, they have chosen not to implement until funding is available.

- Loss of public trust – Currently the Hinkson Creek Restoration Project and the clean sweep events help to tie the community to the watershed. The magnitude of the requirements in this TMDL, the inadequately proven science and the cost could unite the community against doing anything to help the creek.

In conclusion, we understand the problem of urbanization and we want to do the right thing. But to do that, we need a scientifically defensible TMDL. A TMDL that identifies a specific pollutant, or suite of pollutants, and sets a load requirement that is proportional to the problem. If the Department is requiring a volume reduction in the TMDL that amount needs to be clarified. A watershed wide volume reduction is impossible to meet, will cause environmental damage, and cost the MS4 millions of dollars to implement. We would suggest that the Department look at subwatersheds to determine the percent imperviousness, and set base flow and channel protection flow requirements per subwatershed. We highly recommend that the state work with the local community and the stakeholder developed stormwater approach to address the water quality problems in Hinkson Creek. Since flow (velocity) is only one aspect of the water quality concerns in Hinkson Creek, we would also suggest that DNR develop requirements to remove pollutants from the water quality volume (1.3 inches).

Whatever direction is decided, the Department needs to realize that the TMDL is tied to the MS4 permit. The statements in the TMDL can, and will, be used as a requirement for the permitted facilities, and NPS grant funding would then be unavailable for the community to use to implement stormwater retrofits.

Sincerely,

Karen M. Miller

Karen M. Miller
Boone County District II Commissioner

Cc: Todd Houts
John Glascock
Bill Florea
Georganne Bowman
Steve Hunt

Enclosures: Appendix A – Geosyntec Report
Appendix B - Specific comments and questions

APPENDIX D

CITY OF COLUMBIA, MISSOURI

PUBLIC WORKS DEPARTMENT

March 20, 2010

Mr. John Hoke
Water Quality Monitoring and Assessment Section
Water Protection Program
Missouri Department of Natural Resources
P.O. Box 176
Jefferson City, MO 65102-0176

Re: Hinkson Creek TMDL in Columbia, Boone County

Dear Mr. Hoke,

Thank you for the opportunity to comment on the draft of the Hinkson Creek Total Maximum Daily Load (TMDL).

In general, as noted in previous comments, the City of Columbia is very concerned about the proposed TMDL because the study to support it appears weak while the costs of implementing it will be very large. The present draft, while better than the first, is still plagued by the appearance of starting with an answer and reasoning backwards rather than using scientific study to clearly identify the problem(s) and reason forward to determine the solution(s).

The remedy in the second draft remains far out of proportion to what the studies of Hinkson Creek have found. According to the studies, the creek appears to be very close to the biological activity required for the stream—many places sampled achieved a score of sixteen, which DNR recognizes as fully supporting, and none received a score of less than twelve. Every location but one was fully supporting at some point during your study. Judging by the study done for Potash Brook in Vermont (a TMDL cited as a precedence for the Hinkson TMDL), Hinkson could be considered a high quality urban reference stream to which other streams in Missouri cities should be compared for attainment.

It is our belief that the stream is improving. Farming practices of the early 20th century removed most of the forest in the watershed which caused damage to the stream that it is still recovering from today. Many of the harmful effects said to stem from urban development today also came from farming practices then, including low baseflow as forests and prairies were replaced with pastures and row crops. The baseflow that is noted in the study to have been present in the late 1960's certainly contained a high percentage of effluent from water treatment operations effluent. Most of this effluent baseflow resulted from the delivery of piped, potable water to households in the watershed as opposed to rain water falling on the watershed. This effluent was known to be of poor quality which is why the City of Columbia has tried so hard to remove those facilities over the years. Since the middle of the last century, the City of Columbia, has eliminated approximately

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10 million gallons per day of poor quality treated effluent from Hinkson Creek. (This estimate is based upon the actual or design flows for 54 wastewater treatment plants that were eliminated.)

The City of Columbia wants to further the improvement of Hinkson Creek and make it as healthy as possible, but we want to be assured that what we do will make the stream healthier; and we want to do it as efficiently as possible. For instance, the removal of sewage treatment plant effluent "baseflow" has certainly improved the quality of water for aquatic life. By contrast, there remains the possibility that too much control of volume and flow, called for by this TMDL, can be as damaging as not enough control, and spending so much effort and money to reach an inordinately high target will take money away from the numerous other water quality concerns we have to manage.

This is particularly troubling when a method for approaching this TMDL exists which would ensure that we do more precisely what is needed; a phased approach. It has never been adequately explained to us why a phased approach is off the table when it makes so much sense to use it in this situation. The studies that have already been done, while not identifying a pollutant of concern, make it easier to target a phased approach so that Hinkson Creek gets the help it needs in a timely manner.

We are heartened to see something of a phased approach in the implementation, but it appears to us that only the Wasteload Allocation part of the TMDL has the force of law. This being the case, the implementation could potentially be thrown out by a permitting authority (whether EPA or DNR), or by a lawsuit brought against the City, the MS4 or DNR. Therefore, a phased approach needs to be in the regulatory portion of the TMDL.

To expend a great deal of time, effort and money to reach a goal that is so poorly supported by scientific study seems to us unwise, not to say irresponsible.

A more detailed list of comments follows:

Section 2.1

Impaired section described here does not match that shown in the drawing on page 2.

Section 2.2

Areas that have been urban for some time in Flat Branch and County House Branch are shown as Grassland or Forest in the 1993 graphic. Those watersheds were essentially built out by 1993 and very little development has occurred in them since.

Much of the development noted on page 2 in the second paragraph (inset) was in Bear Creek. Therefore this overstates the case.

Section 2.3

The assertion in the first paragraph that soils become more permeable in the lower third of the watershed is not supported by the following paragraphs. In those paragraphs it is noted that most of the land in the lower third, though well-drained has slow infiltration. It is more true to say that the soils become a little more permeable as one moves from the ridge of the watershed to the

floodplain. And, in fact, the more permeable floodplains remain remarkably untouched and open through Columbia.

Most soils in the watershed provide less than the recommended ½" per hour for infiltration which is the minimum generally recommended for infiltration type practices. This will limit the effectiveness of vegetated infiltration practices like rain gardens.

Section 2.5.1

The sample size of the biological assessments is small. Some of the poor scores were explained by things that were immediately addressed such as salt laden runoff from a road maintenance facility and poorly stored insecticides. The limited number of assessments done reveal a stream that is hovering near attainment so that the costs of the proposed rule are enormous compared to the problem being addressed.

Section 2.5.2

Most of the runoff from the area noted now runs through water quality BMPs, and the road salt storage facility is no longer there.

Section 2.6

Last clause in the last sentence of the second paragraph: there is no assurance that attainment of water quality standards will follow from this TMDL because the studies that are said to support it are inconclusive.

The regulations do not seem to support the use of a surrogate for an unidentified pollutant. They support the use of a surrogate for a pollutant that has been identified but is difficult to measure or regulate, and for which a clear relationship between the surrogate and the pollutant(s) can be established.

The regulations do support the use of a phased approach to TMDLs. The ability to use a phased approach appears to have been included in Federal regulations for just this situation; an inconclusive study coupled with the need to begin addressing the situation as soon as possible.

Section 5

In this section runoff volume is said to be the surrogate, but later in the document the target given is flow. The two are related, but there are situations in which flow can be reduced although volume stays the same. This is the case with traditional dry detention, for instance. This inconsistency should be rectified.

With respect to what this section says about volume, volume is not the only concern, timing is important, too. We can envision a situation in which we do an excellent job of volume control and leave stream life starved for water during critical times of its life cycle.

Section 5.1

First paragraph: the comparison given does not really show anything except that there was more flow during four months in 2007 than the same four months in 1967. There are many reasons why this could be true. A much longer study time is needed to show a relationship.

Second paragraph: as noted near the beginning of this comment letter, another reason that base flow has decreased is that numerous small waste water treatment facilities have been removed by diverting this often-polluted flow to the City's waste water treatment plant. The ultimate origin of this baseflow was well water from much lower in the watershed and/or the Missouri river floodplain, not infiltration of rainwater

Section 5.2

Last sentence: see other comments above regarding base flow.

Section 5.3

First paragraph: here the target is said to be runoff reduction whereas later in this section it is said to be flow.

Second paragraph: why was the flow value of 0.3 percent chosen? In the Potash Brook TMDL, it was chosen because studies of the stream showed that was the flow that tended to move the sediment which was impairing the use. This was a clear link between the impaired use, the pollutant, and the TMDL. No such link is presented here.

Section 7

This section is speaking of runoff volume as the load allocation whereas Section 5 largely speaks of flow as the target.

The reference to Table 13 is incorrect.

Section 11

Sixth paragraph (inset): the one year average annual storm is not the Water Quality Storm. The Water Quality Storm for the Columbia area is 1.3 inches, which approximately represents the depth of 90% of all 24-hour rain events and thus a little more than 90% of the rainfall volume. The MS4 intended to say that focusing on the water quality storm for volume reduction could result in the modest volume reductions proposed for the one-year average annual stream flow at the official stream gauge.

A basis of comparison still needs to be established for the one-year average annual flow measured at the stream gauge near Providence Road if this approach is used.

Section 11.3.1

The second sentence makes it seem as if grassy and/or vegetative swales are the only low impact development practice.

In summary, the proposed TMDL is not supported by the studies done on the creek. The work required by the proposed TMDL is far out of proportion to the impairment found by studies. Judging from what we know of what was happening in the watershed in the early-to-mid twentieth century, the stream is likely improving. Columbia wants to further the improvement with what the stream actually needs rather than an expensive approach which is only assumed to work. Federal guidelines support the use of a phased approach to TMDLs in situations such as this. We propose that a phased approach be used; that the approach given in the implementation section be used as a starting point and that it be brought into the regulatory part of the TMDL.

Again, thank you for the opportunity to comment on this regulation which will have such a great impact on our City.

Respectfully,
Columbia Public Works

John Glascock

John Glascock, P.E., Director

c: Todd A. Houts, University of Missouri Asst. Director of Environmental Health and Safety, City-County-University Joint MS4, University Representative

Bill Florea, Boone County Senior Planner, City-County-University Joint MS4, County Representative

APPENDIX E

UNIVERSITY *of* MISSOURI

ENVIRONMENTAL HEALTH AND SAFETY

April 21, 2010

Department of Natural Resources
Water Protection Program
Water Quality Monitoring and Assessment Section
P.O. Box 176
Jefferson City, MO 65102-0176

Re: Hinkson Creek second draft Total Maximum Daily Load (TMDL), Boone County, Missouri

Dear Mr. Hoke,

The University of Missouri (MU) wishes to thank you for the opportunity to comment on the Hinkson Creek second draft TMDL placed on public notice March 8, 2010.

As has been noted in previous correspondence on this subject, as well as at public and informational meetings held on October 20, 2009; December 16, 2009; and April 20, 2010, MU has grave concerns regarding the draft TMDL in its current state. This second draft, while making marginal improvements on the first draft that was withdrawn prior to MU having an opportunity to submit official written comments, still suffers from many of the faults MU has identified in the aforementioned meetings.

Our major concerns are:

1. The failure of the Department to identify a pollutant causing the occasional impairment, which in reviewing the history of the TMDL program, is key to the process.
2. The failure of the Department to link the observed fluctuations of the aquatic invertebrate community to urbanization of the watershed.
3. The methodology used to reach the conclusions contains many unsupportable assumptions and compares and simplifies data that is fundamentally different – particularly troubling considering the magnitude of the solution presented.
4. The failure of the Department to consider the potential permit implications of the draft Waste Load Allocation (WLA) in spite of repeated communication of this concern by the affected permit holders.
5. The lack of clarity in the document as to the Department's expectations of affected parties including the inappropriate use of flow and volume interchangeably, and the disconnect between the reported impairment and the point where the TMDL process ends.
6. The failure of the Department to craft the TMDL as a phased approach as clearly applicable in these specific circumstances based on EPA documents provided to the Department by MU.
7. The failure of the department to coordinate companion programs working toward the same goal in the Water Pollution Control Branch instead of allowing each program to craft isolated solutions to the same problem.
8. The failure of the Department to have estimated the cost for implantation of the TMDL as written.

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9. The stated driving force of the Department being the lawsuit against EPA that consequently compelled the Department to craft a document by December 31, 2009 instead of being driven to find a sound, workable solution for the people of Missouri.

Concern 1: The failure of the Department to identify a pollutant causing the occasional impairment, which in reviewing the history of the TMDL program, is key to the process.

In referring to the Clean Water Act, it was initially clear a pollutant was necessary to initiate listing of an impaired waterbody under Section 319. However in EPA guidance specific to the 1998 listing (where Hinkson Creek was ultimately added) http://www.epa.gov/owow/tmdl/lisgid.html [emphasis MU's]:

> **Waterbodies Impaired by an Unknown Source or an Unidentified Pollutant**
>
> 40 CFR section 130.7(b)(1) provides that waterbodies included on State section 303(d) lists are those waterbodies for which pollution controls required by local, State, or Federal authority, including technology-based or more stringent point source effluent limitations or nonpoint source best management practices, are not stringent enough to implement any water quality standard applicable to such waters. In addition, 40 CFR section 130.7(b)(4) requires States to identify, in each section 303(d) list submitted to EPA, the "pollutants causing or expected to cause violations of the applicable water quality standards."
>
> These regulatory provisions apply even if the source of the pollutant cannot be identified at the time of listing. Therefore, for the 1998 listing cycle, waterbodies impaired by an unknown source should be included on 1998 State section 303(d) lists, as long as there is a pollutant associated with the impairment. Listing may be based on pollutant loadings from unknown point and nonpoint sources, and includes situations where a pollutant is found in fish tissue such that there is an exceedance of applicable water quality standards, but the pollutant is not traceable to a particular source.
>
> In addition, 40 CFR section 130.7(b)(4) requires States to include on their lists an identification of the *specific* pollutant(s) causing or expected to cause exceedances of applicable water quality standards. In some situations, however, **a *specific* pollutant has not been identified at the time of listing.** Therefore, for the 1998 listing cycle, where a water is impaired but a specific pollutant has not been identified, **States should, if possible, indicate** on the 1998 State section 303(d) lists **the class of pollutants** (e.g., metals or nutrients) **causing, or believed to be causing, the impairment.** Moreover, for the 1998 listing cycle, States should indicate whether the water is impaired for one or more pollutants.

While EPA did allow the listing of a creek without a specific identified pollutant, it does not change the requirement of identifying a pollutant for the TMDL process. At the April 20, 2010 meeting, John Hoke attempted to address this lack of identifying a pollutant of concern by stating, "We found lots of pollutants so we can say we found a pollutant." The identification of intermittent pollutants, many of which were attributable to direct sources which were subsequently eliminated, without the establishment between a specific pollutant of concern and the observed impairment, fails the criteria of identifying a pollutant. In fact, Section 2.6 of the draft TMDL contradicts Hoke's statement by stating, the conclusion of the study is that "no particular pollutant, or suite of pollutants, appears to be the main cause of the impairment observed in Hinkson Creek."

Concern 2: The failure of the Department to link the observed fluctuations of the aquatic invertebrate community to urbanization of the watershed.

In the introduction to this draft TMDL (Section 1) DNR states, "Because the pollutants of concern impairing Hinkson Creek are unknown, this TMDL calculates a reduction in storm water runoff as a surrogate for any pollutants of concern. This approach has been used and approved by EPA in other states and is supported in federal rule at 40 CFR 130.2(i) for TMDL development as an 'other appropriate measure'." DNR has verbally referred to the Vermont Potash Brook TMDL as an example of when a surrogate has been used: "Flexibility in federal rules, where you can't identify a pollutant, you can use a surrogate. This is what they did out east [Potash Brook]." (John Hoke, April 20, 2010, Boone County Commission Chambers.) The Department, however, is incorrect in comparing this TMDL to the Vermont one in that Vermont has, as required, identified a pollutant of concern – sediment. A supplementary document to that TMDL (Expanded Technical Analysis: Utilizing Hydrological Targets as Surrogates for TMDL Development in Vermont's Stormwater Impaired Streams) draws a direct link between the pollutant and the appropriate use of a surrogate. The Department does not draw such a link; instead the methodology of the Vermont TMDL is used virtually step-by-step without clearly showing that link. Additional, it appears from the MSCI data that the creek was already improving from 2001 to 2006 further undermining the department's conclusions.

See Attachment A (Geosyntec report) comments 3.B.2, 3.C.1, and 3.C.4 s for additional support for this concern.

Concern 3: The methodology used to reach the conclusions contains many unsupportable assumptions and compares and simplifies data that is fundamentally different – particularly troubling considering the magnitude of the solution presented.

The Vermont Expanded Technical Analysis also references the "Report of the Federal Advisory Committee on the Total Maximum Daily Load (TMDL) Program" (FACA Report, July 1998), which says, "...the state should try to identify another (surrogate) environmental indicator that can be used to develop a quantified TMDL using numerical analytical techniques where they are available, and best professional judgment (BPJ) where they are not...The use of BPJ does not imply the lack of rigor; it should make use of the 'best' scientific information available, and should be conducted by 'professionals.' When BPJ is used, care should be taken to document all assumptions, and BPJ-based decisions should be clearly explained to the public at the earliest possible stage." The department has not clearly identified all assumptions made, as evidenced by the many questions at the most recent public meeting, nor have these BPJ-based decisions been explained at the earliest possible stage. A specific example of a statement by the Department that illustrates the failure to meet these criteria came in response to how the Department can say Hinkson Creek was in attainment in 1967, "It is assumed there was attainment." (John Hoke, April 20, 2010, Boone County Commission Chambers.) The magnitude of the final result (50.5%) also doesn't support the Department's answer to the question, "Do any urban streams in Missouri consistently achieve a fully supporting aquatic invertebrate community?" The response, "We haven't looked at very many places but they may not be supporting either. Hinkson Creek is right on the edge so it just needs this little extra bit." (John Hoke, April 20, 2010, Boone County Commission Chambers.) A 50% reduction will do more than change the hydrology of the creek "a little bit." In response to "Is it reasonable to expect that urban streams can consistently achieve a fully supporting aquatic invertebrate community?" those in attendance were told, "I'm an optimist. I

think so." (John Hoke, April 20, 2010, Boone County Commission Chambers.) Basing a TMDL approach on what one thinks will happen versus defensible scientific data illustrates the disconnect between the Department's theoretical approach, and the real world knowledge of those working in Boone County toward healthy creeks and streams.

See Attachment A (Geosyntec report) comments 3.A.1, 3.A.2, 3.A.3, 3.A.5, 3.A.6, 3.A.7, 3.B.1, 3.B.2, 3.B.3, 3.B.4, 3.C.1, 3.C.6, 3.C.8, 3.C.10, and 3.D.2 for additional support for this concern.

Concern 4: The failure of the Department to consider the potential permit implications of the draft Waste Load Allocation (WLA) in spite of repeated communication of this concern by the affected permit holders.

MU has clearly communicated at every opportunity that the Joint City/County/University NPDES MS4 Permit (http://dnr.mo.gov/env/wpp/permits/issued/R040000.pdf), referenced by the TMDL, contains language that only the WLA will be considered for imposing implementation of the TMDL. Yet even at the last meeting, the audience was told, "While that number [50.5%] looks like a big number, it doesn't have to be done all at once." (John Hoke, April 20, 2010, Boone County Commission Chambers.) The NPDES General Small MS4 permit says otherwise (in particular section 3.1.3) :

3.	**Special Conditions**
3.1	Discharges to Water Quality Impaired Waters
3.1.1	If discharges from the MS4 are upstream from a 303(d) listed (impaired) waterbody, the permittee shall, in consultation with the department:
3.1.1.1	Determine whether storm water discharges from any part of the MS4 significantly contribute pollutants directly or indirectly to a 303(d) listed (i.e., impaired) waterbody. If the permittee has discharges meeting this criteria, the permittee shall comply with Section 3.1.2. If the permittee does not, Section 3.1 does not apply to the permittee.
3.1.1.2	Determine whether a Total Maximum Daily Load (TMDL) has been developed and approved by EPA for the listed waterbody. If there is such a TMDL, the permittee shall comply with both Sections 3.1.2 and 3.1.3. If no TMDL has been finalized, Section 3.1.3 will apply when the TMDL is finalized and approved by EPA.
3.1.2	*Water Quality Controls for Discharges to Impaired Waterbodies.* The permittee's SWMP document required under Section 4 shall include a description of how the permittee's program will control the discharge of measurable pollutants of concern and ensure the permittee's discharges will not cause or contribute to instream exceedances of the water quality standards. This discussion shall specifically identify measures and BMPs that will collectively control the discharge of the pollutants of concern.
3.1.3	*Consistency with TMDL Allocations.* If a TMDL has been finalized and approved by EPA for any waterbody into which the permittee discharges, the permittee, shall:
3.1.3.1	Determine whether the approved TMDL is for a pollutant likely to be found in storm water discharges from the permittee's MS4;
3.1.3.2	Determine whether the TMDL includes a pollutant wasteload allocation (WLA) or other performance requirements specifically for storm water discharge from the permittee's MS4;
3.1.3.3	Determine whether the TMDL addresses a flow regime likely to occur during periods of storm water discharge;
3.1.3.4	After the determinations above have been made and if it is found that the permittee's MS4 shall implement specific WLA provisions of the TMDL, assess whether the WLAs are being met through implementation of existing storm water control measures or if additional control measures are necessary;

3.1.3.5 Document all control measures currently being implemented or planned to be implemented. The permittee shall also include a schedule of implementation for all planned controls and shall document the calculations or other evidence that shows that the WLA will be met;

3.1.3.6 Describe a monitoring program to determine whether the storm water controls are adequate to meet the WLA; and

3.1.3.7 If the evaluation shows that additional or modified controls are necessary, describe the measures to be taken and the schedule for their implementation. The permittee shall continue meeting the requirements of 3.1.3.4 through 3.1.3.7 for this permit duration until the department determines WLAs are being met or that water quality standards are being met.

In spite of the Department's attempt to reduce the impact of the WLA through language in the implementation section, EPA does not approve that optional section, nor does it have legal standing. Instead, the permit section must compare the NPDES permittee's program solely with the WLA, in this case 50.5% reduction in flow (or volume, depending on written clarification of the Department's intent).

Concern 5: The lack of clarity in the document as to the Department's expectations of the affected parties, including the inappropriate use of flow and volume interchangeably, and the disconnect between the reported impairment and the point where the TMDL process ends.

Throughout the document the Department interchanges the terms "volume" and "flow", most notably in Section 6 (WLA) and 7 (Load Allocation). Table 15 (referred to as Table 13 in the text) states the percentages noted are for "flow reduction" while in the corresponding text "target runoff volume". Table and figure numbering frequently does not match in-text references: Table 3 referenced in 3.1.1 appears to refer to Table 4; Figure 2 referenced in 3.1.1 appears to refer to Figure 3; Table 2 referenced in 4.5 appears to refer to Table 3; Table 13 referenced in 6 and 7 appears to refer to Table 15; and Table 11 referenced in 3.1.1 appears to refer to Table 12. The data first used to verify some impairment of Hinkson Creek, aquatic invertebrate community testing, is only mentioned as a secondary goal of the TMDL; reduction of the recorded flow from the single USGS gage is sited as the primary target. But in spite of the Department's attempts to use a surrogate of flow in this TMDL, restoring the aquatic invertebrate community should be the primary target. Furthermore the document should be specific as to what percentage of sampling sites for what period of time will be considered supporting. It appears the TMDL is targeting 100% attainment, while the reference streams do not achieve that goal.

See Attachment A (Geosyntec report) comments 3.A.1, 3.A.2, 3.A.3, 3.A.5, 3.A.6, 3.A.7, 3.B.1, 3.B.2, 3.B.3, 3.B.4, 3.C.1, 3.C.6, 3.C.8, 3.C.10, and 3.D.2 for additional support for this concern.

Concern 6: The failure of the Department to craft the TMDL as a phased approach as clearly applicable in these specific circumstances based on EPA documents provided to the Department by MU.

In email correspondence on October 21, 2009, following the first public meeting on the initial TMDL, research at MU discovered the EPA document "Clarification Regarding 'Phases' Total Maximum Daily Loads" (http://www.epa.gov/owow/tmdl/tmdl_clarification_letter.html). The essence of the document is that EPA supports phased approaches to the TMDL when: (1) significant data uncertainty is present; or (2) when using a surrogate to interpret a narrative standard; or (3) when uncertainty about the

effectiveness of implementation activities exists. These cases clearly represent the situation with the Hinkson Creek. The heart of this document reads (emphasis MU):

> ***Phased TMDLs***
>
> We recommend the use of the term "phased TMDLs" be limited to **TMDLs that for scheduling reasons need to be established despite significant data uncertainty** and where the State expects that the loading capacity and allocation scheme will be revised in the near future as additional information is collected. In other words, phased TMDLs would be reserved for the second scenario described in the 1991 Guidance. [Second scenario = Guidance recommends the phased approach for situations where available data only allow for "estimates" of necessary load reductions or for "non-traditional problems" where predictive tools may not be adequate to characterize the problem with a sufficient level of certainty.]
>
> The phased TMDL approach would be used in situations where limited existing data are used to develop a TMDL and the State believes that the use of additional data or data based on better analytical techniques would likely increase the accuracy of the TMDL load calculation and merit development of a second phase TMDL. **Such significant uncertainty may arise, for example, because the State is using a surrogate to interpret a narrative standard,** or because there is little information regarding the loading capacity of a complex system such as an estuary and it is difficult to predict how the a water body will react to the planned load reductions. An example of a phased TMDL could be a TMDL for phosphorus in a lake watershed where there are uncertain loadings from the major land uses and/or limited knowledge of in-lake processes. In such a case, the loading capacity of the water body may be difficult to establish and the State may decide to include a schedule for establishing a revised TMDL based on follow-up monitoring. Phased TMDLs may also occur when a revision of the applicable standard is underway and will necessitate development of a second phase, revised TMDL to comply with the new standard.
>
> All phased TMDLs must include all elements of a regular TMDL, including load allocations, wasteload allocations and a margin of safety. As with any TMDL, each phase must be established to attain and maintain the applicable water quality standard. In addition, EPA recommends that a phased TMDL document or its implementation plan include a monitoring plan and a scheduled timeframe for revision of the TMDL. (These elements would not be an intrinsic part of the TMDL and would not be approved by EPA, but may support a rationale for approving the TMDL. See also "Nonpoint Source Program and Grants Guidelines for states and Territories, Federal Register Vol. 68, pp 60653-74.)
>
> Since phased TMDLs will in all likelihood need to be revised and therefore require more overall effort, **States should carefully consider the necessity of such TMDLs, for example to meet consent decree deadlines or other mandatory schedules.** Upon revision of the loading capacity, wasteload, or load allocations, the TMDL would require re-approval by EPA.
>
> ***TMDLs with Adaptive Implementation and Trading Provisions***
>
> Adaptive implementation is an iterative implementation process that makes progress toward achieving water quality goals while using any new data and information to reduce uncertainty and adjust implementation activities. The National Research Council report suggests that adaptive implementation include "immediate actions, an array of possible long-term actions, success monitoring, and experimentation for model refinement". By using the adaptive implementation approach, one can utilize the new information available from monitoring following initial TMDL implementation efforts to appropriately target the next suite of implementation activities.

> Phased TMDLs are an example of the adaptive implementation approach because each new phase utilizes new information to reevaluate the original TMDL. However, even for TMDLs where there is little uncertainty regarding the loading capacity of the water body and the necessary load reductions, an adaptive implementation approach can be a useful tool. Implementation of TMDLs can take many years and **when uncertainty about the effectiveness of implementation activities exists, TMDLs would benefit from containing elements that would facilitate adaptive implementation such as, for example, provisions for a flexible load allocation/waste load allocation scheme.** EPA is currently working to clarify how TMDLs can be written to provide for adjustments in the load and wasteload allocations in approved TMDLs.
>
> EPA understands that not all TMDLs can be implemented using adaptive implementation methods due to the more intensive monitoring and added administrative steps associated with this iterative approach. Nonetheless, EPA believes that in appropriate cases it should be feasible for States to develop TMDLs that facilitate implementation of practicable controls while additional data collection and analysis are conducted to guide implementation actions. **Follow-up monitoring is integral to the adaptive implementation approach.** Monitoring addresses uncertainty in the efficacy of implementation actions and can provide assurance that implementation measures are succeeding in attaining water quality standards, as well as inform the ongoing TMDL implementation strategy. If adaptive implementation activities reveal that a TMDL loading capacity needs to be changed, the revision would require EPA approval. In most cases adaptive implementation is not anticipated to lead to the re-opening of a TMDL. Instead, it is a tool used to improve implementation strategies.

It is unclear to MU why this applicable EPA recommended approach was dismissed while considerable effort was made to fit the existing limited data to another approach, namely the use of reference streams. MU continues to believe this phased approach is the most workable solution, which would allow the city, county and university to continue improvements to the health of Hinkson Creek, while addressing the Department's now-imminent deadline of compliance with the EPA's consent decree. This approach does not require leaps of faith, broad guesses or assumptions, nor the need to fit inadequate data the Department presently has into another ill-fitting model.

See Attachment A (Geosyntec report) comments 3.A.3, and 3.C.6 for additional support for this concern.

Concern 7: The failure of the department to coordinate companion programs working toward the same goal in the Water Pollution Control Branch instead of allowing each program to craft isolated solutions to the same problem.

While Hinkson Creek was first listed on the 303(d) list in 1998, no draft compliance document for the TMDL was available until September 2009. In the meantime, the NPDES Phase II Small MS4 regulations came into effect, prompting Boone County/City of Columbia/University of Missouri to obtain a joint permit in 2003. While that permit is not limited to the Hinkson Creek watershed, the intent of the Phase II program is to elicit change in nonpoint source pollution with the ultimate goal of creating cleaner waters of the state. The regulation requires the use of education, public participation, illicit discharge elimination and better practices during and after construction to achieve the performance based goals. Change in human behavior does not happen overnight, but considering the changes in regulations, stream buffers, storm water utilities, stream cleanups, etc. it is clear that the program, now in its seventh year is making a difference. Yet the TMDL program, while referencing the MS4 permit, does not attempt to account for the improvements that would have occurred, most likely after 2006 due to the establishment of these Phase II programs. Further, the TMDL continues to reference specific problems found during the Stream Survey Sampling Report, Phase I (Section 2.5.2.). The joint MS4 was notified in

writing by the Department it was the duty of those permittees to address the items with specific sources (i.e., pesticides from a shopping center parking lot and salts from a road salt storage and handling facility) under the NPDES permit. Six years later, another Water Pollution Control Branch (WPCB) program (the TMDL program) cites these same problems already tasked for correction by DNR under a fellow WPCB program (the Small MS4 program) as examples to justify this document. It is clear communication, even between programs within the same branch, are failing to coordinate efforts. Instead affected permittees receive multiple directions from the Department to address the same program, often with wildly different approaches and costs. At a minimum, since the Small MS4 program has been in place for seven years, the Department should verify that the cited aquatic invertebrate community problem has not already been addressed by this companion DNR program.

See Attachment A (Geosyntec report) comments 3.C.1, and 3.C.4 for additional support for this concern.

Concern 8: The failure of the Department to have estimated the cost for implementation of the TMDL as written.

As was communicated to the Department following the first draft, a reduction in storm water flow or volume of this magnitude would be extremely expensive. As noted in communication from Boone County: "Cost estimates range up to $500,000,000 dollars to implement the TMDL in Hinkson Creek. The Potash Brook TMDL is in a similar situation, although Hinkson Creek watershed is 13 times larger. In January 2010, the [Vermont Department of Environmental Conservation] found the cost to implement that TMDL would be $25 million for the seven square mile watershed. Therefore, they have chosen not to implement until funding is available."

See Attachment A (Geosyntec report) comment 3.D.2 for additional support for this concern.

Concern 9: The stated driving force of the Department being the lawsuit against EPA that consequently compelled the Department to craft a document by December 31, 2009 instead of being drive to find a sound, workable solution for the People of Missouri.

MU is significantly troubled by the Department's apparent greater concern for their relationship with EPA rather than their relationship with the citizens of Missouri. Only releasing the first public version of this TMDL slightly more than three months before the court ordered deadline has done the citizens of Boone County a great disservice. It is not the fault of the permittees and citizens that they were given no seat at the table during DNR's development of the first document, yet the passing of the initial deadline for EPA's needs of December 31, 2009 is the mantra the Department continues to repeat as a response to any criticism, effectively using that deadline as an excuse to not address the comments and concerns of the people of Boone County.

Concluding Remarks

The report prepared by Geosyntec for the city/county/university (Appendix A) has been referenced several times throughout this document, including references to specific comments within that document. However MU wishes to stress our support for the entire document, not just the portions referenced above. One final reference to that attachment is from section 2, the summary of findings:

In general, our review finds that runoff reduction targets cited in the TMDL are not well supported and are ambitious, given the uncertainty of key technical linkages. Uncertainties identified in our review include but are not limited to:

- Stressor-Effect Relationship. The draft TMDL does not establish causality between runoff and beneficial use attainment in either Hinkson Creek or 'attainment' streams. Information presented in the TMDL does not provide any assurance that benthic macroinvertebrate metrics will respond to changes in stormwater runoff.

- Runoff and Baseflow Time Trends. Information contained in the TMDL does not demonstrate that runoff volume has increased or that baseflow has decreased in the Hinkson Creek watershed over time.

- Comparability of Attainment Streams. It is not clear what methodology grounded in peer-reviewed literature, or agency guidance, supports the process used to select 'attainment' streams set forth in the TMDL.

- Current and Historical Impervious Landuse. Landuse data and analysis cited in the TMDL are inconclusive. While impervious area has likely increased in the Hinkson catchment to some degree, GIS coverages used in the TMDL are not well suited for demonstrating urban landuse changes at the scale of interest.

The proposed TMDL tries to impose an out-of-proportion solution as a remedy for a creek that is fully supporting part of the time and marginally supporting almost all of the remaining time. This has the potential to cost the community hundreds of millions of dollars for a solution that may or may not address the situation. It is the opinion of MU this document is so seriously flawed the only option is for the Department to step back, notify EPA a completely different approach using the aforementioned phased approach will be drafted and submitted to EPA as soon as possible. EPA has until December 31, 2010 to approve a final document. By creating a working group of members of DNR, EPA, impacted permittees, developers and concerned citizens, all working toward a rapid but reasonable approach, will allow the TMDL to gain the acceptance it needs so that Boone County can put efforts toward a solution instead of wasting efforts having to explain the unworkable nature of this document to the Department.

Sincerely,

Todd Houts

Todd Houts
Assistant Director, Environmental Health & Safety, University of Missouri

cc: Peter Ashbrook, University of Missouri
Georganne Bowman, Boone County
Bill Florea, Boone County
John Glascock, City of Columbia
Steven Hunt, City of Columbia
Karen Miller, Boone County

Attachment: Geosyntec Report

APPENDIX F

Geosyntec consultants

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Final Memorandum

Date:	21 April 2010
To:	Georganne Bowman, Boone County Public Works
	Tom Wellman, Public Works Department, City of Columbia, MO
	Todd Houts, University of Missouri
Copies to:	Eric Strecker, P.E., Geosyntec Portland, OR
From:	Trent Stober, P.E., Geosyntec Columbia, MO
Subject:	Technical Evaluation of Draft Hinkson Creek Total Maximum Daily Load (TMDL)

1. BACKGROUND

Hinkson Creek is a perennial Ozark-border stream draining a 90 mi^2 catchment in Boone County, Missouri. In 2004, Hinkson Creek was placed on Missouri's list of impaired waters ('303(d) list') as some monitored reaches did not fully attain applicable biocriteria metrics at frequencies specified by regulatory guidance. The pollutant initially listed as causing the aquatic life impairment was 'unknown'. Bioassessment and ecotoxicology evaluations performed by the Missouri Department of Natural Resources (MDNR) through 2006 did not conclusively identify a causative agent. A draft Total Maximum Daily Load (TMDL) document for Hinkson Creek included for Public Notice on March 8th, 2010 targets reductions in stormwater runoff as a surrogate for a cumulative, but unidentified mixture, of pollutants that may occur in urban and agricultural environments.

A Municipal Separate Storm Sewer System (MS4) permit is jointly held by the City of Columbia, MO, Boone County, and the University of Missouri. At the request of MS4 co-permittees ('permittees'), Geosyntec conducted a third-party technical review of the methods and approaches used in developing the TMDL. This memorandum conveys conclusions and specific comments identified during our review. Where possible, we have suggested approaches that may improve the usefulness or defensibility of TMDL elements. Section 2 summarizes the major findings of our review. Specific technical comments related to hydrologic, landuse, and biologic data interpretations are included in Section 3.

2. SUMMARY OF FINDINGS

Aquatic communities inhabiting streams and rivers flowing through urban areas are exposed to a variety of stressors that are either not present in undeveloped landscapes, or occur less frequently. Measures of aquatic community health and biologic integrity have been negatively correlated with impervious area metrics (Miltner et al. 2003, Schuler 1994, Klein 1979). However, as Adams (2003) points out, statistically significant correlation does not establish causation.

In order to meet mandated TMDL development timelines, MDNR and the U.S. Environmental Protection Agency (USEPA) are required to move forward with establishing a TMDL for Hinkson Creek. The draft TMDL currently on Public Notice prescribes a significant catchment-wide reduction in runoff as a surrogate for a stressor-effect relationship that MDNR has been unable to establish or quantify. In general, our review finds that runoff reduction targets cited in the TMDL are not well supported and are ambitious, given the uncertainty of key technical linkages. Uncertainties identified in our review include but are not limited to:

- Stressor-Effect Relationship. The draft TMDL does not establish causality between runoff and beneficial use attainment in either Hinkson Creek or 'attainment' streams. Information presented in the TMDL does not provide any assurance that benthic macroinvertebrate metrics will respond to changes in stormwater runoff.

- Runoff and Baseflow Time Trends. Information contained in the TMDL does not demonstrate that runoff volume has increased or that baseflow has decreased in the Hinkson Creek watershed over time.

- Comparability of Attainment Streams. It is not clear what methodology grounded in peer-reviewed literature, or agency guidance, supports the process used to select 'attainment' streams set forth in the TMDL.

- Current and Historical Impervious Landuse. Landuse data and analysis cited in the TMDL are inconclusive. While impervious area has likely increased in the Hinkson catchment to some degree, GIS coverages used in the TMDL are not well suited for demonstrating urban landuse changes at the scale of interest.

Given the documented increases in population and residential development in the Columbia area, there is little doubt that runoff into Hinkson Creek has increased compared to the 1960s. However, information presented in the draft TMDL does not demonstrate or quantify temporal changes in Hinkson Creek hydrographs. Little tangible evidence is offered in the TMDL that supports changes in runoff volume are responsible in whole, or in part, for periodic depressions in benthic macroinvertebrate scores.

We believe that additional stressor-response data and a more refined hydrologic analysis approach are necessary to assure that compliance with TMDL targets will yield consistent attainment of Hinkson Creek aquatic life uses. In addition, we suggest that attainment of biocriteria at frequencies prescribed by Missouri's 303(d) listing methodology and biocriteria documents serve as the primary TMDL target as (1) bioassessment scores served as the rationale for listing Hinkson Creek as impaired and (2) site-specific causal relationships between runoff and ecological health have not been established in the TMDL.

3. SPECIFIC COMMENTS

3.A. HYDROLOGIC ANALYSIS AND INTERPRETATION

Comment 3.A.1. Periods of record for comparative analyses appear to be inconsistent.

Comparison of landuses from 1993 and 2005 are presented to support the claim of increased imperviousness. However, the flow-duration curves presented in Section 5.1 are compared for 1967 and 2007. Because the time periods of comparative analysis differ, potential changes to *the flow-duration curve are not clearly the result of unquantified changes in urbanization.* Is it possible that changes in farming practices or climatic patterns have influenced hydrograph and flow-duration characteristics?

We also request explanation of the following period-of-record related comments and observations:

- In Table 8, precipitation and flow statistics for 1967 and 2007 are compared for the April 1 – July 31 period. Why are only 4 out of 12 months of available data being used to describe precipitation and runoff? Should MDNR believe that conclusions drawn from fall biological surveys are relevant in assessing use attainment in Hinkson Creek, it would seem appropriate that flow data collected in the late summer/ fall season also be incorporated into hydrologic analyses and comparisons. How do we know that antecedent precipitation regimes did not influence the results a 4-month comparison? Furthermore, as precipitation and streamflow data generally do not follow a normal statistical distribution, we question the use of the arithmetic means to describe central tendencies. If the period of record is expanded to all available and comparable months for 1967 and 2007 (March 11 – December 31, n=296), we note that the median, geometric mean, and cumulative Period of Record (POR) streamflow values for 1967 (median=5.75 cfs) are greater than values for 2007 (median= 3.05 cfs). Side-by-side boxplots of the two data sets (Exhibit 1) indicate both years have very skewed daily average flows, *which suggests that the arithmetic mean is a biased estimator* and the median is a more appropriate metric of the central tendency of data. More importantly, the medians are not statistically different from each other based on the non-parametric Mann-Whitney test (p=0.95).

The lack of statistical difference between the median daily average flow for 1967 and 2007 indicates that *the data do not support the claim that the flow regime in the creek has been significantly changed.* It is not clear why a truncated period of record was selected.

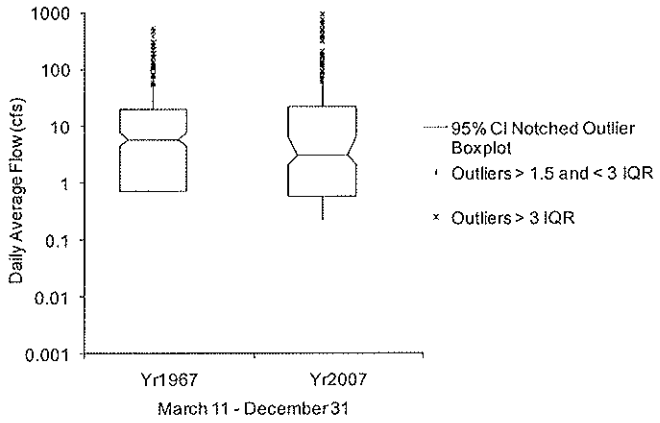

Exhibit 1. Side-by-side boxplots of daily average flows for 1967 and 2007 (USGS 06910230 Hinkson Creek in Columbia, MO)

- In reference to Figure 4 and based on the arguments presented above, the full available and comparable period of record (April 1 – December 31) should be presented to capture seasonal patterns in rainfall and runoff. In addition, we note that higher baseflows in 1967 (referenced in relation to Figure 4, Page 21) could be attributed to wastewater treatment facilities (WWTFs) that historically discharged to Hinkson Creek. Approximately fifty-three (53) WWTFs that discharged historically within the Hinkson Creek basin have been eliminated. *It is not clear that presumed reductions in baseflow can be wholly attributed to unquantified infiltration reductions in the catchment.*

  We also point out that Figure 8 suggests that Hinkson Creek has a relatively high normalized base or low-flow compared to reference streams. We suggest that MDNR conduct a baseflow separation and trend analysis on the entire period of record at the Hinkson gage to determine if baseflows from discharging groundwater have significantly decreased over time and whether any changes are due to other causes.

- Flow duration curves inherently require long-term continuous flow records to adequately capture the large variation in rainfall and runoff characteristics. *The selection of only four months (April 1 – July 31) for only two individual years (1967 and 2007, Figure 4) is not adequate for identifying differences in precipitation-runoff responses.* Presumed differences in the flow-duration curves could be attributed to differences in precipitation characteristics alone. A comparison of the intensity-duration curves should supplement the flow-duration curve analysis to ensure differences in precipitation characteristics are not the cause of the presumed differences in the flow-duration relationship. Also, the trend analysis uses precipitation data from two different rainfall gages without evaluating whether the observed trends are simply due to differences in rainfall characteristics at the two gages. The Columbia Regional Airport weather station (COOP ID 231791) includes hourly data from 1970 through 2010. *A single gage should be used or the differences between the gages should be quantified and accounted for in the analysis.*

Comment 3.A.2. Runoff volume trend analysis appears to be incomplete and may be inconclusive.

Long-term flow data from the USGS gauge in Hinkson Creek was used with rainfall records from two separate weather stations to develop a multivariate regression stormwater runoff model for the watershed. In addition to rainfall, the other independent variables included the year and month. There are several technical shortcomings present in this analysis. These concerns are discussed below.

- Figure 5 is a linear regression of rainfall versus storm event runoff volume, but there is no discussion of how rainfall events were defined (e.g., 24-hour totals, 6-hour hour minimum inter-event times etc.) or how storm event runoff volumes were computed (i.e., baseflow separation methods). Methods, models, or algorithms used to calculate runoff and baseflow volumes (Appendix C) from USGS streamflow records are not documented or described in the TMDL. A fundamental premise of the TMDL is that runoff volume has increased over time, yet there is no means of being able to determine how runoff volume was calculated or derived in the TMDL. MDNR should provide additional documentation that describes the methods and assumptions used in developing runoff and baseflow volumes, listed in TMDL appendices. All runoff calculations should be based on streamflow data averaged over the same time period. Runoff volumes computed from daily average flows are not comparable to volumes derived from hourly average flow values.

- The multivariate regression model shown on Page 22 that relates runoff volume to precipitation, year, and month has a low coefficient of determination (R^2). Pearson's coefficient of determination (R^2) describes the fraction of the variance in the dependent variable that is explained by one or more of the independent variables. An R^2 of 0.37 indicates that only 37% of the variation in runoff volume can be explained by precipitation and time. In other words, the majority (1-0.37=63%) of the runoff volume record is explained by factors and variables other than time and precipitation. While the regression model as a whole may be statistically significant ($p<0.05$), the model is not particularly meaningful with such high unexplained variability. Also, the significance of the individual linear coefficients was not documented. A fundamental component of multivariate regression analyses is to evaluate the relative importance of the independent variables and ensure the residuals are independent and identically distributed. Most importantly, the statistical significance of the stated 3.4% increase in the logarithm of runoff volume must be provided to verify the validity of the model. *We recommend MDNR include p-values for each coefficient included in the model and then only include variables with $p<0.05$.*

  Other factors that may influence changes in streamflow include precipitation type (rain or snow), changes in watershed characteristics, and rainfall intensity. Much of these data are likely available for the Columbia area and it is not clear why these other factors (independent variables) were not included in the multiple regression analysis. As currently presented, the multivariate regression does not add any substantive technical value to the TMDL.

- The t-test (Table 9) describing differences for the two periods, 1974-1991 and 2007-2009, was performed on runoff volumes adjusted for precipitation and season. It is not clear how these adjustments were made. If the multivariate regression model was used to predict the runoff volumes, the t-test is not valid because the differences would be a direct result of the presumed 3.4% increase in the logarithm of the runoff volume. MDNR should clearly describe the method for adjusting the runoff volumes so the analyses can be duplicated and independently verified. Also, the appropriateness of using the t-test on the logarithms of the runoff volumes should be demonstrated. The t-test is only valid on normally-distributed data. Therefore, the distribution of the logarithms of the volumes should be documented. For the purposes of transparency during re-analysis, it is recommended that MDNR use distribution-free methods (non-parametric) for evaluating statistical differences, unless normality is clearly demonstrated.

- It is not clear what rationale supports purposeful selection of unequal sample sizes in the t-test included as Table 9. *The period for 1974-1991 (n=87) has nearly twice the number of samples compared to 2007-2009 (n=45).* Furthermore, why was the period of 1974-1991 selected? We note that Figure 4 and Table 8 use 1967 as a reference for a less-impacted hydrograph.

Comment 3.A.3. Rationale for modeling approach and TMDL attainment stream analyses are unclear.

Four streams within the same ecoregion of Hinkson Creek that are achieving their biological metrics were selected for flow-duration comparisons. Flow-duration curves for these watersheds were adjusted based on watershed size and annual precipitation. However, the rationale for, and the details of, these adjustments are not provided. All of the attainment streams have larger watersheds with different landuse areas compared to Hinkson Creek. Dividing each flow rate by the watershed size and annual precipitation does not adequately account for differences in runoff volumes, flow rates, or rainfall characteristics (e.g. intensity, timing etc.). Many other watershed factors must be considered including imperviousness, soil types, and time-of-concentration. Time-of-concentration can have a significant impact on the flow duration curve and is affected by slope, degree of channelization, stream order, surface roughness, etc. *Because of these many factors, rainfall-runoff relationships are very non-linear and very watershed specific.* As such, the validity of the simple linear adjustment that was made to flow duration curves is highly questionable. Also, the selection of the 1-year return flow for the target flow appears arbitrary and is not supported by monitoring data or analysis that would suggest this return period is biologically or geomorphologically significant. The selection of a slightly different return period, such as 2 times per year or 2/365=0.5% instead of the 0.3% value, the target flow rate reductions would be nearly 50% less (i.e., target reductions would be approximately 25% instead of 50%).

Comment 3.A.4. TMDL requirements are unclear.

Throughout the TMDL, flow is used interchangeably with volume, but these are two distinctly different hydrologic metrics that have very different control strategies. Flow rate reductions may be achieved using detention storage with controlled release to shave peaks, while volume reductions require increased infiltration, evapotranspiration, and/or harvest and use. Because the target reductions are based on a comparison of flow duration curves at the 1-year return period, one may surmise that flow rate reductions are required such that the 1-year peak flow in Hinkson Creek must match the target 1-year peak flow of the attainment streams. The applicability of these reductions for any other flow return period is not supportable because the differences between Hinkson Creek and the attainment streams vary with the frequency of occurrence.

If the intent is to require volume reductions, then flow-duration analyses are inappropriate. *Instead, a comparison of average annual runoff volumes or a comparison of design storm runoff volumes should have been conducted.* MDNR should clarify the proposed metric for this TMDL and at what temporal scale it applies. If flow-duration curves are determined to be the parameter of interest, then flow-duration matching should be the TMDL goal vs. volume reduction, with specified parts of the flow-duration curve based upon geomorphic analyses supporting the beneficial use.

Comment 3.A.5. Volume reductions may cause increases of in-stream concentrations.

Without understanding the sources of pollutants and delivery pathways from certain landuses, basin-wide reductions may actually increase in-stream concentrations due to less dilution. Lumping of all urban landuses for the landuse-based TMDL allocations may cause increases in concentrations. Commercial and industrial areas will have fewer opportunities for reducing runoff volumes than residential areas and infiltration may even be prohibited for some types of industries. However, commercial and industrial landuses generally produce higher concentrations for several pollutants. *If residential areas reduce runoff volumes more than commercial and industrial areas, then in-stream concentrations could increase.*

Comment 3.A.6. Reductions in runoff may not proportionally reduce unidentified pollutant loading.

Understanding pollutant generation, transport, and delivery processes are necessary in developing effective control and restoration measures. Application of a catchment-wide surrogate for a pollutant is likely to yield unintended consequences. Reducing runoff volume (transport medium) on a basin-wide basis infers that beneficial uses as measured by macroinvertebrate scores respond in a continuous, linear, and negative manner to pollutant load. However, toxicological responses are frequently concentration-driven, often threshold in nature (not continuous), and may be non-linear (sigmoid).

If periodically lower biological metrics are the result of discrete activities that have been remediated or abated, such as chloride wash-off from road salt storage facilities, how will basin-wide runoff reductions improve ecological health? Furthermore, if impacts were related to chloride or other 'urban' contaminants, how will reducing runoff from agricultural land benefit biological scores?

Many contaminants may be transported by fine sediment in the adsorbed phase. Although not documented, contaminated sediments could be a critical exposure pathway for macroinvertebrate communities in Hinkson Creek. Adsorbed pollutants are subject to sediment transport and delivery phenomena that can operate at timescales much slower than the Hinkson Creek study period (2001 – 2006). It is possible, but uncertain, that biological scores may have been affected by contaminated sediment generated several years ago that is now being released from storage

and delivered to the Hinkson Creek channel. *We note that MDNR survey reports suggest that evaluating the effects of sediment should be considered in subsequent investigations.* Where contaminated sediment may represent a significant exposure pathway, the role of sediment budgeting techniques (Walling and Owens 2003, Walling 1999) may be useful during TMDL re-analysis.

Comment 3.A.7. The runoff reduction approach does not adequately consider groundwater delivery processes or alterations in the water balance.

The runoff reduction approach posed by the TMDL does not adequately consider fate and transport of pollutants that may contaminate groundwater in urban areas. For example, if the unidentified pollutant(s) are discharged from groundwater sources during baseflow conditions then reducing runoff volumes could potentially increase overall in-stream concentrations. In addition, increasing infiltration in areas where soils are contaminated, or where known up-gradient plumes occur, could in fact cause an increase in pollutant(s) reaching Hinkson Creek.

Targeting runoff volumes calculated from the 1960s is an incomplete approach and does not consider the water balance as a whole. To achieve streamflow characteristics from the 1960's, we may actually have to infiltrate volumes of water that exceed historic rates due to potential reductions in evapotranspiration (Grimmond and Oke 1999). *The TMDL should consider propagated effects on the urban water balance if a runoff-reduction approach continues to be pursued.*

3.B. LANDUSE ANALYSIS AND INTERPRETATION

Comment 3.B.1. Landuse categories in the draft TMDL do not reflect underlying MORAP datasets.

Based on our analysis of the 1993 and 2005 Missouri Resource Assessment Program (MORAP) datasets, we note that there is no strictly "urban" landuse category as presented in the draft TMDL (Exhibit 2). Additionally, the landuse categories differ between the 1993 and 2005 MORAP data and are therefore not directly comparable.

Exhibit 2. Hinkson Creek landuse based on 1993 and 2005 MORAP landuse/land cover data

1993 Land Use Categories	Acres	2005 Land Use Categories	Acres
Urban Impervious	3,819	Impervious	2,758
Urban Vegetated	747	High Intensity Urban	1,288
Barren or Sparsely Vegetated	0	Low Intensity Urban	7,843
Row and Close-Grown Crop	7,462	Barren or Sparsely Vegetated	79
Cool-season Grassland	27,892	Cropland	6,641
Warm-season Grassland	11	Grassland	21,950
Glade Complex	0	Deciduous Forest	14,259
Eastern Redcedar and Redcedar -Deciduous Forest and Woodland	4,348	Evergreen Forest	366
Deciduous Woodland	874	Mixed Forest	0
Deciduous Forest	11,817	Deciduous Woody/Herbaceous	195
Shortleaf Pine-Oak Forest and Woodland	0	Evergreen Woody/Herbaceous	0
Shortleaf Pine Forest and Woodland	0	Mixed Woody/Herbaceous	0
Bottomland Hardwood Forest	59	Woody-Dominated Wetland	634
Swamp	0	Herbaceous-Dominated Wetland	49
March and Wet Herbaceous Vegetation	21	Open Water	1,389
Open Water	401		
Total	**57,451**		**57,451**

Note: Acreage values are based on the Hinkson Creek watershed boundary GIS shapefile provided by MDNR. Acreage values provided above may differ slightly than those found in Tables 1 and 2 in the draft TMDL. It appears that MDNR may have used different versions of the Hinkson Creek watershed boundary GIS shapefile to calculate acreage values in the draft TMDL.

Despite dataset differences, MDNR appears to have grouped the following landuse categories into a single "urban" category:

- 1993 MORAP landuse categories grouped as "urban" by MDNR:
  - Urban impervious
  - Urban vegetated
- 2005 MORAP landuse categories grouped as "urban" by MDNR:
  - Impervious
  - High intensity urban
  - Low intensity urban

By grouping 1993 and 2005 data in this manner, the draft TMDL infers that all urban landuses contribute equally to stormwater runoff. However, not all urban uses are equal and their impacts to stormwater runoff differ substantially. We also note that increases to "urban" area referenced in the TMDL are due to the definition of "low intensity urban" landuses. The 2005 MORAP metadata defines "low intensity urban" as "vegetated urban environments with a low density of buildings". It is highly unlikely that "low intensity urban" landuses contribute to stormwater runoff with the same magnitude as "impervious" landuses.

Comment 3.B.2. The assertion that percent "urban" land cover increased approximately 160% from 1993 to 2005 is not supported by the underlying MORAP datasets.

The 2005 landuse category "low intensity urban" has no "urban" landuse counterpart in the 1993 dataset. We note that comparison of the 2005 MORAP dataset with aerial imagery indicates that "low intensity urban" is primarily residential land. Based on our aerial imagery analysis, we also note that residential land is generally *excluded* from any "urban" landuse category in the 1993 MORAP dataset. As further evidence, we performed a GIS spatial analysis of the MORAP datasets and found that the 2005 "low intensity urban" landuse was identified by any one of 10 different categories in 1993 (Exhibit 3). Of the 7,843 acres categorized as "low intensity urban" in 2005, non-"urban" landuses, as identified by the 1993 dataset, accounted for 6,450 acres (i.e., 82.2%). However, this does not indicate an actual increase in "urban" landuse as suggested in the draft TMDL. *Neighborhoods established well before 1993 are generally categorized as "cool-season grassland" or "deciduous forest" in the 1993 dataset.* Again, as noted above, few if any residential neighborhoods are identified under any "urban" category in the 1993 dataset. Therefore, it may not be appropriate to draw any conclusions regarding urban area increases attributed to the 2005 "low intensity urban" landuse category.

Exhibit 3. Distribution of 2005 "Low Intensity Urban" acreage within landuse categories established in 1993 for the Hinkson Creek watershed.

1993 MORAP Land Use Category	2005 "Low Intensity Urban" Acres
Urban Impervious	1,279
Urban Vegetated	114
Row and Close-Grown Crop	178
Cool-season Grassland	3,949
Warm-season Grassland	2
Eastern Redcedar and Redcedar -Deciduous Forest and Woodland	635
Deciduous Woodland	44
Deciduous Forest	1,627
March and Wet Herbaceous Vegetation	0
Open Water	15
Total	7,843

Note: Acres do not represent the total number of acres within the Hinkson Creek watershed, but rather the number of acres within the 2005 "low intensity urban" landuse category. This analysis was performed using the intersect tool in ArcGIS

A more appropriate comparison between the 1993 and 2005 MORAP datasets might be between the following categories:

- "Urban impervious" (1993 dataset) and "impervious" (2005 dataset), and
- "Urban vegetated" (1993 dataset) and "high intensity urban" (2005 dataset).

However, this would suggest a decrease of approximately 1,061 acres in impervious urban area from 1993 to 2005. Comparing "urban vegetated" to "high intensity urban" suggests a nominal increase of only 541 acres from 1993 to 2005 (Exhibit 2). We also note that our spatial analysis presented in Exhibit 3 suggests that 1,279 acres of "urban impervious" land was converted to "low intensity urban" from 1993 to 2005. Given the cited differences between 1993 and 2005 datasets, it is unlikely that definitive time-trend conclusions regarding urban landuse in Hinkson Creek may be determined from MORAP datasets.

Comment 3.B.3. Landuse data from 1976 was not presented or discussed.

We note that MDNR did not consider 1976 landuse GIS data as part of the TMDL. Landuse data provided by MDNR suggests there were approximately 6,978 urban acres within the Hinkson Creek watershed in 1976, whereas the draft TMDL suggests there were approximately 4,527 urban acres in 1993. There was likely no such decrease in urban landuse, but further underscores the questionable validity of available landuse datasets in establishing meaningful time-trends.

Comment 3.B.4. Inconsistencies between the MORAP datasets suggests inaccuracies and lack of comparability.

We note that Tables 1 and 2 in the draft TMDL suggest that open water acreage within the Hinkson Creek TMDL increased from 422 to 1,439 acres from 1993 to 2005. Closer inspection of the data and associated metadata suggests this does not represent an actual increase in open water acreage, but rather improved techniques for classifying waters between 1993 and 2005. Although the datasets suggest an increase of approximately 240% in open waters, in actuality there was likely no change. *This illustrates that landuse data digitized under different methodologies are not comparable.*

3.C. BIOLOGICAL ANALYSIS AND IMPLEMENTATION

Comment 3.C.1 Historical biological community health is not documented in the TMDL.

Throughout this TMDL document, an assumption has been made that the biological community was attaining the beneficial use prior to increased urbanization and that restoring hydrology to historical levels will restore biological health. There is really not much evidence that this was the case in the 1960-1990 period. The biological health of Hinkson Creek has not been adequately documented for this time period and anecdotal evidence suggests that the water quality and biological health of Hinkson Creek was poor and has improved considerably since the 1960's. MDNR should investigate their own records for water quality and biological data collected during this time period. We note that approximately 53 WWTFs historically discharged within the Hinkson Creek watershed and that agricultural practices may have changed in the past 50 years.

Comment 3.C.2. The return interval targeted by the TMDL does not establish a linkage with the beneficial use.

Although the use of a surrogate measure (stormwater runoff volume) for "pollutants" has merit in specific and targeted situations where multiple stressors exist, we believe that a TMDL must ultimately be linked to the protection of a beneficial use. For example, in the Potash Brook TMDL (VTDEC 2006) performed by the Vermont Department of Environmental Conservation, such a link was established. A stream geomorphic data assessment of Potash Brook performed in 2005 documented "less than stable" in-stream sediment conditions that provide the link to the impaired biotic community. The Potash Brook TMDL has been cited by MDNR as an example of a TMDL that has successfully used stormflow as a surrogate for multiple impairments. *We note that a link between Missouri attainment stream return intervals and biological endpoints has not been established.*

In the TMDL, MDNR appears to have assumed that higher biological scores in the four "flow attainment" streams are due solely to the differences between the upper 0.3% of the flow hydrographs. While the literature (Hughes et al. 1986) and USEPA guidance (Barbour et al. 1996) support the reference approach when evaluating regional stream differences, MDNR has not provided sufficient data to quantify the assumed cause-effect relationship between storm flow and biological health in any of the study streams. No information is presented in the TMDL to suggest that the higher biological scores were directly linked to stormwater runoff or impervious area. At a minimum, a statistically significant ($p<0.05$) correlation relating biological scores and impervious area is needed to justify future studies capable of detecting and quantifying causation.

Although MDNR's series of stream evaluations did include elements of USEPA's Stressor Identification Guidance (Cormier et al. 2003), it appears as if MDNR's approach did not support the structured assessment methods recommended by USEPA and the technical literature. As a result of MDNR's approach, some important data (e.g., biological samples in Hinkson Creek and flow attainment streams) were collected inconsistently or, as MDNR itself admits, not collected at all. For example, on page 11 of the draft document, MDNR states the following:

"Sediment, a pollutant which could explain the low level of impairment, was not studied. Sediment has been established as the primary source of impairment in numerous TMDLs throughout the country."

MDNR should consider re-evaluating stressors in Hinkson Creek and attainment streams according to a structured watershed monitoring plan which adheres to stressor identification guidance and the technical literature. Adams (2003) offers several criteria useful in establishing causation between stressors and observed effects.

Comment 3.C.3. Biomonitoring endpoints should serve as the primary TMDL target.

The TMDL document suggests that a 50.5% reduction in stormwater runoff is required to attain acceptable protection of the biological community (Page 27, Table 12). If a linkage between stormwater runoff and the biological community does exist we question whether a 50.5% reduction or some other value would be required to achieve a fully supporting biological community based on macroinvertebrate data collected since 2001. *This further suggests that achieving a fully supporting biological community should be the primary water quality target rather than a reduction of stormwater input, since aquatic life impairment is the driver for placement of Hinkson Creek on the impaired waters list.* On Page 11, Section 2.6, 2nd paragraph of the Hinkson Creek TMDL it says that "Federal regulation also states that TMDLs may be established using a biomonitoring approach as an alternative to the pollutant-by-pollutant approach [40 CFR 130.7 (c)(1)])." Again, it is unclear to us why biomonitoring is not the primary water quality target instead of a technically unsupported runoff reduction.

Comment 3.C.4. The biological community in Hinkson Creek may not be currently impaired.

With the exception of the spring of 2002 assessment, macroinvertebrate samples collected by MDNR have shown the urban portion of Hinkson Creek to be *fully supporting or very nearly so each time the biological community has been evaluated* (MDNR 2002, 2004, and 2006). The last comprehensive investigation of the macroinvertebrate community was conducted by MDNR in the fall of 2001 and spring of 2002. To our knowledge the last macroinvertebrate sampling of any kind was performed by MDNR in the spring of 2006, nearly 4 years ago. We believe that a more methodical investigation into the biological community is warranted to better understand the biological health of Hinkson Creek.

Comment 3.C.5. Several significant differences exist between the Hinkson Creek TMDL and the Potash Brook template.

The Potash Brook TMDL has been cited as an example of a TMDL that has successfully used storm flow as a surrogate for multiple impairments. As such, this approach is being used as a template for the Hinkson Creek TMDL. However, there are several major differences between the two watersheds that must be recognized. Potash Brook is a 7.1 mi^2 watershed compared to Hinkson Creek which is approximately 90 mi^2. Potash Brook has a heavily impaired aquatic community as opposed to Hinkson Creek, which regularly is found to be between fully supporting and partially supporting. Are there lessons to be learned in the Potash Brook TMDL? Have the runoff reduction targets been achieved, and if so, has the biological community been restored as a result?

Comment 3.C.6. The attainment stream selection process cited in the TMDL is questionable.

The second paragraph of Section 4.5 in the TMDL ('Water Quality Targets') states that the linkage between "aquatic life impairment, and stormwater will be accomplished using streams that are physiographically similar to Hinkson Creek and where the biological community is attaining the aquatic life designated use." This is the framework that was used in the Potash Brook TMDL.

The Potash Brook TMDL also states that the use of "attainment" streams as opposed to "reference" streams is used "because reference tends to imply that the ultimate goal for the impaired steam approaches pristine. Instead, the attainment watershed(s), while meeting or exceeding the Vermont water quality standards criteria for aquatic life, should contain some level of development in order to better approximate the true ecological potential of the impaired stream." This use of "attainment streams" gave recognition to the fact that highly developed watersheds would not be expected to attain reference conditions.

A fairly rigorous approach was used for the selection of attainment streams by the Vermont Department of Environmental Conservation using an analysis described in Foley and Dowden (2005). These attainment watersheds were evaluated for similar size, slope, soils, climatic patterns, channel type and landuse/cover and were all in relatively close geographical proximity to Potash Brook. In addition, they all contained some level of development in order to approximate what the true ecological potential might be.

Unfortunately, the streams selected for the Hinkson Creek TMDL are not physiographically similar to Hinkson Creek. To be physiographically similar, the "attainment" streams selected for the Hinkson Creek TMDL should be of similar size and should have similar levels of urbanization. The selected attainment streams are 3-7 times larger (313 – 620 mi^2) than the Hinkson Creek watershed area of ~90 mi^2 and all contain very low levels of urbanization. The

"attainment" streams selected for the Hinkson Creek comparison were primarily based on the availability of macroinvertebrate data and the presence of a USGS gauging station in order to supply flow information.

It is our opinion that the selection process of attainment streams for this TMDL is inadequate and not sound. Two of the four "attainment" streams are actually "reference" streams for their particular Ecological Drainage Units, a comparison that we believe is not appropriate. On page 14 of the Potash Brook TMDL the authors state "However, haphazard matching of attainment streams, and thus flow targets, to Potash Brook could lead to targets with a high degree of uncertainty as to whether standards would be met." This is certainly the case with the attainment streams selected for the Hinkson Creek comparison. It is our opinion that either other urban streams that are attaining their beneficial uses, or other similar streams within the Ozark/Moreau/Loutre Ecological Drainage Unit be used for comparisons to Hinkson Creek.

Comment 3.C.7. Biomonitoring scores cited in the TMDL should be corrected

The Missouri Stream Condition Index (MSCI) scores in the TMDL (Page 8, Table 3) contains some errors and inconsistencies with previously published aquatic macroinvertebrate data in addition to those in italics that were recalculated based on more recent reference stream sampling. The largest error is the fall 2001 Rogers Road site (#8) which was changed from an MSCI score of 12 in the original report MDNR (2002) to a 16 in the TMDL report based on the recalculation using more current reference stream data. This analysis appears to be an error. The Rogers Road site remains a 12 even when compared to the new data. It is interesting to note that during the fall of 2001, the Walnut Street site (#6) scored better in 3 of the 4 individual metrics than the Rogers Road site (#8) even though its MSCI score is listed as 12 as opposed to the 16 listed for Rogers Road in this TMDL.

Another example is the Scott Road site (#1) of the fall 2001 survey. The recalculated MSCI score is 14 when it should correctly be scored as a 16 given in the original MDNR report (MDNR 2002). As noted in Table 3 (page 8) some of these changes were made due to rescoring, but at least some of the errors are a result of Metric Value assignment (5, 3, 1) based on the 25th percent quartile value and the bisection value. We therefore recommend that these scores be reevaluated to ensure their correctness.

Comment 3.C.8. Rescoring historic biomonitoring data is not appropriate.

Rescoring of historic data based on more recent sampling of reference streams (TMDL Table 3, italics) is not appropriate in our opinion. It makes it extremely difficult, if not impossible, to make impairment decisions that could change based on data that will be collected in the future. Study streams should be evaluated based upon the scoring criteria that are in effect at the time of sampling. For example, MSCI scores determined in the fall of 2001 should be assessed based on the reference stream criteria that were available and in effect in 2001. Changing or updating

scores increases the likelihood of circular use attainment decision. For example, Rogers Road, (site #8) was not impaired in Fall 2001, but could be interpreted at impaired based on re-scoring the information collected in the Spring of 2002. This would clearly make impairment determinations difficult at best, especially of streams that regularly hover near the border between partially and fully supporting (14-16).

We strongly recommend that any given stream be scored based on the reference stream scoring criteria that is available at the time of sampling, and as scoring criteria for reference streams changes as a result of the collection of additional data, then only new data collected on study streams be appropriately compared to the new scoring criteria. Included below as Exhibit 4 is a table containing MSCI scores that we believe to be correct and consistent with previous reported results.

Exhibit 4. Corrected Missouri Stream Condition Indices for Hinkson Creek.

Missouri Stream Condition Index Scores for Hinkson Creek													
Site #	Site	Fall 2001		Spring 2002		Fall 2003	Spring 2004	Spring 2005	Fall 2005		Spring 2006		
8	Rogers Rd.	16	12	16	18								
7	Hinkson Creek Rd.	12		18		18	18	18	18				
6.5	Hwy 63 Connector						*17*						
6	Walnut St.	12		12		16	14	18	16	18			
5.5	Broadway St.					16	16	16	12	14			
5	Capen Park	16		14	12								
4	Rock Quarry Rd.	*17*		12	14								
3.5	Recreation Dr.							14	14				
3	Forum Blvd.	18		14							16		
2	Twin Lakes	16	18	14							12	14	
1	Scott Rd.	14	16	14							16		
			Correct Values										

Based on our interpretation of the above MSCI scores, the upstream sites (sites 7 and 8) score as fully supporting 78% (7 of 9) of the time. The lower Hinkson sites (sites 1-6) scored as fully supporting 52 % (13 of 25) of the time. It should be noted, however, that following the spring 2002 sampling event the MSCI scores within the urbanized portion of Hinkson Creek have been fully supporting nearly 70% of the time. This is *quite comparable* to MDNR's TMDL web page (http://www.dnr.mo.gov/env/wpp/waterquality/303d.htm) that indicate that reference streams in this Ecological Drainage Unit score as fully supporting approximately *75-80%* of the time.

In addition, it is not clear why MDNR is targeting a higher biocriteria attainment frequency (100%, see TMDL, Page 20) than what is typically achieved in reference streams. *A 100% attainment frequency for Hinkson Creek is unrealistic and not supported by MDNR biocriteria guidance.*

Comment 3.C.9. The spring 2002 biomonitoring dataset may be an anomaly.

The spring 2002 sampling of macroinvertebrates seems to be the driver for the determination of impairment in the urban portion of Hinkson Creek. When compared to all of the other macroinvertebrate sampling events, the spring 2002 was the only sampling event that consistently showed MSCI scores below 16. It is possible that the 2002 sampling event was an anomaly. We recommend that a comprehensive bioassessment of Hinkson Creek similar to that conducted in 2001-2002 be performed to better assess the current status of the aquatic community.

Comment 3.C.10. Little data are presented to support the claim that reducing peak storm flow volume (Q = 0.3%) will increase baseflows, improve dissolved oxygen, and ultimately enhance the biological health of Hinkson Creek.

Several times throughout the draft TMDL document (e.g., Section 2.6, Section 4.5, Section 11), MDNR suggests that peak storm flow runoff volume reductions will result in increased baseflows and higher dissolved oxygen concentrations during baseflow periods. On page 11, MDNR states the following:

> "water quality studies did reveal, however, that a large percentage of the problems noted above, including increased sediment and low dissolved oxygen at low flows, can be attributed to urban runoff conditions which result in excessive stormwater runoff and lower than normal baseflow conditions."

MDNR has offered no data to support the claim that "lower than normal" baseflows are directly caused by urban runoff conditions. In fact Schuler (1994, page 2), a paper which is cited in the draft TMDL, states that actual data have demonstrated that this is rarely the case. Furthermore, MDNR's assumption that low dissolved oxygen concentrations indirectly result from urban runoff conditions is unsubstantiated. As MDNR is aware, recently collected continuous data demonstrated that prolonged periods of low dissolved oxygen (below 5.0 mg/L) occur in several Missouri reference stream reaches during baseflow conditions. As reference stream reaches represent the "best available representatives of ecoregion waters in a natural condition with respect to habitat, water quality, biological integrity and diversity, watershed landuse, and riparian conditions" (10 CSR 20-7.031(1) (U)), *it is unclear why MDNR believes that baseflow dissolved oxygen concentrations in Hinkson Creek can improve to acceptable levels when it has been demonstrated that baseflow dissolved oxygen conditions in reference streams cannot.*

Comment 3.C.11. Physical habitat limitation should be explored as a causal variable.

Habitat quality limits the biological potential for streams and rivers (Rabeni 2000). Reduced habitat quality within urban stream reaches is well documented in literature (Booth and Jackson 1997, among others). According to MDNR standard operating procedures (SOPs), habitat quality is measured during bioassessments. Furthermore, SOPs stipulate that habitat quality scores for study streams (e.g. Hinkson Creek) must be within a specified percentage of reference stream habitat scores, otherwise application of biocriteria to study streams is unjustified (i.e. habitat limited). Habitat limitation appears to offer a plausible explanation of periodically lowered macroinvertebrate scores in Hinkson Creek. *However available habitat data do not appear to be evaluated to any substantive degree in the TMDL.* Restoration strategies leading to improved habitat quality may differ from the volume reduction approach recommended in the TMDL.

3.D. IMPLEMENTATION FEASIBILITY

Comment 3.D.1. TMDL implementation targets are ill-defined.

As mentioned previously, the TMDL does not clearly define whether runoff volumes or flow rates must be reduced. The approximately 50% reduction target is based on a comparison of 1-year return flows in Hinkson Creek as compared to the median 1-year return flow from the four attainment streams. Therefore, one would assume that flow rates are being regulated not runoff volumes. However, Section 11 of the TMDL states that "stormwater runoff volume reductions can be accomplished by stormwater retention and enhanced infiltration and evapotranspiration." Therefore, it appears the TMDL is regulating runoff volumes, but it is not clear when or where these volume reduction requirements apply. On page 33 of Section 11, the TMDL references the one-year average annual storm as measured at the USGS stream gage near Providence Road and then describes how TMDL reductions shall be implemented if new monitoring data indicate water quality standards are not being met. However, the one-year average annual storm is not defined in terms of flow rate, volume, rainfall depth, intensity, duration, or any other metric that would allow one to quantify the reduction target.

Comment 3.D.2. TMDL implementation feasibility is uncertain.

Without a clearly defined target, it is difficult to assess the feasibility and cost implications associated with meeting the TMDL. Assuming the 1-year average annual storm is equal to the volume associated with the 0.3% normalized daily flow in Hinkson Creek as defined in the TMDL (53.6 cfs/mi^2), such that the volume would be:

$$V = \left(53.6\frac{cfs}{mi^2}\right) \times (69.8\ mi^2) \times (24\ hrs) \times \left(3600\frac{s}{hr}\right) = 323 \times 10^6 cf = 7421\ ac \cdot ft$$

A 50.5% volume reduction requirement would then result in a target volume loss of 3,748 ac ft. This volume is equivalent to requiring the complete retention and infiltration/evapotranspiration of approximately 1-inch of rainfall over the entire watershed, *which is significantly greater than the current volume reduction requirements of the Boone County Stormwater Ordinance*. The Ordinance requires that the runoff from 10% of the 1.3-inch water quality volume must be permanently reduced. However, the Ordinance allows for a waiver of this requirement if there is a risk for groundwater contamination or site constraints make infiltration infeasible. *The TMDL does not provide any consideration for site constraints that may inhibit volume reductions.*

For many parts of the watershed and during many times of year the retention of large runoff volumes may not be feasible due to:

- High groundwater table
- Permeability of soils
- Limited pervious space availability
- Limited areas for evapotranspiration in dense developed areas
- Desirability of dense development vs. sprawl
- Potential for water balance issues and un-natural baseflow impacts
- Lack of non-potable demand for harvested stormwater

For areas that are conducive to achieving volume losses, other site constraints may impact the practicability of implementing infiltration facilities due to the presence of existing infrastructure and location of available space relative to the tributary drainage area. The Mid-America Regional Council Manual of Best Management Practices for Stormwater Quality (MARC, 2009) recommends that infiltration basins have a maximum depth of 2 feet for an infiltration basin and 1 foot for a bioretention area. Therefore, when considering side slopes and pre-treatment requirements, between 2000 and 4000 square feet of land would likely be required per impervious acre. For the purposes of calculation, if we assume that the Hinkson Creek watershed is 20% urban and infiltration is feasible everywhere then 500 to 1000 acres of land would be needed to achieve the required volume reductions. This land would also need to be strategically located such that surface runoff could be routed by gravity; otherwise pump stations would be needed. According to the User's Guide to the BMP and LID Whole Life Cost Models (WERF, 2009), curb-contained bioretention systems without underdrains cost approximately $13 per square foot. Therefore, the capital costs associated with retrofitting the entire watershed with bioretention facilities could be as high as $500M. Additional costs could be incurred if pump stations or larger storage facilities are needed or if significant infrastructure conflicts arise.

For agricultural areas, infiltration facilities may be more attractable than bioretention facilities. However, the feasibility of achieving volume reductions in the agricultural areas is even more uncertain than it is for urban areas. Agricultural lands generally have very low imperviousness such that runoff and shallow subsurface interflow typically only occurs when the soils become saturated.

During these conditions infiltration rates would be expected to be reduced and infiltration basins would need to be sized to retain stormwater for longer periods of time in order to reduce volumes.

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APPENDIX G

Metropolitan
St. Louis Sewer
District

2350 Market Street
St. Louis, MO 63103-2555
(314) 768-6200

April 22, 2010

Department of Natural Resources
Water Protection Program
Water Quality Monitoring and Assessment Section
P.O. Box 176
Jefferson City, MO 65102-0176

Re: Comments on Draft Total Maximum Daily Load (TMDL) for Hinkson Creek

To Whom It May Concern:

The Metropolitan St. Louis Sewer District (MSD) is writing to provide comments on the draft TMDL for Hinkson Creek in Boone County, Missouri. As an MS4 permittee, coordinating authority for nearly 40 percent of the regulated MS4s in Missouri, and serving a highly urbanized area of Missouri, MSD has an interest in the development and implementation of any TMDL focused on stormwater volume reduction. MSD sees this TMDL, the first of its kind in Missouri, as a precedent setting endeavor.

MSD concurs that hydrology and its affect on stream modification is a significant driver of urban stream impairment. However, using runoff volume as a surrogate for other pollutants in the TMDL process is a relatively new approach. Granted, similar TMDLs have been approved in Vermont (EPA Region 1) and elsewhere on a limited number of watersheds, but its application is not widespread throughout the nation. EPA regulations [40 CFR 130.2(i)] allow for the use of "other appropriate measures", and the Federal Advisory Committee on the Total Maximum Daily Load (TMDL) Program recommended that in some instances EPA and the States use surrogate measures in TMDL development.[1] However, some members of that Committee believed the TMDL program should be limited to pollutant loading because TMDLs are best suited to addressing those issues. Additionally, the Committee Report placed flow (i.e., hydrology) modifications in a special category of "extremely difficult problems" warranting special consideration. MSD echoes these sentiments and respectfully recommends proceeding carefully.

The proposed TMDL states, "A reduction in storm water runoff can be accomplished by storm water retention and enhanced infiltration and evapotranspiration." Implied is that the TMDL only addresses post-construction runoff impacts because these fate and transport

[1] Report of the Federal Advisory Committee on the TMDL Program. EPA 100-R-98-006.

process are not typically applied to construction stormwater runoff controls. Issues with this approach in the context of meeting the overall goal of removal from the impaired stream list are further described below.

Page 11, section 2.6, the stated intent of the TMDL is to restore the stream's natural peak and base flow dynamics, and that the TMDL will restore habitat and reduce the release of toxic pollutants into Hinkson Creek. The relationship between urbanized areas and impervious area, and stream health is well established; however, the reasons and mechanisms related to water quality are not entirely understood. Accordingly, we have concerns that the statements in this section may not be accurate. For example, some stressors and pollutants listed in tables 6 and 7 represent materials used or disposed into the environment irregardless of rainfall volume reduction, and will eventually enter waters of the state. One such example includes chloride, which is an environmental pollutant in runoff as well as in groundwater (via, infiltration). Chloride is better addressed by other source reduction best management practices unrelated to reducing runoff volume. Granted, volume reducing solutions may provide a detention effect that reduces the concentrated of chloride that discharges into the stream. However, employing volume reduction BMPs may be not be the most effective or least costly way to addressing pollutants like chloride. Additionally, post-construction volume reduction does not address all nonpoint source pollution issues, including control of erosion and sediment from land disturbance sites, which also significantly contribute to sedimentation and stream impairment. The TMDL discusses the impacts of sediment and sedimentation related to urbanization and runoff; however, sediment as a pollutant from construction sites was not evaluated, and this is concerning. With so many unknowns related to whether post-construction runoff alone is the problem, it seems a tremendous burden has been placed on the MS4s to reduce runoff from already developed areas without knowing with certainty the problem.

Page 23, Figure 5 and 6 show considerable variation in flow. Developing a resultant TMDL with legal implications for specific flow reductions to the tenth of a percent based on this data appears statistically unsupportable given the apparent variability of data.

Page 26, Figure 8 seems to indicate that the flow duration curve for Hinkson creek is in the range of the reference streams. As the TMDL document references, streams impaired by modifying the flow regime of urban runoff exhibit long periods of smaller baseflows, with short periods of larger peak flows. However, the flow duration curve suggests that Hickson Creek's baseflow is typical of the reference streams. Thus, while Figure 4 indicates that baseflow has decreased, it doesn't appear that baseflow levels are unacceptable. This again seems to indicate that hydrologic changes resulting from post-construction urban runoff are not the only cause of the impairment.

Page 27, the basis for selecting volume reduction goals (Figure 9 and Table 12) at the Q 0.3% flow occurrence is unclear, and MDNR should explain why Q 0.3% will return the stream to attainment. (Methods for assessing and developing ecological stream flows are available.) The TMDL states, "This (Q 0.3%) value approximates the one year return flow, based on the rank of the flow rate above which the probability of occurrence is ~1/365." It isn't clear what MDNR intends by this statement: specifically, does Q 0.3% correlate to the 1-year 24-hour

storm? If MDNR intends to apply the TMDL to BMP design using a 1-year 24-hour design storm (P=2.5"), then this is concerning.

- As the TMDL indicates on Page 33, precipitation events less than 1.5" are responsible for about 75 percent of runoff pollutant discharges and are key events when addressing mass pollutant discharges into urban streams. If a 1-year 24-hour design storm (P=2.5") rainfall is used to size BMPs, then roughly half of the BMP volume will have minimal impact on pollutant loads carried by stormwater runoff. On the other hand, this would double BMP size (and construction costs). For many typical urban redevelopment sites, this will increase the development costs by $40,000-$100,000/acre.
- Because application of volume reduction BMPs is best applied at the micro-scale (not regional scale), the use of distributing infiltrating BMPs of this size (P=2.5") in an urban setting will be a limiting factor due to space constraints. The use of larger, more economical regional infiltration BMP approaches is not desirable (maintainable or effective) in our experience.
- Redevelopment of sites and the accompanying controls that are put in place to limit stormwater load are an important component to long-term improvement of water quality in urban areas. If the rate of control implementation is slowed because of lack of redevelopment projects, then attainment may not be observed for a very long time (and/or the MS4 forced to spend valuable public dollars to subsidize redevelopment).

Because of the tremendous burden designing for Q 0.3% (and the 1-year 24-hour storm) could place on the MS4 and development community, it is critically important that MDNR have a vision for how the TMDL will be implemented through BMP design. MSD supports a reasonable, balanced, scientifically defensible, iterative approach to setting goal and implementing actions to achieve results (emphasis added). As proposed, this TMDL implementation could lead to several unintended consequences, including technical and cost impracticability that ultimately drives development further from the urban core (generating other environmental and pollution problems). Additionally, a reality of this rule is that permittees must either raise revenues or cut services in other areas to cover the costs of carrying out these stormwater rules (as part of their small MS4 permit).

Conclusion –

This 303d listing and TMDL is concerning as it would appear to apply to many areas across the State that have over 10% impervious areas, shopping center parking lots, and other situations common with urbanized areas. It is not appropriate to evaluate and declare all urban streams as impaired based on impervious area alone, nor feasible to assess or even address all such streams Statewide through the TMDL process.

Another concern MSD has about the TMDL process relates to the broader perspective of storm water quality strategies. If watersheds with over 10% impervious area begin to degrade stream water quality, then waiting until the stream is included in the 303d list and then retrofitting controls provides a disincentive to development through the better site design practices like large conservation efforts that provide enhanced storm water management

performance. Possibly a more appropriate approach for MDNR is to lower the applicability threshold to the MS4 permit, to ensure new development in high growth areas will be protective of the water environment. Efforts to expand regulation to currently unregulated sources of pollution, like agriculture, should also be considered. In summary, prevention is a more prudent approach than the difficult, costly efforts to restore a watershed through retrofitting. This approach would also level the playing field with regard to eliminating circumstances that promote sprawl.

MSD applauds the efforts of the citizens, government leaders and MDNR in addressing the negative impacts of urbanization, however, we have concerns with how the TMDL will be applied, particularly where no pollutant can be identified. We further recommend that the effort to address non-point source pollution within the entire State rests with the MS4 general permit.

Thank you for the opportunity to comment. If you have any questions, please contact Bruce Litzsinger at 314-436-8757 or Jay Hoskins at 314-768-2709.

Sincerely,

for Randy E. Hayman
General Counsel

Susan M. Myers
Environmental Attorney
Office of General Counsel

CC: John Lodderhose, MSD
Bruce Litzsinger, MSD

APPENDIX H

Comments on the March 2010 version of the Hinkson Creek TMDL

John Holmes, P.E., Allstate Consultants, LLC.

April 22, 2010

General

As I interpret this and the previous version of the TMDL, the requirement for a reduction in volume of runoff has switched from being based on a single large design storm to an annual runoff volume reduction. I applaud this switch as it will result in both a cost savings and a better solution for our streams.

It would be clearer if instead of saying the surrogate is "storm water runoff volume", the TMDL said "annual storm water runoff volume".

Page 4 – This page talks about how much more development has occurred, but it doesn't discuss how many more people are served by the new development. If the people who will be served by the added development don't live and conduct business in the Hinkson Creek basin, they will do so elsewhere and have negative impacts on other basins where there is relatively little regulation. Wouldn't it make more sense to look at allowable impact per person than maximum impact per area? This would result in some streams that don't meet their beneficial uses, but these would be offset by less impact to other streams that are closer to pristine.

Page 6, section 2.4 first paragraph – Why is the problem no longer listed as "unspecified pollution due to urban non-point runoff"? How was the unspecified pollution originally detected? Were there earlier biological assessments and if so, why aren't they discussed in this TMDL and compared to the more recent ones?

Page 9, fourth bullet – How many water samples were collected in total?

Page 11, section 2.6, third paragraph, third sentence – Should this say that the surrogate is annual volume of flow instead of peak flow following storm events?

Page 19, section 4.4 – The title says "Specific Criteria" but the section seems to talk about general criteria. Is this a typo?

Page 20, Section 4.5, third paragraph – If only 93% of the reference stream samples are supporting, why are you requiring 100% for Hinkson. Maybe 100% isn't possible.

Page 21 section 5.1 – Why does the TMDL show flow duration curves from only two four month periods of time? Given all the variables that go into determining the volume of runoff that occurs from a given depth of rainfall, it doesn't seem that 4 months of data would be statistically significant. What were the

rainfall distributions during the storms? What were the antecedent moisture conditions? Appendix C doesn't list the rainfall events during the April-July 1967 time period so I can't look at the relative durations of the storms in the two periods or how much rain occurred in the month prior. However, the average duration of the storms listed in Appendix C for April-July 2007 is 53.3 hours whereas the average duration of all storms listed in Appendix C is 99.7 hours. So, it seems possible that the storms were more intense in the 2007 time period.

Page 24, Section 5.3 – What were the SCI scores for the attainment streams?

USGS Water Resources Investigation Report 95-4231 lists average main channel slopes for 4 of these 5 streams (see table below). Hinkson Creek is significantly steeper than at least 3 of the four attainment streams. Likewise, when USGS rural peak flow regression equations are applied to these watersheds they predict that Hinkson, if it wasn't urbanized, would produce twice the peak flow rate per square mile for the 2 year storm that the other basins would. My point is that a rural Hinkson Creek would be expected to be naturally flashier than any of these three reference streams. I suspect that if someone were to calculate the Main Channel Slope for the Middle Fork of the Salt River and apply the USGS regression equations they would find that it is not predicted to be as naturally flashy as Hinkson either.

Stream	Size (mi^2)	Main Channel Slope	Hydrologic Region	Predicted 2 Year Peak Flow, USGS 1995 Regression Equations*
Hinkson	69.8	11.1	2	47.4
Big Creek	414	3.3	2	21.4
Middle Fk. Salt River	313	Not published.	1	
North River	354	5	1	22.1
S. Fabius River	620	3.4	1	16.2

* USGS Water Resources Investigation Report 95-4231, Techniques for Estimating the 2-to 500-Year Flood Discharges on Unregulated Streams.

Page 27, Table 12. The percent reduction in flow that would be required to match the Middle Fork Salt River is only 31.9%. So a 50.5% reduction is likely to be at least 19.6% more reduction than is needed to fully support. We are not sure that the Middle Fork Salt River represents the threshold of impairment. For all we know, it could possibly handle more runoff and still fully support the use. But the other rivers are likely to exceed the threshold since they have significantly less volume of runoff. So, by using the

median of these rivers we would be clearly exceeding what is needed to match another stream that is supporting.

Page 30, Table 15 – Should this table be clarified by adding a heading to the last column stating that the percentages are of the total runoff from the entire basin? These percentages could be incorrectly interpreted as being a 24% reduction of the water from the individual land use. It would probably be clearer if you added another column listing what percentage of the current runoff from each land use category must be reduced (about 50.5% from each).

Page 30, third paragraph under "6.", first sentence – Is the listed table number correct?

Page 30, first sentence under "7." – There appears to be an error with regards to which table is being referenced, however, none of the tables provide "precipitation intensities". Should this be "precipitation depths"?

Page 30, section "7." – It is hard to imagine how the Hinkson Creek Watershed Management Plan is going to significantly reduce the runoff from predominantly agricultural areas when agricultural areas are exempt from the CWA. Even if all the water from "open areas" was captured, it wouldn't make much of a dent in the volume of runoff from agricultural areas.

Page 30, last sentence – This appears to require that new developments can't produce any additional runoff. If that is the intent, it needs to be clear for what storms this applies. The way this is worded it seems as if the community can do some calculations that will prevent added runoff. It will really be the developers who will have to physically prevent added runoff.

Page 31, Section 8. Do we really need to provide a 20% margin of safety?

Page 33, Third paragraph –The water quality storm is 1.3" and represents the depth of rainfall for which 90% of storms are smaller. I think the TMDL should include a definition of the "one-year average annual storm"? It doesn't sound like the sort of thing that would be equivalent to the water quality storm. The 24 hour 1 year return period storm in this area is 3". The 1 hour 1 year return period storm in this area is about 1.2". The water quality storm doesn't have a duration or rainfall distribution associated with it. Different durations and distributions of 1.3" storms will produce different volumes of runoff. So, it is not clear how we will measure the runoff from the water quality storm at the USGS gage. I can imagine how we might measure the runoff of some particular 1.3" storm with a given duration and distribution if we can get it to happen but what would we compare it to to see if we've achieved the reduction? The equation presented on page 22 might be used, but it has an R-squared value of only 0.37 so I don't think it is appropriate.

What happens after the five year period? How do the 1% and 4% reductions mentioned in this paragraph relate to the 50.5% reduction discussed earlier?

APPENDIX I

[Received from Dan Obrecht, 4/22/10, via e-mail]

Comments and Questions concerning the Hinkson Creek TMDL

USE OF THE 0.3% HIGH FLOW VALUE TO SET TARGET REDUCTIONS

The major technical concern with the draft Hinkson Creek TMDL is use of the 0.3% high flow value (HFV) to compare Hinkson to four attainment streams/rivers. This comparison is the cornerstone in setting the target reduction of flow by 50.5%, a flow reduction that seems excessive relative to the level of impairment measured in Hinkson Creek. More importantly, use of the 0.3%HFV renders the attempted comparison of stream systems moot, as it fails to evaluate the relation between stream flow and watershed characteristics.

The flow duration curves (Figure 8 in the TMDL), when taken as a whole, represent discharge over the range of conditions and allow for comparisons of how discharge is influenced by watershed characteristics. The ends of the curves reflecting extreme discharge values relating to unusually intense storm events (left side of curve) or extended dry periods (right side of curve). Comparisons made at the ends of the curves are greatly influenced by out of the ordinary meteorological events, and thus do a poor job of reflecting the differences in discharge that actually relate to watershed characteristics. The 0.3%HFV may relate to channel forming events, but that is a separate issue from nonpoint pollution. Because the TMDL is using discharge as a surrogate for nonpoint source pollution (Table 7 of TMDL), habitat loss and sedimentation (factors influenced by any runoff event), the comparison of flow duration curves should not be strictly tied to the 0.3%HFV.

Table 1 contains information concerning the four highest discharge values from Hinkson Creek during the period represented in Figures 8 & 9 of the TMDL. If the whole of the stated period of March 2007 to October 2009 (Table 10 in TMDL) were included in the analysis, the Hinkson data shown in Figure 8 represent discharge values from 975 days. The vertical line in Figure 9 of the TMDL that represents the 0.3%HFV would therefore be placed along the curve at a point between the second and third highest normalized discharge values.

As shown in Table 1, the precipitation events that relate to the most extreme discharge values in Hinkson Creek are well above what would be considered normal. There is no doubt that the impervious surfaces within Columbia had an influence on how much runoff reached Hinkson Creek during these events, but the influence of urbanization is obscured by the extremity of the precipitation events.

Table 1. The four highest discharge values for Hinkson Creek during March 2007 – October 2009. Precipitation data are from Sanborn Field weather station.

Mean Daily Discharge (cfs)	Date	Rain Event
5150	10/8/09	5.32" of rain fell on this day
5320	7/28/08	7" of rain during preceding week
6280	4/30/09	4.5" of rain during April 28-30
7810	9/14/08	6.3" of rain during Sept. 12-14

*I do not use normalized discharge values in this table because the TMDL fails to mention how the data were normalized, other than to say that watershed and annual precipitation were taken into consideration.

Table 2. Highest discharge values for four attainment streams/rivers during the time frames listed in Table 10 of the Hinkson Creek TMDL. Precipitation data are from the Paris, Kingsville, Steffenville and Palmyra weather stations.

Stream	Mean Daily Discharge (cfs)	Date	Rain Event
Middle Fork Salt River	17400	7/25/08	Rainfall of 6.1" on the 25th, with an additional 2.2" falling on the 28th
	22900	7/26/08	
	10300	7/27/08	
	10500	7/28/08	
Big Creek	12700	6/30/07	A total of 9.65" of rain fell at the Kingsville weather station during June 27-30
	15300	7/1/07	
	11300	7/2/07	
South Fabius River	11000	6/26/08	4.9" of rain on 25th, with 1.26" additional rain on 26th & 27th
	12500	6/27/08	
	12500	6/28/08	
	11000	9/14/08	Rainfall of 2.9" on 14th, after 6.9" of rain had fallen during previous 11 days
	10500	9/15/08	
	12000	9/16/08	
	10700	9/17/08	
North River	10400	3/31/98	Rainfall of 1.2" on 31st
	5650	11/3/98	Rain of 1.4" on 3rd, after 1.7" the previous 2 days
	8260	1/22/99	Rainfall of 1.2" on 22nd
	6450	4/16/99	Rained 1.4" on 15th and 1.3" of 16th

The highest discharge values for the four attainment streams/rivers are shown in Table 2. Again, the very highest of discharges were related to above normal precipitation events or extended periods of rain. The exceptions would be the high discharge values for the North River on March 31, 1998 and January 22, 1999. Both of these peak discharges occurred with only 1.2" of rainfall. It is possible that the ground was frozen during both of these events, which would greatly reduce, if not eliminate, infiltration into the soil.

Use of the 0.3%HFV does not truly compare the systems in a way that provides any measure of how the watersheds influence discharge. Instead, the comparison in the TMDL is, in essence, a comparison of individual rain events (i.e. how did discharge in Hinkson Creek after 7" of rain in a week's time compare to discharge in Big Creek after 9.65" of rain in a four day period). Unless DNR feels that the failure of Hinkson Creek to meet water quality standards is related only to the most extreme of flows (which would suggest that nonpoint source pollution is not an issue 99.7% of the time) this comparison is seriously flawed and does not achieve what it sets out to do.

Figure 8 in the TMDL represents around 4260 daily discharge values from the five streams. Collectively, the data provide a "big picture" comparison that could be useful in setting target reductions in Hinkson Creek. Choice of the 0.3%HFV as the only point of comparison effectively ignores 99.7% of the data in Figure 8. To make a useful comparison using the flow duration curves would require, at a minimum, for the comparison to be made at a point on the curve that represents discharge relating to more typical precipitation events. It may be worth considering comparisons at multiple points along the curves to better encompass the relationship between discharge and watershed characteristics.

The four attainment streams/rivers are all bigger than Hinkson Creek (based on average discharge) and have substantially larger watersheds (4.5 to 8.9 times larger). Smaller streams tend to be flashy compared to larger systems, with water levels coming up and going back down faster than observed in larger rivers. This difference in response can be observed when comparing Table 1 and 2 (above). Hinkson Creek and the North River are the only two streams that had peak discharge values that related to individual precipitation events. The other three rivers had multiple high discharge values on consecutive days, indicating that the peak flows were spread out over time after a substantial precipitation event. The differences in stream and watershed size among these systems needs to be considered when comparisons of flow duration curves are made.

OTHER CONCERNS AND QUESTIONS

Out of the 34 SCI scores recorded for Hinkson Creek (Table 3 in TMDL), 20 resulted in values that indicate the creek is fully supporting aquatic life (score of 16-20), with the remainder registering scores indicative of partially supporting aquatic life (10-14). Even if the two most up-stream sites are excluded from the analysis, 50% of the SCI scores are still at or above a value of 16. An average of the 26 scores from these sites results in a value of 14.8 (15.3 when up-stream scores are included). It would seem that Hinkson Creek is not meeting criteria, but is missing it by a fairly small margin. Does DNR truly feel that the suggested reduction of discharge by 50.5% is a fitting fix to what would seem to be a minor problem?

Figure 4 in the TMDL compares flow duration curves from four month periods in 1967 and 2007. According to the USGS website containing data from the Hinkson Creek gauging station, there are a total of 23 years in which discharge data is available for the April-July period (and 19 years in which the full year of data are available). Given the abundance of information, why does the TMDL only compare data from two four month periods?

Figure 6 in the TMDL seems to indicate that discharge has only increased minimally during the fall, winter and spring seasons, and substantially during the summer season when data from the 1970s, 1980s and 2000s were compared. Given that urbanization and its impacts on watershed runoff are year-round phenomena, what is the explanation for the differences among seasons? Does this graph suggest that the city only really needs to focus on runoff during the summer because changes in discharge have been nominal during the other seasons?

In section 5.3 of the TMDL it is stated that the attainment streams are in watersheds that are within an order of magnitude of the size of the Hinkson Creek watershed. Given that these streams/rivers have watersheds that are between 4.5 and 8.9 times larger than the Hinkson Creek watershed, are there any assumptions that DNR is making about how these systems compare? If so, what are they? Were there any streams that are more similar to the Hinkson in size that have both discharge and invertebrate data?

What were the SCI scores for the attainment streams?

In section 5.5 of the TMDL it is stated that forest and wetland land use is not expected to generate significant runoff. Given that these land covers account for 29.4% of the watershed (Table 13 in TMDL), and the measure of success for the TMDL is a reduction in stream discharge, shouldn't the runoff from these land uses be taken into account? I realize that the reduction in runoff will be made on the other

land cover types, but discounting the contribution of 29% of the watershed to the creek's flow seems inappropriate. This would seem especially true given that the target reduction was based on discharges that occurred in conjunction with extreme rain events. For example, a total of 5.32" of rain fell within a 24 hour period on October 8, 2009. Does the DNR truly feel that there was no runoff from this precipitation event from the forested areas in the watershed?

If the city is capable of meeting the goal of a 50% reduction in discharge during extreme rain events (5" in a 24 hour period; 7" within a week) it will take a substantial amount of capacity in terms of rain barrels, rain gardens, detention ponds, etc. If these infrastructures are in place to catch this large amount of runoff from making it to the creek, what is going to happen when a normal rains occurs? If we have the capacity to hold the runoff from 2-3" of rain, will the water from a ½" rain ever make it to the creek?

In section 5.1 of the TMDL it is noted that the average daily flow during April-July 2007 was 80% higher than the average flow April-July 1967. Were daily flow values normally distributed during the four month periods in each of these two years? Would geometric mean values be a better descriptive statistic than arithmetic means in this situation? What was the difference in geometric mean daily flow values for these two periods?

Flow data in Figure 8 were normalized for watershed size and yearly precipitation. Could DNR expand on how these data transformations were conducted?

Current work in the Watershed

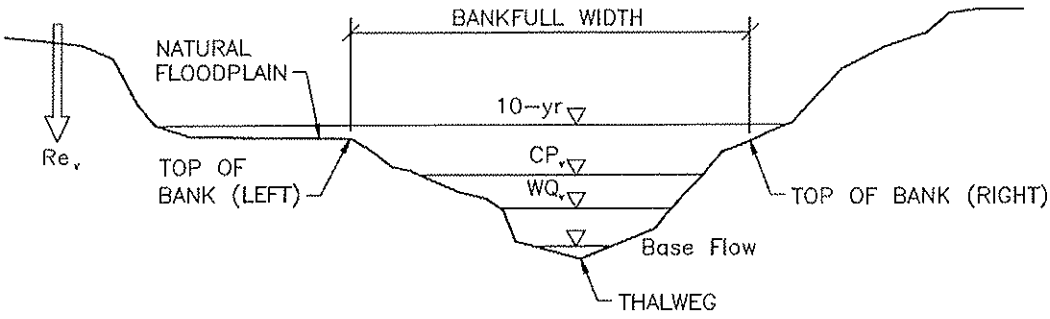
The data used to establish the TMDL is outdated and incomplete. The MS4s have made great strides towards reducing storm flows and cleaning up Hinkson Creek. None of that information was provided in the TMDL. We would suggest that you include the following:

Stream Buffer – both the City of Columbia and Boone County have passed a Stream Buffer Ordinance. This ordinance is a set-back requirement dependant on stream size. Blue lined streams, as defined by the USGS topographic maps (the entire impaired section of Hinkson Creek), are categorized as Type 1 streams. They have a required set-back of 100-feet from the ordinary high water mark. Type 2 streams (dashed blue lines) and type 3 streams (unmarked tributaries with a drainage area greater than 50 acres) have 50-foot and 30-foot set backs respectively. Each of those set-backs is divided into two zones. The streamside zone or "No Mow" zone is for undisturbed native vegetation. The outer zone can have managed landscaped areas, but no new structures. This ordinance went into effect in the city in 2007, and the county in 2009. Although this does not capture previously platted properties, it will prevent new structures from being built adjacent to the creek, and increase stream bank vegetation and stabilization. This ordinance will also help reduce pollutants, including stream temperature.

Ordinances – Both Columbia and Boone County have stormwater ordinances that addresses many of the problems created by urban runoff. I would suggest that you review these documents, or work with staff to incorporate these activities into the TMDL document. The draft County ordinance can be found on-line
http://showmeboone.com/pw/StormwaterProgram/newReleases.asp

The county ordinance is based on the Center of Watershed Protection's Model Ordinance. In a nutshell the county will use a nested approach to stormwater management to treat different runoff volumes.

1. Runoff reduction – this is the recharge volume (Re). The center of watershed protection suggests 10% reduction. But with our heavy clay soils, that is almost impossible. The Boone County ordinance requires 10% of the water quality amount or 0.13 inches. This can be accomplished through deep rooted vegetation on 10% of the site.
2. Treat the Water Quality (WQ) storm. 90% of the rainfall events are 1.3 inches or less. By requiring that this volume be run through a filtration BMP, we can capture the majority of pollutants in the runoff.
3. Provide channel protection. The two year storm (3.5 inches in Boone County) will fill the creek channel. These bankfull events have the ability to modify the channel – often incising and eroding the banks. By capturing these flows and releasing them below the bankfull level, we reduce the amount of work that the water can do, thereby reducing channel erosion and degradation.
4. **Just doing those three levels of protection should treat and detain 96% of the rainfall events.**
5. However, there are the rare flood events. Detain the flood events, or safely route them through the system.



STREAM SECTION

Other Protective Measures: Currently the County has partnered with the City and the University on a 319 project in the Hinkson Creek Watershed. This restoration project is updating the watershed management plan, so that all of EPA's 9-key elements are included. In addition, the project has developed a feasibility study to examine and provide cost estimates for retrofitting areas in the impaired section of the creek. Our next step in that process is to approach landowners to cost-share the placement of retrofits that will reduce peak flows to the creek in the impaired section.

Other ongoing projects are demonstration and out-reach grants such as the Columbia Rain Garden Mini-grant, and the Jefferson Farms Demonstration Project. The City, County and University also work cooperatively on clean-up activities. The last event was held on October 17, 2009. Over 400 local citizens volunteered at least two hours of time to clean up Hinkson Creek.

University Hydrology Study of the creek. This study was initiated in 2008. The researcher has collected data for about one year. That data will be extremely helpful in developing the TMDL, and validating the changes in the watershed due to the stormwater ordinances, and stream buffer regulations.

APPENDIX J

EXHIBIT A

BOONE COUNTY REGIONAL SEWER DISTRICT
ACTIONS TO ENHANCE HINKSON CREEK WATERSHED
POST 303(D) LISTING

1. Closed the Fairway Meadows West Lagoon by installing a pump station and pumping flows to the City of Columbia. The Fairway Meadows West Lagoon discharged into a tributary of the north fork of the Grindstone, which is a tributary to Hinkson Creek.

2. Closed the Fairway Meadows East Lagoon by in installing a pump station and pumping flows to the City of Columbia. The Fairway Meadows East Lagoon discharged into the north fork of the Grindstone, which is a tributary to Hinkson Creek.

3. Closed the Lake of the Woods Wastewater Treatment Plant by installing a gravity sewer that connected to the City of Columbia's wastewater collection system. The Lake of the Woods Wastewater Treatment Plant discharged into the north fork of the Grindstone, which is a tributary to Hinkson Creek.

4. Closed the El Chaparral Lagoon by installing a gravity sewer that connected to the City of Columbia's wastewater collection system. The El Chaparral Lagoon was the largest remaining wastewater treatment plant in the Hinkson Creek watershed controlled by the public. It discharged into the south fork of the Grindstone, which is a tributary to Hinkson Creek.

5. Closed the Sunrise Estates Wastewater Treatment Plant by installing a gravity sewer that connected to the City of Columbia's wastewater collection system. The Sunrise Estates Wastewater Treatment Plant discharged into the south fork of the Grindstone, which is a tributary to Hinkson Creek.

6. Closed the OTSCON Wastewater Treatment Plant by installing a gravity sewer that connected to the City of Columbia's wastewater collection system. The OTSCON Wastewater Treatment Plant discharged into the south fork of the Grindstone, which is a tributary to Hinkson Creek.

7. Boone County voters approved a $21 million revenue bond issue in April, 2008, to further improvements to Hinkson Creek. These will close additional discharges to the Hinkson Creek watershed and/or improve wastewater treatment at existing Boone County Regional Sewer District facilities. These include the closure of the Sun Valley Lagoon, the Hillview Acres Lagoon, the Lake Capri Lagoon, the Fall Creek Recirculating Sand Filter, and the Sheraton Hills Wastewater Treatment Plant in 2011. All these facilities are in the Hinkson Creek watershed and are located along State Highway HH. The closure of these facilities will be accomplished by the construction of about five pump stations and forced mains along Highway HH with connection to the City of Columbia's wastewater collection system.

8. In 2010, the budget calls for closure of the Shaw Wastewater Treatment Plant by installing a gravity sewer that connects to the City of Columbia's wastewater collection system. This is a joint project with the City of Columbia. The Shaw Wastewater Treatment Plant discharges into the north fork of the Grindstone, which is a tributary to Hinkson Creek.

These improvements will result in the removal of over 700,000 gallons per day design capacity from discharging into the Hinkson Creek watershed, removing various pollutant loads and bacteria from the watershed, reducing impact.

The District has also increased its sewer system maintenance activities to reduce risk to sewer integrity, which might result in discharges to the environment during peak events and enhancing the integrity of the system.

EXHIBIT B

CITY OF COLUMBIA
ACTIONS TO ENHANCE HINKSON CREEK WATERSHED
POST 303(D) LISTING

1. A significant sewer line has been repaired, which had a direct impact on Hinkson Creek.

2. New storm water, illicit discharge, and stream buffer ordinances were passed from late 2004 to early 2007. A new Storm Water and Water Quality Manual was released in early 2007 and was revised in early 2009.

3. New ordinances require scoring for water quality treatment, which are established up front for development or redevelopment projects. The developer is required to add water quality treatments to the plan until the required score is achieved for the site. These include storm water best management practices that address volume reduction and hydrology modification.

4. All projects, both redevelopment and new development, are impacted by the new ordinance. These include modifications to impervious surfaces, BMP's, volume reductions, and hydrological modifications. Improvements such as rain gardens and bio-retention cells are included in the alternatives to provide scoring.

5. New rules encourage the use of edge buffer outfalls, which work together with the stream buffer ordinance. Water is dispersed through the buffer before reaching the stream so that more water is absorbed and stored in the buffer soil.

6. The point system provided in the rules encourages the preservation of existing soil strata and vegetation through point reductions.

7. The new rules allow for the use of channel protection detention rather than traditional detention in order to modify the hydrograph. The new rules and ordinances have resulted in significant extended detention wetlands being installed behind businesses on Conley Road (just west of Highway 63 and south of I-70) that were identified as hot spots in the original 303(d). These basins treat a significant amount of impervious area and can be expected to have significant beneficial effects on the Hinkson Creek watershed.

8. A number of other private businesses have been required to retrofit storm water treatment practices in the Hinkson Creek watershed as a result of the manual. Some examples include:

   A. Rain gardens and a wetland have been added and the stream buffer enhanced at Stevens Lake Park along the main reach of Hinkson Creek.

   B. Pervious pavement and underground detention are being installed at the Columbia City Hall development and redevelopment along the Flat Branch, which is a tributary to the Hinkson Creek.

C. Pervious pavement and a large bio-retention cell was installed with the help of grants at the City's new Fire Station No. 7, which discharges to Mill Creek, which is in the Hinkson Creek watershed.

D. Rain gardens were installed on the Harvard Drive Rehabilitation project, which discharges to County House Branch, a tributary to the Hinkson Creek.

E. MKT Trail Head Park redeveloped a former industrial area in downtown Columbia, removing contaminated soil and stabilizing stream banks with large rocks and planting. A rain guard was installed in the most recent phase. These all impacted the Flat Branch, which is a tributary to the Hinkson Creek.

CITY SANITARY SEWER CHANGES IN THE HINKSON CREEK WATERSHED

1. The City has implemented sanitary sewer changes that have benefited Hinkson Creek, which include the construction of interceptors that eliminate small treatment facilities and performed pipe and manhole rehabilitation projects. They include:

   A. The South Grindstone Interceptor and the Lake of the Woods Mobile Home Park Lagoon Interceptor removed several small treatment plants from the watershed and connected them to the City's sewer system. These were in cooperation with the Boone County Regional Sewer District.

   B. The City has implemented a program involving cured-in-place linings of old pipes and manholes. These projects stopped sewage from leaving old systems as well as preventing overflows by preventing storm water from entering the system.

   C. The City has undertaken an effort to eliminate "private sewer systems" that were prone to bad repair and overflow problems. An example is the Sewer District 154 Project in the Flat Branch watershed, which eliminated 20+ acres of failing sewers. The City has methodically taken over and rehabilitated private sewers that especially impacted the Hinkson Creek system.

2. The City has a history of eliminating wastewater treatment plants and direct discharges to Hinkson Creek. These include both City plants and County plants in an effort to improve the watershed. This began in the early 1970's and continues to this day.

EXHIBIT C

UNIVERSITY OF MISSOURI
ACTIONS TO ENHANCE HINKSON CREEK WATERSHED
POST 303(D) LISTING

1. Best Management Practices at the University Power Plant in conjunction with its NPDES permit have resulted in extremely low Total Suspended Solids (TSS) in spite of the Power Plant sitting directly on the Flat Branch, which is a tributary to the Hinkson Creek. A comprehensive street sweeping program at the Power Plant takes place every day coal is delivered, and there are numerous controls that have been established at storm sewer inlets in the area near the Plant.

2. Each of the University's large aboveground fuel storage units has individual NPDES permits, which require strict controls on discharge of storm water that accumulates in secondary containment. The University continues its history of having no illicit discharges from any of its AST's. The University has three Spill Prevention Containment and Control Plans covering parts of the watershed. These plans provide formal procedures to prevent release to waters of the state of any oil products, which include both inorganic and organic oils and fats.

3. All construction on the University Campus is coordinated by a designated land disturbance permitting authority on the campus. The campus has dedicated employees that provide weekly and post-rain event inspections on all University construction for compliance. Additional inspections are provided by University Environmental Health and Safety, and audits are conducted of all open land disturbance events.

4. The University's Master Plan for the entire campus, which is reviewed and revised annually, incorporates storm water concerns. All campus storm and sanitary sewers are mapped and are in the process of being inspected via in-line cameras.

EXHIBIT D

COUNTY OF BOONE
ACTIONS TO ENHANCE HINKSON CREEK WATERSHED
POST 303(D) LISTING

Boone County has taken significant administrative steps to pass ordinances, including stream buffer protection, that directly impact the quality of Hinkson Creek. None of these appear considered in the TMDL.

1. The County has passed a stream buffer ordinance. This ordinance has a setback requirement depending on stream size. Streams are categorized by USGS topographic maps. Blue line streams are categorized as Type 1 streams. They are required to have a setback of 100 feet from the ordinary high water mark. Type 2 streams (USGS-blue lines) and Type 3 streams (unmarked tributaries with drainage areas greater than 50 acres) have 50-foot and 30-foot setbacks respectively. Each of those setbacks is divided into two zones. The stream-side zone or "no-mow" zone is for undisturbed native vegetation. The outer zone can have managed landscape areas but no new structures. The ordinance went into effect in the county in 2009. The ordinance is not retroactive, but will prevent new structures from being built adjacent to the creek and increase stream bank vegetation and stabilization.

2. The County is in the final stages of a public review of a storm water ordinance that addresses the consequences and impacts of urban runoff and protects waterways from storm water-related pollutant load.

3. The county ordinance is based on the Center of Watershed's Protections model ordinance. The County uses a nested approach to storm water management to treat different runoff volumes. The details of the county ordinance, which is currently going through appropriate public participation, can be found on the County's website.

EXHIBIT E

ACTIVITES BY PRIVATE OR QUASI PUBLIC AGENCIES TO ENHANCE HINKSON CREEK WATERSHED POST 303(D) LISTING

1. The County has partnered with the City of Columbia and the University of Missouri on a 319 project in the Hinkson Creek watershed. The restoration project is updating the watershed management plan so that all of EPA's nine key elements are included. The project has developed a feasibility study to examine and provide cost estimates for retrofitting areas in the impaired section of the Creek. The next step in the 319 grant is to approach landowners to cost share the placement of retrofits that will reduce peak flows to the Creek in the impaired section.

2. The City, County, and University have worked cooperatively on clean-up activities. The last event was held on October 17, 2009. Over 400 local citizens volunteered at least two hours of time to clean up Hinkson Creek and remove debris.

3. University hydrology study of the Creek was initiated in 2008. The researcher has collected data for about one year. That data will be extremely helpful in the triage process, enhancement of the TMDL strategy, and validating the changes in the watershed due to the storm water ordinances and stream buffer regulations. It will assist in providing baseline information.

4. The Missouri Department of Transportation has relocated salt domes and distribution facilities. The facilities were formerly located off Conley Road on the banks of Hinkson Creek. They have been relocated with state-of-the-art storm water control structures. Chlorides have long been a suspect of concern, and they have had a major source removed.

5. Columbia Country Club has provided greater buffer zones along its golf course adjacent to Hinkson Creek.

6. The Conley Road Transportation Development District has constructed significant detention, treatment, and control facilities in an area suspected of impacts to Hinkson Creek. The area has significant parking lots with large impervious square footage and substantial roof structures.

APPENDIX K

UNIVERSITY *of* MISSOURI

ENVIRONMENTAL HEALTH AND SAFETY

Supplement to Appendix D of USEPA draft TMDL for Hinkson Creek (MO_1007 and MO_1008)

To Whom It May Concern,

Appendix D of the above referenced Draft TMDL Exhibit D lists actions taken by the University of Missouri to Enhance Hinkson Creek Watershed post 303(d) listing. The University has one update to the list as published and several additions that were previously omitted.

Update:

Item 2. The university now has four (4) Spill Prevention, Control, and Countermeasure plans – not three (3) as referenced in the draft document.

Additions:

1. Storage capacity (18" of larger open graded stone) was created under Stankowski Field. The synthetic field replaced a grass covered field that did not drain well and provides all weather recreation capability on the site.
2. MU's parking structures constructed since 1998 (Hitt St. Garage, Virginia Ave. Garage and Parking Structure #7)have (conservatively) saved over 30 acres of surface parking.
3. A detention area was constructed as part of the Southwest Housing project at the northeast corner of Providence Rd and Stadium Blvd. This detention was installed to provide capacity to temporarily store water from part of the roof of this new development as well as to remove localized flooding from the nearby impervious road to a more pervious location.
4. An oil separator for the drains was installed in Parking Structure # 7 and a bioswale was constructed on the east side of the project to manage a portion of the storm water from the site.
5. A detention area was constructed on the south end of parking lot RP-10. The parking lot is very close to Hinkson Creek so the addition of this area should dramatically improve the quality of water entering Hinkson Creek that runs off this lot.
6. A detention area was added south of Regional Biocontainment Laboratory. This detention is just prior to a large drop in elevation thereby slowing down runoff and adding clarification of the storm water.
7. The University of Missouri developed a pamphlet ("Managing Storm Water During Projects at MU") aimed specifically at contractors performing work on the MU campus to stress the major compliance points of the MS4 permit.
8. Most MU projects have been developed on areas that were previously paved and typically result in a lower percentage of the area being impervious after the redevelopment than before it was undertaken.

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APPENDIX L

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Final Memorandum

Date:	30 November 2010
To:	Georganne Bowman, Boone County Public Works
	Tom Wellman, Public Works Department, City of Columbia, MO
	Todd Houts, University of Missouri
From:	Trent Stober, P.E., Geosyntec Columbia, MO
Subject:	Technical Evaluation of Draft Hinkson Creek Total Maximum Daily Load (TMDL)

A Municipal Separate Storm Sewer System (MS4) permit is jointly held by the City of Columbia, MO, Boone County, and the University of Missouri. At the request of MS4 co-permittees, Geosyntec conducted a third-party technical review of the methods and approaches used in developing the TMDL. This memorandum conveys conclusions and specific comments identified during our review.

1. SUMMARY OF FINDINGS

Aquatic communities inhabiting streams and rivers flowing through urban areas are exposed to a variety of stressors that are either not present in undeveloped landscapes, or occur less frequently. Measures of aquatic community health and biologic integrity have been negatively correlated with impervious area metrics (Miltner et al. 2003, Schuler 1994, Klein 1979). However, as Adams (2003) points out, statistically significant correlation does not establish causation.

In order to meet mandated TMDL development timelines, the U.S. Environmental Protection Agency (USEPA) is required to move forward with establishing a TMDL for Hinkson Creek. The draft TMDL currently on Public Notice prescribes a significant catchment-wide reduction in runoff as a surrogate for a stressor-effect relationship that USEPA has been unable to establish or quantify. In general, our review finds that runoff reduction targets cited in the TMDL are not well supported and are ambitious, given the uncertainty of key technical linkages. Uncertainties identified in our review include but are not limited to:

- Stressor-Effect Relationship. The draft TMDL does not establish causality between runoff and beneficial use attainment in either Hinkson Creek or 'attainment' streams. Information presented in the TMDL does not provide any assurance that benthic macroinvertebrate metrics will respond to changes in stormwater runoff.

- Runoff and Baseflow Time Trends. Information contained in the TMDL does not demonstrate that runoff volume has increased or that baseflow has decreased in the Hinkson Creek watershed over time.

- Comparability of Attainment Streams. It is not clear what methodology grounded in peer-reviewed literature, or agency guidance, supports the process used to select 'attainment' streams set forth in the TMDL.

- Current and Historical Impervious Landuse. Landuse data and analysis cited in the TMDL are inconclusive. While impervious area has likely increased in the Hinkson catchment to some degree, GIS coverages used in the TMDL are not well suited for demonstrating urban landuse changes at the scale of interest.

Given the documented increases in population and residential development in the Columbia area, there is little doubt that runoff into Hinkson Creek has increased compared to the 1960s. However, information presented in the draft TMDL does not demonstrate or quantify temporal changes in Hinkson Creek hydrographs. Little tangible evidence is offered in the TMDL that supports changes in runoff volume are responsible in whole, or in part, for periodic depressions in benthic macroinvertebrate scores.

We believe that additional stressor-response data and a more refined hydrologic analysis approach are necessary to assure that compliance with TMDL targets will yield consistent attainment of Hinkson Creek aquatic life uses. In addition, we suggest that attainment of biocriteria at frequencies prescribed by Missouri's 303(d) listing methodology and biocriteria documents serve as the primary TMDL target as (1) bioassessment scores served as the rationale for listing Hinkson Creek as impaired and (2) site-specific causal relationships between runoff and ecological health have not been established in the TMDL.

2. SPECIFIC COMMENTS

2.A. Hydrologic Analysis and Interpretation

Comment 2.A.1. Periods of record for comparative analyses appear to be inconsistent.

Comparison of land uses from 1993 and 2005 are presented to support the claim of increased imperviousness. However, the flow duration curves presented in Figure 4 are compared for 1967 and 2007. Because the time periods of comparative analysis differ, potential changes to *the flow-duration curve are not clearly the result of unquantified changes in urbanization.* Is it possible

that changes in farming practices or climatic patterns have influenced hydrograph and flow-duration characteristics?

We also request explanation of the following period-of-record related comments and observations:

- In Table 9, precipitation and flow statistics for 1967 and 2007 are compared for the April 1 – July 31 period. Why are only 4 out of 12 months of available data being used to describe precipitation and runoff? Should USEPA believe that conclusions drawn from fall biological surveys are relevant in assessing use attainment in Hinkson Creek, it would seem appropriate that flow data collected in the late summer/ fall season also be incorporated into hydrologic analyses and comparisons. How do we know that antecedent precipitation regimes did not influence the results of a 4-month comparison? Furthermore, as precipitation and streamflow data often do not follow a normal statistical distribution, we question the use of the arithmetic means to describe central tendencies. If the period of record is expanded to all available and comparable months for 1967 and 2007 (March 11 – December 31, n=296), we note that the median, geometric mean, and cumulative Period of Record (POR) streamflow values for 1967 (median=5.75 cfs) are greater than values for 2007 (median= 3.05 cfs). Side-by-side boxplots of the two data sets (Exhibit 1) indicate both years have very skewed daily average flows, *which suggests that the arithmetic mean is a biased estimator* and the median is a more appropriate metric of the central tendency of data. More importantly, the medians are not statistically different from each other based on the non-parametric Mann-Whitney test (p=0.95).

  The lack of statistical difference between the median daily average flow for 1967 and 2007 indicates that *the data do not support the claim that the flow regime in the creek has been significantly changed.* It is not clear why a truncated period of record was selected.

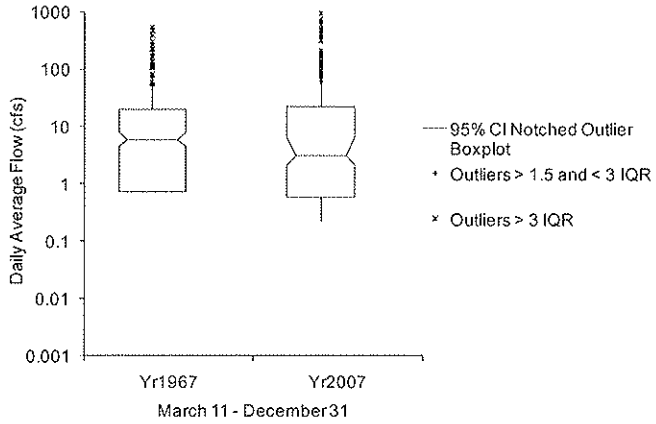

Exhibit 1. Side-by-side boxplots of daily average flows for 1967 and 2007 (USGS 06910230 Hinkson Creek in Columbia, MO)

- In reference to Figure 4 and based on the arguments presented above, the full available and comparable period of record (April 1 – December 31) should be presented to capture seasonal patterns in rainfall and runoff. In addition, we note that higher baseflows in 1967 (referenced in relation to Figure 4, Page 27) could be attributed to wastewater treatment facilities (WWTFs) that historically discharged to Hinkson Creek. Approximately fifty-three (53) WWTFs that discharged historically within the Hinkson Creek basin have been eliminated. *It is not clear that presumed reductions in baseflow can be wholly attributed to unquantified infiltration reductions in the catchment.*

  We also point out that Figure 9 suggests that Hinkson Creek has a relatively high normalized base or low-flow compared to the average synthetic flow duration cuve derived from reference streams. We suggest that MDNR conduct a baseflow separation and trend analysis on the entire period of record at the Hinkson gage to determine if baseflows from discharging groundwater have significantly decreased over time and whether any changes are due to other causes.

- Flow duration curves inherently require long-term continuous flow records to adequately capture the large variation in rainfall and runoff characteristics. *The selection of only four months (April 1 – July 31) for only two individual years (1967 and 2007, Figure 4) is not adequate for identifying differences in precipitation-runoff responses.* Presumed differences in the flow-duration curves could be attributed to differences in precipitation characteristics alone. A comparison of the intensity-duration curves should supplement the flow-duration curve analysis to ensure differences in precipitation characteristics are not the cause of the presumed differences in the flow-duration relationship.

Comment 2.A.2. Reductions in runoff may not proportionally reduce unidentified pollutant loading.

Understanding pollutant generation, transport, and delivery processes are necessary in developing effective control and restoration measures. Application of a catchment-wide surrogate for a pollutant is likely to yield unintended consequences. Reducing runoff volume (transport medium) on a basin-wide basis infers that beneficial uses as measured by macroinvertebrate scores respond in a continuous, linear, and negative manner to pollutant load. However, toxicological responses are frequently concentration-driven, often threshold in nature (not continuous), and may be non-linear (sigmoid).

If periodically lower biological metrics are the result of discrete activities that have been remediated or abated, such as chloride wash-off from road salt storage facilities, how will basin-wide runoff reductions improve ecological health? Furthermore, if impacts were related to chloride or other 'urban' contaminants, how will reducing runoff from agricultural land benefit biological scores?

Many contaminants may be transported by fine sediment in the adsorbed phase. Although not documented, contaminated sediments could be a critical exposure pathway for macroinvertebrate communities in Hinkson Creek. Adsorbed pollutants are subject to sediment transport and delivery phenomena that can operate at timescales much slower than the Hinkson Creek study period (2001 – 2006). It is possible, but uncertain, that biological scores may have been affected by contaminated sediment generated several years ago that is now being released from storage and delivered to the Hinkson Creek channel. *We note that Missouri Department of Natural Resources (MDNR) survey reports suggest that evaluating the effects of sediment should be considered in subsequent investigations.* Where contaminated sediment may represent a significant exposure pathway, the role of sediment budgeting techniques (Walling and Owens 2003, Walling 1999) may be useful during TMDL re-analysis.

Comment 2.A.3. The runoff reduction approach does not adequately consider groundwater delivery processes or alterations in the water balance.

The runoff reduction approach posed by the TMDL does not adequately consider fate and transport of pollutants that may contaminate groundwater in urban areas. For example, if the unidentified pollutant(s) are discharged from groundwater sources during baseflow conditions then reducing runoff volumes could potentially increase overall in-stream concentrations.

In addition, increasing infiltration in areas where soils are contaminated, or where known up-gradient plumes occur, could in fact cause an increase in pollutant(s) reaching Hinkson Creek.

Reducing storm water runoff to achieve historical streamflow patterns from the 1960s is an incomplete approach and does not consider the water balance as a whole. To achieve streamflow characteristics from the 1960's, we may actually have to infiltrate volumes of water that exceed

historic rates due to potential reductions in evapotranspiration (Grimmond and Oke 1999). *The TMDL should consider propagated effects on the urban water balance if a runoff-reduction approach continues to be pursued.*

2.B. Landuse Analysis and Interpretation

Comment 2.B.1. Landuse categories in the draft TMDL do not reflect underlying MORAP datasets.

Based on our analysis of the 1993 and 2005 Missouri Resource Assessment Program (MORAP) datasets, we note that there is no strictly "urban" landuse category as presented in the draft TMDL (Exhibit 2). Additionally, the landuse categories differ between the 1993 and 2005 MORAP data and are therefore not directly comparable.

Exhibit 2. Hinkson Creek landuse based on 1993 and 2005 MORAP landuse/land cover data

1993 Land Use Categories	Acres	2005 Land Use Categories	Acres
Urban Impervious	3,819	Impervious	2,758
Urban Vegetated	747	High Intensity Urban	1,288
Barren or Sparsely Vegetated	0	Low Intensity Urban	7,843
Row and Close-Grown Crop	7,462	Barren or Sparsely Vegetated	79
Cool-season Grassland	27,892	Cropland	6,641
Warm-season Grassland	11	Grassland	21,950
Glade Complex	0	Deciduous Forest	14,259
Eastern Redcedar and Redcedar -Deciduous Forest and Woodland	4,348	Evergreen Forest	366
Deciduous Woodland	874	Mixed Forest	0
Deciduous Forest	11,817	Deciduous Woody/Herbaceous	195
Shortleaf Pine-Oak Forest and Woodland	0	Evergreen Woody/Herbaceous	0
Shortleaf Pine Forest and Woodland	0	Mixed Woody/Herbaceous	0
Bottomland Hardwood Forest	59	Woody-Dominated Wetland	634
Swamp	0	Herbaceous-Dominated Wetland	49
March and Wet Herbaceous Vegetation	21	Open Water	1,389
Open Water	401		
Total	57,451		57,451

Note: Acreage values are based on the Hinkson Creek watershed boundary GIS shapefile provided by MDNR. Acreage values provided above may differ slightly than those found in Tables 1 and 2 in the draft TMDL. It appears that USEPA may have used different versions of the Hinkson Creek watershed boundary GIS shapefile to calculate acreage values in the draft TMDL.

Despite dataset differences, USEPA appears to have grouped the following landuse categories into a single "urban" category:

- 1993 MORAP landuse categories grouped as "urban" by USEPA:
  - Urban impervious
  - Urban vegetated
- 2005 MORAP landuse categories grouped as "urban" by USEPA:
  - Impervious
  - High intensity urban
  - Low intensity urban

By grouping 1993 and 2005 data in this manner, the draft TMDL infers that all urban landuses contribute equally to stormwater runoff. However, not all urban uses are equal and their impacts to stormwater runoff differ substantially. We also note that increases to "urban" area referenced in the TMDL are due to the definition of "low intensity urban" landuses. The 2005 MORAP metadata defines "low intensity urban" as "vegetated urban environments with a low density of buildings". It is highly unlikely that "low intensity urban" landuses contribute to stormwater runoff with the same magnitude as "impervious" landuses.

Comment 2.B.2. The assertion that percent "urban" land cover increased approximately 160% from 1993 to 2005 is not supported by the underlying MORAP datasets.

The 2005 landuse category "low intensity urban" has no "urban" landuse counterpart in the 1993 dataset. We note that comparison of the 2005 MORAP dataset with aerial imagery indicates that "low intensity urban" is primarily residential land. Based on our aerial imagery analysis, we also note that residential land is generally *excluded* from any "urban" landuse category in the 1993 MORAP dataset. As further evidence, we performed a GIS spatial analysis of the MORAP datasets and found that the 2005 "low intensity urban" landuse was identified by any one of 10 different categories in 1993 (Exhibit 3). Of the 7,843 acres categorized as "low intensity urban" in 2005, non-"urban" landuses, as identified by the 1993 dataset, accounted for 6,450 acres (i.e., 82.2%). However, this does not indicate an actual increase in "urban" landuse as suggested in the draft TMDL. *Neighborhoods established well before 1993 are generally categorized as "cool-season grassland" or "deciduous forest" in the 1993 dataset.* Again, as noted above, few if any residential neighborhoods are identified under any "urban" category in the 1993 dataset. Therefore, it may not be appropriate to draw any conclusions regarding urban area increases attributed to the 2005 "low intensity urban" landuse category.

Exhibit 3. Distribution of 2005 "Low Intensity Urban" acreage within landuse categories established in 1993 for the Hinkson Creek watershed.

1993 MORAP Land Use Category	2005 "Low Intensity Urban" Acres
Urban Impervious	1,279
Urban Vegetated	114
Row and Close-Grown Crop	178
Cool-season Grassland	3,949
Warm-season Grassland	2
Eastern Redcedar and Redcedar -Deciduous Forest and Woodland	635
Deciduous Woodland	44
Deciduous Forest	1,627
March and Wet Herbaceous Vegetation	0
Open Water	15
Total	7,843

Note: Acres do not represent the total number of acres within the Hinkson Creek watershed, but rather the number of acres within the 2005 "low intensity urban" landuse category. This analysis was performed using the intersect tool in ArcGIS

A more appropriate comparison between the 1993 and 2005 MORAP datasets might be between the following categories:

- "Urban impervious" (1993 dataset) and "impervious" (2005 dataset), and
- "Urban vegetated" (1993 dataset) and "high intensity urban" (2005 dataset).

However, this would suggest a decrease of approximately 1,061 acres in impervious urban area from 1993 to 2005. Comparing "urban vegetated" to "high intensity urban" suggests a nominal increase of only 541 acres from 1993 to 2005 (Exhibit 2). We also note that our spatial analysis presented in Exhibit 3 suggests that 1,279 acres of "urban impervious" land was converted to "low intensity urban" from 1993 to 2005. Given the cited differences between 1993 and 2005 datasets, it is unlikely that definitive time-trend conclusions regarding urban landuse in Hinkson Creek may be determined from MORAP datasets.

Comment 2.B.3. Landuse data from 1976 was not presented or discussed.

We note that USEPA did not consider 1976 landuse GIS data as part of the TMDL. This landuse data suggests there were approximately 6,978 urban acres within the Hinkson Creek watershed in 1976, whereas the draft TMDL suggests there were approximately 4,527 urban acres in 1993. There was likely no such decrease in urban landuse, but further underscores the questionable validity of available landuse datasets in establishing meaningful time-trends.

Comment 2.B.4. Inconsistencies between the MORAP datasets suggests inaccuracies and lack of comparability.

We note that Tables 1 and 2 in the draft TMDL suggest that open water acreage within the Hinkson Creek TMDL increased from 422 to 1,439 acres from 1993 to 2005. Closer inspection of the data and associated metadata suggests this does not represent an actual increase in open water acreage, but rather improved techniques for classifying waters between 1993 and 2005. Although the datasets suggest an increase of approximately 240% in open waters, in actuality there was likely no change. *This illustrates that landuse data digitized under different methodologies are not comparable.*

2.C. Biological Analysis and Implementation

Comment 2.C.1 Historical biological community health is not documented in the TMDL.

Throughout this TMDL document, an assumption has been made that the biological community was attaining the beneficial use prior to increased urbanization and that restoring hydrology to historical levels will restore biological health. There is really not much evidence that this was the case in the 1960-1990 period. The biological health of Hinkson Creek has not been adequately documented for this time period and anecdotal evidence suggests that the water quality and biological health of Hinkson Creek was poor and has improved considerably since the 1960's. MDNR and USEPA should investigate their own records for water quality and biological data collected during this time period. We note that approximately 53 WWTFs historically discharged within the Hinkson Creek watershed and that agricultural practices may have changed in the past 50 years.

Comment 2.C.2. The return interval targeted by the TMDL does not establish a linkage with the beneficial use.

Although the use of a surrogate measure (reference stream flow duration targets/storm water runoff volume) for "pollutants" has merit in specific and targeted situations where multiple stressors exist, we believe that a TMDL must ultimately be linked to the protection of a beneficial use. For example, in the Potash Brook TMDL (VTDEC 2006) performed by the Vermont Department of Environmental Conservation, such a link was established. A stream geomorphic data assessment of Potash Brook performed in 2005 documented "less than stable" in-stream sediment conditions that provide the link to the impaired biotic community. The Potash Brook TMDL has been cited by USEPA as an example of a TMDL that has successfully used stormflow as a surrogate for multiple impairments. *We note that a link between Missouri attainment stream return intervals and biological endpoints has not been established.*

In the TMDL, USEPA appears to have assumed that higher biological scores in the four "flow attainment" streams are due solely to the differences in flow regimes. While the literature (Hughes et al. 1986) and USEPA guidance (Barbour et al. 1996) support the reference approach when evaluating regional stream differences, USEPA has not provided sufficient data to quantify the assumed cause-effect relationship between storm flow and biological health in any of the study streams. No information is presented in the TMDL to suggest that the higher biological scores were directly linked to storm water runoff or impervious area. At a minimum, a statistically significant ($p<0.05$) correlation relating biological scores and impervious area is needed to justify future studies capable of detecting and quantifying causation.

Although MDNR's series of stream evaluations did include elements of USEPA's Stressor Identification Guidance (Cormier et al. 2003), it appears as if MDNR's approach did not support the structured assessment methods recommended by USEPA and the technical literature. As a result of MDNR's approach, some important data (e.g., biological samples in Hinkson Creek and flow attainment streams) were collected inconsistently or, as USEPA itself admits, not collected at all. For example, on page 8 of the draft document, USEPA states the following:

"Sediment has been established as the primary source of impairment in numerous TMDLs throughout the country. However, since sediment was not studied with respect to the impairment in Hinkson Creek, sediment cannot act as the basis for a surrogate TMDL as it has elsewhere."

USEPA should consider re-evaluating stressors in Hinkson Creek and attainment streams according to a structured watershed monitoring plan which adheres to stressor identification guidance and the technical literature. Adams (2003) offers several criteria useful in establishing causation between stressors and observed effects.

Comment 2.C.3. Biomonitoring endpoints should serve as the primary TMDL target.

The TMDL document suggests that significant flow reductions are required at the three and five percent flow exceedance values (Table 15 of draft TMDL) to protect a fully supporting biological community. If a linkage between stormwater runoff and the biological community does exist, it has not been demonstrated. Therefore, we question whether these significant flow reductions would be necessary to achieve the beneficial uses. *This further suggests that achieving a fully supporting biological community should be the primary water quality target rather than a reduction of stormwater input, since aquatic life impairment is the driver for placement of Hinkson Creek on the impaired waters list.* On Page 8 of the draft TMDL it says that "Federal regulation also states that TMDLs may be established using a biomonitoring approach as an alternative to the pollutant-by-pollutant approach [40 CFR 130.7 (c)(1)])." It is unclear to us why biomonitoring is not the primary water quality target instead of a technically unsupported flow reduction.

Comment 2.C.4. The biological community in Hinkson Creek may not be currently impaired.

With the exception of the spring of 2002 assessment, macroinvertebrate samples collected by MDNR have shown the urban portion of Hinkson Creek to be *fully supporting or very nearly so each time the biological community has been evaluated* (MDNR 2002, 2004, and 2006). The last comprehensive investigation of the macroinvertebrate community was conducted by MDNR in the fall of 2001 and spring of 2002. To our knowledge the last macroinvertebrate sampling of any kind was performed by MDNR in the spring of 2006, nearly 4 years ago. We believe that a more methodical investigation into the biological community is warranted to better understand the biological health of Hinkson Creek.

Comment 2.C.5. Several significant differences exist between the Hinkson Creek TMDL and the Potash Brook template.

The Potash Brook TMDL has been cited as an example of a TMDL that has successfully used storm flow as a surrogate for multiple impairments. As such, this approach is being used as a template for the Hinkson Creek TMDL. However, there are several major differences between the two watersheds that must be recognized. Potash Brook is a 7.1 mi^2 watershed compared to Hinkson Creek which is approximately 90 mi^2. Potash Brook has a heavily impaired aquatic community as opposed to Hinkson Creek, which regularly is found to be between fully supporting and partially supporting. Are there lessons to be learned in the Potash Brook TMDL? Have the runoff reduction targets been achieved, and if so, has the biological community been restored as a result?

Comment 2.C.6. The attainment stream selection process cited in the TMDL is questionable.

The second paragraph of Section 4.6 in the TMDL ('Setting the Water Quality Targets') states that "The instream water quality target for the TMDL is the high flow category of the FDC developed from the biological reference streams." This approach is similar to that used in the Potash Brook TMDL.

The Potash Brook TMDL states that the use of "attainment" streams as opposed to "reference" streams is used "because reference tends to imply that the ultimate goal for the impaired steam approaches pristine. Instead, the attainment watershed(s), while meeting or exceeding the Vermont water quality standards criteria for aquatic life, should contain some level of development in order to better approximate the true ecological potential of the impaired stream." This use of "attainment streams" gave recognition to the fact that highly developed watersheds would not be expected to attain reference conditions.

A fairly rigorous approach was used for the selection of attainment streams by the Vermont Department of Environmental Conservation using an analysis described in Foley and Dowden

(2005). These attainment watersheds were evaluated for similar size, slope, soils, climatic patterns, channel type and landuse/cover and were all in relatively close geographical proximity to Potash Brook. In addition, they all contained some level of development in order to approximate what the true ecological potential might be.

Unfortunately, the streams selected for the Hinkson Creek TMDL are not physiographically similar to Hinkson Creek. To be physiographically similar, the "attainment" streams selected for the Hinkson Creek TMDL should be of similar size and should have similar levels of urbanization. The selected attainment streams are 3-7 times larger (313 – 620 mi^2) than the Hinkson Creek watershed area of ~90 mi^2 and all contain very low levels of urbanization. The "attainment" streams selected for the Hinkson Creek comparison were primarily based on the availability of macroinvertebrate data and the presence of a USGS gauging station in order to supply flow information.

It is our opinion that the selection process of attainment streams for this TMDL is inadequate and not sound. Two of the four "attainment" streams are actually "reference" streams for their particular Ecological Drainage Units, a comparison that we believe is not appropriate. On page 14 of the Potash Brook TMDL the authors state "However, haphazard matching of attainment streams, and thus flow targets, to Potash Brook could lead to targets with a high degree of uncertainty as to whether standards would be met." This is certainly the case with the attainment streams selected for the Hinkson Creek comparison. It is our opinion that either other urban streams that are attaining their beneficial uses, or other similar streams within the Ozark/Moreau/Loutre Ecological Drainage Unit be used for comparisons to Hinkson Creek.

Comment 2.C.7. Rescoring historic biomonitoring data is not appropriate.

Rescoring of historic data based on more recent sampling of reference streams (TMDL Table 8, italics) is not appropriate in our opinion. It makes it extremely difficult, if not impossible, to make impairment decisions that could change based on data that will be collected in the future. Study streams should be evaluated based upon the scoring criteria that are in effect at the time of sampling. For example, MSCI scores determined in the fall of 2001 should be assessed based on the reference stream criteria that were available and in effect in 2001. Continually reassessing MSCI scores whenever new data are collected is unprecedented and will clearly make impairment determinations difficult in the future.

We strongly recommend that any given stream be scored based on the reference stream scoring criteria that is available at the time of sampling, and as scoring criteria for reference streams changes as a result of the collection of additional data, then only new data collected on study streams be appropriately compared to the new scoring criteria.

Following are the MSCI scores that we believe to be correct and consistent with previous reported results:

- Fall 2001
  - Site 2 should be 18.
  - Site 1 should be 16.
- Spring 2002
  - Site 8 should be 18.
- Fall 2005
  - Site 6 should be 18.
  - Site 5.5 should be 14.
- Spring 2006
  - Site 2 should be 14.

Based on our interpretation of the biomonitoring results when the correct (see above) MSCI scores are applied, the upstream sites (sites 7 and 8) score as fully supporting 78% (7 of 9) of the time. The lower Hinkson sites (sites 1-6) scored as fully supporting 52 % (13 of 25) of the time. It should be noted, however, that following the spring 2002 sampling event the MSCI scores within the urbanized portion of Hinkson Creek have been fully supporting nearly 70% of the time. This is *quite comparable* to MDNR's TMDL web page[1] which indicates that reference streams in this Ecological Drainage Unit score as fully supporting approximately *75-80%* of the time.

Additionally, it is not clear why USEPA is targeting a higher biocriteria attainment frequency (100%, page 36) than what is typically achieved in reference streams. *A 100% attainment frequency for Hinkson Creek is unrealistic and not supported by MDNR biocriteria guidance.*

Comment 2.C.8. The spring 2002 biomonitoring dataset may be an anomaly.

The spring 2002 sampling of macroinvertebrates seems to be the driver for the determination of impairment in the urban portion of Hinkson Creek. When compared to all of the other macroinvertebrate sampling events, the spring 2002 was the only sampling event that consistently showed MSCI scores below 16. It is possible that the 2002 sampling event was an anomaly. We recommend that a comprehensive bioassessment of Hinkson Creek similar to that conducted in 2001-2002 be performed to better assess the current status of the aquatic community.

[1] http://www.dnr.mo.gov/env/wpp/waterquality/303d.htm

Comment 2.C.9. Little data are presented to support the assumption that reducing stormwater flows will increase baseflows, improve dissolved oxygen, and ultimately enhance the biological health of Hinkson Creek.

Several times throughout the draft TMDL document (e.g., pages 8, 18, 30), USEPA suggests that peak storm flow reductions will result in increased baseflows and higher dissolved oxygen concentrations during baseflow periods. On page 8, USEPA states the following:

> "MDNR water quality studies did reveal, however, that a large percentage of the problems noted above, including increased sediment and low dissolved oxygen at low flows, can be attributed to urban runoff conditions which result in excessive stormwater runoff and lower than normal baseflow conditions."

Neither USEPA or MDNR has offered data to support the claim that "lower than normal" baseflows are directly caused by peak storm flows or urban runoff conditions. In fact Schuler (1994, page 2), a paper which is cited in the draft TMDL, states that actual data have demonstrated that this is rarely the case. Furthermore, the assumption that low dissolved oxygen concentrations indirectly result from urban runoff conditions is unsubstantiated. As USEPA is aware, recently collected continuous data demonstrated that prolonged periods of low dissolved oxygen (below 5.0 mg/L) occur in several Missouri reference stream reaches during baseflow conditions. As reference stream reaches represent the "best available representatives of ecoregion waters in a natural condition with respect to habitat, water quality, biological integrity and diversity, watershed landuse, and riparian conditions" (10 CSR 20-7.031(1) (U)), *it is unclear why USEPA or MDNR believes that baseflow dissolved oxygen concentrations in Hinkson Creek can improve to acceptable levels when it has been demonstrated that baseflow dissolved oxygen conditions in reference streams cannot.*

Comment 2.C.10. Physical habitat limitation should be explored as a causal variable.

Habitat quality limits the biological potential for streams and rivers (Rabeni 2000). Reduced habitat quality within urban stream reaches is well documented in literature (Booth and Jackson 1997, among others). According to MDNR standard operating procedures (SOPs), habitat quality is measured during bioassessments. Furthermore, SOPs stipulate that habitat quality scores for study streams (e.g. Hinkson Creek) must be within a specified percentage of reference stream habitat scores, otherwise application of biocriteria to study streams is unjustified (i.e. habitat limited). Habitat limitation appears to offer a plausible explanation of periodically lowered macroinvertebrate scores in Hinkson Creek. *However available habitat data do not appear to be evaluated to any substantive degree in the TMDL.* Restoration strategies leading to improved habitat quality may differ from the volume reduction approach recommended in the TMDL.

2.D. IMPLEMENTATION FEASIBILITY

Comment 2.D.1. TMDL implementation feasibility is uncertain.

It is difficult to assess the feasibility and cost implications associated with meeting the TMDL. To attain TMDL flow targets, stormwater volumes will have to be reduced significantly. Currently, the Boone County Stormwater Ordinance requires that the runoff from 10% of the 1.3-inch water quality volume be permanently reduced. However, the Ordinance allows for a waiver of this requirement if there is a risk for groundwater contamination or site constraints make infiltration infeasible. *The TMDL does not provide any consideration for site constraints that may inhibit volume reductions.*

For many parts of the watershed and during many times of year the retention of large runoff volumes may not be feasible due to:

- High groundwater table
- Permeability of soils
- Limited pervious space availability
- Limited areas for evapotranspiration in dense developed areas
- Desirability of dense development vs. sprawl
- Potential for water balance issues and un-natural baseflow impacts
- Lack of non-potable demand for harvested stormwater

For areas that are conducive to achieving volume losses, other site constraints may impact the practicability of implementing infiltration facilities due to the presence of existing infrastructure and location of available space relative to the tributary drainage area. For agricultural areas, infiltration facilities may be more attractable than bioretention facilities. However, the feasibility of achieving volume reductions in the agricultural areas is even more uncertain than it is for urban areas. Agricultural lands generally have very low imperviousness such that runoff and shallow subsurface interflow typically only occurs when the soils become saturated.

During these conditions infiltration rates would be expected to be reduced and infiltration basins would need to be sized to retain stormwater for longer periods of time in order to reduce volumes.

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APPENDIX M

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Sent: Thursday, April 22, 2010 10:16 AM

To: Miller, Karen

Cc: 'JDGLASCO@GoColumbiaMO.com'; 'SSHUNT@GoColumbiaMO.com'; 'TEWELLMA@GoColumbiaMO.com'; DNRContact, bflorea@boonecountymo.org; 'GBowman@boonecountymo.org'; DNRContact, houtst@missouri.edu; Shorr, David; 'TStober@Geosyntec.com'; Totten, Scott; Tippett Mosby, Leanne; Peery, Anne

Subject: Draft Hinkson Creek TMDL (Sec. 6.5)

Attachments: Draft Section 5.6 - Phased TMDL Allocation.doc

Commissioner Miller,

Thank you again for the opportunity to attend and participate in the Hinkson Creek public meeting on Tuesday. In response to MS4 co-permittee concerns regarding implementation of reductions found in the Hinkson Creek TMDL, the Department intends to insert an additional section on "Phased TMDL Allocations" into the load capacity portion of the document (Section 5). Additional reference to phased TMDL allocation and implementation will also be included in the Wasteload Allocation (Section 6) and Load Allocation (Section 7) sections of the TMDL. These additions to EPA approvable sections of the TMDL will clearly state that the reductions will be implemented over a period of time and permit cycles. The language will also state that when Hinkson Creek is assessed as attaining applicable water quality standards, and the assessment is approved by EPA, storm water runoff reductions will no longer be necessary. Reference is also made to the implementation portion of the document (Section 11) for the initial steps toward implementing the TMDL.

The Department appreciates the input and comments from the MS4 co-permittees and believes this additional language will help clarify that the Hinkson Creek TMDL will be implemented in a phased and iterative manner. If you should have questions or would like additional assistance, please let me know. Thank you.

John Hoke
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5.6 Phased TMDL Allocations

TMDL development and implementation guidance issued by the EPA (1991 and 2006) and National Research Council (2001) indicate that phased TMDL allocations may be appropriate in certain situations. In particular, these guidance documents indicate that phased TMDLs are appropriate when TMDLs must be established despite significant data uncertainty and where the State expects that the loading capacity and allocation scheme will be revised in the near future as additional information is collected. For these reasons, the Hinkson Creek TMDL qualifies as a candidate for the phased TMDL allocation approach.

EPA guidance states that "significant uncertainty may arise, for example, because the State is using a surrogate to interpret a narrative standard, or because there is little information regarding the loading capacity of a complex system ... and it is difficult to predict how the water body will react to the planned load reductions" (EPA 2006). In this case, the TMDL calculates a reduction in storm water runoff as a surrogate for the unknown pollutants of concern. While numerous stressors and pollutants have been identified as impacting Hinkson Creek (Tables 6 & 7, respectively), no one pollutant or combination of pollutants has been identified as the cause of the aquatic life impairment. The common element among all the stressors and pollutants, however, is that they impact or are delivered to the stream through storm water runoff. The Department has therefore chosen storm water runoff as a surrogate for all of the pollutants of concern that are impairing Hinkson Creek. Utilizing storm water runoff as a surrogate allows the Department under federal guidance to use a phased TMDL allocation approach to implement the Hinkson Creek TMDL.

As part of the adaptive implementation strategy recommended for Hinkson Creek (Section 11), additional data and information will be collected by the Department or other interested parties. These additional data and information may affect the loading capacity and allocation scheme found in the Hinkson Creek TMDL. For example, additional data collected on stream deposition of sediment or establishment of new water quality criteria for identified pollutants without existing criteria may enable the development of load duration curves for specific pollutants of concern. Also, additional hydrologic data and updated land use information may affect the load capacity calculations and how the TMDL allocations are implemented within the watershed. Because these new data may affect the TMDL allocations, a phased TMDL with adaptive implementation is appropriate for Hinkson Creek.

As required for all TMDLs, the Hinkson Creek phased TMDL contains the required elements of a wasteload allocation (Section 6), load allocation (Section 7), and margin of safety (Section 8). These allocations will be implemented using an adaptive implementation approach such that reductions in storm water runoff will be accomplished over a period of time. Follow-up monitoring by both the Department and permitted entities within the watershed will be instrumental in determining whether the goals and reductions of this TMDL are being met through iterative implementation of permit requirements and best management practices.

The ultimate goal of the Hinkson Creek TMDL is to restore the impaired aqautic life protection designated use to a fully attaining status. Should Hinkson Creek be assessed as attaining applicable water quality standards prior to achieving the full storm water runoff reductions called

for in this TMDL, the Department will submit such data and information to EPA during the next regularly scheduled 303(d) listing cycle. Upon concurrence and approval of the attainment status of Hinkson Creek by the EPA, additional storm water runoff reduction requirements will not be required. However, specific pollutant reductions that have been identified as causing or contributing to the impairment and in-stream monitoring will remain in effect.

Section 6 (WLA) – Additional concluding paragraph: "As stated in Section 5.6, the wasteload allocation portion of the Hinkson Creek TMDL will be implemented through a phased approach. Adaptive implementation will require that wasteload allocation reductions be implemented over a number of permit cycles. The magnitude of wasteload allocation reductions for storm water runoff will be dependent on best available technology and the ability of the MS4 permittees to dedicate resources to accomplish the goals found in the TMDL. Follow-up monitoring and reporting will be required to ensure that steady and sufficient progress toward the reduction goals found in this TMDL are met. Recommendations for initial TMDL wasteload allocation reductions can be found in Section 11.2.

Section 7 (LA) – Additional concluding paragraph: "As stated in Section 5.6, the load allocation portion of the Hinkson Creek TMDL will be implemented through a phased approach. Adaptive implementation will require that load allocation reductions be implemented over a period of time. The magnitude of load allocation reductions for storm water runoff will be dependent on best available technology and the ability of stakeholders and landowners to dedicate resources to accomplish the goals found in the TMDL. Follow-up monitoring and reporting will be required to ensure that steady and sufficient progress toward the reduction goals found in this TMDL are met. Recommendations for initial TMDL load allocation activities can be found in Section 11.3.

References

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EPA 2006 – Memorandum, "Clarification Regarding "Phased" Total Maximum Daily Loads"

National Research Council 2001 – "Assessing the TMDL Approach to Water Quality Management"

APPENDIX N

Chapter 12A

LAND PRESERVATION

ARTICLE I.

IN GENERAL

Sec. 12A-1. Title.

This chapter shall be known as the "Land Preservation Act of the City of Columbia, Missouri." (Ord. No. 13019, § 1, 7-1-91)

Sec. 12A-2. Purpose.

The purpose of this chapter is to:

(1) Protect the health, safety and property of the people of Columbia by regulating the disturbance of

land surface areas by preserving trees, preventing erosion on disturbed areas, and controlling storm water drainage.

(2) Assure that consideration is given to the preservation and restoration of natural features in the grading or development of public and private land.

(3) Assure that proper provisions are made regarding control of sediments resulting from rainfall on graded areas, and that adequate facilities are constructed for the management of storm water.

(4) Assure the movement of emergency vehicles during storm periods.

(5) Protect the public from rapidly flowing water and flash floods.

(6) Minimize storm and flood losses resulting from uncontrolled runoff.

(7) Establish requirements for construction of storm water management facilities in newly developed areas.

(8) Establish reasonable stormwater utility charges to enable the stormwater utility to develop and maintain a stormwater management system.

(Ord. No. 13019, § 1, 7-1-91; Ord. No. 13590 § 1, 2-15-93)

Sec. 12A-3. Limitation on liability related to storm water management facilities.

Floods from storm water runoff may occur which exceed the capacity of storm drainage facilities constructed and maintained as a result of this chapter. This chapter does not guarantee that properties will always be free from storm water flooding or flood damage. This chapter shall not create liability on the part of, or a cause of action against, the city or any city officer or employee for any flood damage. Neither does this chapter purport to reduce the need or the necessity for obtaining flood insurance.

(Ord. No. 13019, § 1, 7-1-91)

Sec. 12A-4. Conflicts.

Where any provision of this chapter imposes restrictions different from those imposed by any other law or regulation, whether state, federal or local, whichever is more restrictive or imposes a higher standard shall control.

(Ord. No. 13019, § 1, 7-1-91)

Sec. 12A-5. Definitions.

For the purposes of this chapter, the following words and phrases shall have the meaning given herein.

Agricultural activity. Normal farming operations including improvements conducted under the auspices of the Natural Resource Conservation Service.

Best management practices (BMP). Activities, practices and procedures which control soil loss and

reduce or prevent water quality degradation caused by nutrients, animal wastes, toxins, organics and sediment in the runoff. BMPs may either be structural (grass swales, terraces, retention and detention ponds, and others); or nonstructural (disconnection of impervious surfaces, directing downspouts onto grass surfaces and educational activities).

Central business district. The area bounded by College Avenue on the east, Elm Street and Elm Street extended on the south, Garth Avenue on the west, and Park Avenue and Park Avenue extended on the north.

City utility service customer. A purchaser of city water, electric, sewage or refuse collection utility service.

Clean fill. Uncontaminated soil, rock, sand, gravel, concrete, asphaltic concrete, cinder-blocks, brick, minimal amounts of wood and metal, and inert solids which are approved by rule or policy of the State Department of Natural Resources for fill, reclamation or other beneficial use.

Clear cutting. The practice of removing over half of the standing climax forest area on a site.

Climax forest. Any woodland community of over twenty thousand (20,000) square feet which is dominated by climax species such as oak, hickory, sugar maple or bottomland hardwoods such as river birch, basswood, sycamore and hornbeam and which includes an area of five thousand (5,000) square feet with a maximum aspect ratio of 4:1.

Critical downstream location. A location within the drainage reach downstream of the subject site, consisting of a channel section, drainage swale, bridge, box culvert, storm sewer, or other conveyance facility or structure having a conveyance capacity which would be exceeded by storm water runoff from a 10-year frequency, 24-hour duration storm under existing land use conditions; or an existing structure or building located downstream of the subject site which has its lowest floor elevation less than one (1) foot above the maximum elevation in an adjacent channel attained by the 100-year frequency, 24-hour duration storm, assuming existing land use conditions with the proposed ultimate development of the subject site in place. The conveyance capacity of a structure operating under inlet control conditions shall be determined with a maximum headwater to diameter ration (HW/D) of 1.25 or with a headwater elevation equal to the top of curb, whichever is less.

dbh (diameter breast height). Trunk diameter at 4.5 feet about ground.

Design year storm. The selected or established frequency or return period of rainfall time-duration for which drainage facilities are to be designed.

Developed land. Real estate altered by the addition of impervious surface which changes the hydrology of the property from its natural state.

Developer. A person whose intent or function is to bring about any change of land use or improvement on any parcel of land.

Development. 1) The improvement of property for any purpose involving construction; 2) the preparation of land for construction; or, 3) land disturbance that requires the issuance of a land disturbance

permit.

Director. The director of public works or the director's designee.

Drainage basin (or watershed). The catchment area from which storm water is carried off by a watercourse or storm drainage system. The area served by a drainage system receiving storm and other surface-borne water. Drainage basin boundaries are a product of natural topography and drainage system configuration.

Drainage facility. A man-made structure or natural watercourse for the conveyance of storm runoff. Examples are channels, pipes, ditches, swales, catch basins, and street gutters.

Dwelling unit. A building or portion thereof, designed to house a family.

Forest land. Forested land area with the aerial canopy dominated by trees greater than four (4) inches in diameter, measured four and one-half (4 1/2) feet above the ground.

Forest parcel. An envelope of trees delineated by the boundaries of grading limits or land disturbances.

Impervious surface. A surface on real property where infiltration of stormwater into the earth has been virtually eliminated by the works of man. Impervious surfaces shall include, but not be limited to: Roofs, paved driveways, patio areas, sidewalks, parking lots, storage areas, and other oil or macadam surfaced areas which prevent percolation of stormwaters into the earth's surface.

Infiltration. The process of percolating stormwater into the subsoil.

Land disturbance. Any activity, including mechanized clearing, which removes the vegetative ground cover.

Land disturbance permit. A permit issued by the City of Columbia that authorizes the commencement of land disturbance activities or logging.

Logging. The removal of more than three (3) existing trees for commercial purposes on any tract of land larger than one (1) acre.

Main floor area. The area within the perimeter of the exterior walls of a building excluding any attached garage. The main floor area does not include the area of decks, porches, patios or garages.

Maximum aspect ratio of 4:1. A means of defining the configuration of an area of trees such that the measurement of length of the area shall not be more than four (4) times as long as the measurement of width of the area.

Mechanized clearing. Clearing of land by tracked or wheeled vehicles which scrape, cultivate or scarify the surface of the ground exposing bare soil and uprooting vegetation.

Multiple-family building. A building with more than one dwelling unit.

Non-point source pollution. Pollution which is generated by various land use activities rather than from an identifiable or discrete source, and which is conveyed to waterways through natural processes, such as rainfall, stormwater runoff, or ground water seepage and infiltration rather than through direct discharge.

Nonresidential use. The use of developed land for any purpose other than for a single-family residence or a multiple-family building.

Occupant. The person in possession or lawfully entitled to possession of a parcel of land.

Owner. Any person having legal title to, or a proprietary interest in real property. Proprietary interest shall include, but not be limited to, estate administration, trusteeship, guardianship, and actions under a valid power of attorney.

Peak runoff. The maximum rate at which stormwater travels across the surface of the ground.

Pollutant. Anything which causes or contributes to pollution. Pollutants may include, but are not limited to: paints, varnishes, and solvents; oil and other automotive fluids; non-hazardous liquid and solid wastes, yard wastes; refuse, rubbish, garbage, litter, or other discarded or abandoned objects, articles, and accumulations, which may cause or contribute to pollution; floatables; pesticides, herbicides, and fertilizers; hazardous substances and wastes; sewage, fecal coliform and pathogens; dissolved and particulate metals; animal wastes; wastes and residues that result from constructing a building or structure; including but not limited to sediments, slurries and concrete rinsate and noxious or offensive matter of any kind.

Redevelopment. Any reconstruction, rehabilitation, addition or other improvement of a property (exclusive of R-1 and R-2 zoned properties) the cost of which equals or exceeds fifty (50) percent of the market value of the structure before the start of construction of the improvement.

Site. The total area of the parcel, tract, lot or ownership of land upon which development or land disturbance is proposed irrespective of the actual limits or size of the proposed development or land disturbance activity.

Storm drain. A closed conduit or open ditch, natural or specifically constructed, for conducting or conveying collected storm water. Conduits and paved open ditches are termed "improved"; unpaved ditches are termed "unimproved".

Storm drainage design manual. A City manual intended primarily for use by land developers in the design of minor storm drainage systems, such as a storm drains, relatively small culverts, associated streets and gutter flow hydraulics, natural drainage swales, storm inlets and detention facilities. The manual includes drainage policy to be followed, standard design methods, computation forms, and City standards.

Storm drainage system. All drainage facilities used for collecting and conducting storm water to, through and from drainage areas to the points of final outlet including, but not limited to, the following: Conduits and appurtenant features, canals, ditches, streams, gullies, flumes, culverts, streets, gutters, and pump stations.

Stormwater. Any surface flow, runoff, and drainage consisting entirely of water from any form of

natural precipitation, and resulting from such precipitation including snowmelt.

Stormwater management facilities. This term includes measures, primarily structural, which are determined to be the most effective, practical means of preventing or reducing point source or non-point source pollution inputs to stormwater runoff and subsequently into water bodies. These facilities are also used to control volume and peak rates of runoff from development and redevelopment sites.

Stream channel. A naturally or artificially created water course with definite bed and banks which conducts continuously or periodically flowing water.

Swale. A wide shallow ditch used to carry storm runoff.

Total suspended solids. Matter suspended in stormwater excluding litter, debris, and other gross solids exceeding one (1) millimeter in diameter.

Tree. Any self-supporting woody perennial plant, usually with one (1) main stem or trunk.

Tree, existing. A tree which meets or exceeds the following size standards: Deciduous shade trees shall have a four (4) inch diameter, measured four and one-half (4 1/2) feet above the ground and ornamental and evergreen species shall be a minimum of six (6) feet in height.

Unimproved land. Land or property having little or no "impervious surface."

Water quality volume. The storage needed to capture and treat ninety (90) percent of an average annual stormwater runoff volume. It is calculated by multiplying the water quality storm times the volumetric runoff coefficient and site area.

Watercourse. A stream, usually flowing in a particular direction (though it need not flow continuously in a definite channel), having a bed or banks and usually discharging into some other stream or body of water.

Watershed. All the land area which drains to a given body of water.
(Ord. No. 13019, § 1, 7-1-91; Ord. 13374, § 1, 7-20-92; Ord. No. 13590 § 1, 2-15-93; Ord. No. 14389 § 1, 3-6-95; Ord. No. 18164, § 1, 7-19-04; Ord. No. 19442, § 1, 3-5-07)

Sec. 12A-6. Administration and enforcement.

The provisions of this chapter shall be administered and enforced by the director of public works.
(Ord. No. 13019, § 1, 7-1-91)

Sec. 12A-7. Revocation of permits.

The director may revoke a land disturbance permit if the permit application or accompanying plan contains any false statement or misrepresentation of fact. The director may revoke a land disturbance permit or a building permit if the permit holder fails to comply with the permit or with any provision of this chapter. Permits revoked under this section shall not be reinstated until the cause for revocation has been corrected or until a mitigation plan for the property has been submitted by the former permit holder and approved by the

director.
(Ord. No. 13859 § 1, 11-15-93)

Sec. 12A-8. Stop work orders.

The director is authorized to issue a stop work order whenever he believes unlawful land disturbance activities are occurring. A stop work order shall be in writing and shall be given to the owner of the property involved or to the owner's agent or to the person engaged in the land disturbance activity. It shall be unlawful for any person to engage in any land disturbance activity or to permit another person to engage in any land disturbance activity in violation of a stop work order.
(Ord. No. 13859 § 1, 11-15-93)

Sec. 12A-9. Reserved.

Sec. 12A-10. Violations.

Whenever any act is required by this chapter, it shall be unlawful to fail to do that act. Whenever any act is prohibited by this chapter, it shall be unlawful to do that act.
(Ord. No. 13859 § 1, 11-15-93)

Sec. 12A-11. Penalties.

(a) Violations of this chapter shall be punishable in the same manner as Class A misdemeanors under Chapter 16 of this Code.

(b) Every day any violation of this chapter shall continue shall constitute a separate offense.

(c) Every one thousand (1,000) square feet of climax forest removed, destroyed or damaged in violation of this chapter shall constitute a separate offense.
(Ord. No. 13859 § 1, 11-15-93; Ord. No. 18164, § 1, 7-19-04)

Sec. 12A-12. Remedies not exclusive.

The remedies set forth in this chapter are cumulative and not exclusive. The city may pursue any available civil remedies in addition to prosecuting violations in municipal court and following the abatement procedures of this chapter.
(Ord. No. 19442, § 1, 3-5-07)

Secs. 12A-13--12A-31. Reserved.

ARTICLE II.

LAND DISTURBANCE PERMIT REQUIREMENTS

Sec. 12A-32. Permit required.

A land disturbance permit is required for any land disturbance activity including streets and utilities construction on any site in excess of one (1) acre. All applications for land disturbance permits shall be submitted on forms issued by the director and shall contain all information required by the director. Phased development of tracts larger than one (1) acre does not exempt the developer from the provisions of this chapter.
(Ord. No. 13019, § 1, 7-1-91; Ord. No. 13258, § 1, 3-2-92; Ord. No. 13859 § 1, 11-15-93; Ord. No. 17278, § 1, 5-6-02)

Sec. 12A-33. Site development plan.

(a) Applications for land disturbance permits for any area greater than one (1) acre shall be accompanied by a detailed site development plan which shall include, a tree preservation plan, a landscaping plan, a soil erosion control plan, and a storm water management plan conforming to the provisions of this chapter. Where practical, drawings may be combined to contain all of the required plans.

(b) No final plat shall be approved prior to approval of a site development plan encompassing the entire area being platted. No building permit shall be issued in a planned district prior to approval of a site development plan encompassing the entire area included in the plan.
(Ord. No. 13019, § 1, 7-1-91; Ord. No. 13258, § 1, 3-2-92; Ord. No. 13859 § 1, 11-15-93; Ord. No. 17278, § 1, 5-6-02; Ord. No. 18164, § 1, 7-19-04; Ord. No. 18493, § 1, 5-2-05)

Sec. 12A-34. Conformance with permit and plans.

All land disturbance activity on property for which a land disturbance permit has been issued shall conform to the requirements of the permit and to the provisions of the approved site development plan.
(Ord. No. 13859 § 1, 11-15-93)

Sec. 12A-35. Exemptions.

(a) A land disturbance permit shall not be required for sites one (1) acre or less or for individual lots in R-1 and R-2 zoned development except that erosion control provisions, grading limits, low floor elevation, and storm drainage work, including piping, swaling, and ditching, shall be shown on the plot plan and approved prior to issuance of a building permit. All land disturbance activity on such property shall conform to the provisions of the approved plot plan.

(b) Agricultural activities are exempted from the provisions of this chapter except that a land disturbance permit is required for the mechanized clearing or removal of trees on sites in excess of one (1) acre.
(Ord. No. 13019, § 1, 7-1-91; Ord. No. 13859 § 1, 11-15-93; Ord. No. 17278, § 1, 5-6-02; Ord. No. 18164, § 1, 7-19-04)

Sec. 12A-36. Application fee.

An application for a land disturbance permit shall be accompanied by a non-refundable fee of two hundred dollars ($200.00). The requirement of this section shall not apply to plot plan applications for sites one (1) acre or less or for individual lots in R-1 and R-2 zoned developments.
(Ord. No. 18216, § 1, 9-20-04)

Secs. 12A-37--12A-48. Reserved.

ARTICLE III.

TREE PRESERVATION AND LANDSCAPING REQUIREMENTS

Sec. 12A-49. Clearing of trees; permit required.

(a) The mechanized clearing of trees, logging of trees or clear-cutting of trees by any means on tracts of land over one (1) acre shall be unlawful unless done in compliance with a land disturbance permit.

(b) A minimum of twenty-five (25) percent of any climax forest area on any tract of land subject to land preservation requirements shall be maintained. Trees thus retained will count toward landscaping requirements contained in the zoning ordinance.

(c) When logging is to occur prior to approval of a tree preservation plan or on property not otherwise subject to land disturbance requirements, a logging plan demonstrating compliance with tree preservation requirements must be submitted to the director. This logging plan will include the area in square feet of forest land, the area in square feet of climax forest, and demonstrate that twenty-five (25) percent of the area of climax forest will be preserved after logging. Each logging operation on the same site will require a separate land disturbance permit. Under no circumstance shall successive logging remove greater than seventy-five (75) percent of the climax forest present upon the site before logging.

(d) A landscaping plan demonstrating compliance with the specific requirements of the existing zoning of the site shall accompany all applications for land disturbance permits. The plan will be a drawing of the site sufficient in detail to illustrate the features of the plan. The plan may be incorporated with other drawings or documents but shall contain the following information.

(1) The area, in square feet or acres, of any climax forest areas on the site and those portions, in square feet or acres, of the climax forest to be preserved. The areas may be determined by actual field measurement or planimetering of scaled aerial photographs.

(2) The number, spacing, size and species of planting materials, including new trees and final ground cover that will be planted as part of the landscaping plan.

(3) The size and location of any walls, earth berms, and fences.

(4) Provisions for watering, soil stabilization, plant protection and maintenance.

(5) Location and description of any barriers to be erected to protect any vegetation from damage both during and after construction.

(e) Tree protection shall be required prior to and during the activities associated with the land disturbance permit in accordance with administrative standards promulgated and enforced by the director, but under no circumstances shall activities with the potential of causing damage to the root systems of trees be

allowed within the perimeter of the drip line of the trees being preserved, protected or planted as part of the landscaping plan.

(f) If any of the trees required to be retained or trees planted as part of the landscaping plan should die within a period of eighteen (18) months after completion of the activities associated with the land disturbance permit, the owner of the property shall replace the trees within six (6) months at a ration of one-to-one with an approved tree having a minimum diameter of two (2) inches measured at a point one (1) foot above natural grade. Shrubbery or other plantings which die within eighteen (18) months of completion of the activities shall be replaced in kind within six (6) months.

(g) All landscaping work must be completed prior to the final inspection of a building or within one (1) year of issuance of the land disturbance permit, whichever occurs later. If completion of the work or building is at such time of the year that the landscaping cannot be completed, a performance bond or other acceptable financial instrument for completion of the work may be accepted to allow the issuance of a certificate of occupancy.

(h) Landscaping plans may be amended during or after development with the approval of the director, but in all cases must comply with the current landscaping requirements of the zoning district in which the site is located.
(Ord. No. 13019, § 1, 7-1-91; Ord. No. 13258, § 1, 3-2-92; Ord. No. 14389 § 1, 3-6-95; Ord. No. 17278, § 1, 5-6-02; Ord. No. 18164, § 1, 7-19-04)

Secs. 12A-50--12A-65. Reserved.

ARTICLE IV.

EROSION CONTROL REQUIREMENTS

Sec. 12A-66. Erosion control requirements.

(a) A soil erosion control plan shall accompany all applications for land disturbance permits. The purpose of the plan is to clearly establish what measures will be taken to prevent erosion and off site sedimentation during and after development. The erosion control plan shall consist of two parts, a site grading and drainage plan and a narrative report describing the nature and scope of the work. The plan shall be prepared and certified by a registered professional engineer, licensed in the State of Missouri.

(b) Erosion and sedimentation control measures must be designed to provide protection from the runoff from a 10-year return frequency, 24-hour duration storm.

(c) All surfaces must be stable and non-erosive within the lesser of thirty (30) working days or one hundred twenty (120) calendar days after completion of the work authorized by the land disturbance permit. When such work is associated with the construction of a building, no certificate of occupancy shall be issued until such surfaces are stable and non-erosive. If completion of the work or building is at such time of the year that stabilization with ground cover is not possible, a performance bond or other acceptable financial instrument for completion of the work may be accepted to allow the issuance of a certificate of occupancy.
(Ord. No. 13019, § 1, 7-1-91)

Sec. 12A-67. Site grading and drainage plan.

(a) The site grading and drainage plan shall include the following:

(1) *Existing features.*

a. A drainage area map showing topography of the entire drainage basin(s) contributing to the site. The scale of the map shall be no smaller than 1 inch = 200 feet for drainage areas up to five hundred (500) acres. A topographic map of appropriate scale shall be provided for larger areas upstream from the design area. The drainage map is to show total acreage of the site and the acreage of all drainage areas contributing to the site.

b. A site plan having a scale no smaller than one (1) inch equals one hundred (100) feet and existing contour intervals of not more than five (5) feet. The plan shall show topographic features such as highways, utilities, natural watercourses, existing drainage facilities and structures, adjacent property lines, north arrow, scale, and vicinity map. The site plan is to also show the limits of the adopted one hundred-year flood plain on the site and any critical environmental areas such as streams, lakes, ponds and wetlands. Area and geological types of predominant soils as well as the nature and extent of existing vegetation shall also be shown on the plan.

(2) *Proposed alterations of the site.*

a. A plan drawing that shows the limits of clearing and grading, cuts and fills, and final contours at not more than two (2) feet intervals. The plan shall identify the phasing of the grading, showing the area(s) to be denuded and the maximum time those areas will remain disturbed (not to exceed the lessor of thirty (30) working days or one hundred twenty (120) calendar days after completion of the work). The plan shall show areas to be used for storage of topsoil and excavated subsoil and plans for access to the site during wet weather.

b. A final site plan showing the location or relocation of all utilities, planned streets, roads, buildings, parking lots, and structures, and all permanent storm water management facilities.

(3) *Temporary erosion and sediment control measures during active construction.*

a. Drawings shall be provided showing types of measures and facilities needed and the location of those measures and facilities with dimensional details. All permanent deviations in overland flow drainage patterns and the location of ingress and egress points with the planned protection provisions are to be indicated. § 12A-69

(4) *Permanent erosion and sediment control measures for long term protection.*

a. Drawings shall be provided showing types of measures and facilities needed and the

location of those measures and facilities with dimensional details. All permanent deviations in overland flow drainage patterns are to be indicated.

(Ord. No. 13019, § 1, 7-1-91)

Sec. 12A-68. Narrative report to accompany plan.

(a) The narrative report describing the nature and scope of the work shall include the following:

(1) The report shall briefly describe the overall project and shall incorporate an explanation of existing significant drainage problems contributing to erosion and siltation problems, particularly those that will be intensified by the alteration to the construction site.

(2) The report shall explain how the project design insures that the project does not promote or aggravate an existing off-site erosion, siltation, or drainage problem. The narrative should include a description of the effect of land disturbance activities off-site.

(3) Runoff producing factors under existing conditions and the estimated changes after construction must be provided.

(4) For design of the erosion control measures and facilities, the report shall include calculations of the peak runoff from a 10-year return frequency, 24-hour duration storm.

(5) Long range management of the erosion and siltation control facilities must be addressed in the report.

(6) The phasing or staging of the land disturbing activity is to be described including information on the sequence of land clearing operations, specifying the maximum area and time span the area will be left denuded, the provisions for the removal, protection and stockpiling of soil, the types of major earth moving and grading activities, dust control measures, and the order of placement of control facility installations.

(7) Explanations for the selection of the erosion and siltation control measures utilized shall be provided.

(8) A schedule shall be provided for inspection and maintenance of the erosion and sediment control facilities to insure maximum effectiveness of the protective measures and to assure that preventive maintenance efforts will be carried out when needed. The report should also include a description of plans for resodding or reseeding of vegetated areas and repair of reconstruction of damaged structural measures, and the method and frequency of removal and disposal of waste materials removed from the control facilities or project area including the disposal of temporary structural measures after they have served their purpose.

(Ord. No. 13019, § 1, 7-1-91)

Sec. 12A-69. Grading and pavement permits.

No permit for grading or constructing any public street shall be issued until the temporary erosion

control measures set forth in the site grading and drainage plan, or in the plot plan for a site exempt from land disturbance permit requirements, have been properly installed.
(Ord. No. 13859 § 1, 11-15-93)

Sec. 12A-70. Temporary erosion control measures.

The temporary erosion control measures described in the site grading and drainage plan, or in the plot plan for a site exempt from the land disturbance permit requirement, shall be properly installed prior to commencement of any land disturbance activity and shall be properly maintained at all times until all land surfaces on the property become stable and non-erosive.
(Ord. No. 13859 § 1, 11-15-93)

Secs. 12A-71--12A-84. Reserved.

ARTICLE V.

STORMWATER MANAGEMENT*

* **Editors Note:** Ord. No. 19442, § 2, adopted March 5, 2007, repealed former Art. V, in its entirety, and enacted provisions designated as a new Art. V to read as herein set out. Former Art. V was entitled, "Storm Water Management Requirements." See the Code Comparative Table for a detailed analysis of inclusion.

Sec. 12A-85. Legislative findings.

The city council makes the following legislative findings:

(1) Land development projects increase impervious surfaces resulting in increased stormwater runoff rates and volumes, flooding, stream channel erosion, sediment transport and deposition, and increased quantities of water-borne pollutants.

(2) Stormwater runoff, soil erosion and non-point source pollution can be most cost-effectively controlled and minimized through land use regulation and preventative measures aimed at reducing stormwater runoff from development sites.

(3) The regulations set forth in this article reasonably reduce the harm caused by land development projects and are in the public interest.

(Ord. No. 19442, § 2, 3-5-07)

Sec. 12A-86. Purpose.

The purpose of this article is to establish minimum stormwater management requirements and controls to protect and safeguard the general health, safety and welfare of the public. This article is intended to meet that purpose through the following objectives:

(1) Minimize increases in stormwater runoff from any development in order to reduce flooding, siltation and streambank erosion and stream channel degradation;

(2) Minimize increases in non-point source pollution caused by stormwater runoff from development which would otherwise degrade local water quality;

(3) Minimize the total annual volume of surface water runoff which flows from any specific site during and following development to not exceed the predevelopment hydrologic regime to the maximum extent practicable; and

(4) Reduce stormwater runoff rates and volumes, soil erosion and non-point source pollution, wherever possible, through stormwater management controls and to ensure that these management controls are properly maintained and pose no threat to public safety.

(Ord. No. 19442, § 2, 3-5-07)

Sec. 12A-87. Applicability.

(a) This article shall apply to all developments and redevelopments that alter the surface of the land, including but not limited to, pavement, buildings and structures with the following exceptions:

(1) Single-family and two-family lots within an approved preliminary plat;

(2) Logging activity performed with a city-approved logging plan; and

(3) Additions or modifications to single-family and two-family structures.

(b) Stormwater detention is not required for redevelopment within the central business district.

(c) Stormwater management shall be provided for land in zoning districts PUD, O-P, C-P, M-R and M-P, for which a conceptual stormwater management plan was approved before September 4, 2007 in accordance with the approved conceptual stormwater management plan or in accordance with this article.

(Ord. No. 19442, § 2, 3-5-07)

Sec. 12A-88. Stormwater management plan required.

(a) A stormwater management plan is required for all development and redevelopment projects subject to this article.

(b) A stormwater management plan must be submitted and approved by the director before issuance of a land disturbance permit and before approval of a final plat or a development plan. The stormwater management plan shall be prepared and certified by a registered professional engineer licensed in the State of Missouri.

(c) The stormwater management plan must show all components of the storm drainage system including street curbs, inlets and piping, junction boxes, engineered and natural channels and stormwater management facilities (for example, retention and detention ponds, bioswales, bioretention areas, etc.). The stormwater management plan may be prepared in conjunction with or separate from the soil erosion plan.

(d) It is recommended that a preliminary stormwater management plan be submitted early in the review process to allow time for city staff to discuss plan concepts with the developer. The stormwater management plan will be discussed as part of the concept review for any proposed development.

(e) The stormwater management plan must comply with all requirements of the city's current Stormwater Management and Water Quality Manual.

(f) The following information must be submitted with a stormwater management plan:

(1) *Worksheets.* All calculations and worksheets used in plan preparation and BMP selection.

(2) *Calculations.* Hydrologic and hydraulic design calculations for the pre-development and post-development for the design conditions specified in the Stormwater Management and Water Quality Manual. These calculations shall include: description of the design storm frequency, intensity and duration; time of concentration; soil curve numbers; peak runoff rates and total volumes for the watershed area; infiltration rates where applicable; culvert capacities; flow velocities; data on the increase in rate and volume of runoff for the design storms referenced in the Stormwater Management and Water Quality Manual; and, documentation of sources for all computation methods and field test results.

(3) *Soils information.* When a stormwater management facility relies on the hydrologic properties of the soils (such as an infiltration basin) the developer shall submit a soils report. The soils report shall be based on onsite boring logs or pit profiles. The number and location of required soil boring or soil pits shall be determined based on what is needed to determine the suitability and distribution of soil types present at the location of the facility.

(4) *Landscaping information.* The developer must include a detailed landscaping and vegetative restoration plan as part of the stormwater management plan. Details on maintenance of the vegetation shall be included in the operation and maintenance plan. The landscaping plan component must be prepared by an individual who can demonstrate knowledge of landscape design or by Missouri Department of Conservation personnel.

(g) The stormwater management plan must include a written operation and maintenance manual for the permanent stormwater management facilities, including landscaping and vegetative cover, proposed as part of the development. This is required whether the facilities are to be publicly or privately maintained. Approval of the operation and maintenance manual is a part of the overall plan approval process.
(Ord. No. 19442, § 2, 3-5-07)

Sec. 12A-89. Stormwater pollution prevention plan required.

If a proposed development includes activities with higher potential pollutant loadings, the director may require the developer to submit a stormwater pollution prevention plan. The director should be consulted before plan preparation if the developer suspects additional stormwater management requirements would be necessary in order to address specific pollutants.
(Ord. No. 19442, § 2, 3-5-07)

Sec. 12A-90. Stormwater management performance standards.

The following general performance standards shall be followed in the preparation of stormwater management plans:

(1) BMP's shall be used to control the peak flow rates of stormwater discharge associated with specified design storms and to reduce the generation of stormwater runoff. These practices must use pervious areas to treat stormwater and to infiltrate stormwater runoff from driveways, sidewalks, roof tops and parking lots to the maximum extent practicable in order to improve water quality and reduce the quantity of stormwater runoff.

(2) Annual groundwater recharge rates shall be maintained to the maximum extent practicable, by promoting infiltration by the use of structural and nonstructural methods. Annual recharge from the post-development sites should mimic the annual recharge from pre-development site conditions.

(3) Structural stormwater facilities shall remove eighty (80) percent of the annual post-development total suspended solids load. It is presumed that facilities comply with this performance standard if they are:

a. Sized to capture the prescribed water quality volume;

b. Designed in accordance with the specific requirements and level of service criteria set out in the Stormwater Management and Water Quality Manual; and

c. Constructed properly and maintained regularly.

(Ord. No. 19442, § 2, 3-5-07)

Sec. 12A-91. Stormwater Management and Water Quality Manual.

(a) The city council approves the Stormwater Management and Water Quality Manual prepared by the public works department dated January, 2007. The director is authorized to revise the Water Quality Manual periodically as advances in stormwater control practices evolve. All such revisions must be consistent with the provisions of this article.

(b) The director is authorized to allow alternate and equivalent best management practices when using the level of service method outlined in the Water Quality Manual. The director shall consider alternate designs of best management practices when it is fully demonstrated that the alternate designs are equal to or better than designs contained in the Water Quality Manual.

(c) Any person who constructs, reconstructs, alters or repairs a stormwater management facility for which a permit is required shall conduct such work in accordance with the Water Quality Manual.

(Ord. No. 19442, § 2, 3-5-07)

Sec. 12A-92. As built drawings.

As built construction drawings that show the final design specifications and are certified by a professional engineer are required on all permanent stormwater management facilities. The as built drawings must be submitted before city approval or acceptance of the facilities.
(Ord. No. 19442, § 2, 3-5-07)

Sec. 12A-93. Permit required.

No portion of a storm drainage system including stormwater management facilities may be constructed, reconstructed, altered, modified or repaired without first obtaining a permit from the director. No such permit shall be issued until the director is satisfied that the plans for the work have been prepared in accordance with an approved stormwater management plan and with the Stormwater Management and Water Quality Manual and until the applicant has posted a performance bond, letter of credit, cash escrow or other performance security acceptable to the director, in the city's favor assuring the construction, reconstruction, alteration, modification or repair of all stormwater management facilities authorized by the permit. The performance security shall be in the amount of the estimated cost of the project.
(Ord. No. 19442, § 2, 3-5-07)

Sec. 12A-94. Certificate of occupancy; when issued.

No certificate of occupancy shall be issued for a structure on any property subject to this article until construction of the required stormwater management facilities is completed in accordance with the approved stormwater management plan. If completion of the work or structure is at such time of the year that completion of the required stormwater management facilities is not feasible, a performance bond or other acceptable financial instrument for the estimated cost of completion of the work may be accepted to allow the issuance of a certificate of occupancy.
(Ord. No. 19442, § 2, 3-5-07)

Sec. 12A-95. Maintenance and repair of stormwater management facilities.

(a) Before approval of a stormwater management plan, the property owner must execute an easement in favor of the city allowing the city access to all stormwater management facilities on the property for inspection and, if the facility is to be maintained by the city, for maintenance.

(b) Maintenance of all stormwater management facilities shall be ensured through the creation of a formal maintenance covenant, which must be approved by the director before final plat or plan approval and subsequently be recorded by the city with the Boone County Recorder of Deeds. The covenant will include a schedule for maintenance of the facilities to insure proper function of each stormwater management facility. The covenant shall also include a schedule for inspections of each facility to ensure proper function of each stormwater management facility between scheduled maintenance functions.

The director, in lieu of a maintenance covenant, may accept dedication of stormwater management facilities for city maintenance based on specific criteria developed by the director and generally limited to those stormwater management facilities which serve multiple properties. Any stormwater management facility accepted by the city for maintenance must meet all the requirements of this article and include adequate access easements for inspection and regular maintenance.

(c) All stormwater management facilities shall be inspected at least once each year to document maintenance and repair needs and to ensure compliance with this article. The facilities should also be inspected after each heavy rainfall and any necessary maintenance should be performed such as removal of silt, litter and debris from all catch basins, inlets, pipes and outlet structures.

All maintenance needs must be addressed in a timely manner. The inspection and maintenance schedule may be modified for each facility based on results of the initial inspection program as deemed necessary to be fully compliant with the purpose of this article.

(d) City inspections may be routine, random or complaint driven. Inspections may involve full evaluation of the physical structure and condition of the facility; review of the prior inspection, repair and maintenance records; and sampling of the surface water, discharges and groundwater as deemed necessary.

(e) Persons responsible for the operation and maintenance of stormwater management facilities shall make records of the inspection, repair, maintenance and any modifications to the facilities and shall retain these records for a minimum of five (5) years. These records shall be made available to the director during inspection of the facility or at any time upon request.

(f) Failure to properly maintain a stormwater management facility is hereby declared a nuisance and may be abated under the procedures set forth in section 12A-202.
(Ord. No. 19442, § 2, 3-5-07)

Secs. 12A-96--12A-108. Reserved.

ARTICLE VI.

APPEALS AND VARIANCES

Sec. 12A-109. Appeals.

Any person aggrieved by any decision of the director in the administration or enforcement of this chapter, other than the nuisance abatement provisions, may appeal such decision to the board of adjustment.
(Ord. No. 13019, § 1, 7-1-91)

Sec. 12A-110. Variances.

(a) Any property owner may petition the board of adjustment for a variance from strict compliance with the requirements of this chapter. The petition shall be in writing and shall state the grounds for the petition and all facts relied upon by petitioner.

(b) The board of adjustment shall not grant a variance from the requirements of this chapter unless it shall make all of the following findings:

(1) Good and sufficient cause based on an unreasonable burden or hardship has been proved.

(2) The granting of the variance would not result in any increase in quantity or velocity of flow,

degradation of water quality, or negative impacts upon adjoining or downstream properties, nor upon the stormwater system.

(3) The degree of variance is the minimum necessary to afford relief from the unreasonable burden or hardship imposed by the requirements of this chapter;

(4) The variance may be granted without defeating the public health, safety and welfare purposes and intent of this chapter.

(c) The board may grant a variance to the stormwater management requirements of Article V only if at least one (1) of the following conditions exist:

(1) Alternative requirements for onsite management of stormwater discharges have been established in a stormwater management plan approved by the director.

(2) Provisions are made to manage stormwater by an existing offsite facility that is adequately sized to provide a level of stormwater control at least equal to that which would be afforded by onsite practices and there is a legally obligated entity responsible for long-term maintenance of the offsite facility.

(3) The board finds that meeting the minimum onsite management requirements is not feasible because of physical characteristics of the site.

The board may not vary the stormwater management requirements of Article V if the variance would result in any of the following impacts in the downstream waterway:

(1) Deterioration of existing culverts, bridges, dams or other structures;

(2) Degradation of biological functions or habitat;

(3) Accelerated stream bank or stream bed erosion or siltation;

(4) Increased threat of flood damage.

If a variance granted by the board will likely result in a lower level of stormwater control, the board shall impose reasonable mitigation measures including, but not limited to, the following:

(1) The purchase and donation of privately owned lands or the grant of an easement to be dedicated for preservation or reforestation. These lands must be adjacent to a stream corridor in order to provide permanent buffer areas to protect water quality and aquatic habitat.

(2) The construction of a stormwater management facility or other drainage improvements on previously developed property, whether public or private, which currently lacks stormwater management facilities, designed and constructed in accordance with the standards and purposes of this chapter and the city's Stormwater Management and Water Quality Manual.

(3) At the petitioner's request, monetary contributions to fund stormwater related studies and projects including regional wetland delineation studies, stream monitoring studies, hydrologic studies, stream assessment studies, including stream monitoring studies for water quality and macroinvertebrates, stream flow monitoring, threatened and endangered species studies and stream restoration projects. The monetary contribution shall be in accordance with a schedule established by the director and shall be based on the cubic feet of storage required but not provided for the stormwater management of the property in question.

(Ord. No. 13019, § 1, 7-1-91; Ord. No. 19442, § 3, 3-5-07)

Sec. 12A-111. Procedure.

The procedures set forth in Chapter 29 for appeals to the board of adjustment shall apply to petitions for appeals or variances from the requirements of this chapter.

(Ord. No. 13019, § 1, 7-1-91)

Secs. 12A-112--12A-125. Reserved.

ARTICLE VII.

CLEAN FILL*

* **Editors Note:** Section 12A-130 of this article shall be effective July 20, 1992, the remaining sections of this article shall take effect September 1, 1992.

Sec. 12A-126. Permits required.

It shall be unlawful to dump, assist in the dumping, direct, solicit or allow the dumping of clean fill at any site within the city unless a clean fill permit for such dumping has been issued by the director. A permit shall not be required to dump topsoil for landscaping or gardening purposes.

(Ord. No. 13374, § 1, 7-20-92)

Sec. 12A-127. Applications for clean fill permits.

(a) No clean fill permit shall be issued unless an application for such permit has been filed with the director which sets forth the location and street address of the dump site and the name and address of the legal owner of the dump site.

(b) No clean fill permit shall be issued on sites two (2) acres or larger unless all applicable requirements of a land disturbance permit are satisfied.

(c) No clean fill permit shall be issued on sites less than two (2) acres unless the application for the permit sets forth reasonable and effective methods to control erosion and to keep adjacent streets and properties free from the clean fill and any mud or other material from the dump site.

(Ord. No. 13374, § 1, 7-20-92)

Sec. 12A-128. Clean fill permits.

The director shall issue a clean fill permit only after he is satisfied that the application complies with the provisions of this article. Every clean fill permit shall have the terms and conditions under which the permit is granted clearly stated upon it.
(Ord. No. 13374, § 1, 7-20-92)

Sec. 12A-129. Clean fill site maintenance.

(a) It shall be a condition of every clean fill permit that no actively used clean fill site shall be left in a rough or unleveled condition for more than ten (10) consecutive days.

(b) Any clean fill site which does not receive clean fill for thirty (30) days shall be considered an inactive fill site.

(c) It shall be a condition of every clean fill permit that inactive fill sites must be seeded and mulched within thirty (30) days of becoming an inactive fill site, provided the period of inactivity is such that seeding and mulching can occur. Otherwise, the owner of the site shall meet performance guarantees as specified for land disturbance permits to assure that seeding and mulching will occur as soon as weather permits.
(Ord. No. 13374, § 1, 7-20-92)

Sec. 12A-130. Hours of operation.

It shall be unlawful to interfere with or disturb the peace and quiet of neighboring inhabitants by dumping in a clean fill site other than between the hours of 7:00 a.m. and 7:00 p.m. on weekdays and between 9:00 a.m. and 5:00 p.m. on Saturdays. Nothing in this section shall prohibit dumping in a clean fill site in connection with disaster cleanup or in connection with work to maintain or restore utility service.
(Ord. No. 13374, § 1, 7-20-92)

Sec. 12A-131. Compliance with permit terms.

It shall be unlawful to dump clean fill or to allow the dumping of clean fill or to maintain a clean fill dump site in any manner which is in violation of the terms or conditions of the clean fill permit or in any manner other than in conformity with the methods set out in an approved clean fill permit application.
(Ord. No. 13374, § 1, 7-20-92)

Sec. 12A-132. Revocation of permit.

The director may revoke a clean fill permit if the permit application contains any false statement or misrepresentation of fact. The director may revoke a clean fill permit if the permit holder fails to comply with the permit conditions or any provision of this article.
(Ord. No. 13374, § 1, 7-20-92)

Sec. 12A-133. Land disturbance permits.

Nothing in this article shall exempt any person from the land disturbance permit requirements of this

chapter.
(Ord. No. 13374, § 1, 7-20-92)

Secs. 12A-134--12A-147. Reserved.

ARTICLE VIII.

STORMWATER UTILITY*

* **Editors Note:** This article is in full force and effect from and after October 1, 1993, and the charges hereby established shall be applied to the utility bills beginning with the first cycle billed in October, 1993.

Sec. 12A-148. Stormwater utility charge.

There is hereby established a monthly stormwater utility charge to be paid by the occupant or owner of each parcel of developed land within the city in accordance with the following table:

Category of land use	Monthly Charge
Multiple-family buildings having more than four units; single-family residences having a main floor area less than 750 sq. ft.....	$0.65 per unit
Multiple-family buildings having four or less units; mobile homes; single-family residences having a main floor area of from 750 sq. ft. to 1,250 sq. ft.....	$0.85 per unit
Single-family residences having a main floor area of from 1,251 sq. ft. to 2,000 sq. ft.....	$1.15 per unit
Single-family residence having a main floor area more than 2,000 sq. ft.....	$1.35 per unit
All non-residential uses of developed land....	$4.00 pr $0.04 per 100 square feet impervious area, whichever is greater.

(Ord. No. 13590 § 1, 2-15-93; Ord. No. 14212 § 1, 9-19-94)

Sec. 12A-149. Liability for charge.

The owner(s) and occupant(s) of developed land, if different, shall be jointly and severally liable for payment of the stormwater utility charge.
(Ord. No. 13590 § 1, 2-15-93)

Sec. 12A-150. Exemptions.

The stormwater utility charge shall not be imposed on the occupants or owners of streets or railroad rights-of-way.
(Ord. No. 13590 § 1, 2-15-93; Ord. No. 14249 § 1, 10-10-94)

Sec. 12A-151. Billing practices.

(a) *General.* The stormwater utility charge shall be billed by the director of finance in accordance with the provisions of this section and the accounts and billings procedures set forth in chapter 27. Except as otherwise herein provided, each city utility service customer shall be billed the stormwater utility charge for the premises where the customer receives water, electric, sewage or refuse collection utility service. Where there is no city water, electric, sewage or refuse collection utility service customer for a parcel of developed land, the stormwater utility charge shall be billed to the property owner.

(b) *Multiple-family buildings.* A stormwater utility charge shall be billed to each utility service customer having an account for an individual dwelling unit in a multiple-family building. When no customer has an account for a dwelling unit, the stormwater utility charge for that unit

shall be billed to the property owner. At the request of the property owner, the stormwater utility charge for some or all dwelling units in a multiple-family building may be billed to the property owner.

(c) *Nonresidential use.* Where there is more than one utility service customer for a parcel of land developed for a nonresidential use, the stormwater utility charge shall be billed to the property owner, except where the property owner and a tenant have agreed that the tenant shall be billed.
(Ord. No. 13590 § 1, 2-15-93)

Sec. 12A-152. Reduction of charge for approved runoff control.

The stormwater utility charge shall be reduced for the occupant or owner of nonresidential property where approved runoff control measures have been implemented, provided that all such runoff control facilities are privately owned and operated. The charge shall be reduced in proportion to the reduction in peak runoff. The director shall determine the percentage reduction in the charge, based on the ratio of peak runoff from the modified property to the peak runoff from the property without reduction in peak runoff.
(Ord. No. 13590 § 1, 2-15-93)

Sec. 12A-153. Use of stormwater utility charge revenue.

All revenue received from the stormwater utility charge shall be used solely for stormwater management purposes.
(Ord. No. 13590 § 1, 2-15-93)

Sec. 12A-154. Computing main floor area and impervious surface.

The director shall be responsible for computing the main floor area of single-family residences and the impervious surface of nonresidential uses subject to the stormwater utility charge. In making such computations, the director may rely on the accuracy of any public records.
(Ord. No. 13590 § 1, 2-15-93)

Sec. 12A-155--12A-159. Reserved.

ARTICLE IX.

DETECTION AND ELIMINATION OF ILLICIT STORM WATER DISCHARGES

DIVISION 1.

IN GENERAL

Sec. 12A-160. Purpose.

The purpose of this article is to insure the health, safety and general welfare of the citizens of the City of Columbia by enhancing the water quality of water courses and water bodies to the maximum extent practicable as required by federal and state laws. This article establishes methods for controlling the introduction of pollutants into the municipal separate storm sewer system in order to comply with the requirements of the National Pollutant and Discharge Elimination System (NPDES) permit process. The objectives of this article are:

(1) To regulate the contribution of pollutants by storm water discharges to the municipal separate storm sewer system or to any water course;

(2) To prohibit illicit connections and discharges; and

(3) To establish legal authority for inspections, surveillance and monitoring procedures necessary to insure compliance with this article.

(Ord. No. 18297, § 1, 11-1-04)

Sec. 12A-161. Definitions.

The following definitions apply to this article:

Accidental discharge. A discharge prohibited by this article which occurs by chance and without planning or consideration prior to occurrence.

Best management practices (BMP). Activities, practices and procedures to prevent or control the discharge of pollutants directly or indirectly into the municipal storm drain system, waters of the state and waters of the United States. BMPs include but are not limited to treatment facilities to remove pollutants from storm waters; operating and maintenance procedures; facility management practices to control runoff, spills or leaks of storm water, waste disposal, and drainage from material storage; erosion and sediment control practices; the prohibition of specific activities, practices and procedures; and such other provisions the city determines appropriate for the control of pollutants.

Clean Water Act. The Federal Water Pollution Control Act (33 U.S.C. § 1251 et seq.) and any subsequent amendments thereto.

Contaminated. Containing a harmful quantity of any substance.

Contamination. The presence of or entry into the municipal separate storm sewer system, waters of the state or waters of the United States of any substance which may be deleterious to the public health or quality of the water.

Director. The director of public works.

Discharge. Any addition or introduction of any pollutant, storm water or any other substance whatsoever into the municipal separate storm sewer system or into the waters of the state or waters of the United States.

Discharger. Any person who causes, allows, permits or is otherwise responsible for a discharge including any operator of a construction site or industrial facility.

Enforcement official. Any person designated by the director to enforce the provisions of this article.

Environmental Protection Agency or *EPA.* The United States Environmental Protection Agency or any duly authorized official of that agency.

Hearing officer. The director or a person designated by the director to conduct hearings under this article.

Illicit connections. An illicit connection is any drain or conveyance not specifically allowed by this article:

(1) Which allows a discharge;

(2) Which is connected to the storm drain system from indoor drains and sinks regardless of whether the drain or connection was previously allowed, permitted or approved by a governmental agency; or

(3) Any drain or conveyance connected from a commercial or industrial land use to the storm drain system which has not been documented in plans, maps or equivalent records and approved by the city.

Municipal separate storm sewer system. The system of conveyances including roads with drainage systems, city streets, catch basins, curbs, gutters, ditches, manmade channels or storm drains owned and operated by the city and designed or used for collecting or conveying storm water and which is not intended for collecting or conveying sewage.

National Pollutant Discharge Elimination System (NPDES). The national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements under Section 307, 402, 318 and 405 of the Federal Clean Water Act.

Non-storm water discharge. Any discharge to the storm drain system that is not composed entirely of

storm water.

Pollutant. Anything which causes or contributes to pollution. Pollutants may include but are not limited to paints, varnishes and solvents; oil and other automotive fluids; non-hazardous liquid and solid wastes; yard wastes; refuse, rubbish, garbage, litter or other discarded or abandoned objects, articles and accumulations that may cause or contribute to pollution; floatables; pesticides, herbicides and fertilizers; hazardous substances and wastes; sewage, fecal coliform and pathogens; dissolved and particulate metals; animal wastes; wastes and residues that result from constructing a building or structure, including but not limited to sediments, slurries and concrete rinsates; and noxious or offensive matter of any kind.

Pollution. The human made or human induced alteration of the quality of waters by waste to a degree which unreasonably affects, or has the potential to unreasonably affect, the waters for beneficial uses or the facilities which serve these beneficial uses.

Storm drain system. The municipal separate storm sewer system.

Storm water. Any flow occurring during or following any form of natural precipitation and resulting from such precipitation including snow melt.

Storm water pollution prevention plan. A document which describes the best management practices and activities to be implemented by a person or business to identify sources of pollution or contamination at a site and the actions to eliminate or reduce pollutant discharges to storm water, storm water conveyance systems, and receiving waters to the maximum extent practicable.
(Ord. No. 18297, § 1, 11-1-04)

Sec. 12A-162. Applicability.

This article shall apply to all water entering the municipal separate storm sewer system unless explicitly exempted by this article.
(Ord. No. 18297, § 1, 11-1-04)

Sec. 12A-163. Responsibility for administration.

The director shall administer, implement and enforce the provisions of this article.
(Ord. No. 18297, § 1, 11-1-04)

Sec. 12A-164. Regulatory consistency.

This article shall be construed to assure consistency with the requirements of the Clean Water Act and regulatory requirements of the Missouri Department of Natural Resources.
(Ord. No. 18297, § 1, 11-1-04)

Sec. 12A-165. Ultimate responsibility.

The standards set forth in this article and promulgated pursuant to this article are minimum standards. Compliance with this article does not insure that there will be no contamination, pollution or unauthorized

discharge of pollutants into the waters of the United States. This article shall not create liability on the part of the city or any agent or employee of the city for any damages that result from any discharges, reliance on this article or any administrative decision made under this article.
(Ord. No. 18297, § 1, 11-1-04)

Secs. 12A-166--12A-175. Reserved.

DIVISION 2.

PROHIBITIONS

Sec. 12A-176. Illegal discharges.

(a) Except as provided in subsection (b), it shall be unlawful for any person to discharge or cause to be discharged into the municipal separate storm sewer system or into any water course any material other than storm water.

(b) The following discharges are exempt from the discharge prohibitions established by this article:

(1) Waterline flushing or other potable water sources;

(2) Landscape irrigation or lawn watering;

(3) Diverted stream flows;

(4) Rising groundwater;

(5) Groundwater infiltration;

(6) Uncontaminated pumped groundwater;

(7) Foundation or footing drains (excluding active groundwater de-watering systems);

(8) Crawlspace pumps, air conditioning condensation;

(9) Springs;

(10) Non-commercial washing of vehicles;

(11) Natural riparian habitat or wetland flows;

(12) Swimming pools (if de-chlorinated -- less than one (1) ppm chlorine);

(13) Fire fighting activities;

(14) Other water not containing pollutants;

(15) Discharges specified by the director as necessary to protect public health and safety;

(16) Dye testing if notification is given to the director before the test; and

(17) Any non-storm water discharge permitted under an NPDES permit, waiver or waste discharge order issued to the discharger and administered under the authority of the Environmental Protection Agency, provided that the discharger is in full compliance with all requirements of the permit, waiver or order and other applicable laws and regulations, and provided that written approval has been granted for any discharge to the municipal separate storm sewer system.

(Ord. No. 18297, § 1, 11-1-04)

Sec. 12A-177. Illicit connections.

(a) It shall be unlawful for any person to construct, use, maintain or have an illicit connection.

(b) This section expressly applies to illicit connections made in the past even if the connection was permissible under law or practices applicable or prevailing at the time of connection.

(Ord. No. 18297, § 1, 11-1-04)

Sec. 12A-178. Waste disposal prohibitions.

It shall be unlawful for any person to place, deposit or dump or to cause or allow the placing, depositing or dumping any refuse, rubbish, yard waste, paper litter or other discarded or abandoned objects, articles and accumulations containing pollutants into the municipal separate storm sewer system or into any waterway.

(Ord. No. 18297, § 1, 11-1-04)

Sec. 12A-179. Connection of sanitary sewer prohibited.

It shall be unlawful for any person to connect a line conveying sewage to the municipal separate storm sewer system or to allow such a connection to continue.

(Ord. No. 18297, § 1, 11-1-04)

Sec. 12A-180. Industrial or construction activity discharges.

It shall be unlawful for any person subject to an industrial activity or construction NPDES storm water discharge permit to fail to comply with all provisions of such permit.

(Ord. No. 18297, § 1, 11-1-04)

Sec. 12A-181. Continuing violation.

Each day that a violation of this article continues shall be deemed a separate offense.

(Ord. No. 18297, § 1, 11-1-04)

Secs. 12A-182--12A-190. Reserved.

DIVISION 3.

REGULATIONS AND MONITORING

Sec. 12A-191. Best management practices.

(a) The city council may, by ordinance, adopt standards identifying best management practices (BMP) for any activity, operation or facility which may cause or contribute to pollution of storm water, the storm drain system, waters of the state or waters of the United States. These standards shall be on file in the office of the director. It shall be unlawful for any person undertaking any activity or owning or operating any facility subject to such standards to fail to comply with the standards.

(b) The owner or operator of a commercial or industrial establishment shall provide reasonable protection from accidental discharge of prohibited materials or other wastes into the municipal separate storm sewer system or water courses through the use of structural and non-structural BMPs. Any person responsible for property which is or may be the source of an illicit discharge may be required to implement additional structural and non-structural BMPs to prevent further discharge. Compliance with all terms and conditions of a valid NPDES permit authorizing the discharge of storm water associated with industrial activity to the extent practicable shall be deemed in compliance with provisions of this section. These BMPs shall be a part of the storm water pollution prevention plan as necessary for compliance with the requirements of the NPDES permit. (Ord. No. 18297, § 1, 11-1-04)

Sec. 12A-192. Monitoring of discharges.

(a) *Applicability.* This section applies to all facilities which have storm water discharges associated with the facility activity including construction activity.

(b) *Access to facilities.*

(1) Enforcement officers are authorized to enter and inspect facilities subject to regulation under this article to determine compliance with this article. If a discharger has security measures in force which require proper identification and clearance before entering its premises, the discharger shall be given the opportunity to make the necessary arrangements to allow access to the enforcement officers. If an enforcement officer is denied entry to the property, the officer or city prosecutor may apply to the municipal court for a warrant under the provisions of Chapter 15 of this Code.

(2) Facilities operators shall allow enforcement officials ready access to all parts of the premises for the purposes of inspection, sampling, examination and copying of records which must be kept under the conditions of an NPDES permit, or local or other state permits to discharge storm water and the performance of any additional duties as defined by state and federal law. If an enforcement officer is denied such access, the officer or city prosecutor may apply to the municipal court for a warrant under the provisions of Chapter 15 of this Code.

(3) The enforcement officer may install devices on any facility to monitor and sample the facility's storm water discharge. If an enforcement officer is not allowed to install such a device, the

officer or city prosecutor may apply to the municipal court for a warrant under the provisions of Chapter 15 of this Code.

(4) An enforcement officer may require a discharger to install monitoring equipment. The discharger shall maintain the facility sampling and monitoring equipment at all times in a safe and proper operating condition. All devices used to measure storm water flow and quality shall be calibrated to insure their accuracy.

(5) At the request of an enforcement officer, a discharger shall promptly remove any obstructions to safe and easy access to a facility to be inspected. The obstructions shall not be replaced.

(Ord. No. 18297, § 1, 11-1-04)

Secs. 12A-193--12A-200. Reserved.

DIVISION 4.

NUISANCES

Sec. 12A-201. Nuisances declared.

(a) Any discharge in violation of this article is a nuisance.

(b) Any illicit connection is a nuisance.

(Ord. No. 18297, § 1, 11-1-04)

Sec. 12A-202. Abatement procedures.

(a) *Abatement notice.* When an enforcement official determines that a nuisance exists in violation of this article, the enforcement official may initiate a nuisance abatement procedure by serving an abatement notice on the owner of the property upon which the nuisance is believed to exist. The abatement notice shall contain the following:

(1) A description of the location and nature of the alleged nuisance;

(2) A statement of the acts necessary to abate the alleged nuisance;

(3) An order establishing the time for beginning and completing abatement of the alleged nuisance and requiring that abatement activities continue without unreasonable delay;

(4) Information on the right to a hearing and the manner of requesting a hearing to contest the enforcement official's abatement notice; and

(5) A statement that if the nuisance is not abated as ordered and if no request for hearing is made within the prescribed time, the city may abate the alleged nuisance and assess the costs against the property owner and the property.

(b) *Service of abatement notice.*

(1) The enforcement official shall serve the abatement notice on the property owner by first class mail or by personal service in the same manner as legal process is served under any Missouri statute or court rule. Mailed notice shall be presumed received three (3) days after it is mailed.

(2) If the enforcement official is unable to obtain service by either of the above methods, service may be obtained by publishing the abatement notice once in a newspaper of general circulation in the city and by posting the abatement notice on the property where the alleged nuisance exists. Notice shall be considered given on the date the notice is published or the notice is posted, whichever is later.

(c) *Request for hearing.* The owner of property on which the nuisance is alleged to exist may contest the abatement notice by requesting a hearing. The request for hearing must be made in writing and received by the director within seven (7) days of service of the abatement notice. The request for hearing must be either hand-delivered to the office of the director or sent to the director by United States mail, facsimile machine or electronic mail. The request for hearing must state an address to which a notice of hearing may be sent.

(d) *Notice of hearing.* At least ten (10) days written notice of the hearing shall be given to the property owner except in cases where the public health, safety or interest shall make a shorter time reasonable. Notice shall be hand-delivered to the property owner or mailed to the address provided by the property owner in the request for hearing. Notice shall be presumed received three (3) days after it is mailed.

(e) *Hearing and decision.* The hearing officer shall conduct the hearing and enter a decision in accordance with the requirements of Chapter 536, RSMo. If the hearing officer determines that a nuisance exists as charged in the abatement notice, the hearing officer may enter an order of abatement directing that the nuisance be abated under such conditions and within such time as the hearing officer deems appropriate under the circumstances.

(f) *Appeal.* An appeal from the decision of the hearing officer may be made to the circuit court of Boone County in accordance with Chapter 536, RSMo.
(Ord. No. 18297, § 1, 11-1-04)

Sec. 12A-203. Abatement by city.

If the order of abatement is not complied with or if no hearing is requested and the abatement notice is not complied with, the director may have the nuisance abated by city employees or by persons under contract with the city. No person shall enter private property to abate a nuisance unless the owner or occupant has consented to the entry or unless the municipal judge has issued a warrant for the entry.
(Ord. No. 18297, § 1, 11-1-04)

Sec. 12A-204. Collection of abatement costs.

(a) The director shall certify the cost of abatement to the city clerk. The cost shall include administrative costs as well as the actual cost of abating the nuisance. The city clerk shall cause a special tax bill against the property to be prepared in the amount of the abatement costs. The tax bill from the date of its

issuance shall be a lien on the property until paid and shall be prima facie evidence of the recitals therein and of its validity. No clerical error or informality in the tax bill or in the proceedings leading up to the issuance of the tax bill shall be a defense in an action to collect the tax bill. Tax bills issued under this section, if not paid when due, shall bear interest at the rate of eight (8) percent per annum.

(b) The cost of abatement shall also constitute a personal obligation of the owner of the property and of any other person who caused the nuisance.
(Ord. No. 18297, § 1, 11-1-04)

Sec. 12A-205. Emergency abatement.

(a) The director may abate any nuisance without following the abatement procedures of this article if the nuisance presents an immediate threat to the health, safety or welfare of any inhabitant of the city.

(b) The director may assess the cost, including administrative costs, of abating a nuisance under this section against the property on which the nuisance was located. Before assessing costs, the director shall serve a bill of costs on the property owner. The bill of costs shall describe the nuisance that was abated, state the cost of abatement and inform the owner of the right and manner of requesting a hearing.

(c) The bill of costs shall be served on the property owner by first class mail, or by personal service in the same manner as legal process is served under any Missouri statute or court rule. Mailed notice shall be presumed received three (3) days after it is mailed. If service is not able to be obtained by either of the above methods, service may be obtained by publishing notice of the bill of costs in a newspaper of general circulation in the city.

(d) The property owner may contest the assessment of costs by requesting a hearing. The request for hearing must be made in writing and received by the director within seven (7) days of service of the bill of costs or publication of notice of the bill of costs. The request for hearing must be either hand-delivered to the office of the director or sent to the director by United States mail, facsimile machine or electronic mail. The request for hearing must state an address to which a notice of hearing may be sent.

(e) Notice of hearing. At least ten (10) days' written notice of the hearing shall be given to the property owner. Notice shall be hand-delivered to the property owner or mailed to the address provided by the property owner in the request for hearing. Notice shall be presumed received three (3) days after it is mailed.

(f) Hearing and decision. The hearing officer shall conduct the hearing and enter a decision in accordance with the requirements of Chapter 536, RSMo. If the hearing officer determines that the abatement was justified under subsection (a), the hearing officer shall certify the cost of abatement to the city clerk for collection pursuant to the provisions of section 12A-204.

(g) Appeal. An appeal from the decision of the hearing officer may be made to the Circuit Court of Boone County in accordance with Chapter 536, RSMo.
(Ord. No. 18297, § 1, 11-1-04)

Sec. 12A-206. Nuisances on more than one property.

If any nuisance abated by the director extended over more than one (1) parcel of land, the cost of abating the nuisance shall be assessed against each parcel of land on which the nuisance was abated in proportion to the amount of work and expense for each such parcel. Except in the case of an emergency abatement, however, no parcel of land shall be assessed unless an owner of the parcel was served with an abatement notice.
(Ord. No. 18297, § 1, 11-1-04)

Sec. 12A-207. Nuisances attributable to neighboring property.

If any nuisance abated by the director was caused in whole or in part by activities on neighboring property, the cost of abating the nuisance shall be assessed against each parcel of such neighboring property in proportion to the amount of damage attributable to each such parcel. Except in the case of an emergency abatement, however, no property shall be assessed unless an owner of the property was served with an abatement notice. The owner of such property shall be entitled to the same hearing and appeal rights as the owner of property on which a nuisance is alleged to exist.
(Ord. No. 18297, § 1, 11-1-04)

Secs. 12A-208--12A-214. Reserved.

DIVISION 5.

VARIANCES

Sec. 12A-215. Variances.

(a) The director may grant a variance for the following:

(1) Projects or activities serving a public need where no feasible alternative is available.

(2) The repair and maintenance of public improvements where avoidance and minimization of adverse impacts to wetlands and associated aquatic ecosystems have been addressed.

(b) The applicant shall submit a written request for a variance to the director. The application shall include specific reasons justifying the variance and any other information necessary to evaluate the proposed variance request. The director may require site design, landscape planting, fencing, the placement of signs, and the establishment of water quality best management practices in order to reduce adverse impacts on water quality, streams, wetlands, and floodplains.
(Ord. No. 18297, § 1, 11-1-04)

Secs. 12A-216--12A-230. Reserved.

ARTICLE X.

STREAM BUFFER REQUIREMENTS

Sec. 12A-231. Purpose and findings.

(a) Stream buffers provide numerous benefits including:

(1) Restoring and maintaining the chemical, physical and biological integrity of streams;

(2) Removing pollutants delivered in urban stormwater;

(3) Reducing erosion and controlling sedimentation;

(4) Stabilizing stream banks;

(5) Providing infiltration of stormwater runoff;

(6) Maintaining base flow of streams;

(7) Contributing organic matter needed by the aquatic ecosystem for food and energy;

(8) Providing tree canopy to shade streams and promote desirable aquatic organisms;

(9) Providing riparian wildlife habitat;

(10) Furnishing scenic value and recreational opportunity;

(11) Protecting the public from flooding, property damage and loss; and

(12) Providing sustainable, natural vegetation.

(b) The purpose of this article is to protect streams in the city by establishing minimum stream buffer requirements.
(Ord. No. 19343, § 1, 1-2-07)

Sec. 12A-232. Applicability.

(a) This article applies to all land in the city except the following:

(1) Land used for farming activities covered by an approved Natural Resources Conservation Services (NRCS) conservation plan that includes the application of Best Management Practices (BMPs).

(2) Land included in a preliminary or final plat approved before January 2, 2007.

(3) The portion of land for which a valid, unexpired building permit has been issued or for which application for a building permit is pending on January 2, 2007.

(4) Land used for surface mining operations that is operating in compliance with a state-approved surface mining permit.
(Ord. No. 19343, § 1, 1-2-07)

Sec. 12A-233. Definitions.

The following definitions apply to this article:

Best Management Practices (BMPs) means conservation practices or management measures which control soil loss and reduce water quality degradation mainly caused by nutrients, animal wastes, toxins, sediment in the runoff. BMPs may be either structural (for example, grass swales, terraces, retention and detention ponds), or non-structural (for example, disconnection of impervious surfaces, directing downspouts onto grass surfaces and educational activities).

Buffer means a vegetated area including trees, shrubs, managed lawn areas, and herbaceous vegetation which exists or is established to protect a stream system, lake or reservoir.

Development means:

(1) The improvement of property for any purpose involving construction; or

(2) Subdivision or the division of a tract or parcel of land into two (2) or more parcels; or

(3) The combination of any two (2) or more lots, tracts, or parcels of property for any purpose;

(4) The preparation of land for construction; or

(5) Land disturbance that requires the issuance of a land disturbance permit.

Farming activities means disturbance of any area greater than twenty thousand (20,000) square feet for the purpose of planting, cultivating and harvesting any crop product for commercial use.

Managed lawn areas means any area greater than five hundred (500) square feet where the vegetative ground cover is maintained at a uniform height of less than three (3) inches.

Non-point source pollution means pollution which is generated by various land use activities rather than from an identifiable or discrete source, and is conveyed to waterways through natural processes such as rainfall, storm runoff or groundwater seepage and infiltration rather than through direct discharge.

Pollution means any contamination or alteration of the physical, chemical, or biological properties of any waters that will render the waters harmful or detrimental to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses; or to livestock, wild animals, birds, fish or other aquatic life.

Streams means perennial and intermittent watercourses identified through site inspection and United States Geological Survey (USGS) maps and further defined and categorized as follows:

(1) *Type I Streams* are defined as perennial streams shown as solid blue lines on the United States Geological Survey seven and one-half (7.5) minutes series topographical map.

(2) *Type II Streams* are defined as intermittent streams shown as dashed blue lines on the United States Geological Survey seven and one-half (7.5) minutes series topographical map.

(3) *Type III Streams* are defined as waterways or natural channels which are not shown on the United States Geological Survey seven and one-half (7.5) minutes series topographical map as either blue or dashed blue lines which have drainage areas of greater than fifty (50) acres.

Waterways means natural or manmade lakes, natural channels, rivers, streams, and creeks which store or convey stormwater runoff.

Wetlands means areas that are inundated or saturated by surface or groundwater at frequency and duration sufficient to support and under normal circumstances do support a prevalence of vegetation typically adapted for life in saturated soil conditions.
(Ord. No. 19343, § 1, 1-2-07)

Sec. 12A-234. No land disturbance in stream buffer before plan approved.

It shall be unlawful for any person to clear, grade, disturb vegetation or build a structure on any land subject to this article that is located within one hundred (100) feet of a Type I Stream, fifty (50) feet of a Type II Stream or thirty (30) feet of a Type III Stream, as measured in section 12A-236(b), before the director has approved a stream buffer plan for the land.
(Ord. No. 19343, § 1, 1-2-07)

Sec. 12A-235. Stream buffer plan requirements.

(a) All development plans and plats shall include or be accompanied by a stream buffer plan that sets forth an informative, conceptual and schematic representation of the proposed stream buffers by means of maps, graphs, charts, or other written or drawn documents to enable the city to determine whether the plan or plat is in compliance with the requirements of this article.

(b) Stream buffer plans shall contain the following information:

(1) A site plan map at a minimum scale of one (1) inch equals two hundred (200) feet.

(2) Field delineated and surveyed streams, springs, seeps, bodies of water, sink holes, and wetlands (include a minimum of two hundred (200) feet into adjacent properties).

(3) Delineated stream buffers.

(4) Limits of the ultimate one hundred-year floodplain as shown on the adopted floodplain maps for the City of Columbia.

(5) Steep slopes greater than fifteen (15) percent for areas adjacent to and within two hundred (200) feet of streams, wetlands, or other waterbodies.

(c) A stream buffer plan shall be submitted in conjunction with the required land disturbance plan

for each development, and the buffer must be clearly delineated on the site grading plan. Each site grading and drainage plan shall include a note stating, "There shall be no clearing, grading, construction or disturbance of vegetation except as specifically approved by the city."
(Ord. No. 19343, § 1, 1-2-07)

Sec. 12A-236. Design standards for stream buffers.

(a) An adequate buffer for a stream system shall consist of a predominantly undisturbed strip of land extending along both sides of a stream and its adjacent wetlands, floodplains or slopes. The buffer width may be adjusted to include contiguous sensitive areas, such as steep slopes or erodible soils, where disturbance may adversely affect water quality, streams, wetlands, or other water bodies.

(b) The buffer shall begin and be measured from the ordinary high water mark of the channel during base flows.

(c) The required base width for all stream buffers is shown in Table I.

Table I. Required Stream Buffer Width	
Waterway Type	Required Width (each side)
Type I	100 feet
Type II	50 feet
Type III	30 feet

(d) Stream buffer width shall be increased where there are steep slopes in close proximity to the stream that drain into the stream system as set forth in Table II.

Table II. Modifications to Stream Buffer Width Based on Slope	
Percent Slope	**Width of Buffer**
0--14%	No Change
15%--25%	add 25 feet
Greater than 25%	add 50 feet

(e) Buffer averaging. The stream buffer width may be relaxed and the buffer permitted to become narrower at some points as long as the average width of the buffer meets the minimum requirement. This averaging of the buffer may be used to allow for the presence of an existing structure or to recover a lost lot, as long as the streamside zone (Zone I) is not narrowed by the averaging.
(Ord. No. 19343, § 1, 1-2-07)

Sec. 12A-237. Stream buffer function, vegetation and uses.

(a) The stream buffer shall be composed of two (2) distinct zones, each having its own function, allowed vegetation and permitted uses as set forth in this section and as summarized in Table III. The streamside zone will begin and be measured as set forth in section 12A-236(b) and extend away from the ordinary high water mark a distance as shown in Table III. The outer zone will begin at the outside edge of the streamside zone and extend outward, away from the streamside zone the distances shown in Table III.

Table III. Stream Buffers							
Streamside Zone				Outer Zone			
Type I Waterway		Type II Waterway	Type III Waterway	Type I Waterway		Type II Waterway	Type III Waterway
Width	50	25	15	Width	50	25	15
Vegetation	Indigenous Vegetation			Vegetation	Type I - Indigenous Vegetation Type II - Managed Lawns Permissible Type III - Managed Lawns Permissible		
Uses	Flood control, footpaths, road crossings, utility corridors			Uses	Biking/hiking paths, flood control, detention/retention structures, utility corridors, stormwater BMPs, residential yards, landscaped areas		
Function	Protect the physical and ecological integrity of the stream ecosystem			Function	Protect key components of the stream and filter and slow velocity of water runoff		

(b) The width of the streamside zone is set forth in Table III. The normal width of the outer zone is set forth in Table III but will vary if the stream buffer is increased or decreased on an approved stream buffer plan.

(c) The function of the streamside zone is to protect the physical, biological and ecological integrity of the stream ecosystem. The function of the outer zone is to prevent encroachment into the streamside zone and to filter runoff from residential and commercial development.

(d) Indigenous vegetation must be preserved in the streamside zone and in the outer zone of Type I Streams. Managed lawns are permitted in the outer zone of Type II and Type III Streams although landowners are encouraged to preserve or plant indigenous vegetation in order to increase the filtering capability of the buffering system.

(e) The structures, practices and activities permitted in the streamside zone of the buffer are limited to the following:

(1) Roads and bridges;

(2) Utilities where no practical alternative exists;

(3) Paths and recreation trails (but use of the outer zone is preferred);

(4) Removal of diseased or dead trees, brush and trash;

(5) Removal of debris which could cause flooding;

(6) Selective (spot) spraying of noxious or other vegetation consistent with recommendations from the city arborist or the Missouri Department of Conservation;

(7) Water quality monitoring and stream gauging;

(8) Maintenance of city-approved bank stabilization measures;

(9) Maintenance of all city-approved improvements, including utilities.

(f) The following practices and activities are specifically prohibited within the streamside zone of the stream buffer, except by the city:

(1) Clearing of existing vegetation.

(2) Soil disturbance by grading, stripping, or other practices;

(3) Filling or dumping;

(4) Drainage by ditching, underdrains, or other systems;

(5) Use, storage, or application of pesticides, except as provided for in subsection (e)(6);

(6) Storage or operation of motorized vehicles, except for maintenance and emergency use approved by the city;

(7) Housing, grazing, or other maintenance of livestock.

(g) The structures, practices and activities permitted in the outer zone of the buffer are limited to the following:

(1) All uses permitted in the streamside zone;

(2) Flood control structures;

(3) Detention and retention structures;

(4) Utility corridors;

(5) Stormwater BMPs;

(6) Managed lawns (Type II and III Streams only); and

(7) Landscaped areas.

(h) There shall be no septic systems, permanent structures or impervious cover, with the exception of foot paths, roads, bridges and utilities within the outer zone.

(i) The following activities are specifically prohibited within the outer zone of the stream buffer of Type I Streams, except by the city:

(1) Clearing of existing vegetation;

(2) Soil disturbance by grading, stripping, or other practices.

(3) Filling or dumping.
(Ord. No. 19343, § 1, 1-2-07)

Sec. 12A-238. Additional land use restriction near streams.

The following land uses and activities are potential water pollution hazards and must be set back from any stream or waterbody by the distance indicated below:

1.	Storage and use of hazardous substances	300 feet
2.	Above- or below-ground petroleum storage facilities	300 feet
3.	Drain fields from on-site sewage disposal and treatment systems	200 feet
4.	Raised septic systems	200 feet
5	Salvage yards or automobile recyclers	600 feet
6.	Confined animal feedlot operations	500 feet
7.	Tilled land (for crops)	200 feet

(Ord. No. 19343, § 1, 1-2-07)

Sec. 12A-239. Temporary boundary markers.

Temporary boundary markers shall be installed by the applicant before clearing and grading operations begin and shall be maintained throughout the development activities. The markers will be placed on the outside edge of the buffer zone before the start of any activity adjacent to the buffer zone. Markers shall be clearly visible and shall be spaced at a maximum of one hundred (100) feet. The markers shall be joined by marking tape or fencing.
(Ord. No. 19343, § 1, 1-2-07)

Sec. 12A-240. Nuisances.

(a) Any condition prohibited by this article is a nuisance.

(b) The abatement procedures and other provisions of Article IX, Division 4 of this chapter apply to this article.
(Ord. No. 19343, § 1, 1-2-07)

Sec. 12A-241. Variances by the director.

(a) The director may grant a variance or waiver for the following:

(1) Projects or activities serving a public need where no feasible alternative is available;

(2) The repair and maintenance of public improvements where avoidance and minimization of

adverse impacts to wetlands and associated aquatic ecosystems have been addressed.

(b) The applicant shall submit a written request for a variance or waiver to the director. The application shall include specific reasons justifying the variance and any other information necessary to evaluate the proposed variance. The director may require an alternatives analysis that clearly demonstrates that no other feasible alternatives exist and that minimal impact will occur as a result of the project or development.

(c) In granting a request for a variance, the director may require site design, landscape planting, fencing, the placement of signs, and the establishment of water quality best management practices in order to reduce adverse impacts on water quality, streams, wetlands, and floodplains.
(Ord. No. 19343, § 1, 1-2-07)

Sec. 12A-242. Conflict with other regulations.

Where the standards and management requirements of this article are in conflict with other laws, regulations, and policies regarding streams, steep slopes, erodible soils, wetlands, floodplains, timber harvesting, land disturbance activities, or other environmental protective measures, the more restrictive requirement shall apply.
(Ord. No. 19343, § 1, 1-2-07)

APPENDIX O

Section 1. General Provisions

1.1. FINDINGS OF FACT

It is hereby determined that:

(1) Land development activities and associated increases in site impervious cover alter the hydrologic response of local watersheds and increase stormwater runoff rates and volumes, flooding, stream channel erosion, sediment transport and deposition;

(2) This stormwater runoff contributes to increased quantities of water-borne pollutants;

(3) Illicit and non-stormwater discharges to the storm drain system can contribute a wide variety of pollutants to waterways, and the control of these discharges is necessary to protect public health and safety and water quality;

(4) Improper design and construction of stormwater best management practices (BMPs) can increase the velocity of stormwater runoff thereby increasing stream bank erosion and sedimentation;

(5) Clearing and grading during construction increases soil erosion and adds to the loss of native vegetation;

(6) Impervious surfaces allow less water to percolate into the soil, thereby decreasing groundwater recharge and stream baseflow;

(7) Substantial economic losses can result from these adverse impacts on the waters of the County;

(8) Stormwater runoff, soil erosion and nonpoint source pollution can be controlled and minimized through the regulation of stormwater runoff from land development activities;

(9) The regulation of stormwater runoff discharges from land development activities in order to control and minimize increases in stormwater runoff rates and volumes, stream channel erosion, and nonpoint source pollution associated with stormwater runoff is in the public interest and will minimize threats to public health and safety.

(10) Regulation of land development activities by means of performance standards governing stormwater management and site design will produce development compatible with the natural functions of a particular site or an entire watershed and thereby mitigate the adverse effects of stormwater runoff from development.

1.2 INTENT AND PURPOSE

The purpose of this ordinance is to establish minimum stormwater management requirements and controls to protect and safeguard the general health, safety, and welfare of the public residing in watersheds within Boone County. This ordinance seeks to meet that purpose through the following objectives:

(1) To protect the safety and welfare of citizens, property owners, and businesses by minimizing the negative impacts of increased stormwater discharges from new land development and redevelopment.
(2) To control the rate, quality and volume of stormwater originating from development and redevelopment sites so that surface water and groundwater are protected and flooding and erosion potential are not increased.
(3) To encourage responsible development to occur in Boone County
(4) To control nonpoint source pollution and stream channel erosion.
(5) To maintain the integrity of stream channels and networks for their biological functions, drainage, and natural recharge of groundwater.
(6) To protect the condition of state (and U.S.) waters for all reasonable public uses and ecological functions.
(7) To provide long-term responsibility for and maintenance of stormwater BMPs.
(8) To establish legal authority to carry out all the inspection and monitoring procedures necessary to ensure compliance with this ordinance.
(9) To enable Boone County Public Works to comply with the National Pollution Discharge Elimination System permit and applicable federal and state regulations.

1.3 APPLICABILITY

This ordinance shall be applicable to all land development, including, but not limited to, site plan applications, subdivision applications, and grading applications, unless exempt pursuant to Section 1.4. These provisions apply to any new development or redevelopment site within Boone County that meets one or more of the following criteria:
(1) Land development that disturbs 1 acre or more.
(2) Redevelopment that creates or adds three thousand (3,000) square feet or more of impervious cover.
(3) Land development in or near an ecologically and/or environmentally sensitive area (as defined in Section 4.7) that disturbs more than 3000 square feet.
(4) Land development activities that are smaller than the minimum applicability criteria set forth above if such activities are part of a larger common plan of development, even though multiple, separate and distinct land development activities may take place at different times on different schedules.

1.4 EXEMPTIONS

The following activities are exempt from this ordinance:

(1) Projects that are exclusively for agricultural and silvicultural uses. Agricultural or silvicultural roads that are used to access other lands subject to this ordinance are not exempt. Agricultural structures that are used for other uses subject to this ordinance are not exempt.

(2) Maintenance and repair to any stormwater BMP deemed necessary by Boone County Public Works.

(3) Any emergency project that is immediately necessary for the protection of life, property, or natural resources.

(4) Linear construction projects, such as pipeline or utility line installation that does not result in the creation of impervious cover or land disturbance greater than one acre, as determined by Boone County Public Works. Such projects must be designed to minimize the number of stream crossings and width of disturbance, and are subject to County erosion and sediment control practices.

(5) Any part of a land development that was approved by Boone County Planning Department prior to the effective date of this ordinance.

1.5. LEGAL AUTHORITY

These regulations are adopted pursuant to the authority granted in 64.907, 64.825 – 64.885, Revised Statutes of Missouri.

1.6. COMPATIBILITY WITH OTHER PERMIT AND ORDINANCE REQUIREMENTS

This ordinance is not intended to interfere with, abrogate, or annul any other ordinance, rule or regulation, statute, or other provision of law. The requirements of this ordinance should be considered minimum requirements, and where any provision of this ordinance imposes restrictions different from those imposed by any other ordinance, rule or regulation, or other provision of law, whichever provisions are more restrictive or impose higher protective standards for human health or the environment shall be considered to take precedence.

1.7. LIMITATIONS ON LIABILITY.

Floods from stormwater runoff may occur which exceed the capacity of stormwater drainage facilities constructed and maintained under this chapter. This chapter does not guarantee that property will be free from stormwater flooding or flood damage. This chapter shall not create a liability on the part of, or cause of action against, the County or any officer or employee thereof for any flood damage. This chapter does not purport to reduce the need or the necessity for obtaining flood insurance.

Section 2. Definitions

Unless specifically defined below, words or phrases in this chapter shall be interpreted so as to give them the meaning they have in common usage and to give this chapter its most reasonable application:

"Applicant" means a property owner or agent of a property owner who has filed an application for a permit.

"Bankfull" An established river stage/elevation at a given location along a river which is intended to represent the maximum safe water level that will not overflow the river banks or cause any significant damage within the river reach.

"Best Management Practice (BMP)" Activities, practices and procedures which control soil loss and reduce or prevent water quality degradation caused by nutrients, animal wastes, toxins, organics and sediment in the runoff. BMPs may either be structural (grass swales, terraces, retention and detention ponds, and others); or non-structural (disconnection of impervious surfaces, directing downspouts onto grass surfaces, ordinances and educational activities).

"Boone County Stormwater Design Manual" means the engineering and/or project review document maintained by Boone County Public Works containing technical standards and specifications, policies, procedures, and other materials deemed appropriate to assist with compliance with the provisions of this ordinance as adopted February 2010.

"Building" means any structure, either temporary or permanent, having walls and a roof, designed for the shelter of any person, animal, or property, and occupying more than 160 square feet of area.

"Channel" means a natural or artificial watercourse with a definite bed and banks that conducts continuously or periodically flowing water.

"Clearing" means any activity which removes the vegetative surface cover through disturbance of the root zone.

"County Commission" means the Boone County Commission.

"County" is Boone County, Missouri.

"Dedication" means the deliberate appropriation of property by its owner for general public use.

"Detention" is the temporary storage of storm runoff in a stormwater BMP with the goals of controlling peak discharge rates and providing gravity settling of pollutants.

"Developer" is a person directing or participating in the direction of improvements on and/or to land, including, but not limited to, the owner of the land, a general contractor or a commercial agent engaged for such activity.

"Development" A change in the zoning, intensity of use or allowed use of any land, building, structure or premises for any purpose. The subdivision or severance of land. The construction, erection or placing of one or more buildings or structures on land or use of land or premises for storage of equipment or materials. Making of an addition, enlargement or alteration to a building or structure, in, on, over or under land, which has the effect of increasing the size or usability thereof. Land disturbance activities such as but not limited to site-grading, excavation, drilling, removal of topsoil or the placing or dumping of fill and installation of drainage works. The use of the term shall include redevelopment in all cases unless otherwise specified in these regulations.

"Director" The Boone County Director of Public Works or Boone County Director of Planning and Building Inspection or his/her designee, as determined by the County Commission.

"Drainage Facility" is a man-made structure or natural watercourse used for the conveyance of stormwater runoff. Examples are channels, pipes, ditches, swales, catch basins and street gutters.

"Easement" means a legal right granted by a landowner to a grantee allowing the use of private land for conveyance or treatment of stormwater runoff and access to stormwater practices.

"Environmentally Sensitive Area" is any area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem; or an area of land that contributes water to the habitat of an aquatic animal that is rare or valuable; or an area of land with increased vulnerability (presence of karst features, steep terrain, highly erodable soils) where the proposed human activities would likely cause disproportional damage to the environment; or as defined in Section 4.6.

"Erosion and Sediment Control Plan" is a plan designed to minimize the loss of soil and prevent discharge of sediment from a site during, and after construction activities.

"Flood Routing Path" is that part of the major storm drainage system that carries the runoff that exceeds the capacity of the designed drainage facilities. Essentially, the complete drainage system of an urban area contains two (2) separate drainage elements. The storm sewers collect the frequent events while surface drainage-ways must be provided for the major flow from more intense storms, or the event of clogging.

"Grading" means excavation or fill of material, including the resulting condition thereof.

"Groundwater Management Area" is a geographically defined area that may be particularly sensitive in terms of groundwater quantity and/or quality by nature of the use or movement of groundwater, or the relationship between groundwater and surface water, and where special management measures are deemed necessary to protect groundwater and surface water resources. Example includes the Devils Icebox Recharge Area.

"Hazardous Materials" means any material, including any substance, waste, or combination thereof, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause, or significantly contribute to, a substantial present or potential hazard to human health, safety, property, or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

"Illegal Discharge" means any direct or indirect non-storm water discharge to the storm drain system, except as exempted by this ordinance.

"Illicit Connections" means either of the following: Any drain or conveyance, whether on the surface or subsurface, which allows an illegal discharge to enter the storm drain system. These include but are not limited to any conveyances that allow any non-storm water discharge including sewage, process wastewater, and wash water to enter the storm drain system and any connections to the storm drain system from indoor drains and sinks, regardless of whether said drain or connection had been previously allowed, permitted, or approved by an authorized enforcement agency. Illicit connections also includes any drain or conveyance connected from a commercial or industrial land use to the storm drain system which has not been documented in plans, maps, or equivalent records and approved by an authorized enforcement agency.

"Impaired Waters" means those streams, rivers and lakes that currently do not meet their designated use classification and associated water quality standards under the Clean Water Act.

"Impervious Cover" includes those surfaces that cannot effectively infiltrate rainfall (e.g., building rooftops, pavement, sidewalks, driveways, etc).

"Industrial Stormwater Permit" means a National Pollutant Discharge Elimination System permit issued to a commercial industry or group of industries that regulates the pollutant levels associated with industrial stormwater discharges or specifies on-site pollution control strategies.

"Infill Development" means land development that occurs within designated areas based on local land use, watershed, and/or utility plans where the surrounding area is generally developed, and where the site or area is either vacant or has previously been used for another purpose.

"Infiltration" means the process of percolating stormwater into the subsoil.

"Infiltration Facility" means any structure or device designed to infiltrate retained water to the subsurface. These facilities may be above grade or below grade.

"Land Development" means a human-made change to, or construction on, the land surface that changes its runoff characteristics.

"Land Disturbing Activity" means any activity that changes the volume or peak flow discharge rate of rainfall runoff from the land surface. This may include the grading, digging, cutting, scraping, or excavating of soil, placement of fill materials, paving, construction, substantial removal of vegetation, or any activity that bares soil or rock or involves the diversion or piping of any natural or man-made watercourse.

"Land Disturbance Permit" – an authorization for the permittee to develop land and conduct activities in accordance with County ordinances and erosion and sediment control practices outlined in an approved Stormwater pollution prevention plan.

"Landowner" the legal or beneficial owner of land, including those holding the right to purchase or lease the land, or any other person holding proprietary rights to the land.

"Maintenance Agreement" is a legally recorded document that acts as a property deed restriction, and that provides for long-term maintenance of stormwater BMPs.

"Motorized Equipment" vehicles or equipment which are motorized except this definition shall not apply to equipment used for the farming of land, or normal yard maintenance.

"Municipal Separate Storm Sewer System (MS4)" a publicly-owned facility by which stormwater is collected and/or conveyed, including but not limited to any roads with drainage systems, municipal streets, gutters, curbs, catch basins, inlets, piped storm drains, pumping facilities, retention and detention basins, natural and human-made or altered drainage ditches/channels, reservoirs, and other drainage structures.

"National Pollutant Discharge Elimination System (NPDES) Stormwater Discharge Permit" a permit issued by the State under authority delegated pursuant to 33 USC § 1342(b), that authorizes the discharge of pollutants to waters of the State, whether the permit is applicable on an individual, group, or general area-wide basis.

"Non-Stormwater Discharge" any discharge to the storm drain system that do not originate from precipitation events, such as but not limited to septic system discharges, floor drains, and laundry or commercial car wash facilities.

"Non-Structural Measure" a stormwater control and treatment technique that uses natural processes, restoration or enhancement of natural systems, or design approaches to control runoff and/or reduce pollutant levels. Such measures are used in lieu of or to supplement structural practices on a land development site. Non-structural measures include, but are not limited to: minimization and/or disconnection of impervious surfaces;

development design that reduces the rate and volume of runoff; creation, restoration or enhancement of natural areas such as riparian zones, wetlands, and forests; and on-lot practices such as rain barrels, cisterns, and vegetated areas that intercept rainfall and surficial runoff.

"Nonpoint Source Pollution" pollution from any source other than from any discernible, confined, and discrete conveyances, and shall include, but not be limited to, pollutants from agricultural, silvicultural, mining, construction, subsurface disposal and urban runoff sources.

"Ordinary High Water Mark" – That line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter or debris, or other appropriate means that consider the characteristics of the surrounding area.

"Off-Site Facility" means a stormwater BMP located outside the subject property boundary described in the permit application for land development activity.

"On-Site Facility" means a stormwater BMP located within the subject property boundary described in the permit application for land development activity.

"Owner" the owner or owners of the freehold of the premises or lesser estate therein, a mortgagee or vendee in possession, assignee of rents, receiver, executor, trustee, lessee or other person, firm or corporation in control of a piece of land. As used herein, owner also refers to, in the appropriate context: (i) any other person authorized to act as the agent for the owner; (ii) any person who submits a stormwater management concept or design plan for approval or requests issuance of a permit, when required, authorizing land development to commence; and (iii) any person responsible for complying with an approved stormwater management construction plan.

"Perimeter Control" means a barrier that prevents sediment from leaving a site either by filtering sediment-laden runoff, or diverting it to a sediment trap or basin.

"Permanent Stormwater BMP" a stormwater best management practice (BMP) that will be operational after the construction phase of a project and that is designed to become a permanent part of the site for the purposes of managing stormwater runoff.

"Person" means a natural person, corporation, partnership or other entity.

"Phasing" is the clearing a parcel of land in distinct phases, with the stabilization of each phase before the clearing of the next.

"**Point source**" is any discernible, confined and discrete conveyance including, but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, separate storm sewer or vessel or

other floating craft from which pollutants are, or may be, discharged. (Code of State Regulations – 10 CSR 20-2)

"Pollutant" means anything that causes or contributes to pollution. Pollutants may include, but are not limited to: paints, varnishes, and solvents; oil and other automotive fluids; non-hazardous liquid and solid wastes and yard wastes; refuse, rubbish, garbage, litter, or other discarded or abandoned objects, ordinances, and accumulations, so that same may cause or contribute to pollution; floatables; pesticides, herbicides, and fertilizers; hazardous substances and wastes; sewage, fecal coliform and pathogens; dissolved and particulate metals; animal wastes; wastes and residues that result from constructing a building or structure; and noxious or offensive matter of any kind.

Predevelopment: The time period prior to a proposed or actual development activity at a site. Predevelopment may refer an undeveloped site or a developed site that will be redeveloped or expanded.

"Professional Engineer" – a licensed engineer who is registered with and authorized to practice engineering in the state of Missouri

"Professional Geologist" is a licensed geologist who is registered with and authorized in the state of Missouri.

"Receiving Stream or Channel" means the body of water or conveyance into which stormwater runoff is discharged.

"Recharge" means the replenishment of underground water reserves.

"Redevelopment" means a change to previously existing, improved property. This includes but is not limited to the demolition or building of structures, filling, grading, paving; including the conversion of gravel areas to pavement, or excavating. Redevelopment excludes ordinary maintenance activities such as remodeling of buildings on the existing footprint, resurfacing and/or repaving of existing paved areas, and exterior changes or improvements that do not materially increase or concentrate stormwater runoff or cause additional nonpoint source pollution.

"Responsible Party" means any individual, partnership, co-partnership, firm, company, corporation, association, joint stock company, trust, estate, governmental entity, or any other legal entity; or their legal representatives, agents, or assigns that is named on a stormwater maintenance agreement as responsible for long-term operation and maintenance of one or more stormwater BMPs.

"Riparian Zone / Riparian Buffer" is the land adjacent to streams, rivers, and lakes that actively interfaces with the waterbody through physical and chemical processes. Riparian zones filter nutrients and sediments, increase streambank stability, and provide shade that reduces stream temperatures

"Runoff Reduction (RR)" is defined as the total annual runoff volume reduced through canopy interception, soil infiltration, evaporation, transpiration, rainfall harvesting engineered infiltration or extended filtration.

"Sediment Control" means measures that prevent eroded sediment from leaving the site.

"Sensitive Area" means areas containing features that are of critical importance to the protection of ecological or environmental resources, and include bluffs, caves, sinkholes, springs, and wetlands.

"Sinkhole Cluster Area" any area that contributes surface water to a sinkhole which is located in a group of two (2) or more sinkholes grouped within 500 feet.

"Sinkhole Drainage Area" means the land area around a sinkhole that contributes surface water directly to the sinkhole(s).

"Sinkhole" means any closed depression formed by removal (typically underground) of water, surficial soil, rock, or other material. The existence of a sinkhole shall be as indicated by the closed depression contour lines on the topographical maps of the county or as may be determined by a field survey. Its actual limits may, however, be determined by field measurements with concurrence of the Director. Sinkholes may be either circular in plan or irregular, depending upon structural control.

"Sinkhole Ponding Elevation" means the maximum elevation of either the elevation as determined by using currently accepted methods of the Natural Resource Conservation Service (formerly Soil Conservation Service) to calculate the total volume of runoff from the sinkhole drainage area to the sinkhole utilizing an eight (8) inch rainfall and no sink outlet or the historical elevation or the published flood elevation. NOTE: Overflow conditions will establish maximum ponding elevation.

"Stabilization" means the use of practices that prevent exposed soil from eroding.

"Start of Construction" means the first land-disturbing activity associated with a development, including land preparation such as clearing, grading and filling; installation of streets and walkways; excavation for basements, footings, piers or foundations; erection of temporary forms; and installation of accessory buildings such as garages.

"Stop Work Order" means an order issued that requires that all construction activity on a site be stopped except as necessary to remedy the issue(s) for which the order was issued.

"Stormwater" means any surface flow, runoff, and drainage consisting entirely of water from any form of natural precipitation (such as rain or snow), and resulting from such precipitation.

"Stormwater drainage system" means all drainage facilities used for collecting and conducting stormwater to, through and from drainage areas to the points of final outlets including, but not limited to, any and all of the following: Conduits and appurtenant features, canals, ditches, streams, gullies, flumes, culverts, streets, gutters and pump stations.

"Stormwater Hotspot" means an area where land use or activities generate highly contaminated runoff, with concentrations of pollutants in excess of those typically found in stormwater.

"Stormwater Management" means the use of structural or non-structural practices that are designed to reduce stormwater runoff pollutant loads, discharge volumes, peak flow discharge rates and detrimental changes in stream temperature that affect water quality and habitat.

"Stormwater Pollution Prevention Plan (SWPPP)" means a narrative plan, usually required by a permit, to manage stormwater associated with industrial, commercial, institutional, or other land use activities, including construction. The SWPPP commonly describes and ensures the implementation of practices that are to be used to reduce pollutants in stormwater and non-stormwater discharges.

"Stormwater Retrofit" means a stormwater BMP designed for an existing development site that previously had either no stormwater BMP in place or a practice inadequate to meet the stormwater management requirements of the site.

"Stormwater Runoff" is the rain or snowmelt that runs off streets, parking lots, lawns and other surfaces and drains into natural or manmade conveyance systems. Often stormwater transports accumulated material including litter, soil, nutrient, pathogens, chemicals, pesticides, oils and grease.

"Stream Buffer" is a vegetated area including trees, shrubs, managed lawn area, and herbaceous vegetation which exists or is established to protect the stream system. Alteration of this natural area is strictly limited by the stream buffer ordinance dated June 1, 2009.

"Water Quality Storm" is the storm event that produces less than or equal to 90 percent stormwater runoff volume of all 24-hour storms on an annual basis.

"Water Quality Volume (WQv)" means the storage needed to capture and treat 90% of the average annual stormwater runoff volume.

"Watercourse" means a permanent or intermittent stream or other body of water, either natural or man-made, which gathers or carries surface water.

"Watershed" or "Catchment" is the entire geographical area drained by a river and its tributaries; an area characterized by the conveyance of all runoff to the same outlet.

"Watershed Management Plan" means a document, usually developed cooperatively by government agencies and other stakeholders, to protect, restore, and/or otherwise manage the water resources within a particular watershed or subwatershed. The plan commonly identifies threats, sources of impairment, institutional issues, and technical and programmatic solutions or projects to protect and/or restore water resources.

"Wetland" Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.

"Wetland Hydroperiod" means the pattern of fluctuating water levels within a wetland caused by the complex interaction of flow, topography, soils, geology, and groundwater conditions in the wetland.

Section 3. Plan Submittal/Review Requirements

Each developer/owner subject to this ordinance shall submit to Boone County Public Works for review and approval a stormwater management plan as provided herein:

3.1. Pre-Application Meeting

All applicants shall participate in a concept review and pre-application meeting with the Public Works and Planning departments to discuss potential approaches for stormwater design and opportunities to use design techniques to reduce runoff rates, volumes, and pollutant loads. During the pre-application meeting, the applicant shall provide information regarding design considerations as outlined in the Boone County Stormwater Design Manual.

3.2. Preliminary Stormwater Management Plan

After the pre-application review, the applicant shall prepare a preliminary stormwater management plan describing, in general, how stormwater runoff through and from the development will be treated and conveyed. Required information is provided in the Boone County Stormwater Design Manual.

(1) **Maximize Use of Techniques to Reduce Runoff by Design:** The preliminary stormwater management plan shall utilize to the maximum extent practicable site planning and design technique that reduce runoff rates, volumes, and pollutant loads. Such techniques include, but are not limited to, minimization and/or disconnection of impervious surfaces; development design that reduces the rate and volume of runoff; restoration or enhancement of natural areas such as riparian zones, wetlands, and forests; and distributed practices that intercept and treat runoff from developed areas.

(2) **Preliminary Plan Prior to Design Plan**: The preliminary stormwater management plan must be approved by Boone County Public Works prior to submission of a stormwater management construction plan (as part of the construction or final site plan) for the entire development, or portions thereof.

3.3. Clearing and Rough Grading

If the developer/owner only desires to obtain a land disturbance permit for purposes of clearing and grading, they may do so upon approval of the preliminary plan, erosion and sediment control plan and a stormwater pollution prevention plan.

3.4. Stormwater Management Construction Plan

A stormwater management construction plan containing all appropriate information as specified in this Ordinance and outlined in the Boone County Stormwater Design Manual shall be submitted to Boone County in conjunction with the final subdivision plat, final

development plan, final site plan, construction plan, or any other land development plan subject to this ordinance.

(1) **Application Requirements:** The stormwater management construction plan submittal shall contain:
- a completed application form provided by Boone County Public Works for any applicable permits as outlined in Section 8,
- the fee(s) required by Section 8.5,
- a stormwater management construction plan that satisfies the requirements of this section and the Boone County Stormwater Design Manual,
- a stormwater facilities and/or BMP maintenance plan, and
- owner and developer certification stating that all requirements of the approved plan will be complied with. Failure of the owner to demonstrate that the project meets these requirements, as determined by Boone County Public Works, shall be sufficient reason to refuse review and/or deny approval of the plan.

(2) **Consistency between Preliminary Plans and Construction Plans:** A copy of the approved preliminary stormwater management plan shall be submitted with the construction plans. Boone County Public Works shall check the construction plan for consistency with the preliminary plan.

(3) **Stormwater management construction plan content:** The stormwater management construction plan shall contain maps, charts, graphs, tables, photographs, narrative descriptions, explanations, calculations, citations to supporting references, a record of all major permit decisions, and other information as may be necessary for a complete review of the plan, and as specified in the Boone County Stormwater Design Manual.

3.5. CONSTRUCTION PLAN REVIEW PROCEDURES

(1) **Review for Completeness of Plan:** Boone County Public Works shall have a maximum of ten (10) workdays from the receipt of an application for preliminary review to determine if the application is complete. After this period, the application will be accepted for review, which will begin the thirty (30) calendar day review period, or rejected for incompleteness. For detailed procedures, refer to the Stormwater Design Manual.

(2) **Review Period:** The thirty (30) calendar day review period begins on the day the complete stormwater management construction plan is accepted for review by Boone County Public Works. During the thirty (30) day review period, Boone County Public Works shall either approve or disapprove the plan and communicate the decision to the applicant in writing. Approval or denial shall be based on the plan's compliance with this Ordinance and the Boone County Stormwater Design Manual. Within thirty (30) days after receiving an application, the County shall, in writing:

A. approve the permit application; or

B. approve the permit application subject to such reasonable conditions as may be necessary to secure substantially the objectives of this regulation, and issue the permit subject to these conditions; or

C. disapprove the permit application, indicating the deficiencies and the procedure for submitting a revised application and/or submission.

(3) **Modifications Needed for Approval:** In cases where modifications are required to approve the plan, Boone County shall have an additional thirty (30) days to review the revised plan from the initial and any subsequent resubmission dates. If the plan is approved, one copy bearing certification of such approval shall be returned to the applicant. If the plan is disapproved, the applicant shall be notified in writing of the reasons.

(4) **Substantive Changes to Plan:** No substantive changes shall be made to an approved plan without review and written approval by the Director. The County may request additional data with a plan amendment as may be necessary for a complete review of the plan and to ensure that changes to the plan will comply with the requirements of this ordinance.

(5) **Expiration of Plan Approval:** The stormwater management construction plan is contingent on the land disturbance permit approval. These plans will expire two years from the date of approval unless work has begun on the site; or a land disturbance permit extension request from the owner or design engineer has been received by the Director. If the land disturbance and/or stormwater management construction plan approval expires and is not granted an extension, the applicant shall file with Boone County for reapproval of the stormwater management construction plan.

3.6. COORDINATION WITH OTHER APPROVALS AND PERMITS

(1) **Approval of Other Permits:** Unless exempt, no stormwater discharge permit or building permit shall be issued for land development without approval of a stormwater management construction plan.

(2) **Coordination with Other Plans:** Approval of the stormwater management construction plan shall be coordinated by Boone County with approval of an erosion and sediment control or construction stormwater plan with regard to the location, schedule, and/or phasing for temporary and permanent stormwater management measures. If natural drainage features or other natural areas are to be preserved, then these areas must be shown and measures provided for their protection on both the erosion and sediment control plan and the stormwater management construction plan. If other elements of the stormwater management construction plan utilize soils, vegetation, or other natural features for infiltration or treatment, then these areas must be shown on the erosion and sediment control plan and measures provided for their protection during construction

(3) **Other Permits or Approvals May Be Needed:** Approvals issued in accordance with this ordinance do not relieve the applicant of responsibility for obtaining all other necessary permits and/or approvals from other federal, state, and/or local agencies. If requirements vary, the most restrictive shall prevail. These permits may include, but are not limited to: applicable state and federal permits for stream and wetland impacts and applicable dam safety permits. Applicants are required to show proof of compliance with these regulations before Boone County will issue a land disturbance, stormwater discharge, or building permit.

(4) **Stormwater Measures within Designated Flood Hazard Areas:** Construction of stormwater measures or facilities within a Federal Emergency Management Agency (FEMA) designated floodplain or floodway shall be avoided to the extent possible. When this is unavoidable, all stormwater BMP construction shall be in compliance with all applicable requirements of the Flood Plain Management Ordinance.

3.7. MAINTENANCE AGREEMENT AND PLANS

Prior to approval by the Director of a stormwater management construction plan, each owner shall submit a maintenance agreement and maintenance plan in accordance with the following:

(1) **Responsible Party:** The owner shall be responsible for the operation and maintenance of such measures and shall pass such responsibility to any successor owner, unless such responsibility is accepted by the County.

(2) **Requirement for Maintenance Agreement & Plan:** If a stormwater management construction plan requires structural or nonstructural measures, the owner shall execute a stormwater maintenance agreement prior to the Director granting final approval for the plan, or any plan of development or other development for which a permit is required under this Ordinance. The agreement shall be recorded by the responsible party in the office of the Boone County Recorder of Deeds and shall run with the land.

(3) **Required Elements for Maintenance Agreement & Plan:** The stormwater maintenance agreement shall be in a form approved by the County, and shall, at a minimum:

(a) **Designate Responsible Party:** Designate for the land development the owner, governmental agency, or other legally established entity (responsible party) which shall be permanently responsible for maintenance of the structural or non-structural measures required by the plan.

(b) **Pass Responsibility to Successors:** Pass the responsibility for such maintenance to successors in title.

(c) **Right of Entry for Stormwater Authority**: Grant Boone County Public Works and its representatives the right of entry for the purposes of inspecting all stormwater facilities and BMPs at reasonable times and in a reasonable manner. This includes the right to enter a property when Boone County Public Works has a reasonable basis to believe that a violation of this Ordinance is occurring or has occurred and to enter when necessary for correction of a violation of this Ordinance.

(d) **Maintenance Plan:** Ensure the continued performance of the maintenance obligations required by the plan and this ordinance through a maintenance plan (which may be an attachment to the actual maintenance agreement). The plan shall include a list of inspection and maintenance tasks, a schedule for routine inspection and maintenance, required maintenance actions, and other items listed in the Boone County Stormwater Design Manual.

Section 4. Performance Criteria for Stormwater Management

4.1. General Stormwater Management Criteria

(1) **Compliance with Federal & State Regulations:** All stormwater facilities and conveyance systems shall be designed in compliance with all applicable state and federal laws and regulations, including the Federal Clean Water Act and all applicable erosion and sediment control, wetland and flood plain regulations.

(2) **Protect Public Health, Safety & General Welfare:** The design of stormwater BMPs shall consider public health, safety, and general welfare. These considerations include, but are not limited to: preventing the flooding of structures; safe passage of vehicles on roadways; preventing standing water in facilities, manholes, inlets, and other structures in a manner that promotes breeding of mosquitoes; preventing attractive nuisance conditions and dangerous conditions due to velocity or depth of water and/or access to orifices and drops; and preventing aesthetic nuisances due to excessive slopes, cuts and fills, and other conditions.

(3) **Adherence to Boone County Stormwater Design Manual:** All stormwater facilities and BMPs shall be designed to the standards of the Boone County Stormwater Design Manual, unless a variance is granted or the applicant is exempt from such requirements.

(4) **Stormwater Authority Discretion:** If hydrologic, geologic, topographic, or land use conditions warrant greater control than that provided by the minimum control requirements, the Director may impose additional requirements prior to the approval of the preliminary stormwater management plans, as deemed reasonable and necessary to control the volume, timing, rate and/or quality of runoff. The Director

may restrict the use of certain stormwater BMPs, require additional pretreatment, and/or require a post-construction stormwater pollution prevention plan in certain circumstances. These include, but are not limited to: stormwater generated from stormwater hotspots, stormwater discharges that are conveyed with non-stormwater discharges, and stormwater discharged in important groundwater management areas, areas with known flooding problems, areas with slopes greater than 25%, areas discharging to impaired waterways or areas where geologic conditions are conducive to groundwater contamination (e.g., karst). The Director may use this authority to mitigate impacts anticipated by a proposed development or redevelopment project. However the additional requirements must be proportional to the impact being mitigated.

(5) **Hydrologic Computation Assumptions:** Hydrologic parameters shall reflect the ultimate land development and shall be used in all engineering calculations. All pre-development calculations shall consider woods and fields to be in good condition, regardless of actual conditions at the time of application.

(6) **Location of Stormwater Facilities on Lots:** Stormwater facilities within residential subdivisions that serve multiple lots and/or a combination of lots and roadways shall be on a lot owned and maintained by an entity of common ownership, unless an alternative arrangement is approved by the Director. Stormwater practices located on individual lots shall be placed within an easement and either maintained by the lot owner or maintained by an entity of common ownership.

4.2. ENGINEERED SYSTEMS

(1) **Replicating Pre-Development Hydrology:** Stormwater management designs shall preserve the natural hydrologic functions, stream channel characteristics, and groundwater recharge of the pre-developed site as outlined in the Boone County Stormwater Design Manual and to the maximum extent practical. This shall be accomplished by treating runoff at the source, disconnecting impervious surfaces, preserving or enhancing natural flow paths and vegetative cover, preserving or enhancing natural open spaces and riparian zones, and other measures that replicate pre-development hydrologic conditions. The Director shall exercise discretion in the application of this standard, especially in cases of infill development, redevelopment, or other unique circumstances.

(2) **Overland Flood Routes:** Overland flood routing paths shall be used to convey stormwater runoff from the 100-year storm event to an adequate receiving water resource or stormwater BMP such that the runoff is contained within the drainage easement for the flood routing path and does not cause flooding of buildings or related structures. The peak 100-year water surface elevation along flood routing paths shall be at least one foot below the finished grade elevation at the structure. When designing the flood routing paths, the conveyance capacity of the site's storm sewers shall be taken into consideration.

(3) **Velocity Dissipation:** Velocity dissipation devices shall be placed at discharge locations of the stormwater conveyance system and along the length of any outfall to provide non-erosive flow velocity from the structure to an adequate receiving stream or channel so that the natural physical and biological characteristics and functions of the receiving stream are maintained and protected.

(4) **Discharges to Adjacent Property:** Concentrated discharges from the stormwater drainage system or stormwater best management practices shall not be discharged onto adjacent property without adequate conveyance in a natural stream or storm sewer system. Drainage easements are required when stormwater discharges must cross an adjacent or off-site property before reaching an adequately sized conveyance.

(5) **Flow toward streets**: In order to have sufficient traffic safety, any concentration of surface flow in excess of two (2) cubic feet per second (cfs) for the ten-year frequency rain shall be intercepted before reaching the street right-of-way and shall be carried by a storm drain to connect with a drainage structure at the low point in the street right-of-way or to discharge to a watercourse.

4.3. NATURAL SYSTEMS

Stream & Wetland Crossings: All stream and wetland crossings subject to Section 404 of the Clean Water Act and/or state stream and/or wetland regulations shall minimize impacts on streams and wetlands, to the extent practical and achievable, by crossing streams and wetlands at a right-angle, reducing the footprint of grading and fill, matching the existing stream profile grade, and utilizing bridges, open bottom arches, spans, or other structures that do not restrict or alter stream or wetland hydrology. Mimic the natural multi-stage channel shape as much as possible. If culverts are placed within streams and/or wetlands, at least one culvert shall be countersunk at least one foot (1') below the natural channel flowline, (or 10% of the pipe diameter whichever is less) to allow movement of aquatic organisms.

Limited Stream Assessment Required: A limited stream assessment as outlined in the Boone County Stormwater Design Manual is required when construction will enter the stream or streamside buffer zone.

4.4. STORMWATER QUANTITY AND QUALITY CONTROL

(1) **Runoff Reduction:** In an effort to replicate pre-development hydrologic conditions, and to promote baseflow to streams and wetlands, ten percent (10%) of the water quality volume shall be permanently reduced. This may be accomplished through infiltration practices where soil conditions allow, by disconnecting impervious areas, maintaining or reestablishing deep-rooted vegetation, maintaining sheet flow to areas of natural vegetation such as riparian corridors and undisturbed forest lands, and/or collection and reuse of runoff.

The Director may waive the requirements of this section as specified in (A) and (B) below:

A. **Risk of Groundwater Contamination:** Stormwater hotspots, contaminated soils, and sites in close proximity to karst or drinking water supply wells may not be subject to groundwater recharge/infiltration requirements, as determined by the Director. The Director may impose reasonable conditions such as increased forest, buffer or pervious areas in granting such a waiver.

B. **Site Constraints:** Areas characterized by high water table, shallow bedrock, contaminated soils, and other constraints may be subject to reduced volume control requirements, as determined by the Director. The Director may impose reasonable conditions in granting such a waiver.

(2) **Water Quality Protection:** In order to protect the receiving waters from nonpoint source pollution, the remainder of the water quality volume that was not removed through runoff reduction, shall be treated through filtration BMPs such as sand filters, vegetated swales, or proprietary products.

A. **Treatment of the Water Quality Volume:** Post-development runoff from the water quality rainfall event that is not permanently removed through the application of the runoff reduction criterion shall be captured and treated in a water quality BMP to prevent or minimize water quality impacts from land development.

B. **Vegetated Filter Strips:** Up to 25%, of a site's total impervious surface may discharge in a sheet flow condition through established vegetation such as may exist in a stream buffer without otherwise being treated.

C. **Pretreatment:** Each stormwater BMP shall have an acceptable form of water quality pretreatment if required to provide adequate long-term operation and maintenance of the BMP.

D. **Treatment of Off-Site Stormwater:** Off-site stormwater conveyed through a land development shall be placed within an easement and conveyed in a manner that does not increase upstream or downstream flooding. Off-site stormwater shall be conveyed around on-site stormwater BMPs, unless the facilities are designed to manage the off-site stormwater. The Director may allow the treatment of off-site stormwater in lieu of the treatment of the entire site's water quality volume.

E. **Additional Criteria for Stormwater Hotspots:** In addition, stormwater discharges from stormwater hotspots may require the use of specific structural, non-structural, and/or pollution prevention practices, including enhanced pre-treatment. Discharges from a stormwater hotspot shall not be infiltrated without enhanced pre-treatment, as approved by the Director.

F. **Landscape Plan:** The design of vegetative stormwater BMPs shall include a landscape plan detailing both the vegetation in the BMP and the maintenance requirements, and who will manage and maintain the vegetation.

(3) **Channel Protection Criteria:** The stormwater system shall be designed so that post-development discharges will not erode natural channels or steep slopes. This will protect in-stream habitats and reduce in-channel erosion. The applicant shall use either Tier 1 or Tier 2 performance standards, as applicable, to meet this criterion.

A. **Tier 1 Performance criteria:** sites having less than 5 acres of land disturbance OR less than 20% imperviousness on the entire tract shall apply the following performance standards:

1. Wherever practical, maintain sheet flow to riparian buffers or vegetated filter strips. Vegetation in buffers or filter strips must be preserved or restored where existing conditions do not include dense vegetation .
2. Energy dissipaters and level spreaders must be used to spread flow at outfalls.
3. On-site conveyances must be designed to reduce velocity through a combination of sizing, vegetation, check dams, and filtering media (e.g., sand) in the channel bottom and sides.
4. If flows cannot be converted to sheet flow, they must be discharged at an elevation that will not cause erosion or require discharge across any constructed slope or natural steep slopes.
5. Outfall velocities must be non-erosive from the point of discharge to the receiving channel or waterbody where the discharge point is calculated.

B. **Additional criteria for Tier 2 sites**: Sites greater than 5 acres of land disturbance OR greater than 20% imperviousness on the entire tract shall apply the performance standards in subsection (A), in addition to the following performance standards:

Site design techniques that decrease runoff volumes and peak flows. This shall be accomplished by controlling the post-development peak discharge rate to the pre-development rate.

This criterion shall be met for the post-development 2-year, 24-hour storm event, (or equivalent storm runoff volume using other methodologies). The release rate shall be equal to or less than the pre-development 1-year, 24-hour storm event. Boone County will give credit for the application Runoff Reduction and WQv measures towards meeting the storage requirements.

OR

In an effort to encourage micro-detention and utilize stormwater BMPs to detain stormwater, the difference (increase) in the runoff volume that is predicted due to the development during the 2-year event will be stored and released at no more

than 0.1 cfs/acre; providing that 75% of the water leaving the site drains through at least one storage basin, and that the volume stored accounts for the added runoff from the entire disturbed site.

(4) **Flood Control Criteria:** Downstream overbank flood and property protection shall be provided by controlling the post-development peak discharge rate to the pre-development rate. This criterion shall be met for the 25-year, 24 hour storm event on property zoned REC, REC-P, C-O, C-N, C-G, C-GP, M-L, M-LP, M-G, M-GP.

Stormwater BMPs that impound water shall demonstrate that the 100-year storm can safely pass through the structure without overtopping or creating damaging conditions downstream.

The Director may waive some or all of the requirements of this section as specified in (A), (B), (C) and (D) below:

A. **Discharge to Large Waterbody:** The land development discharges directly to a flood plain, major river or waterbody and the Director determines that waiving the flooding criteria will not harm public health and safety. The applicant shall secure drainage easements from any downstream property owners across whose property the runoff must flow to reach the flood plain, major river or waterbody. The applicant shall also demonstrate that any piped or open-channel system in which the runoff will flow has adequate capacity and stability to receive the project's runoff plus any off-site runoff also passing through the system.

B. **Insignificant Increases in Peak Flow:** The land development results in insignificant increases in peak flow rates, as determined by the Director.

C. **Alternative Criteria Provided:** The land development is subject to a floodplain study that recommends alternative criteria for flood control.

D. **Increases in Downstream Peak Flows or Flood Elevations:** The Director determines that complying with the requirements of this section will result increases in peak flows or downstream flooding conditions due to coincident peaks from the site and the contributing watershed or another factor.

E. **Documentation for Waiver:** When seeking a waiver in accordance with either (1), (2), (3) or (4) above, the applicant shall demonstrate that stormwater discharges will not unreasonably increase the extent, frequency, or duration of flooding at downstream properties and structures or have an unreasonable adverse effect on streams, aquatic habitats, and channel stability. In making its determination to allow full or partial waivers, the Director shall consider cumulative impacts and the land development's adherence to the land use plans and policies of Boone County, including the promotion of infill and redevelopment in particular areas.

4.5. REDEVELOPMENT CRITERIA

Land development that qualifies as redevelopment shall meet one of the following criteria:

(1) **Reduce Impervious Cover:** Reduce existing site impervious cover by at least 20%.

(2) **Provide Treatment:** Provide water quality treatment for at least 20% of the site's pre-development impervious cover and 100% of any new impervious cover, not to exceed 150% of the total new impervious.

A. This can be accomplished through stormwater BMPs designed in accordance with the criteria in Sections 4.2 through 4.3 and the Boone County Stormwater Design Manual.

B. Runoff reduction may be used instead of water quality treatment on land zoned Residential, Transition or Agriculture where the lot size is at least 2.5 acres and impervious cover is less than 10%.

(3) **Apply Innovative Approaches:** Utilize innovative approaches to reduce stormwater impacts across the site. Examples include green roofs and pervious parking materials.

(4) **Provide Off-Site Treatment:** Provide equivalent stormwater treatment at an off-site facility within the same watershed and as immediately downstream of the site as feasible.

(5) **Address Downstream Issues:** Address downstream channel and flooding issues through channel restoration, increase in existing system capacity and/or other off-site remedies.

(6) **Combination of Measures:** Any combination of (1) through (5) above that is acceptable to Boone County Public Works.

4.6 ENVIRONMENTALLY SENSITIVE AREAS: ENHANCED CRITERIA

This section shall be applicable to all land development, including, but not limited to, site plan applications, subdivision applications, and grading applications, in or draining to an environmentally sensitive area that disturbs more than 3000 square feet.

(1) These provisions apply to any stormwater discharge or drainage on new development or redevelopment sites within Boone County that meets one or more of the following criteria:

A. Within 1000 feet of and draining to a losing stream*, Outstanding National or State Resource Water*

B. Within 100 feet of a Class P Stream*, or Type 1 stream per the Stream Buffer Regulations
C. Within 1000 feet of and draining to, or changes the site hydrology of, a jurisdictional wetland as defined by the U.S. Army Corps of Engineers; or
D. Runoff that discharges to a groundwater point recharge feature such as a sinkhole or other direct conduit to groundwater such as a cave.

*See listings in Missouri Water Quality Standards 10 CSR 20-7.031. This information is also provided in the Boone County Stormwater Design Manual – Appendix C.

(2) **Land Disturbance Permit Threshold Lowered:** When any of the above conditions exist, permitting related to land disturbance, stormwater management and water quality control will be required for any land disturbance greater than 3000 square feet.

(3) **General Stormwater Management:** Drainage patterns for proposed development must be designed to protect sensitive areas from the effects of runoff from developed areas, and to maintain the drainage areas of groundwater recharge features in a natural state. Special controls must be used where necessary to avoid the effects of erosion, sedimentation, and/or high rates of flow.

(4) **Buffer zone limitations and prohibitions:** The natural vegetative cover must be retained within a buffer zone described in this section. All construction activities including grading and filling are prohibited. Additionally, wastewater disposal or irrigation is prohibited.

(5) **Buffer zone widths:** The following buffer widths are required to reduce construction activities and retain the natural vegetative cover in unique and environmentally sensitive areas throughout the County.

A. Point Recharge Feature (Sinkholes): For a point recharge feature, the buffer zone coincides with the topographically defined drainage area, except that the width of the buffer zone from the edge of the sensitive area shall not be less than 150 feet, or greater than 300 feet from the sinkhole eye.
B. Wetlands: For a wetland, the buffer zone shall be at least 50 feet.
C. Outstanding Resource Waters/Losing Streams: For national or state outstanding resource waters, the buffer zone shall be twice that of the stream buffer requirement. (Chapter 26 Boone County Zoning Regulations)
D. Other Features: For other environmentally sensitive areas, the buffer zone shall be at least 50 feet.

(6) **Wetland Protection:** Wetlands meeting the Army Corps of Engineers definition of a jurisdictional wetland must be protected in all watersheds. Protection methods for wetlands include:

A. Appropriate setbacks that preserve the wetlands or wetland functions;
B. Wetland mitigation, including wetland replacement;
C. Wetland restoration or enhancement.

The Director may approve the removal and replacement of a wetland as approved by the U.S. Army Corps of Engineers or the elimination of setbacks from a constructed wetland that is primary use is for water quality control.

(7) Sinkhole/Cave Protection:

A. **Sinkhole Evaluation:** The developer/owner of any development that will discharge runoff to a sinkhole shall submit a Sinkhole Evaluation during the pre-application meeting or preliminary plat/plan review. A professional engineer or professional geologist must complete a sinkhole evaluation, with the following information.

i. Drainage area map
ii. Details of the drainage path of the discharge from the development to the sinkhole (offsite sinkholes)
iii. Sinkhole boundary map based on topography
iv. Geological Evaluation

B. **Geological Evaluation:** A professional geologist or a professional engineer with a demonstrated expertise in geotechnical applications is required to prepare a geologic evaluation of off-site sinkholes to determine the structural integrity of the geology, and the stability of the formation. The geological evaluation shall provide the following information:

i. Identification of all sinkholes as depression or collapse sinkholes.
ii. A map of the topographic rim (highest closed contour) of all depression sinkholes, based on a 2-foot contour interval or less.
iii. A map of all depression and collapse sinkholes contributing to the groundwater recharge of the area.
iv. A map showing no-build areas for buildings and other structures based on topographic and geologic rims of depression and collapse sinkholes.
v. Detail of proposed stabilization of collapse sinkholes, if applicable.

C. **Sinkhole or Cave-Related Non-Buildable Areas:** The Director may, based upon the topography, geology, soils, and history of the sinkhole(s) and/or cave(s) (such as past filling) and the engineer's storm water analysis, establish sinkhole or cave-related non-buildable areas. No grading or installation of parking areas, streets or other infrastructure shall be permitted within the said non-buildable area unless otherwise authorized by the Director.

This non-buildable area shall follow the limits of the sinkhole in most cases. However, the non-buildable area may be expanded or contracted by action of the Director where warranted, due to the nature of the specific sinkhole or cave, the underlying geology, soils, drainage, and any related information, such as depth to bedrock.

In sinkhole cluster areas, the Director may require the developer to provide recommendations from a consulting engineer and a consulting hydrogeologist, based upon substantial and state-of-the-art field studies and evaluation of the specific sinkhole or cave system. These studies shall be submitted to the Director

D. **Development in Sinkhole Drainage Areas without Discharge to Sinkhole:** Development may occur in the immediate sinkhole drainage area if the developer provides alternative surface drainage away from the sinkhole, while keeping the water in the same surface drainage basin, and providing that the water shall not go into another sinkhole drainage area off the applicant's property. The immediate sinkhole drainage area (or portion thereof) which cannot be provided with an alternative drainage system can be deleted from the development area for calculations utilizing this information to meet regulatory requirements.

E. **Development in Sinkhole Drainage Areas with Discharge to Sinkhole:** For portions of the sinkhole drainage area where alternative surface drainage methods cannot be provided, the sinkhole can be used for limited surface runoff drainage of a proposed development if the following conditions are met:

i. That the runoff from the development area is either completely retained in a retention basin or detained in a detention basin. The flow rate out of the above basins shall be regulated so that it is no greater than the flow rate into the sinkhole of the development area prior to development.

ii. Enough runoff is diverted from the sinkhole drainage area so that the development of the remaining area does not increase the total quantity or deteriorate the water quality of runoff into the sinkhole. Where additional runoff is anticipated, a consulting engineer and hydrogeologist shall evaluate and show the effect of any additional quantity of runoff to the sinkhole and sinkhole system. The Director shall review the study findings and make a determination that the plan is acceptable.

iii. Where the sinkhole outlet is off site, either the runoff leaving the subject property must be shown to be no greater in flow or in quantity than that which existed before development, or easements must be obtained from owners of property where any increase in flow or quantity of water must go to reach the sinkhole outlet. Easement areas shall be approved by the Director based upon the developer's engineer's calculations of the proposed ponding elevation.

F. **Filling in sinkholes and sinkhole drainage areas:**

i. No street shall be placed below an elevation of at least one (1) foot above the sinkhole ponding elevation and only when collapse of the sinkhole will not adversely affect the road.

ii. No increase in the ponding elevation will be allowed by grading or filling without a storm water analysis approved by the Director.

iii. It shall be unlawful for any person to place, dump or deposit trash, debris, rubbish, brush, leaves, grass clippings, yard waste, hazardous waste or similar materials within a sinkhole.

G. **Grading or alteration of land near or over Sinkhole:** The alteration of land in a sinkhole by means of grading or the use of motorized equipment without a permit is a violation of this ordinance.

Section 5. Construction Site Runoff Control

5.1. General

Grading, erosion control practices, sediment control practices, and waterway crossings shall be adequate to prevent transportation of sediment from the site. The design and construction guidance in the Boone County Stormwater Design Manual shall be followed insofar as it is applicable. Other pollutants shall be controlled as necessary to prevent potential discharge to waters of the State.

5.2. Clearing and Grading

(1) Clearing and grading of natural resources, such as forests and wetlands, shall not be permitted, except when in compliance with all other County regulations.
(2) Clearing techniques that retain natural vegetation and retain natural drainage patterns shall be used to the maximum extent practicable.
(3) Clearing, except that necessary to establish sediment control devices, shall not begin until all sediment control devices have been installed and have been stabilized.
(4) Cut and fill slopes shall be *no greater than 3:1*, except as approved by the County to meet other community or environmental objectives.
(5) Phasing shall be required on all sites disturbing greater than *thirty* acres, with the size of each phase to be established at plan review.
(6) Other measures may be required in order to ensure that sediment is not tracked onto public streets by construction vehicles, or washed into storm drains.

5.3. Erosion Control

(1) Soil must be stabilized within 14 days of clearing or inactivity in construction, unless otherwise authorized, and shall be effectively maintained throughout the duration of any inactivity.
(2) Soil stockpiles must be stabilized or covered at the end of each work day unless otherwise protected from allowing sediment to leave the site.
(3) Techniques shall be employed to prevent the blowing of dust or sediment from the site.
(4) Techniques that divert upland runoff past disturbed slopes shall be employed.

5.4. SEDIMENT CONTROLS

(1) Sediment controls shall be provided in the form of settling basins or sediment traps or tanks, and perimeter controls.
(2) Where possible, settling basins shall be designed in a manner that allows adaptation to provide long term stormwater management.

(3) Adjacent properties shall be protected by the use of a vegetated buffer strip, in combination with perimeter controls wherever possible.

5.5. WATERWAYS AND WATERCOURSES

(1) When a wet watercourse must be crossed regularly during construction, a temporary stream crossing shall be provided, and an approval obtained from the U.S. Army Corps of Engineers and the Missouri Department of Natural Resources if deemed a jurisdictional stream.
(2) When in-channel work is conducted, the channel shall be stabilized before, during and after work.
(3) Stabilization adequate to prevent erosion must be provided at the outlets of all pipes and paved channels.

5.6. CONSTRUCTION SITE ACCESS

(1) A temporary access road or driveway shall be provided at all sites.
(2) Regardless of the amount of land disturbance at a particular site, it shall be the responsibility of the permit holder and/or property owner to ensure streets open to the public surrounding a permitted site are kept free of debris and sediment throughout construction. Upon notification that a problem exists, the permit holder and/or property owner shall remedy the issue within 12 hours.

5.7. CONTROL OF OTHER CONSTRUCTION POLLUTANTS

(1) **Concrete Truck Washout**: Concrete truck washout shall not discharge surplus concrete or drum wash water on the site in such a manner that promotes contact with storm waters or natural streams discharging from the site.

(2) **Construction Waste**: All construction waste material shall be collected, deposited, and stored in a manner to prevent contact with storm waters discharging from the site and shall be disposed of by a licensed solid waste management contractor. No waste shall be buried on the site.

(3) **Sanitary Waste:** A state licensed sanitary waste management contractor shall collect all sanitary waste from portable units that will be maintained on a regular basis for any site that cannot provide other means of sanitary waste disposal.

(4) **Petroleum Products:** All construction equipment and vehicles shall be monitored for leaks and receive regular preventative maintenance to ensure proper operation and reduce the risk for leaks or spills. Petroleum products shall be stored in clearly labeled and tightly sealed containers or tanks. Fuel or oil contaminated soil shall be removed and disposed of properly.

(5) **Fertilizers**: Fertilizers shall be applied following manufacturer's recommendations. Fertilizers shall be stored in a covered area or in watertight containers. Partially used products shall be properly sealed and stored to avoid spills or leaks.

(6) **Hazardous materials**: Storage areas for hazardous materials such as oils, greases, paints, fuels, and chemicals, shall be provided with secondary containment to ensure that spills in these areas do not reach waters of the State. All hazardous waste materials shall be disposed of according to state regulation or the manufacturer's recommendations.

Section 6. Ongoing Maintenance for Stormwater BMPs

6.1. General Maintenance Requirement

All stormwater facilities and BMPs shall be maintained in accordance with the approved and recorded stormwater maintenance agreement and stormwater maintenance plan. If no maintenance agreement or plan is in place, the owner shall maintain the facility as it was designed in order to continue the mitigation of stormwater quantity and quality impacts. This maintenance shall include removal of overgrown vegetation, repair of erosion, repairs to any inlet/outlet structures, and removal of excess silt or any other maintenance deemed necessary to provide said mitigation. The design of stormwater facilities shall incorporate maintenance accommodation and long-term maintenance reduction features.

6.2. Maintenance Responsibility

The responsible party named in the recorded stormwater maintenance agreement (**Section 3.7**) shall maintain in good condition and promptly repair and restore all structural and non-structural stormwater facilities and BMPs and all necessary access routes and appurtenances (grade surfaces, walls, drains, dams and structures, vegetation, erosion and sedimentation controls, and other protective devices) in order to maintain the mitigation of stormwater quantity and quality impacts. Such repairs or restoration and maintenance shall be in accordance with the approved stormwater management construction plan, the stormwater maintenance agreement, and the stormwater maintenance plan.

6.3. Inspection by Boone County Public Works

The County shall be permitted to enter and inspect facilities subject to regulation under this ordinance as often as may be necessary to determine compliance with this ordinance. If the site has security measures in force that require proper identification and clearance before entry into its premises, the responsible party shall make the necessary arrangements to allow access to representatives of the County.

Unreasonable delays in allowing the County access to a permitted facility is a violation of a storm water discharge permit and of this ordinance.

If the County has been refused access to any part of the premises from which stormwater is discharged, and is able to demonstrate probable cause to believe that there may be a violation of this ordinance, or that there is a need to inspect and/or sample as part of a routine inspection and sampling program designed to verify compliance with this ordinance or any order issued hereunder, or to protect the overall public health, safety, and welfare of the community, then the County may seek issuance of a search warrant from any court of competent jurisdiction.

6.4. Records of Maintenance Activities

The responsible party shall make records of the installation and of all maintenance and repairs, and shall retain the records for at least five (5) years. These records shall be made available to the Director during inspection of the facility and at other reasonable times upon request.

6.5. Failure to Provide Adequate Maintenance

In the event that the stormwater BMP has not been maintained and/or becomes a danger to public safety or public health, the Director shall notify the responsible party by registered or certified mail. The notice shall specify the measures needed to comply with the maintenance agreement and the maintenance plan and shall specify that the responsible party has thirty (30) days or other time frame mutually agreed to between the Director and the responsible party, within which such measures shall be completed. If such measures are not completed, then the Director shall pursue enforcement procedures pursuant to Section 9 of this Ordinance.

If a responsible person fails or refuses to meet the requirements of an inspection report, maintenance agreement, or maintenance plan the Director, after thirty (30) days written notice (except, that in the event the violation constitutes an immediate danger to public health or public safety, 24 hours notice shall be sufficient), may correct a violation of the design standards or maintenance requirements by performing the necessary work to place the practice in proper working condition. The Director may assess the responsible party of the practice for the cost of repair work which shall be a lien on the property, or prorated against the beneficial users of the property, and may be placed on the tax bill and collected as ordinary taxes by Boone County.

6.6. REQUIRED EASEMENTS

Whenever improvements to land are made, easements for the stormwater management facilities including structural facilities, engineered channels and overflow paths, shall be provided across private property. Easements through existing developments shall be obtained as deemed necessary. Drainage easements shall include access from a convenient public street or parking lot. Minimum dimensions are as follows:

(1) Where a storm drain consists of a closed conduit, the width shall be the greater of fifteen (15) feet or the sum of the conduit diameter and twice the cover depth over the conduit.

(2) The stormwater drainage system easements shall contain the overflow from the 100 year (1% annual chance) storm event and shall indicate the highest expected water surface elevation of said event.

(3) Access easements to and around detention/retention facilities shall be a minimum of fifteen (15) feet wide with cross slopes to be safely accessible by a vehicle unless otherwise approved by the Director.

6.7. INTERFERENCE AND DAMAGE

No person shall damage, discharge or place any substance into the drainage system which will or may cause obstruction to flow or other interference with the operation of the stormwater drainage system. Any person violating this section or damaging the stormwater drainage system shall be liable to the County for all expense, loss or damage incurred by the County due to such violation or damage, in addition to any other penalties set forth herein.

Section 7. Illicit Discharge Detection and Elimination

7.1. GENERAL

(1) **Purpose:** This ordinance is adopted pursuant to the authority granted in 64.907, 64.825 – 64.885, Revised Statutes of Missouri and are intended to regulate non-stormwater discharges to the storm drainage system to the maximum extent practicable as required by federal and state law. This ordinance establishes methods for controlling the introduction of pollutants into the municipal separate storm sewer system (MS4) in order to comply with requirements of the National Pollutant Discharge Elimination System (NPDES) permit process. The objectives of this ordinance are:

A. To regulate the contribution of pollutants to the municipal separate storm sewer system (MS4) by stormwater discharges by any user

B. To prohibit Illicit Connections and Discharges to the MS4

C. To establish legal authority to carry out all inspection, surveillance and monitoring procedures necessary to ensure compliance with this ordinance

(2) **Applicability:** This ordinance shall apply to all water entering the storm drain system generated on any developed and undeveloped lands unless explicitly exempted.

(3) **Ultimate Responsibility:** The standards set forth in this article and promulgated pursuant to this article are minimum standards. Compliance with this article does not insure that there will be no contamination, pollution or unauthorized discharge of pollutants into the waters of the United States. This article shall not create liability on the part of the County or any agent or employee of the County for any damages that result from any discharges, reliance on this article or any administrative decision made under this article.

(4) **Stormwater Pollution Prevention:** Any owner or operator of a commercial or industrial establishment shall provide, at their own expense, reasonable protection from accidental discharge of prohibited materials or other wastes into the municipal storm drain system or watercourses through the use of structural and non-structural BMPs. Further, any person responsible for a property or premise, which is, or may be, the source of an illicit discharge, may be required to implement, at said person's expense, additional structural and non-structural BMPs to prevent the further discharge of pollutants to the municipal separate storm sewer system. Compliance with all terms and conditions of a valid NPDES permit authorizing the discharge of storm water associated with industrial activity, to the extent practicable, shall be deemed compliant with the provisions of this section. These BMPs shall be part of a stormwater pollution prevention plan (SWPPP) as necessary for compliance with requirements of the NPDES permit.

7.2. PROHIBITIONS

(1) **Illegal Discharges**: It shall be unlawful for any person to discharge or cause to be discharged into the municipal separate storm sewer system or into any watercourse any material other than stormwater. The following discharges are exempt from the prohibitions established by this article:

A. Waterline flushing or other potable water sources;
B. Landscape irrigation or lawn watering;
C. Diverted stream flows;
D. Rising groundwater;
E. Groundwater infiltration;
F. Uncontaminated pumped groundwater;
G. Foundation or footing drains excluding active groundwater de-watering systems;
H. Crawlspace pumps, air conditioning condensation;
I. Springs;
J. Non-commercial washing of vehicles;
K. Natural riparian habitat or wetland flows;
L. Swimming pools if de-chlorinated to less than 1 ppm chlorine;
M. Fire fighting activities;
N. Other water not containing pollutants;
O. Discharges specified by the County as necessary to protect public health and safety;
P. Dye testing if notification is given to the County before the test; and
Q. Any non-storm water discharge permitted under an NPDES permit, waiver or waste discharge order issued to the discharger and administered under the authority of the Environmental Protection Agency, provided that the discharger is in full compliance with all requirements of the permit, waiver or order and other applicable laws and regulations, and provided that written approval has been granted for any discharge to the municipal separate storm sewer system.

(2) **Illicit connections**:

A. It shall be unlawful for any person to construct, use, maintain or have an illicit connection.

B. This section expressly applies to illicit connections made in the past even if the connection was permissible under law or practices applicable or prevailing at the time of connection.

(3) **Waste disposal prohibitions**: It shall be unlawful for any person to place, deposit or dump or to cause or allow the placing, depositing or dumping any refuse, rubbish, yard waste, paper litter or other discarded or abandoned objects, articles

and accumulations containing pollutants into the municipal separate storm sewer system or into any waterway.

(4) **Connection of sanitary sewer prohibited**: It shall be unlawful for any person to connect a line conveying sewage to the municipal separate storm sewer system or to allow such a connection to continue.

(5) **Industrial or construction activity discharges**: It shall be unlawful for any person subject to an industrial activity or construction NPDES storm water discharge permit to fail to comply with all provisions of such permit.

7.3. NOTIFICATION OF SPILLS

Notwithstanding other requirements of law, as soon as any person responsible for a facility or operation, or responsible for emergency response for a facility or operation has information of any known or suspected release of materials which are resulting or may result in illegal discharges or pollutants discharging into storm water, the storm drain system, or water of the U.S. said person shall take all necessary steps to ensure the discovery, containment, and cleanup of such release. In the event of such a release of hazardous materials said person shall immediately notify emergency response agencies of the occurrence via emergency dispatch services. In the event of a release of nonhazardous materials, said person shall notify the County in person or by phone or facsimile no later than the next business day. Notifications in person or by phone shall be confirmed by written notice addressed and mailed to the County within three business days of the phone notice. If the discharge of prohibited materials emanates from a commercial or industrial establishment, the owner or operator of such establishment shall also retain an on-site written record of the discharge and the actions taken to prevent its recurrence. Such records shall be retained for at least three years.

7.4. REGULATIONS AND MONITORING

(1) The County Commission may, by ordinance, adopt standards identifying best management practices (BMP) for any activity, operation or facility which may cause or contribute to pollution of storm water, the storm drain system, waters of the state or waters of the United States. These standards shall be on file at Boone County Public Works. It shall be unlawful for any person undertaking any activity or owning or operating any facility subject to such standards to fail to comply with the standards.

(2) The owner or operator of a commercial or industrial establishment shall provide reasonable protection from accidental discharge of prohibited materials or other wastes into the municipal separate storm sewer system or water courses through the use of structural and non-structural BMPs. Any person responsible for property which is or may be the source of an illicit discharge may be required to implement additional structural and non-structural BMPs to prevent further discharge. Compliance with all terms and conditions of a valid NPDES permit authorizing the

discharge of stormwater associated with industrial activity to the extent practicable shall be deemed in compliance with provisions of this section. These BMPs shall be a part of the storm water pollution prevention plan as necessary for compliance with the requirements of the NPDES permit.

Section 8. Permits

8.1. Promulgation of Rules

The Director may promulgate rules governing the issuance of the permits required by this section and may produce forms to effectuate the intent of this ordinance.

8.2. Stormwater Discharge Permit

(1) **Authorization to Discharge to MS4:** If runoff from a land development will flow to a municipal separate storm sewer system (MS4) or other publicly-owned storm sewer system, then the applicant shall obtain authorization from the system's owner to discharge into the system. The applicant must demonstrate that the system has adequate capacity for any increases in peak flow rates and volumes.

(2) **Permit Required:** No stormwater drainage facility shall be constructed, altered or reconstructed without a stormwater discharge permit. To obtain a permit, the application form provided by the County shall be completed and plans must be submitted for review and approval of the Director. All such construction shall comply with the general requirements and design procedures, as set forth in this chapter, and the criteria of the Boone County Stormwater Design Manual.

(3) Prior to the issuance by the County of a permit for any type of construction, the property owner, the developer or their agent shall have a stormwater management plan approved by the County in accordance with Section 3. The property owner, developer or their agent shall, at his own expense, submit necessary plans, designs and specifications to the County for review and approval. This plan shall:

- Include a pre- and post-development hydrologic analysis of the site
- Identify pollutants of concern for each area of the site
- Identify pollution prevention measures
- Identify controls that provide treatment and reduce stormwater volumes and velocities
- Identify any environmentally sensitive areas and provide a plan for protection of these areas per this chapter
- Identify Low Impact Development opportunities that can best mimic the natural hydrology of the site and filter pollutants from the runoff.
- Provide for long term operation and maintenance of controls

(4) Provisions of this section for plan requirement shall be waived provided no land is disturbed and no trees, shrubs, grass or vegetation is destroyed or removed for construction, reconstruction, repair or alteration of any building provided the improvement does not alter or increase the flow of water.

(5) The post-construction stormwater management plan shall show the location of any environmentally sensitive features (as listed in Section 4.6), the sensitive feature's drainage area, any sinkhole cluster area, or portions of such items, along with ground contours, a hydrologic analysis of the drainage area and significant physical features on the property, and detailed information on the work to be performed in or near the sensitive area.

Upon review of the information presented by the applicant, the site, and such other information as may be available, the Director may issue a permit for work to be performed in or near the sensitive area. All work shall be performed in accordance with the permit. The Director may designate certain areas where grading or construction equipment is not permitted or is otherwise limited.

8.3. Land Disturbance Permit

(1) **Applicability:** No clearing, grading, borrowing or filling of land resulting in a land disturbance greater than one acre shall commence prior to obtaining a land disturbance permit. All such work shall also comply with an approved erosion and sediment control plan in conjunction with an approved site development plan. Additionally, no person shall engage in the grading of land in excess of 3000 square feet or the use of motorized equipment in or near a sinkhole, losing stream, cave, spring, wetland or other environmentally sensitive area without first securing a permit from the Director.

(2) **Individual Lots Not Separate Land Development:** Residential, commercial or industrial developments shall apply these stormwater management criteria to land development as a whole. Individual residential lots in new subdivisions shall not be considered separate land development projects, but rather the entire subdivision shall be considered a single land development project.

(3) **Expiration:** Every approval under this subsection for clearing, grading, borrowing or filling of land shall expire within two (2) years from the date of issuance. This permit may be renewed for up to two (2) years by submitting a written request for an extension to the Director with the appropriate fee as listed in Section 8.5.

8.4. Performance Bond or Guarantee

(1) **Performance Bond or Guarantee Required:** Upon approval of the Storm Water Pollution Prevention Plan (SWPPP) and prior to issuance of a Land Disturbance Permit, the developer shall post a security in the form of a cash bond, cash or

equivalent of not less than 150% of the value of all erosion and sediment control measures, which are part of the SWPPP. For land disturbance permits where no other security is required, the only type of security which will be accepted will be a cash bond. For land disturbance permits where other security is established for public improvements, the erosion control security may be added to the security for public improvements. If the bond, or other security document is placed in default, or the insurance is terminated or not maintained at a satisfactory level, then no additional permits or approvals, including building permits, shall be issued for the developer's property located in the development for which the security was given, until the improvements are completed to the satisfaction of the County.

(2) **Term of Performance Bond or Guarantee:** Any portion of the deposit not expended or retained by the County hereunder shall be refunded to the applicant within sixty (60) days of the closing of the Land Disturbance Permit, after soil and drainage conditions are stabilized to the satisfaction of the County

(3) **Term Extended for Initial Maintenance**: At the discretion of the Boone County Public Works, the performance bond or guarantee may be extended beyond the time period specified above to cover a reasonable period of time for testing the practices during storm events and for initial maintenance activities. For the purposes of this section, the time shall not exceed 2 years.

(4) **Partial Release of Bond:** The County shall have the discretion to adopt provisions for a partial pro-rata release of the performance bond or guarantee on the completion of various stages or phases of development.

8.5. Fees

The County has the ability to require a fee to support local plan review, inspection and program administration. Each developer/owner seeking a land disturbance or stormwater discharge permit shall pay a fee upon submittal of the plans, in amounts according to the schedule set forth below.

(1) Stormwater Discharge Permit: $50.00
(2) Major Amendment to a Stormwater management construction plan: $25.00
(3) Land Disturbance Permit: $150.00
(4) Land Disturbance Permit Renewal: $50.00

8.6. Inspection

(1) The County may periodically inspect development sites. Through such periodic inspections, the County shall ensure that the Stormwater Pollution Prevention Plan (SWPPP) is properly implemented and any necessary amendments thereto made in order to protect the environment and the public's health, safety and welfare. The erosion and sediment control measures for the site must be maintained by the

developer until the site is stabilized. Also through such periodic inspections the County shall ensure that the post-construction management plan is properly implemented. The stormwater infrastructure improvements shall be maintained by the responsible party (per Section 6) until the infrastructure is accepted by the County.

(2) The permitee shall notify the County at least two (2) working days before the start of site clearing.

(3) The permitee or his/her agent shall make regular inspections of all control measures in accordance with the inspection schedule outlined on the approved erosion and sediment control plan(s) or in the Stormwater Pollution Prevention Plan (SWPPP). The purpose of such inspections will be to determine the overall effectiveness of the control plan, and the need for additional control measures and/or maintenance of existing measures. All inspections shall be documented in written form and kept readily on site.

Section 9. Violations, Enforcement and Penalties

9.1 VIOLATIONS AND PENALTIES FOR PERMITS

(1) The County may suspend or revoke any permit associated with the site or any permit associated with the person(s) holding the permit(s) for the site for non-compliance with the Land Disturbance Permit or Stormwater Discharge Permit.

(2) Procedure:

A. Upon discovery of a violation of this article, the contractor will be notified and given up to seven (7) days to remedy the violation in a Land Disturbance Permit or up to forty-five (45) days for a Stormwater Discharge Permit. Extensions of time may be granted in the Director's sole discretion.

B. If the violation has not been remedied within the time frame set forth in the notice, a stop work order may be issued and the permit(s) will be suspended. The stop work order shall state the reason for the order and the conditions under which the order and suspension will be lifted.

C. Any person who shall continue to engage in activity for which a permit is required after having been served with a stop work order, except in such work as that person is directed to perform to remove a violation or unsafe condition, shall be a violation of this ordinance.

D. After two (2) stop work orders of a permit for the same site for similar violations, the permit(s) shall be revoked. All applicable procedures will have to be followed for re-issuance of the permit(s). Additionally, any remediation or abatement costs will be required to be paid prior to re-issuance.

E. If the stop work order has not been lifted through compliance with its terms within thirty (30) days from the date of its issuance, the permit shall be revoked. All applicable procedures will have to be followed for re-issuance of

the permit(s). Additionally, any remediation or abatement costs will be required to be paid prior to re-issuance.

F. A person aggrieved by a decision to revoke any permit provided for herein may appeal the revocation to the Boone County Board of Adjustment.

(3) Engaging in activity requiring a permit without first obtaining such permit shall be a violation of this ordinance.

9.2. ADMINISTRATION, PENALTIES AND REMEDIES

(1) **Responsibility for Administration:** The provisions of this chapter shall be administered and enforced by the Director. The Director shall prescribe forms for attainment of the purposes of this chapter and for the proper enforcement thereof. The Director may delegate the administration of this chapter, or any part thereof, subject to limitations of the ordinances of the County, to duly qualified employees, deputies or agents of the County.

(2) **Interpretation:** The provisions of this chapter shall be the minimum requirements for the protection of the public health, safety and general welfare and shall be liberally and broadly construed and applied to the greatest extent permitted by law in order to promote and protect the public health, safety and welfare. These regulations are not intended to conflict with, abrogate or annul any other rule, law or regulation. Where any provisions of these regulations impose restrictions different from those imposed by any other regulation, rule or law, the provision which is more restrictive or imposes a higher standard shall control. These regulations are intended to be construed harmoniously and consistently with each other, the Boone County Stormwater Design Manual, and all other applicable rules, laws and regulations.

(3) **Severability**: If any part or provision of these regulations is declared invalid or unconstitutional then the remainder of these regulations shall not be declared invalid or unconstitutional but shall remain in full force and effect to the greatest extend permitted by law.

(4) **Penalties and Remedies:** Any owner, lessee, tenant, occupier of land or other person who violates any provision of these regulations shall be deemed guilty of a misdemeanor and shall be upon conviction punished as provided by law. In addition, any person permitting, aiding, abetting or concealing a violation of this ordinance shall be deemed guilty of a misdemeanor and shall be upon conviction punished as provided by law. Each day a violation of these regulations continues shall constitute a separate offense. The penalty provided in this section shall not be construed to be exclusive but is intended to be supplemental and in addition to any other remedy provided by law or at equity. The County may institute in the circuit court of the County any appropriate action or proceedings to prevent any unlawful activity proscribed in this ordinance or to correct any violations of this ordinance.

9.3 TEMPORARY ABEYANCE OF DEVELOPMENT APPROVALS AND PERMITS (This section is not in effect at this time)

(1) **Implementation, removal, and exceptions:** The purpose of this section is to provide the criteria for imposing a six year temporary abeyance of development permits or approvals when land is cleared without a land disturbance permit and/or stream buffers are removed. This regulation will apply to all land including land that is currently being used for agricultural purposes. If an agricultural operator or owner of land used for agricultural purposes wants to avoid the temporary abeyance, then he/she may voluntarily apply for a land disturbance permit. If the clearing is done in compliance with the permit then the temporary abeyance will not be imposed. This section also provides standards for the Board of Adjustment to remove a six-year temporary abeyance, and for the director to authorize the construction of one single-family dwelling unit on a site that is subject to a six-year temporary abeyance.

A. **Actions That Result in a Temporary Abeyance**. The following actions shall result in a six-year temporary abeyance being imposed by the Director or his/her designee:

1. Clearing of any land, including land used for agricultural purposes, without a land disturbance permit issued by Boone County (Note: a land disturbance permit is not necessary to clear land for agricultural use except to avoid imposition of the six year temporary abeyance);
2. Removal of vegetation in violation of or in a manner that is inconsistent with the Boone County Stream Buffer Regulations;
3. Removal of vegetation within a stream buffer in a manner that is in conflict with the standards in Boone County Stream Buffer Regulations, on land used for agricultural purposes;

B. **Consequences of a Temporary Abeyance**.

1. Boone County shall suspend review of any application for development of land which is, or becomes, subject to a six-year temporary abeyance.
2. Boone County shall not accept applications for any development of land which is subject to a six-year temporary abeyance.
3. A temporary abeyance imposed by Boone County shall apply to all portions of the lot, tract or parcel on which the clearing activity occurred that is within 1,000 feet of the cleared or disturbed area.

C. **Effective Date of the Temporary Abeyance**. The property owner shall be provided ten business days to request a Pre-imposition Review.

1. If the property owner does not submit a request for Pre-imposition Review the temporary abeyance shall be imposed on the date the 10-day period expires.

2. If the property owner does submit a request for Pre-imposition review and the County Commission decides to impose the temporary abeyance it shall be effective on a date specified by the County Commission.

D. **Notice of Temporary Abeyance and Pre-imposition Review**

1. The Director shall send a Notice of Intent to impose the temporary abeyance to the owner of record as indicated by the records of the Boone County Assessor by Certified and Regular U.S. Mail. Said notice shall include the following:

   (a) The parcel number(s) on which the clearing activity occurred

   (b) The proposed date of imposition of the temporary abeyance

   (c) The deadline for requesting Pre-imposition Review

2. **Pre-imposition Review**. The property owner shall have 10 days from the date of the Notice of Intent to file a request for pre-imposition review. Such request shall be filed with the Director in a form specified by the Director. The Director shall refer the request to the County Commission who shall hold a public hearing on the matter before issuing a final decision whether to impose the temporary abeyance. The County Commission shall render a written decision including Findings of Fact and Conclusions of Law.

(2) **Request for Removal of Temporary abeyance**. A temporary abeyance may be considered for removal by the Board of Adjustment. All applications for removal shall be filed with the Director and after review thereof the Director shall make a recommendation to the Board to grant or deny the request and state the reasons for his/her recommendation. The application shall be on form(s) provided by the Director and shall be accompanied by supporting documentation and a filing fee.

A. The Board of Adjustment shall review all documentation provided by the applicant and the County, any comments received, and applicable county regulations or policies. The members of the Board may inspect the property prior to rendering a decision.

B. The Board of Adjustment may approve an application for a request to remove a temporary abeyance, approve the application with conditions, require modifications of the proposal to comply with specified requirements of local conditions, or deny the application if it fails to comply with requirements of this section.

C. Removal of a temporary abeyance may be approved by the Board of Adjustment if the following findings can be made regarding the proposal and are supported by the record

1. Any required mitigation plan has been completed or the performance thereof has been adequately bonded.
2. Any bonding required as part of a mitigation requirement has been established to county satisfaction.
3. Payment has been made of all other fees, penalties, liens, or taxes owed to the county which have been assigned to the subject parcel including reimbursement of any county expenses incurred relating to enforcement and/or preparation for the waiver hearing.
4. All permit conditions have been addressed.
5. Any environmental damage or alteration resulting from the activity that caused the six-year temporary abeyance to be imposed has been repaired and/or mitigated
6. Neither the applicant nor any person who acted in privity with the applicant:

    (a) Has circumvented any requirement of the Boone County Stormwater, Land Disturbance or Stream Buffer regulations by taking the actions for which the temporary abeyance was imposed; or

    (b) Has engaged in a pattern or practice of violations of any applicable regulations.

(3) **Request for Single-Family Dwelling Exception**. The Director may administratively grant an exception to the mandatory six-year temporary abeyance to allow the construction of one single-family dwelling unit and associated accessory structures pursuant to the following standards:

A. General Requirements.

1. Permitted Area. The area that is permitted to be developed pursuant to this administrative exception shall not exceed 2.5 acres in size unless site and/or well and wastewater constraints require a larger area, in which case the area developed is not to exceed five acres. Access roads shall not be included in the total area permitted to be developed.

2. Upon approval of a single-family dwelling unit exception, a memorandum of agreement (MOA), on forms provided by the Director, shall be recorded with the Boone County Recorder of Deeds by the landowner that includes a site plan depicting the area of the parcel to be dedicated for the single-family dwelling, yard area, permitted accessory structures, and access road. The MOA shall identify the action to be taken by the landowner to correct any violations of county ordinances or regulations. The land owner shall be responsible for the cost of recording the MOA.

3. The temporary abeyance shall remain in effect for the remainder of the site.

B. **Review Criteria**. One single-family dwelling, permitted accessory structures, lawns and landscaped area, and access road may be constructed together with site development activities necessary to construct the dwelling on land subject to a temporary abeyance provided, that:

1. The construction of the single-family dwelling, lawn and landscaping area, accessory structures, and access road are in compliance with all applicable county regulations;

2. The landowner corrects any violations of relevant stormwater, land disturbance or stream buffer requirements if any have occurred on the permitted area;

C. **Required Written Findings and Determinations**. A single-family dwelling unit exception may be approved by the director on a site that is subject to a six-year temporary abeyance only if all of the following findings can be made regarding the proposal and are supported by the record:

1. The single-family exception to the six-year temporary abeyance will not be detrimental to the public health, safety, and general welfare.

2. The single-family exception to the six-year temporary abeyance will not be injurious to the property or improvements adjacent to and in the vicinity of the proposal.

3. The single-family exception to the six-year temporary abeyance will not result in significant adverse environmental impacts.

4. The granting of the single-family exception to the six-year temporary abeyance is consistent with the review criteria in subsection (3)(b) of this section.

5. The single-family exception to the six-year temporary abeyance is consistent and compatible with the goals, objectives, and policies of the Master Plan, appropriate community plan or subarea plan, and the provisions of this section.

D. Six-year temporary abeyance will be administratively removed by the director or his/her designee when it is determined that the abeyance has been attached to an incorrect parcel.

9.4. VARIANCES

(1) **General**: Where undue hardships or practical difficulties may result from strict compliance with this chapter, the developer may file an application for a variance.

Said applications shall be directed to the Boone County Board of Adjustment organized and existing under the zoning regulations of Boone County, Missouri, which shall have the jurisdiction and shall be charged with the duty of hearing and deciding applications for variances from the strict application of the provisions of this ordinance. The Board may grant a variance only if it finds after public hearing and upon competent and substantial evidence that the applicant meets the following criteria:

A. The variance shall not have the effect of nullifying the intent and purpose of this stormwater ordinance;
B. The granting of the variance will not be detrimental to the public safety, health or welfare, or injurious to other property or improvements.
C. The conditions upon which the request for a variance is based are unique to the property for which the variance is sought, are not applicable generally to other property, and are not self-imposed.
D. Because of the particular physical surroundings, shape or topographical conditions of the specific property involved, a particular hardship to the owner would result, as distinguished from a mere inconvenience, if this chapter was strictly interpreted and carried out.

(2) **Conditions:** In recommending variances and exceptions, staff may recommend and the Board may require such conditions as will, in the judgment of each, secure substantially the objectives of the standards or requirements of this chapter.

(3) **Application:** An application for a variance shall be submitted at the time of filing for a preliminary plat or for application for a building permit, whenever possible. The application shall be on forms provided by the County and shall state fully the grounds for the request and all facts relied upon by the practitioner. The application shall be filed with the Director and after review thereof the Director shall make a recommendation to the Board to grant or deny the application and state the reasons for his or her recommendation. Either the applicant or the Director may appeal or seek judicial review of any decision of the Board as provided by law.

CHAPTER 26
STREAM BUFFER REGULATIONS

26.1 Title, Purpose and Intent

26.1.1 Title. This chapter shall be known as the "Stream Buffer Regulations of Boone County, Missouri."

26.1.2 Purpose. The County Commission of Boone County, Missouri has determined that these regulations are necessary for the purpose of promoting the health, safety, comfort, and/or general welfare; and conserving the values of property throughout the County; and lessening or avoiding undue impact of stormwater runoff on adjoining properties and the environment. Buffers adjacent to stream systems provide numerous environmental protection and resource management benefits which can include the following:

- Restoring and maintaining the chemical, physical and biological integrity of the water resources,
- Removing pollutants delivered in urban storm water,
- Reducing erosion and controlling sedimentation,
- Stabilizing stream banks,
- Providing infiltration of storm water runoff,
- Maintaining the base flow of streams,
- Contributing the organic matter that is a source of food and energy for the aquatic ecosystem,
- Providing tree canopy to shade streams and promote desirable aquatic organisms,
- Providing riparian wildlife habitat,
- Furnishing scenic value and recreational opportunity,
- Protecting the public from flooding, property damage and loss, and
- Providing sustainable, natural vegetation.

26.1.3 Intent. It is the purpose of this section to establish minimum acceptable standards for the design of stream buffers to protect the streams, wetlands, floodplains and riparian and aquatic ecosystems of the County of Boone, and the implementation of specifications for the establishment, protection and maintenance of vegetation along all stream systems and/or waterbodies within our County's authority. It is the desire of the County to protect and maintain natural vegetation in riparian and wetland areas by implementing specifications for the establishment, protection and maintenance of buffer vegetation along stream systems and/or waterbodies within our County's authority.

26.1.4 Jurisdictional Area – These regulations apply to all unincorporated lands within Boone County.

26.1.5 Authority – These regulations are adopted pursuant to the provisions of Sections 64.825 – 64.885 and 64.907, Revised Statutes of Missouri.

26.1.6 Applicability

26.1.6.1 This article shall apply to:

26.1.6.1.1 All proposed development except as provided in Section 26.1.6.2

26.1.6.1.2 Activities that involve clearing, earthwork and excavation within the buffer zone as defined herein.

26.1.6.1.3 All tracts and parcels of land in the County except as provided in Section 26.1.6.2.

26.1.6.2 This article shall not apply to:

26.1.6.2.1 Development which prior to the effective date of this article:

- Is covered by a plat recorded of record in accordance with subdivision regulations.
- Is covered by an approved and unexpired Preliminary Plat or Review Plan.
- Is covered by a valid, unexpired building permit.
- Has applied for a building permit.

26.1.6.2.2 This article shall not apply to surface mining operations which are operating in compliance with a State-approved surface mining permit.

26.1.6.2.3 This article shall not apply to agricultural or farming activities.

26.1.6.2.4 This article shall not be construed so as to prevent modifications to stream channels or wetlands if such modifications have been approved and permitted by a Federal Agency such as the U.S. Army Corps of Engineers.

26.1.6.2.5 Structures that exist on or before the date of adoption of this section, that do not conform to this section and cannot be made to conform by using the stream buffer averaging provisions of Section 26.5.6 shall be

allowed to remain in the present location and footprint. Such structures can be expanded or enlarged if the expansion or enlargement is vertical and/or away from the stream being buffered.

26.2 Administration

26.2.1 Limitation on liability. This chapter does not guarantee that properties will always be free from storm water flooding or flood damage. This chapter shall not create liability on the part of, or a cause of action against, the county or any county officer or employee for any flood damage.

26.2.2 Conflicts. Where any provision of this chapter imposes restrictions different from those imposed by any other law or regulation, whether state, federal or local, whichever is more restrictive or imposes a higher standard shall control.

26.2.3 Administration and Enforcement. The provisions of this chapter shall be administered and enforced by the Director. The Director shall receive applications required by these regulations and issue permits. He/she shall examine premises for which permits have been issued, and shall make the necessary inspections to see that the provisions of law are complied with. He/she shall, when requested by the County Commission, or when the interests of the county so require, make investigations in connection with matters referred to in these regulations and render written reports on the same. For the purpose of enforcing compliance with the law, he/she shall issue such notices or orders as may be necessary.

- Inspections: Inspections shall be made by the Director or his/her designee(s).
- Rules/ Policies: For carrying into effect its provisions, the County Commission and/or its designee may adopt rules/ policies consistent with these regulations.
- Records: The Director shall keep careful and comprehensive records of applications, of permits issued, of inspections made, of reports rendered, and of notices of orders issued. All such records shall be open to public inspection at reasonable hours, but shall not be removed from the office of the Director.

26.2.4 Appeals. Any person aggrieved by any decision of the Director in the administration or enforcement of this Chapter may appeal such decision to the Board of Adjustment.

26.2.5 Variances

26.2.5.1 Variances by the Director. The Director may grant a waiver for the following:

- Those projects or activities serving a public need where no feasible alternative is available.
- The repair and maintenance of public improvements where avoidance and minimization of adverse impacts to wetlands and associated aquatic ecosystems have been addressed.

26.2.5.1.1 Application. The applicant shall submit a written request for a variance to the Director in a form specified by the Director. The application shall include information specified by the Director and specific reasons justifying the variance and any other information necessary to evaluate the proposed variance request. The Director may require an alternatives analysis that clearly demonstrates that no other feasible alternatives exist and that minimal impact will occur as a result of the project or development.

26.2.5.1.2 Review by Director. Upon receipt of all application materials the Director shall certify the application complete. The Director shall have 10-working days from the date of the complete application in which to issue a decision. If during review of the application the Director requests additional information, then the time between when the request was made and when the information is submitted shall not count against the 10-day review period.

26.2.5.2 Other Variances. Where undue hardships or practical difficulties may result from strict compliance with this chapter, the developer may file an application for a variance. Said applications shall be directed to the Boone County Board of Adjustment organized and existing under the zoning regulations of Boone County, Missouri, which shall have the jurisdiction and shall be charged with the duty of hearing and deciding applications for variances from the strict application of the provisions of this ordinance. The Board may grant a variance only if it finds after public hearing and upon competent and substantial evidence that the applicant meets the following criteria:

- The variance shall not have the effect of nullifying the intent and purpose of these regulations;
- The granting of the variance will not be detrimental to the public safety, health or welfare, or injurious to other property or improvements.
- The conditions upon which the request for a variance is based are unique to the property for which the variance is sought, are not applicable generally to other property, and are not self-imposed.
- Because of the particular physical surroundings, shape or topographical conditions of the specific property involved, a particular hardship to the

owner would result, as distinguished from a mere inconvenience, if this chapter was strictly interpreted and carried out.

26.2.5.2.1 Conditions: In recommending variances and exceptions, staff may recommend and the Board may require such conditions as will, in the judgment of each, secure substantially the objectives of the standards or requirements of this chapter.

26.2.5.2.2 Application: An application for a variance shall be submitted at the time of filing for a preliminary plat or for application for a building permit, whenever possible. The application shall be on forms provided by the County and shall state fully the grounds for the request and all facts relied upon by the practitioner. The application shall be filed with the Director and after review thereof the Director shall make a recommendation to the Board to grant or deny the application and state the reasons for his or her recommendation. Either the applicant or the Director may appeal or seek judicial review of any decision of the Board as provided by law.

26.3 Definitions

Best Management Practices (BMPs) - Conservation practices or management measures which control soil loss and reduce water quality degradation mainly caused by nutrients, animal wastes, toxins, sediment in the runoff. BMPs may be either structural (grass swales, terraces, retention and detention ponds), or non-structural (disconnection of impervious surfaces, directing downspouts onto grass surfaces and educational activities).

Buffer - A vegetated area including trees, shrubs, managed lawn areas, and herbaceous vegetation which exists or is established to protect a stream system. Alteration of this natural area is strictly limited.

Development - A change in the zoning, intensity of use or allowed use of any land, building, structure or premises for any purpose. The subdivision or severance of land. The construction, erection or placing of one or more buildings or structures on land or use of land or premises for storage of equipment or materials. Making of an addition, enlargement or alteration to a building or structure, in, on, over or under land, which has the effect of increasing the size or usability thereof. Land disturbance activities such as but not limited to site-grading, excavation, drilling, removal of topsoil or the placing or dumping of fill and installation of drainage works. The use of the term shall include redevelopment, as defined in the stormwater regulations, in all cases unless otherwise specified in these regulations.

Director – The Boone County Director of Public Works or Boone County Director of Planning and Building Inspection as designated by the County Commission.

Farming Activities – See **Agriculture or Farming Activity (Zoning Regulations Section 2)**

Flood Control Structures– Use of levees, walls, ditching or reservoirs in an effort to minimize the occurrence of floods.

Indigenous Vegetation – Any species that was present in Missouri prior to European Settlement (approximately 1735 A.D.) or any plant identified as native or indigenous on lists maintained by agencies such as the Missouri Department of Conservation or United States Department of Agriculture.

Managed Lawn Areas - Any area greater than five hundred (500) square feet where the vegetative ground cover is maintained at a uniform height of less than 5-inches.

Ordinary High Water Mark – That line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter or debris, or other appropriate means that consider the characteristics of the surrounding area.

Pollution - Any contamination or alteration of the physical, chemical, or biological properties of any waters which will render the waters harmful or detrimental to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses; or to livestock, wild animals, birds, fish or other aquatic life.

Streams - Perennial and intermittent watercourses identified through site inspection and United States Geological Survey (USGS) maps and further defined and categorized as follows:

A. Type I Streams are defined as perennial streams shown as solid blue lines on the United States Geological Survey seven and one-half minutes series topographical map and have a drainage area of greater than 50 acres.

B. Type II Streams are defined as intermittent streams shown as dashed blue lines on the United States Geological Survey seven and one-half minutes series topographical map and have a drainage area of greater than 50 acres.

C. Type III Streams are defined as intermittent streams or natural channels which are not shown on the United States Geological Survey seven and one-half minutes series topographical map as either blue or dashed blue lines which have drainage areas of greater than 50 acres..

Wetlands - Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence

of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

26.4 Stream Buffer Plan Requirements

26.4.1 General Plan Requirements. All administrative surveys, plats, development plans and building permits shall set forth an informative, conceptual and schematic representation of the proposed stream buffers by means of maps, graphs, charts, or other written or drawn documents so as to enable the Director an opportunity to make a reasonably informed decision regarding the proposed activity.

26.4.2 Specific Plan: Stream buffer plans shall contain the following information and shall be shown on one or more sheets as required by the Director:

26.4.2.1 A site plan map at a minimum scale of 1"=200'.

26.4.2.2 Field delineated and surveyed streams, springs, seeps, bodies of water, sink holes, and wetlands (include a minimum of 200 feet into adjacent properties).

26.4.2.2.1 Stream buffer plans for an individual single family or two family dwelling or an administrative survey are not required to survey the features listed above.

26.4.2.3 Delineated stream buffers.

26.4.2.4 Limits of the 100-year floodplain as shown on the adopted floodplain maps for the County of Boone.

26.4.2.5 Steep slopes greater than 15% for areas adjacent to and within 200 feet of Type I, II or III streams

26.4.3 Plan Submittal. The buffer plan shall be submitted in conjunction with the required development permit application or land disturbance plan for any development, whichever is submitted first. The buffer must be clearly delineated on the site grading plan.

26.4.3.1 Provide a note on the site grading and drainage plans or development site plan stating, "There shall be no clearing, grading, construction or disturbance of vegetation except as specifically approved by the Director."

26.4.4 Temporary Boundary Markers. Markers will be installed by the applicant prior to commencing clearing and grading operations and maintained throughout the applicant's development activities. The markers will be placed on the outside edge of the buffer zone

prior to the start of any activity within 50-feet of the buffer or as shown on a land disturbance plan approved by Boone County. Markers shall be clearly visible and shall be spaced at a maximum of 100 feet. The markers shall be joined by marking tape or fencing. Orange construction fencing should be used to delineate the limits of the stream buffer.

26.4.5 Plan Preparation. Stream buffer plans, except for single family dwellings, two family dwellings or administrative surveys, shall be prepared by a professional surveyor, engineer or architect licensed to practice in the State of Missouri.

26.5 Design Standards for Stream Buffers

26.5.1 General. An adequate buffer for a stream system shall consist of a predominantly undisturbed strip of land extending along both sides of a stream and their adjacent wetlands, floodplains or slopes. The buffer width may be adjusted to include contiguous sensitive areas, such as steep slopes or erodible soils, where disturbance may adversely affect water quality, streams, wetlands, or other water bodies. All specified stream buffer widths are minimums and may be increased as specified in these regulations or on a voluntary basis by the property owner.

26.5.2 Buffer Measurement. The buffer shall begin and be measured from the ordinary high water mark of the channel during base flows.

26.5.3 Minimum Buffer Width. The required base width for all buffers shall be determined based on the type of stream being protected, as specified in TABLE I. of this ordinance below:

TABLE I. Required Minimum Stream Buffer Width	
Stream Type	Required Width (each side)
Type I	100 feet
Type II	50 feet
Type III	30 feet

26.5.4 Modifications to Buffer Width. Stream buffer width shall be modified if there are steep slopes which are above the ordinary high water mark and within the required stream buffer width and drain into the stream system. In those cases, the buffer width will be adjusted according to the guidance in TABLE II. Below:

TABLE II. Modifications to Stream Buffer Width Based on Slope	
Percent Slope	Width of Buffer
0 – 14%	No Change
15% - 25%	add 25 feet
Greater than 25%	add 50 feet

26.5.5 No Buffer Required. A stream buffer shall not be required for portions of a stream that are less than 150 feet in length due to the stream having been previously enclosed within a pipe or box structure immediately upstream and downstream of the subject location. In such cases, said stream portion may be similarly enclosed in a pipe or box structure.

26.5.6 Stream Buffer Averaging. The stream buffer width may be relaxed and the buffer permitted to become narrower at some points to allow for structures existing on the date of adoption of these regulations provided:

26.5.6.1 The average width of the stream buffer must meet the minimum requirement specified in Table 1 and Table 2.

26.5.6.2 There is no reduction in the width of the Streamside Zone (Zone 1)

26.5.6.3 No new structures are built in the 100-year floodplain. This does not restrict allowable uses in the streamside zone as defined in Section 26.6.1 and 26.6.2.3.

26.6 Two Zone Stream Buffer System

26.6.1 Buffer Zones. The stream buffer shall be composed of two distinct zones, with each zone having its own set of allowable uses and vegetative targets as specified in this section. (Table III contains information that has been condensed from subsequent text. For a complete listing of uses see Section 26.6.2 and 26.6.3).

Table III. Stream Buffers							
Streamside Zone (Zone 1)				Outer Zone (Zone 2)			
	Type I Stream	Type II Stream	Type III Stream		Type I Stream	Type II Stream	Type III Stream
Width	50	25	15	Width	50	25	15
Vegetation	Indigenous Vegetation			Vegetation	Type I – Indigenous Vegetation Type II - Managed Lawns Permissible Type III – Managed Lawns Permissible		
Uses	Flood control, permeable-surfaced foot and bicycle paths, road crossings, utility crossings, stream or stream bank restoration and restoration of indigenous vegetation			Uses	All uses allowed in Streamside Zone, hard-surfaced biking/hiking paths, detention/retention structures, utility corridors, storm water BMPs, residential yards, landscaped areas		
Function	Protect the physical and ecological integrity of the stream ecosystem			Function	Protect key components of the stream and filter and slow velocity of water runoff		

26.6.2 Zone 1. Streamside Zone

26.6.2.1 Function. The function of the streamside zone is to protect the physical, biological and ecological integrity of the stream ecosystem. The vegetative target for the streamside zone is undisturbed indigenous vegetation.

26.6.2.2 Adjoining Wetlands. The streamside zone will begin and be measured as defined and extend away from the ordinary high water mark a distance as shown in Table III. Wetlands that adjoin the buffer shall be added to the buffer. There shall be a 15-foot buffer around any edge of the wetland that is not within the stream buffer (inner or outer zone).

26.6.2.3 Allowable uses in the streamside zone:

- Flood control structures, stream gauging and water quality monitoring equipment, stormwater treatment facilities in accordance with an approved plan
- Utility crossings

- Permeable surfaced foot and bicycle paths
- Road crossings
- Utilities where no practical alternatives exist as determined by the director.
- Stream restoration, stream bank restoration or restoration of indigenous vegetation in accordance with an approved plan
- Roads, that exist on or before the date of adoption of these regulations, and associated maintenance activities.

26.6.2.4 Restricted uses in the streamside zone. The following uses are prohibited except where incidental to an allowable use:

- Clearing of existing vegetation,
- Grading, stripping or other soil-disturbing practices,
- Filling or dumping,
- Draining the buffer area by ditching, underdrains or other systems,
- Use, storage or application of pesticides, except for the spot spraying of noxious weeds or other species consistent with recommendations of the Missouri Department of Conservation, Boone County Soil and Water Conservation District, United States Department of Agriculture or University of Missouri Extension Service
- Storage or operation of motorized vehicles except for maintenance or emergency use.
- Walls, solid fences, chain link fences, woven or welded wire fences
- Structures or any type of impervious surface except as provided above

26.6.3 Zone 2, Outer Zone.

26.6.3.1 Function. The function of the outer zone is to prevent encroachment into the streamside zone and to filter runoff from residential and commercial development.

26.6.3.2 Adjoining Wetlands. The outer zone will begin at the outside edge of the streamside zone and extend outward, away from the streamside zone the distances as shown in Table III. Wetlands that adjoin the buffer shall be added to the buffer.

There shall be a 15-foot buffer around any edge of the wetland that is not within the stream buffer (inner or outer zone).

26.6.3.3 Allowable uses in outer zone

- All uses allowed in the streamside zone
- Utilities
- Hard-surfaced biking/hiking paths,
- Detention/retention structures,
- Storm water BMPs,
- Landscaped areas (Type II and Type III streams only) although planting of indigenous vegetation is encouraged.

26.6.3.4 Restricted Uses in Outer Zone

- Walls, solid fences, chain link fences, woven or welded wire fences
- Structures or any type of impervious surface except as provided above

26.7 Stream Buffer Management and Maintenance

26.7.1 Management, Responsible Party. The stream buffer, including wetlands and floodplains, shall be managed by the landowner to enhance and maximize the unique value of these resources. Management includes specific limitations on alteration of the natural conditions of the land and vegetation.

26.7.2 Allowed maintenance practices and activities in the streamside zone of the buffer. All allowed uses may be maintained subject to the review of the County. Any entity conducting an allowed activity within the streamside zone shall restore any disturbed area to it previous condition or in accordance with a plan approved by the Director. In addition to maintenance of allowed uses, the following maintenance activities may be conducted:

- Roads, bridges, paths, and utilities existing as of the date of adoption of these regulations.
- Rights of way for roads and utilities should be the minimum width to allow for installation, access and maintenance.
- Removal of diseased or dead trees, brush and trash.
- Maintenance of all County-approved improvements, including utilities
- Removal of debris which could cause flooding.
- Selective (spot) spraying of noxious or other vegetation consistent with recommendations from the Missouri Department of Conservation, Boone County Soil and Water Conservation District, United States Department of Agriculture or University of Missouri Extension Service

26.7.3 Restricted maintenance practices and activities within the streamside zone of the stream buffer:

- Clearing of existing vegetation.
- Soil disturbance by grading, stripping, or other practices.
- Filling or dumping.
- Drainage by ditching, under drains or other systems.
- Use, storage, or application of pesticides, except as provided for in 26.7.2 above.
- Storage or operation of motorized vehicles, except for maintenance and emergency use approved by the County or when operated on a legally established roadway.

26.7.4 Allowed maintenance practices and activities within the outer zone of the stream buffer:

- All Allowed Uses
- All maintenance practices and activities that are allowed in the Streamside Zone.

26.7.5 Restricted maintenance practices and activities within the outer zone of the stream buffer:

- Structures or buildings except as otherwise allowed by these regulations

26.7.6 Water pollution hazards – The following land uses and/or activities are designated as potential water pollution hazards and must be set back from any stream by the distance indicated below:

- Storage & use of hazardous substances 300 feet provided:
  - Up to 20 gallons of liquid fertilizer or pesticide is allowed but must remain outside of the stream buffer
  - Up to100 pounds of granular fertilizer or pesticide is allowed but must remain outside of the stream buffer
- Above- or below-ground petroleum storage facilities 300 feet provided:
  - Up to 500 gallons of heating oil, gasoline or diesel fuel is allowed but must remain outside of the stream buffer
  - Up to 1000 gallons of propane is allowed but must remain outside of the stream buffer

- Salvage yards or Automobile Recyclers 600 feet

26.8 Violations, Penalties and Remedies

It shall be unlawful for any person to violate any provision or fail to comply with any of the requirements of these regulations. A violation of or failure to comply with any of the requirements of these regulations shall constitute a misdemeanor and shall be upon conviction punished as provided by law. In addition, any person permitting, aiding, abetting or concealing a violation of this ordinance shall be deemed guilty of a misdemeanor and shall be upon conviction punished as provided by law. Each day a violation of these regulations continues shall constitute a separate offense. The penalty provided in this section shall not be construed to be exclusive but is intended to be supplemental and in addition to any other remedy provided by law or at equity. The County may institute in the circuit court of the County any appropriate action or other proceedings to prevent any unlawful activity proscribed in this ordinance or to correct any violations of this ordinance.

26.9 Conflict with Other Regulations

Where the standards and management requirements of this buffer ordinance are in conflict with other laws, regulations, and policies regarding streams, steep slopes, erodible soils, wetlands, floodplains, timber harvesting, land disturbance activities, or other environmental protective measures, the more restrictive shall apply.

26.10 Severability

If any part or parts of this Ordinance shall be held unconstitutional, invalid, or otherwise unenforceable by any court of competent jurisdiction, such decision shall not affect the validity of the remaining provisions of this Ordinance.